

Interim Committee for Coordination of  
Investigations of the Lower Mekong Basin



PERSPECTIVES FOR  
**MEKONG**  
DEVELOPMENT

Summary report

Revised Indicative Plan  
(1987) for the development  
of land, water and related  
resources of the lower  
Mekong basin.



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# Perspectives for Mekong development

**Revised Indicative Plan (1987) for the development of land, water and related resources of the lower Mekong basin.**

**Summary report**

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*The Mekong river is an extremely valuable natural resource. Its potential for irrigation, hydropower, navigation, fisheries and related development is more than adequate to raise significantly the standard of living of the people of the lower Mekong basin as well as that of many others in the riparian countries outside the river's catchment area. While an intensive use of this resource has only been initiated in a most preliminary fashion, the need to do so is evident considering that a large part of the basin's population is still living at close to subsistence level.*

*The Mekong Committee, since its establishment in 1957 and in its present interim status since 1978, is dedicated to the coordinated development of the basin's resources, on the basis of reasonable and equitable sharing between the riparian states as stated in the Committee's declaration of principles. To guide these efforts, an indicative plan for the resources of the basin was drawn up in 1970. The plan presented a framework for the development of water and related resources of the lower Mekong basin to meet the anticipated needs of the basin area up to the year 2000.*

*The 1970 plan covered a period of three decades, but the first half of this period saw a number of important changes in the region. For this reason, the Interim Mekong Committee decided that a major updating of the plan was necessary. The present study, of which this document is the summary report, is the result of that exercise, but at the same time it reflects a number of new elements in relation to the medium-term development of the basin's resources.*

*The Interim Mekong Committee is keenly aware of the limitation of a sectoral plan for water resources development of the basin in the light of changing technological, economic, social and political circumstances which may have a sometimes profound influence on planning efforts. It is for this reason that this study, as its 1970 predecessor, is presented as an indicative plan.*

*For the same reason, it is the Committee's intention to revise and update this plan at regular intervals whenever new circumstances arise or information becomes available which would make an adjustment desirable. For this purpose, a review will be made at least annually, in conjunction with the consideration of the Committee's Work Programme. Specifically, a significant revision would be required once the present interim status of the Committee comes to an end.*

*The present plan is the result of an intensive cooperative effort by many parties over most of the year 1987 and part of the year 1988. It heavily involved the national Mekong committees as well as various ministries and departments in the three member countries and the Committee's Secretariat, through many consultations at various levels. The effort was assisted by a consortium of consultants led by the Netherlands Engineering Consultants (Nedeco) of the Netherlands with Electrowatt Engineering Services of Switzerland and Asian Engineering Consultants of Thailand, who undertook a wide range of supporting studies. The Mekong Secretariat has an extensive file of these and related studies.*

*The Committee wishes to express its great appreciation for the close, active and dedicated cooperation received from all the participants in this complex effort. It also wishes to acknowledge with special gratitude the assistance from the United Nations Development Programme, which has supported this activity under its continuing programme of support for the Committee's Development Action Programme.*

*Finally, the Interim Mekong Committee wishes to express its deep appreciation to the many cooperating countries and organizations for their continuing support of the Committee's activities.*

*In approving the present Indicative Basin Plan, the Interim Mekong Committee reaffirms its commitment to an optimal coordinated development of the important Mekong resource. It also reaffirms its steady belief in the importance of international harmony and understanding as a prerequisite to reach this goal. It finally reaffirms its confidence that such conditions will ultimately prevail, making it possible for all parties to concentrate fully on the development of the lower Mekong basin for the benefit of its people.*

Bangkok  
April 1988

# The scope of the plan

The lower basin of the Mekong river covers large areas of Kampuchea, the Lao PDR, Thailand and Viet Nam. The river is a huge, underused resource. It could, through irrigation, fisheries and hydropower, feed and otherwise support not only the basin's population but also many who live outside its catchment area. No single country can develop the river properly on its own. Each country has its own powerful reasons for cooperating in the river's development.

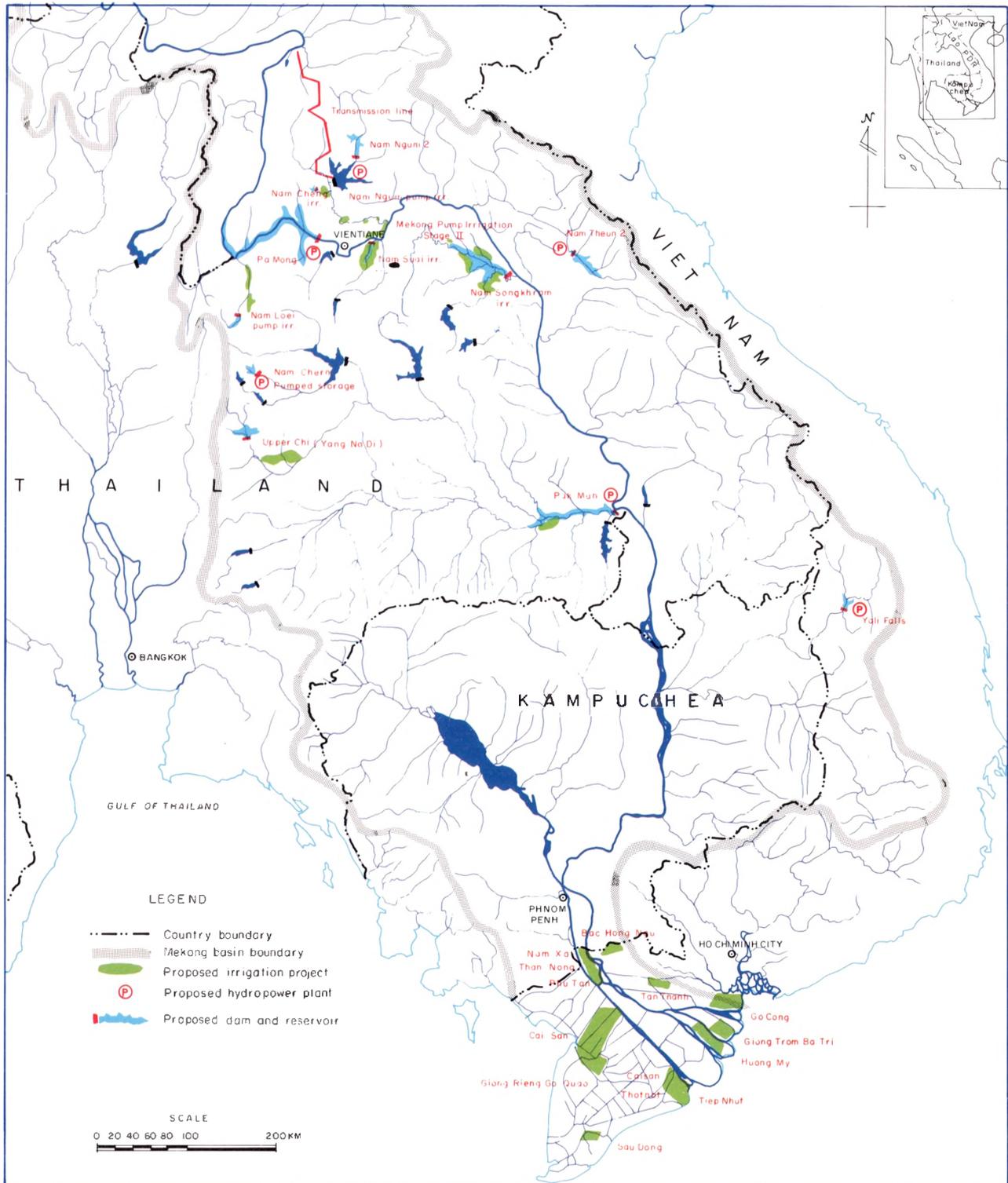
The Committee for Coordination of Investigations of the Lower Mekong Basin produced an indicative plan in 1970 for the basin's development. The plan focused on hydropower production and irrigation in the short range (1971-1980) and the long range (1981-2000). There were also investigations and studies to allow for more definitive planning.

Political, economic, social and technological change has since swept the region. The short-range plan was largely carried through in the Lao PDR and Thailand, but in Kampuchea and Viet Nam, war and lack of money prevented much progress. The long-range plan, however, remains more or less as it stood in 1970. In the light of this, the Mekong Secretariat commissioned a revision of the plan in order to put the basin's development into today's perspective. This document is the summary volume of the resultant report. Entitled "Perspectives for Mekong development", the report has four elements:

- a long-term perspective of the basin's development potential;
- an investment plan covering 1988-2000;
- a concurrent programme of studies and investigations;
- proposals to put the Mekong Secretariat in a position to be able to guide and coordinate this work.

The immediate aim of the longer-term perspective of the basin's development potential is to serve as a framework within which the shorter-term possibilities may be evaluated.



