EMERGING ENERGY SECURITY ISSUES

Report Series No. 3

Indochina Energy Outlook

Program on Resources: Energy and Minerals
East-West Center
Honolulu, Hawaii

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Executive Summary

- Indochina contains large energy resources of oil, gas, coal, and hydropower, and will become an important oil, gas, and electricity exporter in Southeast Asia over the next decade.

- The combination of substantial energy resources and economic reforms in Vietnam, Laos, and Cambodia are attracting major investments in the energy sector.

- Private investment in the energy sector is dominated by oil and gas exploration, but will expand rapidly to include gas pipelines, thermal power plants, a refinery in Vietnam, and hydroelectric developments in Laos.

- Electricity generating capacity in Indochina is projected to increase by about 400 percent in the next fifteen years to 15,000 -18,000 MW.

- Vietnam has an estimated eleven oil and gas discoveries that are likely to be developed as commercial fields. Vietnam is projected to almost triple crude oil production within seven years to nearly 500 thousand barrels per day (mid-range projection).

- Rapid growth in internal oil consumption will return Vietnam to a net importer in about fifteen years.

- The gas potential in Vietnam is larger than expected and will not only partially meet domestic energy needs, but may be exported by pipeline to Thailand and perhaps eventually to southern China.

- Vietnam is resolving its boundary disputes with Malaysia and Thailand. The boundary dispute with China is more intractable, but military conflict can be avoided.

- Vietnam is the only country in Indochina with substantial coal reserves and significant production. Coal occurrences exist in both Cambodia and Laos, and further exploration could result in discovery of commercial deposits of modest size.

- Three oil and gas discoveries over the past year in offshore Cambodia suggest that a commercial development is likely within three years.

- Agreement on joint exploration and development of the highly gas-prone disputed area between Thailand and Cambodia is likely in the near future.

- The onshore oil and gas potential of Cambodia is untested, owing to less favorable prospects and safety risks. Selected areas have sufficient oil and gas potential to justify exploration.

- Laos is expected to rapidly expand hydroelectric developments to supply electricity to Thailand. The more than 20 memorandums of understanding for hydropower developments in Laos greatly exceed the number of commercial candidates for the 1990s.

- Laos has a substantial lignite deposit near its border with northern Thailand that is being evaluated for a possible mine-mouth power plant for electricity exports to Thailand. However, commercial development of the proposed lignite mine and the associated 600 MW lignite-fired power plant is not projected for the 1990s.

Economy

Basic economic indicators for the three countries of Indochina—Vietnam, Laos, and Cambodia—are outlined in Table 1. The GDP growth rates of all three countries averaged between 5 and 7 percent for the period between 1989 and 1994. Vietnam enjoyed the highest average GDP growth rate of the three countries at 7 percent. Laos was next with an average GDP growth rate of 6 percent followed by Cambodia's at 5 percent. The GDP growth rates in all three countries are expected to achieve a higher average over the 1995-2000 period.

Table 1. Basic Economic Indicators

	Cambodia	Laos	Vietnam
Land area (square kilometers)	113,013	147,109	204,739
Population (million people)	10.3	4.7	73.1
Literacy (percent 1992)	37.8	55	88.6
GDP per capita	$1,266	$2,071	$1,263
GDP growth rate (%)	4.9	8.0	8.8
Exports (US$ billion)	0.21 (1993)	0.15 (1993)	3.6
Imports (US$ billion)	0.4 (1993)	0.32 (1993)	4.5
Energy production (MTOE)	negligible	0.08	11.3
Energy consumption (MTOE)	0.2	0.14	7.2

Note: All data are for the year 1994 unless otherwise noted.

Vietnam

GDP in Vietnam is growing at 8-9 percent per year, and the growth rate might reach double digit levels in the late 1990s. Vietnam's present levels of investment and trade are small compared with most of the other high growth economies in the region. But, the combination of economic reforms, accelerating levels of foreign investment, and rapid

growth in exports make Vietnam a contender to eventually become another Asian tiger. Vietnam's relatively large and literate population of almost 75 million people is one of Asia's lowest cost manufacturing bases, and Vietnam will become a substantial new consumer market by 2000, as well as a substantial exporter of manufactured products.