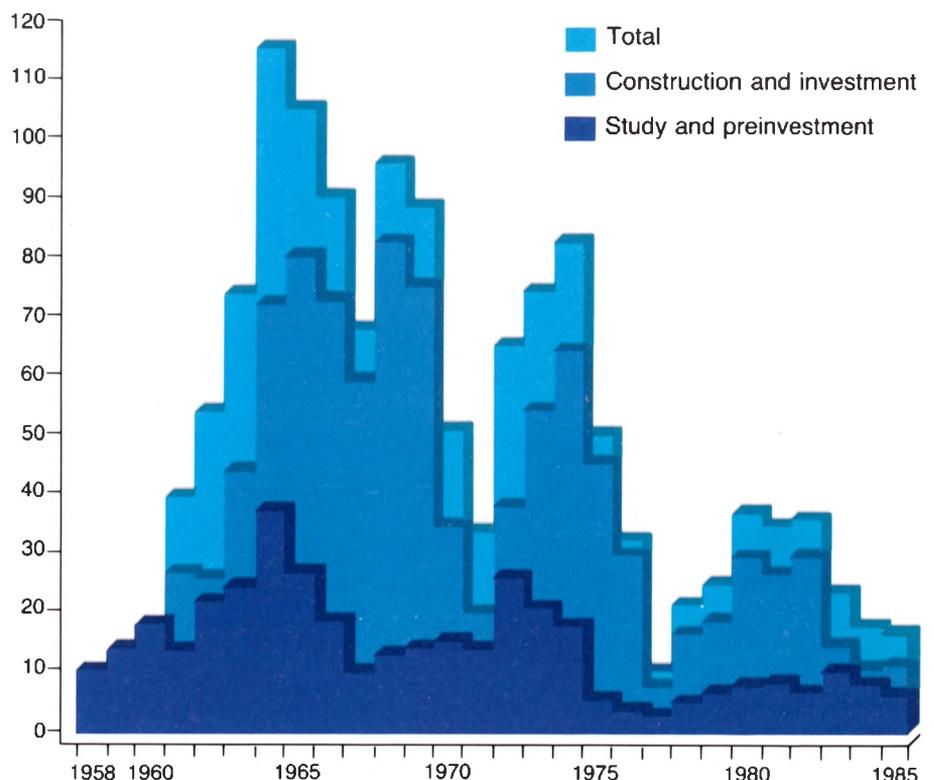


*The lower Mekong basin, showing the possible development projects retained for final analysis in the revision of the indicative plan*

The investment plan covers 29 carefully selected projects, 26 of which are national in scope, the remaining three international. All involve either hydropower or irrigation development or both. All were identified in cooperation with the National Mekong Committees of the Lao PDR, Thailand and Viet Nam, and respond to those countries' national priorities. Both the national and the international projects were selected for inclusion at the interim stage of the preparatory studies for this report. The national projects in particular have been selected not only on economic grounds but also according to other criteria such as food security and employment generation. The national projects have been scheduled into an investment plan, but the sociopolitical complexity and the lack of some crucial techno-economic data prevent the international projects from being so scheduled.

The 1970 plan helped to underpin an estimated US\$ 1,600-2,000 million (1987) investment in basin development. It is hoped that this new perspective will be at least as successful as its predecessor in mobilizing resources for sustained progress.

*Contributions to the Mekong Committee, 1958-1985: three-year moving averages inflated to 1987 US dollars*



# The basin and its resources

The Mekong is the world's twelfth longest river and its tenth greatest in terms of annual flow. Rising in Tibet, it has a total length of 4,200 km. The lower Mekong basin, in which mainstream length is 2,400 km, begins where the river becomes the border between the Lao PDR and Thailand. It covers 609,000 km<sup>2</sup>, about 77% of the Mekong's total catchment area, including almost all of the Lao PDR and Kampuchea, large parts of Thailand, and the delta provinces and part of the Central Highlands in Viet Nam. In 1985, of the total population of the four countries, over one third, 46 million, lived in the basin, 14% in Kampuchea, 7% in Lao PDR, 42% in Thailand and 37% in Viet Nam.

The basin contains five distinct landform divisions, termed the northern highlands, the Korat plateau, the eastern highlands, the lowlands and the southern uplands.

## *Landforms of the lower Mekong basin*

	<i>Rainfall</i>	<i>Vegetation</i>	<i>Provincial population density</i>	<i>Chief economic activity</i>	<i>Potential</i>	<i>Problems</i>
Northern highlands	Wet, 2,000-2,800 mm/year	Grassland and hill evergreen	Low, 8-15/km <sup>2</sup>	Shifting agriculture	Very limited	Erosion, forest destruction
Korat plateau	Relatively dry, 1,000-1,600 mm/year	Scrub and grassland, arable land	Moderate, 80-160/km <sup>2</sup>	Irrigated and rainfed agriculture	Further agricultural development, diversification	Limited water resources, intermittent floods and drought, salinization, rather low fertility
Eastern highlands	Wet, 2,000-3,200 mm/year	Upland savanna, rainforest	Low, 6-33/km <sup>2</sup>	Shifting agriculture	Limited	Soil erosion, soil degradation, forest destruction
Lowlands	Variable, 1,100-2,400 mm/year	Arable land	Moderate to dense, variable, 10-570/km <sup>2</sup>	Rice farming	Irrigation, better water management, diversification	Flooding, waterlogging, acid-sulphate soils, salinity intrusion, drought
Southern uplands	Very wet, up to 4,000 mm/year	Dense forest	Very low, less than 4 km <sup>2</sup>	Undeveloped, some shifting agriculture	Limited forestry potential, natural reserve	Vulnerable environment

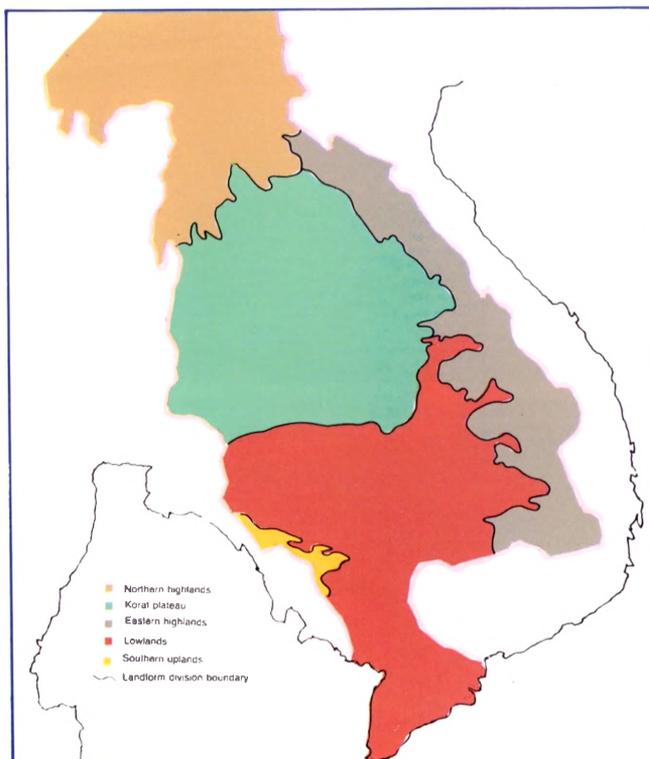
The basin's water resources are ample. Total mean annual flow into the sea, for example, is estimated at over 475,000 million cubic metres, or nearly 600 mm depth over the entire basin. Distribution over space and time though, is uneven: for instance Northeastern Thailand has plentiful land but limited water resources, while the Lao PDR has ample water but not enough cultivable land.

The lower Mekong's hydrological regime is largely independent of conditions further upriver. Instead it reflects the alternating dry and wet seasons of the region's monsoon climate. The river begins to rise in May each year, peaking in August or September towards the end of the southwest monsoon, and then it falls rapidly away as the dry northeasterly winds set in. At Kratie, just before the river enters the delta, average low flow is about 1,750 m<sup>3</sup>/s. Flood flows, in contrast, average 52,000 m<sup>3</sup>/s, while average flows are 14,000 m<sup>3</sup>/s. The Mekong's seasonal flood is largely fed from its left bank tributaries in the Lao PDR and Viet Nam.

The Great Lake in Kampuchea has a natural regulating effect on flooding by the Mekong in the delta, as the Tonle Sap reverses flow when the Mekong is in flood. Nevertheless, of the 3.9 million ha which are in Viet Nam, 1.2-1.4 million ha are flooded each year. The floods can last for 2-6 months, with water depths near the Vietnamese-Kampuchean border of up to 4.5 m. An additional 1.0-1.2 million ha of the Vietnamese delta is subject to waterlogging.

Conversely, the dry season in the delta is also pronounced. It lasts from December to April, when much land suffers from salinity intrusion: 1.7-2.1 million ha are affected for 1-8 months. Other areas suffer from acidic water at the beginning of each rainy season. The acid originates in the delta's widespread acid-sulphate soils. In Viet Nam alone, roughly 1.0 million ha are affected annually.

*The lower Mekong basin, showing the five chief landform divisions*

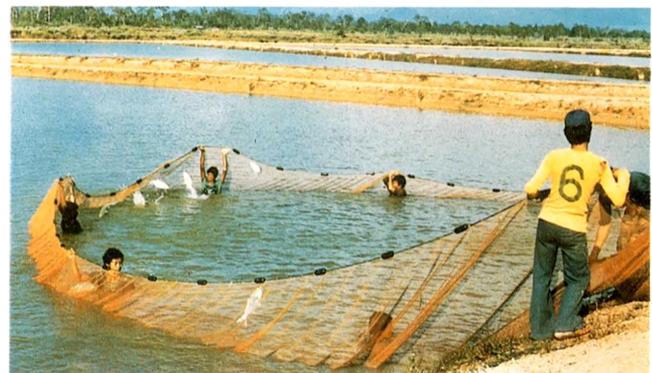
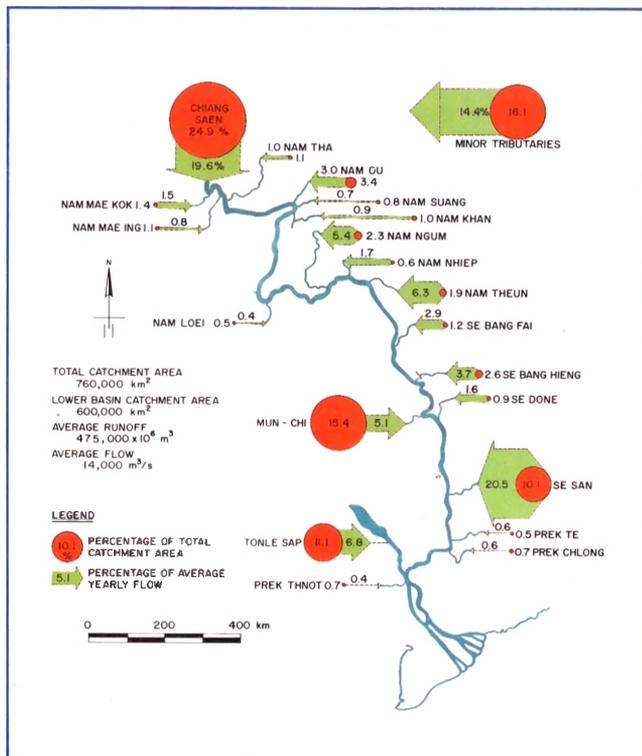


The basin's forests have almost all undergone periodic clearing due to shifting agriculture over many generations. By 1985 only 27% was still under forest. Between 1970 and 1985, some 13 million ha (21% of the basin's area) were cleared, mainly through encroachment, shifting cultivation, and development. Increased erosion and sedimentation have been observed.

Some 13.5 million ha in the basin are currently cultivated. Across all four countries, about 8.5 million ha are planted annually to paddy, but in only about one-sixth of this area is the water regime controlled. In Northeastern Thailand there is scope for increase of production through irrigation, flood control and drainage. The area is suffering from the lack of water, both in the dry season and during dry spells in the wet season, and from annual flooding which causes considerable loss of paddy production. In the other countries there is scope for expansion of the area under the plough, but such areas in the Vietnamese delta currently suffer from actual or potential acid-sulphate soils, saline intrusion, and waterlogging.

The basin's fisheries have great economic and dietary importance. Fish provide the area's primary source of animal protein. Basin-wide estimates in 1973 put the annual catch at 450,000-500,000 t. The Great Lake freshwater fisheries and the delta's brackish and estuarine fisheries are by far the most productive.

### Catchment areas and flow contributions of Mekong tributaries



# The basin's potentials and needs

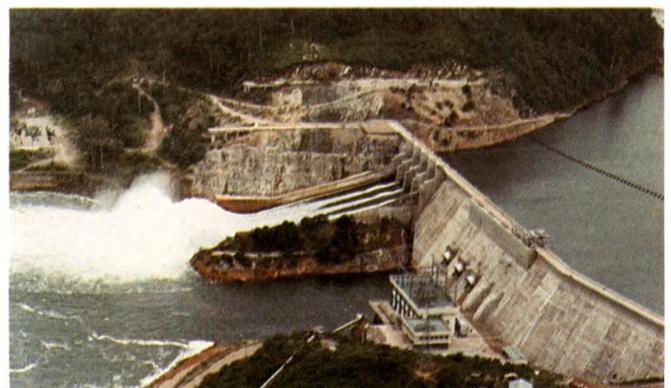
The growth of demand for electric power and rice and the need for water will dominate the scope and pace of basin development. Other influential factors are fisheries and aquaculture potential, inland navigation, and timber and fuelwood needs (forest management).

Total power demand in all three countries in 1986 was estimated at 4,900 MW peak power and 25,200 GWh/year energy. Markets for the basin's energy are, in descending order, Thailand (88%, of which inside the basin 12%), Viet Nam (southern and central regions only, 11%) and the Lao PDR (1%). Total energy demand is expected to grow by 35,000 GWh by 2000 and by a further 42,000 GWh by 2010. Nothing is known about the Kampuchean market for power except that it is small.

The basin's technical hydropower potential is 37,000 MW and 150,000-180,000 GWh/year, of which, significantly, 33% is in Kampuchea and 51% in the Lao PDR. Thus the countries with substantial power markets (Thailand, and to some extent Viet Nam) have only limited potential, whereas Kampuchea and the Lao PDR, both with small power markets, possess much untapped wealth. In aggregate, the basin's hydropower potential far exceeds projected demand over the coming decades.

Rice, with its inherent demand for water and water control, is the other critical development factor. Here too, the perspectives of the four countries are different: the Lao PDR is edging towards self-sufficiency; Viet Nam has a 10-20% deficit (1.5-3.0 million t); and Thailand, though it is one of the world's largest rice exporters, needs to bring the standard of living of its northeastern region into line with that of the rest of the country, implying increased water control for agricultural production. Again, little is known of the situation in Kampuchea.

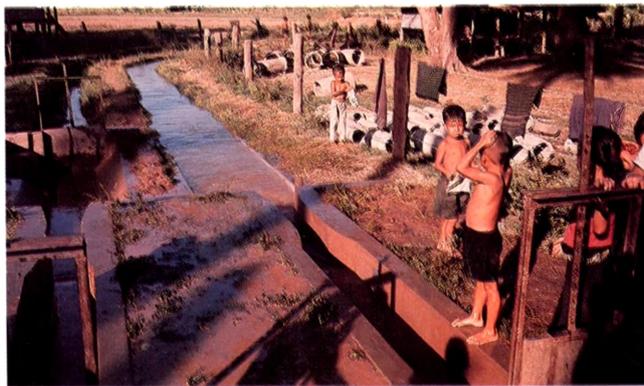
*Nam Ngum dam and reservoir, so far the only hydropower development of international consequence in the basin*



Meeting these demands means different things in the three countries. In the *Lao PDR*, only a few irrigation projects have been identified; more will be needed. The claim on water, however, will be small and will be satisfied mainly by pumping or diversion. In *Northeastern Thailand*, water is the most important physical constraint. Plans for some 140,000 ha of large-scale tributary-fed irrigation development are in various stages of preparation. Thailand is expected anyway to be able to maintain a healthy export surplus because of only modest increases in domestic demand and a “natural” rate of increase in paddy production of about 1% per year. Nevertheless, there is an urgent need to bring in water from the Mekong to meet the northeastern region’s ever-increasing requirements for water for irrigation, both during the dry season and during dry spells in the wet season, and for domestic supply. *Viet Nam* has set its sights firmly on self-sufficiency in rice through development in the delta, which may ultimately demand 2,000-3,000 m<sup>3</sup>/s of fresh water during the dry, low-flow season — to manage potential acid-sulphate soils, to flush out acidic water, to counter saline intrusion and to irrigate the crops. *Kampuchea*’s freshwater requirements are not known at present but are definitely less than those of Viet Nam.

The freshwater demand could be met in several ways, either alone or in combination. First, saline intrusion could be reduced through engineering measures in the delta itself which would “free” fresh water for irrigation. Second, large storage reservoirs on the Mekong mainstream could provide up to 3,500-4,500 m<sup>3</sup>/s. Third, a barrage on the Tonle Sap could provide an additional 2,500-2,700 m<sup>3</sup>/s by modifying the natural storage regime of the Great Lake.

To sum up, while the Mekong represents a vast resource for all four countries, its importance varies from country to country. Its main usefulness to the Lao PDR as a whole is to use hydropower to meet national priorities in agriculture, forest production and agro-industry. For Thailand, it is of vital importance to secure water supply for irrigation and domestic use for its Northeastern region to bring the standard of living of this region more in line with that of the rest of the country, while the country would also stand to gain from hydropower. At the same time in Viet Nam, the main goal of harnessing the Mekong would be to increase the river flows during the dry season to permit full agricultural development of the delta.



# Long-term perspective: harnessing the Mekong

It is clear that there is indeed a will to harness the Mekong. The 1970 plan proposed a “cascade” of seven major dams, which could have stored 136,000 million m<sup>3</sup> and generated 23,300 MW of power. Within this scheme Pa Mong (with reservoir at 250 m elevation and net storage of 77,000 million m<sup>3</sup>) and Stung Treng (net storage of 46,500 million m<sup>3</sup>) were the key developments. Pa Mong would have led off.