In the energy sector, Vietnam actively encourages private investment in oil and gas exploration and production, the refining industry, thermal power plants, and to a lesser extent, in coal mining.

Cambodia

The GDP growth rate in Cambodia averaged 5 percent from 1989 to 1994. Cambodia is attempting to make the difficult transition to a market economy. Establishment of a strong, stable government will take a number of years, and investors will need to operate in an investment environment with periodic political instability. The recently passed foreign investment laws provide liberal terms to investors. Investors in the oil and gas sector bid for contract areas under production sharing agreements. The licenses held by the existing exploration companies reportedly contain liberal terms compared with those in Vietnam.

Laos

The GDP of Laos grew at an average of 6 percent from 1989 to 1994. Most of the 4.5 million population is involved in agricultural activities. The country's limited labor force and inland location hinder the development of major export-oriented manufacturing industries.

Laos moved aggressively in the early 1990s to enact favorable legislation to attract private foreign investments. It recently passed a low 20 percent income tax and still provides tax holidays for up to four years for desired projects. The government is

small and lacks sufficient expertise to manage many major projects simultaneously. These limitations could result in acute problems with hydropower developments. Memorandums of understanding have reportedly been signed with foreign investors for twenty hydroelectric projects (*Power in Asia*, 6 March 1995). Over the past two years there have been almost monthly reports of the signing of more memorandums of understanding for hydroelectric projects. Most of these projects are many years from commercial development, and many may not prove to be commercial. A critical issue is that the Lao government cannot effectively manage more than a few projects at once, and major delays are a near certainty for most of the projects being planned. There is considerable risk of inadequate attention to environmental factors associated with the many planned hydroelectric projects.

Resources, Reserves, and Projected Production

Oil and Gas

Figure 1 shows the distribution of prospective basins for oil and gas in Indochina. The most prospective areas are offshore Vietnam and Cambodia. Figure 1 shows the three producing fields in Indochina (Bach Ho, Rong, and Dai Hung), all of which are located offshore from southern Vietnam. On the basis of energy content, the oil and gas potential is estimated to be distributed as follows: Vietnam, 80 percent; Cambodia, 16 percent; and Laos, 4 percent.

VIETNAM

There is a range of estimates of the oil and gas potential of Vietnam, however exploration is still at a relatively early stage, and no accurate projections can be made at this time.