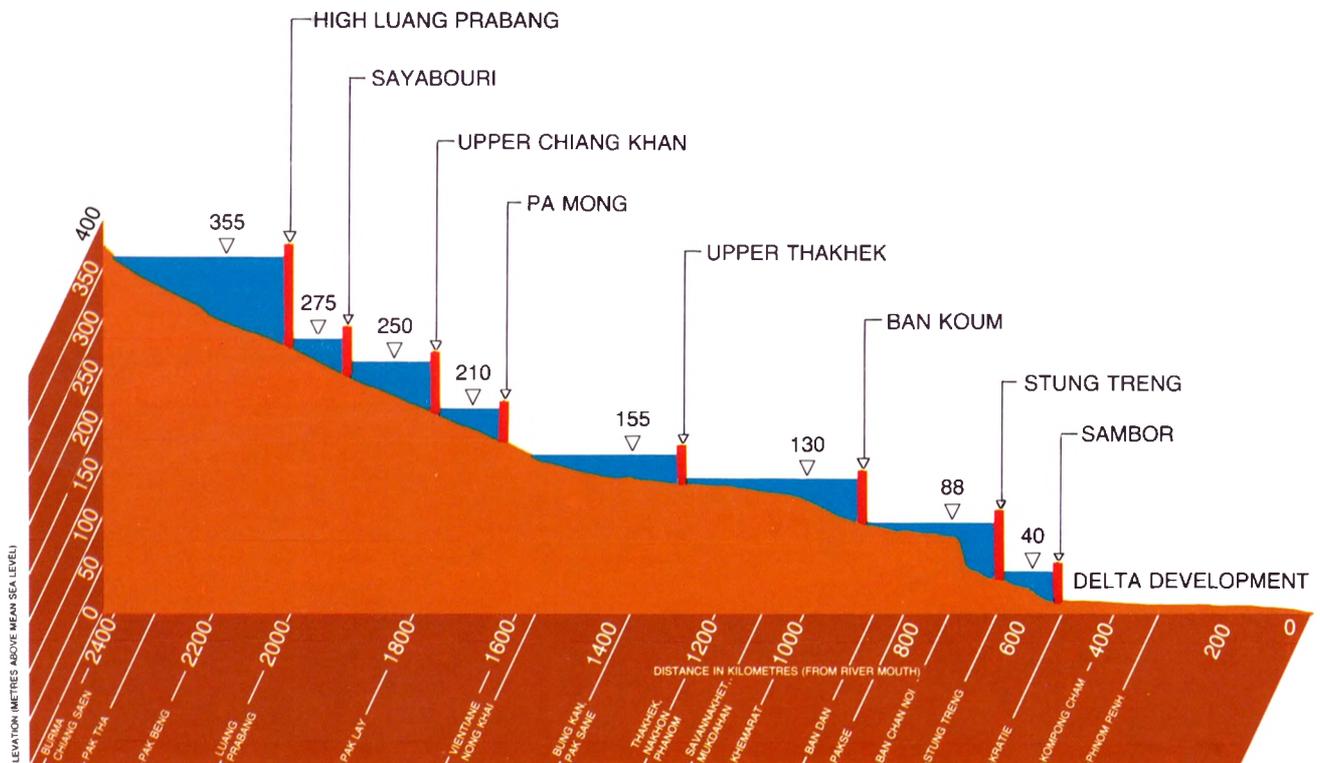
It has since become clear that the Pa Mong scheme as proposed is no longer tenable because of the need to resettle upwards of 250,000 people. An alternative is to build Pa Mong in two steps, with a much lower Pa Mong dam (Low Pa Mong) and a second dam upstream at Chiang Khan. The Low Pa Mong reservoir would have a full supply level between 205 m and 220 m elevation, while that for Upper Chiang Khan would be at about 250 m. Low Pa Mong could still lead off the full development of the cascade. However, it has only been evaluated to prefeasibility level and the need for a feasibility study is urgent. So far though, its technical and economic feasibility appear beyond doubt.

*The Pa Mong project:  
artist's impression*



The cascade now conceived is less powerful than the cascade of 1970: for instance it provides less river regulation than its predecessor due to reduced net storage (76,860 million m<sup>3</sup> instead of 112,740 million m<sup>3</sup>); with a virtually identical installed capacity, it produces 8% less energy; and it results in 1,400 m<sup>3</sup>/s less mean January-May “low flow”. The new cascade can nevertheless satisfy a large portion of the basin’s total power needs while allowing for major development in the riparian countries. It reduces resettlement requirements by about 200,000 people. Full cascade development, however, would be a very long process. Under present conditions the cascade now conceived would not be completed before the second half of the twenty-first century.

*The Mekong Cascade as conceived in 1987*



# The basin's international potential

Seven proposed projects of international consequence have been reviewed: four are on the Mekong's mainstream, three on major tributaries. Three were selected for closer analysis: Low Pa Mong, on the mainstream, and Nam Theun 2 and Nam Ngum 2 on major tributaries.

## International projects: salient features

<i>Feature</i>	<i>Unit</i>	<i>Pa Mong 210</i>	<i>Nam Theun 2</i>	<i>Nam Ngum 2</i>
Average net head	m	44	352	134
Mean annual inflow	10 <sup>6</sup> m <sup>3</sup>	135,600	6,500	6,938
Reservoir net storage	10 <sup>6</sup> m <sup>3</sup>	7,310	4,000	3,400
Installed capacity	MW	2,250	600	400
Energy output	GWh	10,660	4,650	2,180
Resettlement	people	40,000	2,000	1,000
Total investment	US\$ 10 <sup>6</sup>	2,066	615	525
Economic costs of energy	USc/ kWh	2.5	1.7	3.1
Economic internal rate of return <sup>1</sup>	%	18.4	38.3	20.5
Economic internal rate of return <sup>2</sup>	%	18.4	16.9	7.6

<sup>1</sup>Assigning full credit to capacity in respect of power exported.

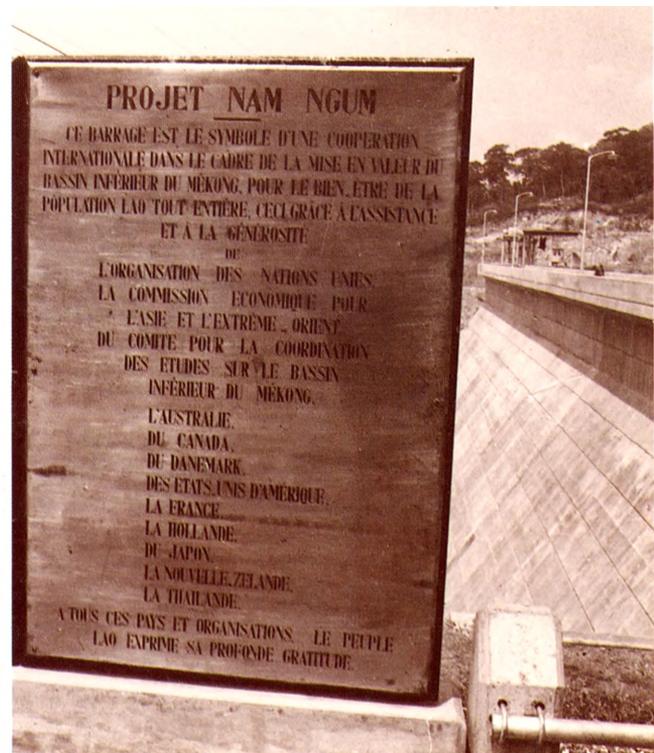
<sup>2</sup>Assigning no credit to capacity in respect of power exported.

Pa Mong 210, Nam Theun 2 and Nam Ngum 2 are projects of international dimensions. Pa Mong 210 is international as a result essentially of its being located on the Lao-Thai border, with an influence that extends downstream. Nam Theun 2 and Nam Ngum 2 have international significance largely due to the fact that the bulk of their power output would have to be marketed outside the Lao domestic system. Nam Theun 2, in addition, would have downstream effects, particularly with respect to the river flows during the dry season.

At this stage, it is hard if not impossible to estimate to what extent power systems that would import power will acknowledge and absorb the imported power, hence to what extent savings on alternative generation capacity would materialize. This report, therefore, rather than guessing at the outcomes of complex technical and political processes of decision making, has chosen to explore the economics of the projects concerned for two extreme possibilities in this respect. In the first case, full credit for capacity is given for all the firm power a project would generate, irrespective of its ultimate destination. In the second case, credit for capacity given only for the firm output absorbed in the domestic grid of the country of origin of the output, which is a very minor portion of the total capacity.

The implication of this valuation procedure for Nam Theun 2 and Nam Ngum 2 is that the (firm) power to be exported is given, alternatively, full or no credit for capacity. With respect to Pa Mong, the situation is different. Pa Mong is a mainstream/border project, not a project in the interior of another country than the one which is supposed to absorb a large part of the power generated. Pa Mong 210 has therefore been taken not to be subjected to a possible condition of no credit for capacity for (part of) its potential firm power output: the firm power output is consistently credited for savings on alternative generation capacity.

The table shows that Low Pa Mong and Nam Theun 2 are economically attractive projects, Nam Ngum 2 rather less so. The table also indicates that the economics of Nam Theun 2 are highly sensitive to the extent capacity credit is granted for the power it would have to export. Both Nam Ngum 2 and Nam Theun 2 are tributary projects. It must be considered improbable that both would feature in the next round of decision making on the mobilization of the basin's land and water resources. On economic grounds, this report has therefore excluded Nam Ngum 2 from further consideration.



# National projects

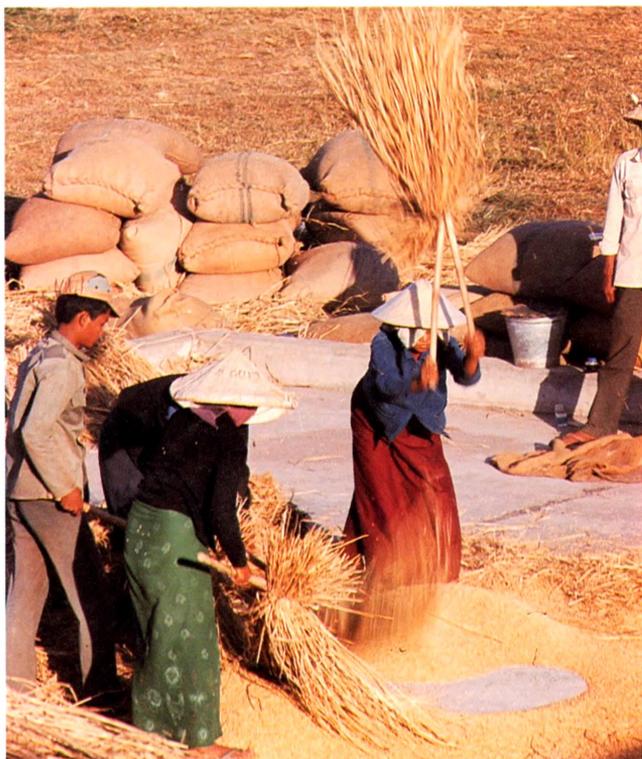
The 26 national projects in the investment plan consist of 5 power and 21 irrigation projects. There are two power projects each in Thailand and Viet Nam and one in the Lao PDR. The Thai power projects include irrigation components. Of the irrigation projects, four are in the Lao PDR, five in Thailand and twelve in Viet Nam.

## National projects: key parameters

	<i>Unit</i>	<i>Lao PDR</i>	<i>Thailand<sup>1</sup></i>	<i>Viet Nam</i>	<i>Total</i>
<b>Power projects</b>					
Generation capacity	MW	—	536	504	1,040
Energy production	GWh/year	— <sup>2</sup>	492	2,850	3,342
Total investment	1987 US\$ 10 <sup>6</sup>	8.3	245.8	547.4	801.5
<b>Irrigation projects</b>					
Total area	ha	19,800	100,000	300,000	419,800
Incremental paddy production	t/year	53,000	247,000	1,450,000	1,750,000
Direct employment	labour places	7,300	46,000	260,000	313,300
Total investment	1987 US\$ 10 <sup>6</sup>	32.4	244.7	413.9	691.0

<sup>1</sup>Including investments in the period 2001-2005 (US\$ 171.6 million)

<sup>2</sup>Transmission line.



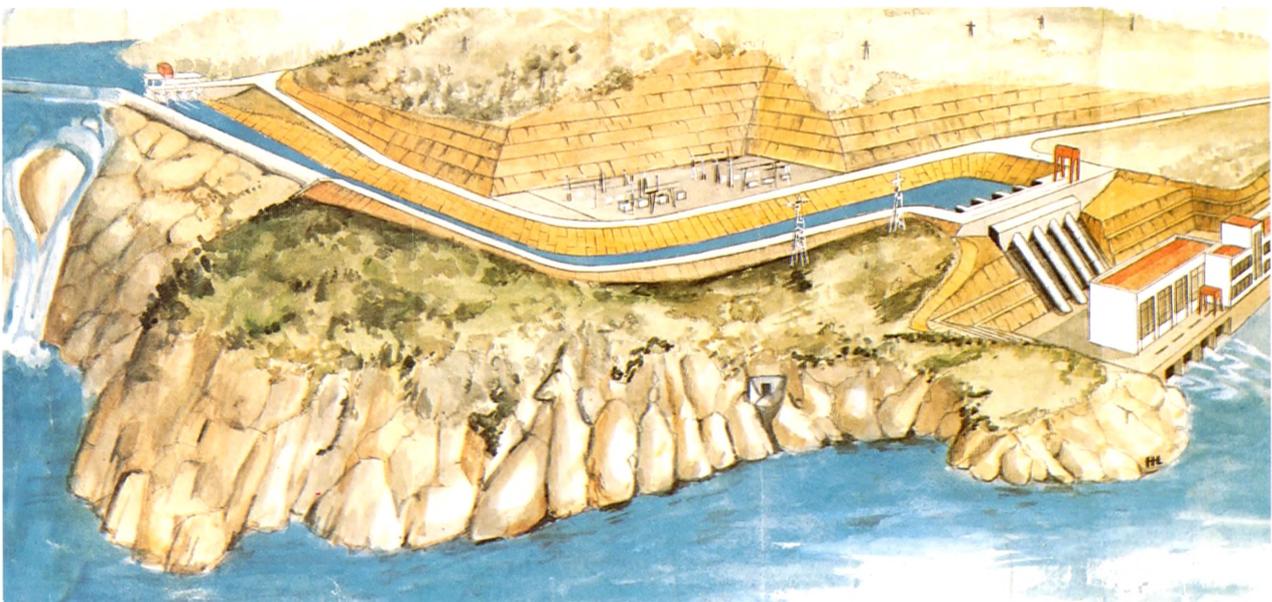
## Power projects

The five power projects are: (1) a 115-kV transmission line in the Lao PDR from the existing Nam Ngum power plant to Luang Prabang; (2) a 400-MW pumped storage plant at Nam Chern, Thailand; (3) a 136-MW hydropower plant at Pak Mun, Thailand; (4) and (5) a staged development of hydropower plants of 24-MW and 480-MW respectively at Yali Falls, in the Central Highlands of Viet Nam.

All five projects are economically attractive with internal rates of return ranging between 15% and 46%. The transmission line, Pak Mun and the small Yali Falls project could be started as soon as additional investigations and final design are completed. Since Nam Chern's output (exclusively peak power) is too large to be accommodated into the Thai grid at present, the project would have to come on line some time early next century. The small Yali Falls scheme would be built before the large one if it were to be built at all. Required investments have been estimated at:

	<i>1987 US\$ million</i>
● 115-kV transmission line	8.3
● Nam Chern, power project only	128.8
● Pak Mun, power project only	117.0
● Yali Falls Small	54.4
● Yali Falls Large	493.0

*Yali Falls hydropower  
project: artist's impression*



## Lao PDR

The four irrigation projects in the *Lao PDR* are:

- Nam Ngum pump irrigation project
- small-scale irrigation in northern Lao PDR, a ten-year programme of improvements to existing irrigation infrastructure
- small pump irrigation, a ten-year programme of small pump irrigation projects along the Mekong and major tributaries
- Nam Cheng irrigation project.



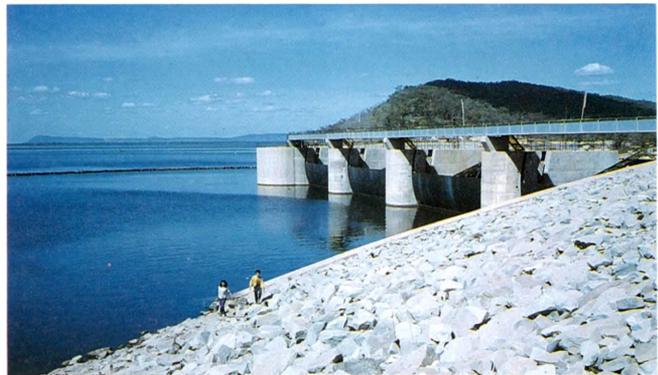
All four projects appear to be technically feasible and the first three are attractive economically. Nam Cheng's economic internal rate of return is estimated at just under 6%. Taken together and at full development the four projects would develop approximately 19,800 ha of land to produce an extra 53,000 t of paddy annually, thus generating employment for 7,300 people. The projects would cost US\$ 32.4 million. All require additional preparatory work, but except for Nam Cheng, implementation could begin in 1988 and 1989, once funding is assured.

According to food balance studies, the 53,000 t of rice mentioned above is far less than the country needs over the next decade. To meet increasing demand, two nation-wide studies were recommended aimed at (1) identifying more projects, and (2) improving productivity in existing irrigation projects, mainly in central Lao PDR. Production even then may not keep up with demand and the Lao PDR may have to make additional efforts to identify, prepare and implement new irrigation projects, or resort to imports of rice.

## Northeastern Thailand

The five irrigation projects in *Northeastern Thailand* are:

- Nam Songkhram
- Nam Suai Stage I
- Upper Chi
- Nam Suai Stage II
- Nam Loei.



There are in addition the irrigation components of the Nam Chern and Pak Mun power schemes. Studies on the above five projects reveal that the economic returns are not very attractive. This is due to low rice prices forecasted and the fact that for Thailand, as a rice exporter, the prices are based on export parity which differs from the other two riparian countries where import parity has been applied. Nevertheless, the economics of the projects may improve considerably, if a greater proportion of upland crops is introduced. Moreover, under the “Green E-Sarn Scheme” and for sociopolitical reasons, irrigation in Northeastern Thailand is likely to be acceptable at somewhat lower economic returns than elsewhere in the country.