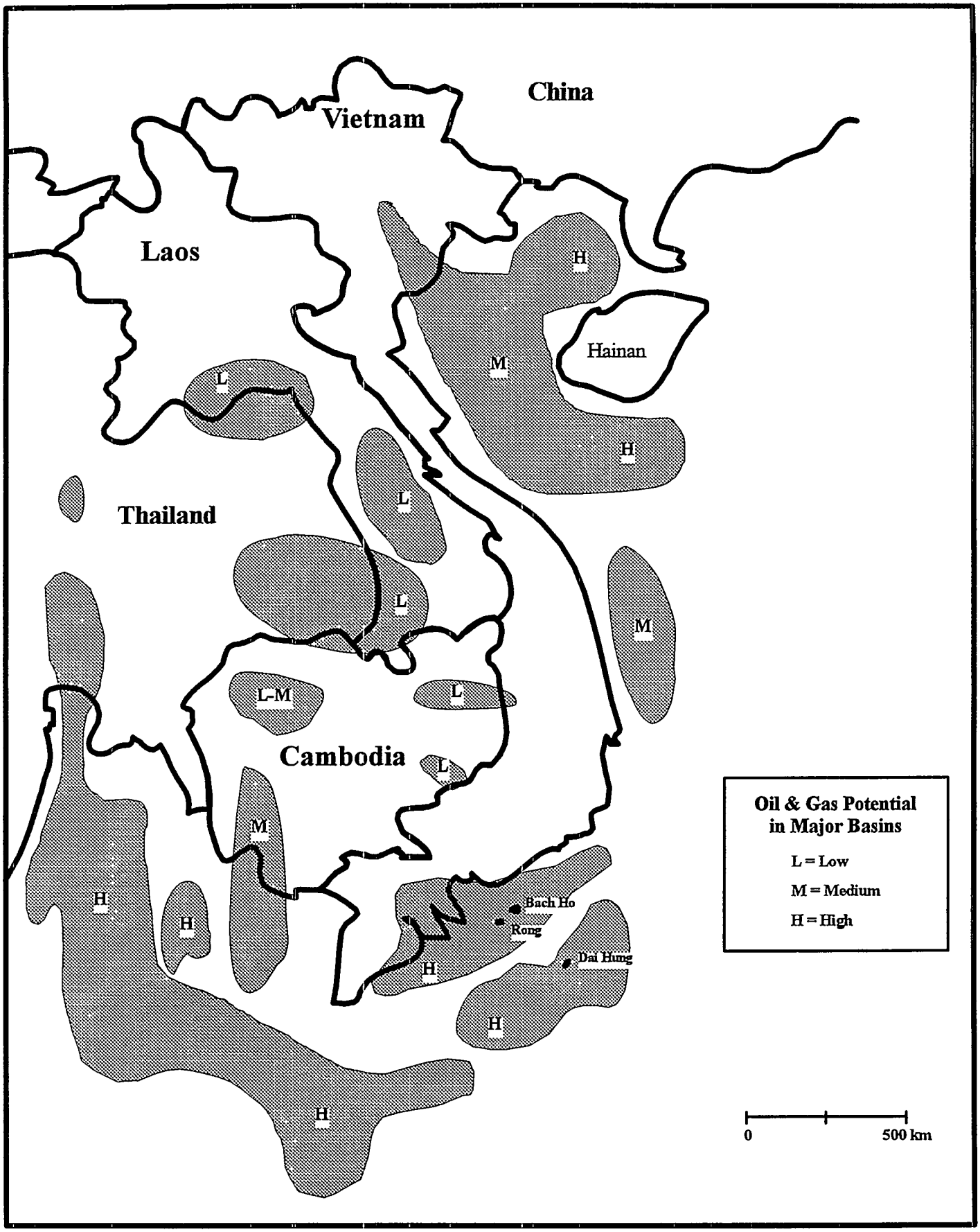


Figure 1. Distribution of Prospective Basins for Oil and Gas and Producing Oil Fields in Indochina

Note: The sizes and locations of basins and fields are approximate and have been generalized from a number of different sources.

Our estimate of proven reserves is 1.4 billion barrels (±10 percent), with total recoverable oil potential at from 1.7-3.5 billion barrels as shown in Figure 2. [1]

Figure 3 shows three production profiles for oil based on the three oil potential estimates in Figure 2. As shown in Figure 3, for the optimistic high production scenario (3.5 billion barrels), production is projected to peak in the 600-700 thousand barrels per day range around 2005. In the medium or best estimate scenario (reserves of 2.4 billion barrels), production peaks at 450-500 thousand barrels about 2002, and under the low production scenario (reserves of 1.7 billion barrels) production peaks at 250-300 thousand barrels about 2003. These production profiles assume that oil field discoveries in Vietnam follow typical oil field production profiles. The estimates in this report vary widely from PetroVietnam's projections, which forecast about 410 thousand barrels per day in 2000, over 600 thousand barrels per day in 2005, and over 800 thousand barrels per day in 2010.

Present petroleum consumption is only about 80-90 thousand barrels per day, but is growing rapidly. A plausible growth rate in consumption is 8-12 percent per year over the 1995-2010 period. As shown in Figure 3, under the assumption of an average growth rate of 10 percent per year, consumption will exceed production by about 2010, with a maximum delay of 5 years under optimistic primary and secondary production assumptions. The conclusion is that, even under the best possible conditions, Vietnam is likely to be a net oil exporter for only about fifteen years.

Natural gas reserves are estimated at around 4-8 trillion cubic feet (Tcf). The range in potential recoverable gas is estimated at 10-30 Tcf with a best estimate of 17.5 Tcf as shown in Figure 4.