Taken together and at full development, the above five plus the two multipurpose projects would develop about 100,000 ha of land to produce 247,000 t of paddy annually, and create 46,000 direct employment places. Investment would be US\$ 244.7 million. All projects still require considerable preparatory work, and the multipurpose projects are heavily dependent on their hydropower components. It is tentatively estimated that the construction of Pak Mun, Upper Chi and Nam Suai I could start from 1990, with the other projects starting 4-10 years later.

## Viet Nam

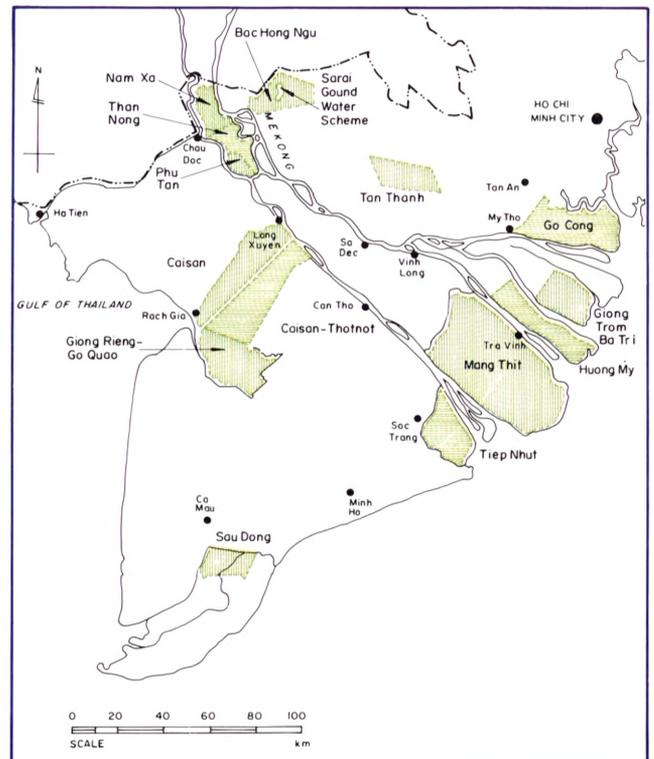
There are twelve irrigation/water control projects in *Viet Nam*:

- Nam Xa Canal
- Khen Than Nong (including Phu Tan as its first phase)
- Giong Rieng — Go Quao
- Tan Thanh
- Giong Trom — Ba Tri
- Cai San — Thotnot
- Go Cong
- Sau Dong
- Tjep Nhut
- Huong My
- Bac Hong Ngu
- Cai San.

The projects would improve agriculture in a variety of ways, but chiefly by providing one or more of the following:

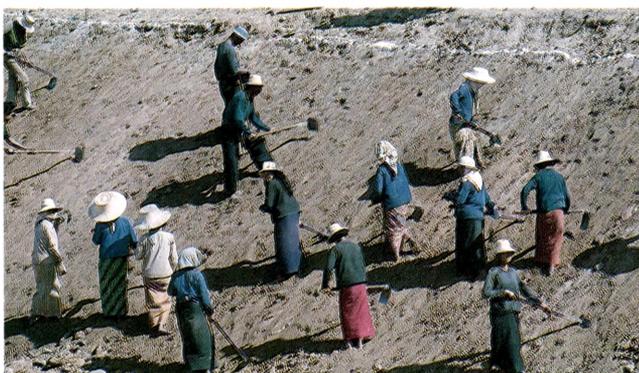
- low-level flood protection, to permit double-cropping
- protection against saline intrusion
- acidity control
- supply of fresh water for irrigation.

*Mekong development potential in the delta, Viet Nam*



Almost all the projects score well economically, with internal rates of return above 20%. Only Tiep Nhut (10.3%), Cai San-Thotnot (13.4%) and Go Cong (16.6%) score lower. The high returns are due to one or more of the following factors: an import-parity price for rice, a weak “without the project” case, and considerable sunk cost by way of existing infrastructure.

Taken together and at full development, the projects would develop about 300,000 ha to produce 1,450,000 t of paddy annually and create 260,000 labour places. Investment would be US\$ 413.9 million. However, all the projects require technical assistance to bring their formulation up to levels acceptable for international funding. It is estimated that, provided funding can be arranged, Tiep Nhut, Huong My and Khen Than Nong could start in 1988, with all the other projects starting from 1990. However, impressive as 1,450,000 t of paddy might be, it still does not cover Viet Nam’s rice deficit. Much greater and more rapid development of the delta will be needed to reduce or erase this.



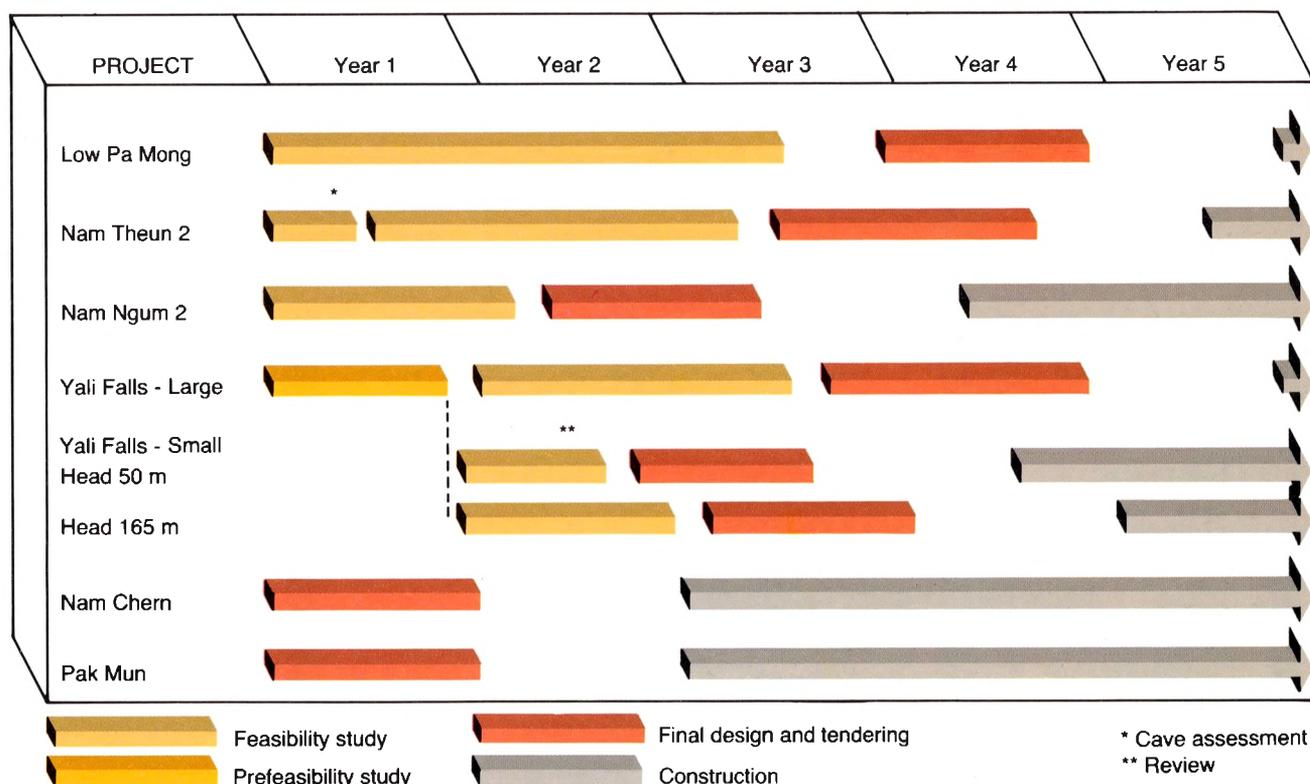
# Programme of studies and investigations

Very few of the projects included in the investment plan are sufficiently mature to proceed directly to implementation. Studies and investigations are still required for most of them and final design for all. These *project-related studies* and investigations are the first component of the programme. The programme, also contains proposals for country and basin-wide studies and investigations. The *country-specific studies* are aimed at probing some urgent country-bound problems and at pinpointing effective countermeasures. The *basin-wide studies* would examine the basin's intricate internal relationships and the potential courses of development. They would permit subsequent preparation of a more comprehensive basin plan than is possible today.

## Project-related studies

The project-related studies and investigations are required to bring the projects in the investment plan to implementation level. Investigations, study and final design will take up to 4 years for some of the projects, depending on the complexity and the degree of earlier preparation. The first studies could start in 1988; the last would be completed in the late 1990's. Total budget requirements are estimated at US\$ 40.5 million, of which US\$ 14.4 million would be spent on Low Pa Mong and Nam Theun 2, US\$ 3.7 million, US\$ 15.8 million and US\$ 6.6 million would be spent on national projects in the Lao PDR, Thailand and Viet Nam respectively.

*Project-related studies and investigations: power and multipurpose projects*



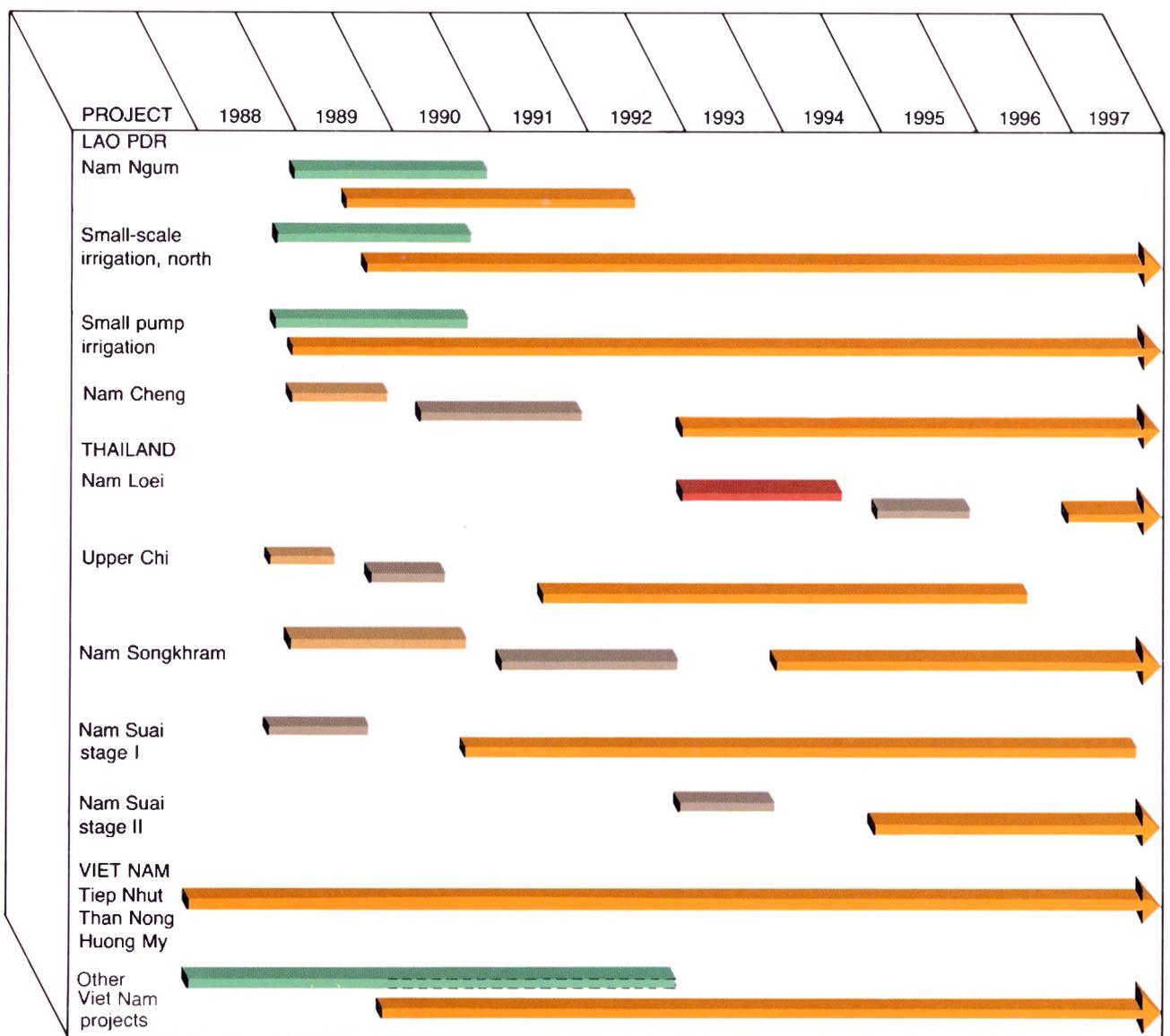
## Country studies

The country studies and investigations would focus on:

- an agricultural potential study for the northern region of the Lao PDR
- a study and technical assistance aimed at increasing productivity in existing Lao irrigation projects
- a study for Northeastern Thailand, to formulate a development programme for rainfed agriculture
- a study on watershed management for Northeastern Thailand
- a study on soil conservation in Northeastern Thailand
- technical assistance to Viet Nam, to bring proposals for projects in the delta to a high enough level to solicit donor support
- a delta fisheries sector study
- a delta navigation sector study

*Project-related studies and investigations: irrigation projects*

These studies would span 1989-1993; total budget requirements are US\$ 4.0 million.

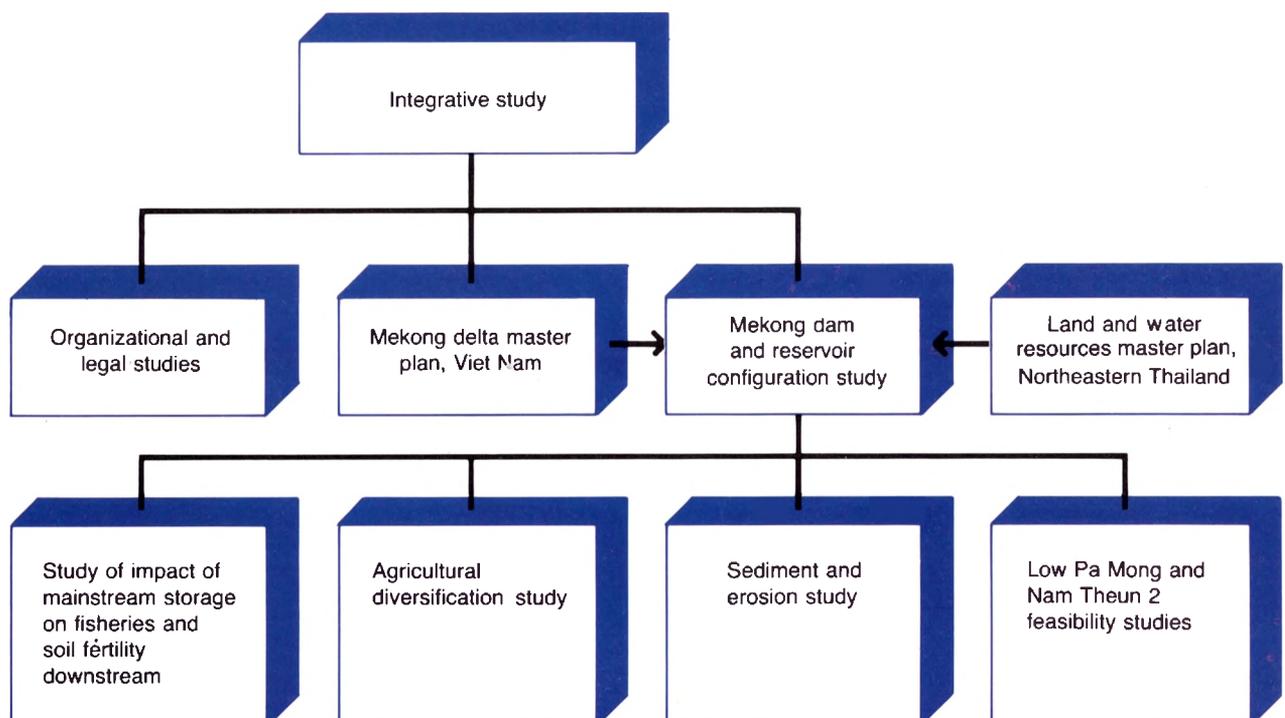


**Hierarchy of studies** A considerable body of basin-wide data has already been built up, yet some of the critical interrelationships between as well as within potential courses of action are still unclear. A single study to cover every important outstanding issue would perhaps not be appropriate: what is needed is a more manageable 'hierarchy' of studies. Each element in the hierarchy would be formulated as a separate activity but would be designed to complement the other elements. The ultimate objective is to prepare for decision making on the basin's larger issues some time in the mid-1990's.

**Lowest tier** The hierarchy's *lowest tier* contains (1) the feasibility studies on Low Pa Mong and Nam Theun 2, (2) a study on the impact of upstream mainstream storage on fisheries and soil fertility downstream, (3) a study on agricultural diversification, and (4) a sediment and erosion study.

The Pa Mong and Nam Theun 2 feasibility studies would screen the technical and economic feasibility of a range of project configurations. The Low Pa Mong study would include an assessment of the Upper Chiang Khan potential in relation to various full supply levels for Low Pa Mong. Both feasibility studies would be truly multipurpose and include consideration of downstream effects.

*Hierarchy of basin-wide studies and investigations*



The sediment and erosion study would assess future erosion and sedimentation parameters in relation to the design and life of the Mekong cascade and other large storage projects.

A study of the potential impact of upstream mainstream storage on fisheries and soil fertility downstream would provide an insight into the consequences of mainstream development and would indicate measures to be taken to mitigate or compensate negative consequences and their associated costs.

Lastly, and particularly in view of the limited scope for rice projects in Northeastern Thailand, an agricultural diversification study would explore courses of agricultural development other than the traditional concept of irrigating for a double rice crop. As farm practices change, they will probably affect future water resources development, so this study would also feed back into the land and water resources master plan.

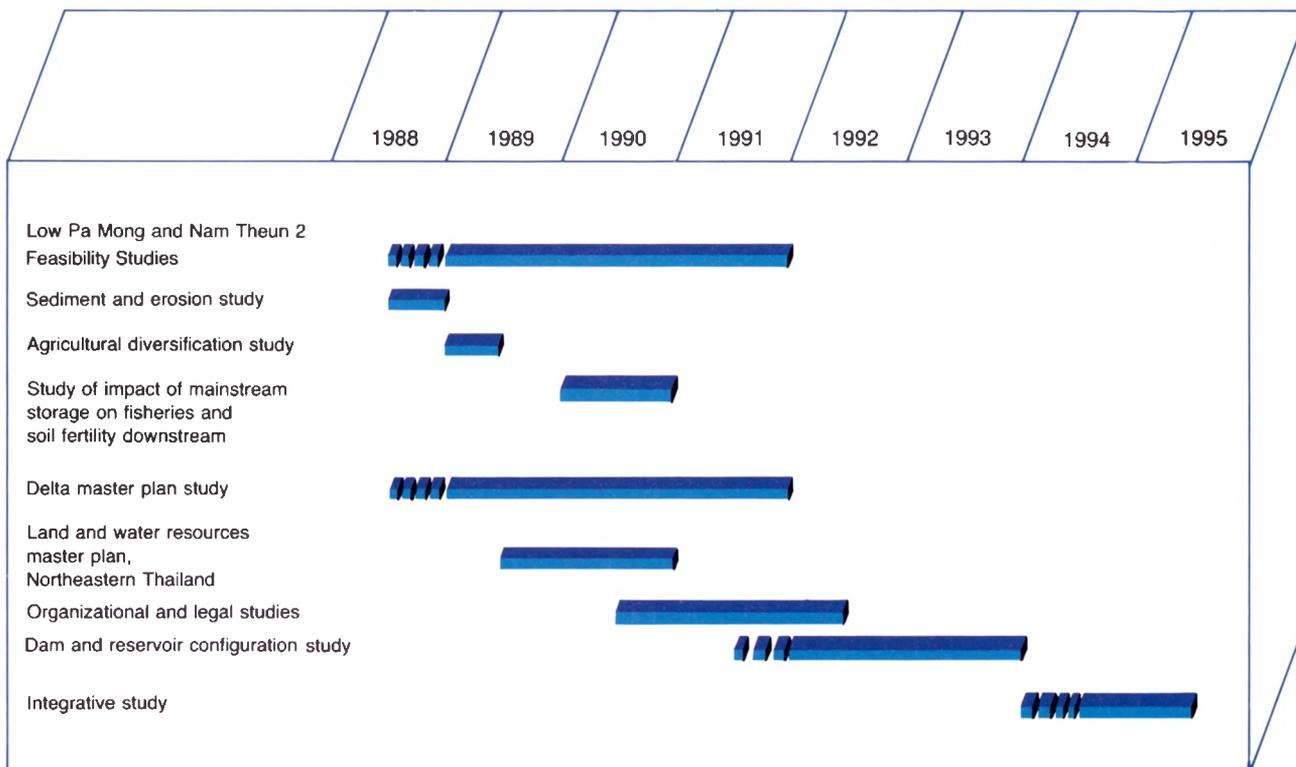
## Middle tier

The hierarchy's *middle tier* comprises (1) a dam and reservoir configuration study; (2) a land and water resources master plan for Northeastern Thailand; (3) a delta master plan study for Viet Nam; and (4) organizational and legal studies.

The first study would produce scheduled, optimal (multicriteria-based) river regulation configurations upstream of the delta. It would naturally consider all or most of the cascade, but it would also investigate the Tonle Sap barrage and the possible effects of some of the large-storage tributary projects. The study would draw upon and synthesize the information gathered in the lowest tier of studies and would thus present the supply side of the Mekong's water balance.

The delta master plan study would establish a framework for integrated agricultural development in the delta. An important aspect of the study would be the demand forecast for fresh water in the Vietnamese delta, i.e. part of the demand side of the Mekong's water balance.





*Tentative time schedule of basin-wide studies*

The land and water resources master plan for Northeastern Thailand would provide information as to the extent to which the drought-stricken and flood-ridden areas in this part of Thailand could make use of the resources potentially available, and the time frame related to such development. The study would also indicate and quantify the demand for mainstream water and the consequences of upstream resources development on mainstream and delta development.

Organizational and legal studies, finally, would then serve to link the supply and demand sides by allocating the river’s water resources, as well as costs and benefits, among countries and investigating feasible organizational models and agreements. They are of course necessary because of the complex international dimensions of the river’s development.

**Top tier**

The *top tier* in the hierarchy contains the integrative study, which would collate and synthesize the intelligence gathered in the two lower tiers. The study would be strongly analytical rather than aimed at producing a “plan” and would support decision making on the basin’s development within the context of different, yet shared, interests among the riparian countries. It would aim to formulate and analyse a number of possible basin-wide development scenarios. The hierarchy of studies, if begun in late 1988/early 1989, could be completed in 1995. Total budget requirements for basin-wide studies are estimated at US\$ 12.7 million, excluding the Low Pa Mong and Nam Theun 2 feasibility studies.

**Budget**

The study programme’s total budget requirement would be US\$ 57.2 million, of which US\$ 12.7 million for basin-wide studies (excluding Low Pa Mong and Nam Theun 2), US\$ 4.0 million for country studies, and US\$ 40.5 million for project-specific studies

# Institutional strengthening

The agencies most critically involved in bringing the investment plan and action programme to fruition are the National Mekong Committees and the Mekong Secretariat. Whatever the precise role to be played by these agencies, their work load is bound to increase sharply in the coming years.

It is evident that the National Mekong Committees need strengthening *(a)* to take an increasing role in carrying out the work within their own countries and *(b)* to strengthen the cooperation with the Secretariat. However, it is hard to assess at this stage of what nature and magnitude this should be. It is therefore advisable that an in-depth study be undertaken to review all operational procedures linking the National Mekong Committees and the Mekong Secretariat to one another and to actual development. The study would formulate proposals for the future and assess staffing and logistic requirements.

For the Mekong Secretariat the following additional operations are likely to become important:

- formulation of terms of reference for a large range of studies
- screening incoming consultants' proposals
- critical monitoring of consultants' studies
- project portfolio management, including annual "rolling over" of the investment plan
- regular evaluation of progress and reformulation of the long-term plan.

The additional annual budget needs are estimated at US\$ 300,000-600,000, depending on origin of recruitment and the degree to which replacement may be possible. Hence, approximately US\$ 6 million for 1988-2000. A further total budget for the plan period of the order of US\$ 500,000 is proposed to cater for the preparation of terms of reference for the more complicated studies.



# Investment plan and total funding requirements

The complex international dimensions of Low Pa Mong and Nam Theun 2 make it impossible at this stage to schedule construction costs. Low Pa Mong would take 11 years to build at an estimated total investment of 1987 US\$ 2,066 million; Nam Theun 2 five years at US\$ 615 million.

The consolidated financial consequences of the proposals herein are shown in the table. Included under "Other Secretariat activities" is an allowance for Secretariat activities not included in this plan. These include fisheries, navigation and environment programmes and projects, the collection and validation of hydrological data, flood and low flow forecasting, and other research or project-related activities. These activities are estimated to require US\$ 5.0-6.0 million annually, hence approximately US\$ 75 million for 1988-2000.

## Consolidated financial budget of the plan, 1988-2000 (1987 US\$ million)

	<i>Lao PDR</i>	<i>Thailand</i>	<i>Viet Nam</i>	<i>Basin-wide</i>	<i>Total</i>
Investment, national projects <sup>1</sup>	40.7	318.9	961.3	n.a.	1,320.9
Investment, international projects <sup>2</sup>	n.a.	n.a.	n.a.	2,681.0	2,681.0
Project-related studies and investigations					
(a) National projects	3.7	15.8	6.6	n.a.	26.1
(b) International projects	n.a.	n.a.	n.a.	14.4 <sup>3</sup>	14.4
Country studies and investigations	1.1	1.0	1.9	n.a.	4.0
Hierarchy of basin-wide studies					
(a) Basic studies	n.a.	n.a.	n.a.	1.1	1.1
(b) Second-tier studies	n.a.	n.a.	n.a.	10.4	10.4
(c) Integrative study	n.a.	n.a.	n.a.	1.2	1.2
Reinforcement of Mekong Secretariat					
(a) Staff (total 1988-2000)	n.a.	n.a.	n.a.	6.0	6.0
(b) Various funds <sup>4</sup>	n.a.	n.a.	n.a.	0.5	0.5
Other Secretariat activities	n.a.	n.a.	n.a.	75.0	75.0
Total (excluding investment in international projects)	45.5	335.7	969.8	108.6	1,459.6
Total (including investment in international projects)	45.5	335.7	969.8	2,789.6	4,140.6

n.a.: not applicable

<sup>1</sup>Investment is restricted to period 1988-2000.

<sup>2</sup>Low Pa Mong and Nam Theun 2: investment is not restricted to period 1988-2000.

<sup>3</sup>Low Pa Mong and Nam Theun 2, including design.

<sup>4</sup>Excluding funds for mathematical models.



**Interim Committee for Coordination of  
Investigations of the Lower Mekong Basin  
May 1988**

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