[1] The recoverable oil and gas estimates used in this paper are defined as the amount of oil and gas that will be declared commercial within a decade. The state oil company, PetroVietnam, which reports directly to the prime minister, estimates the oil potential to be considerably higher than the figures used here, and PetroVietnam believes that production rates will continue to increase until 2010.

Figure 2. Vietnam's Oil Potential

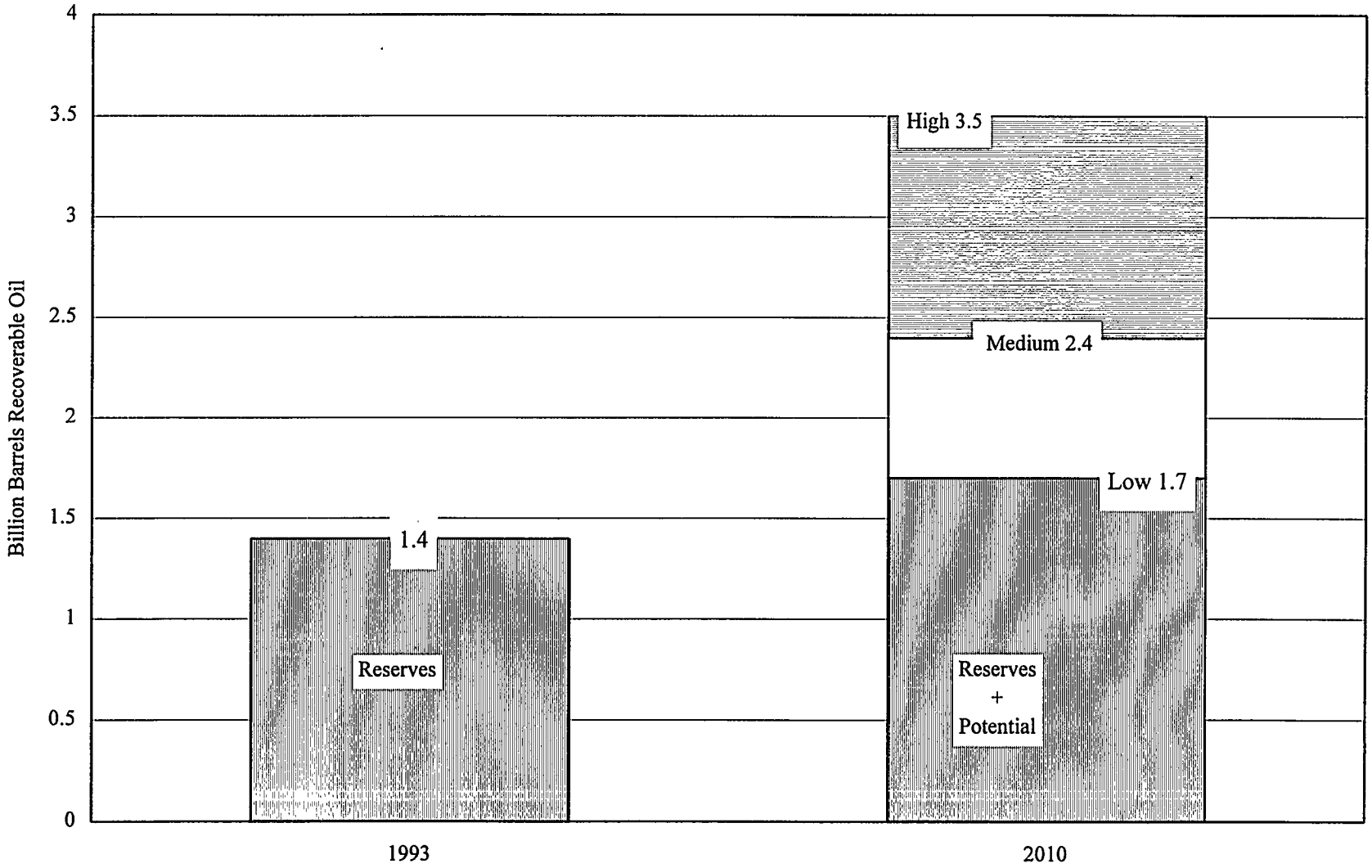


Figure 3. Projections of Oil Production and Consumption in Vietnam, 1993-2012

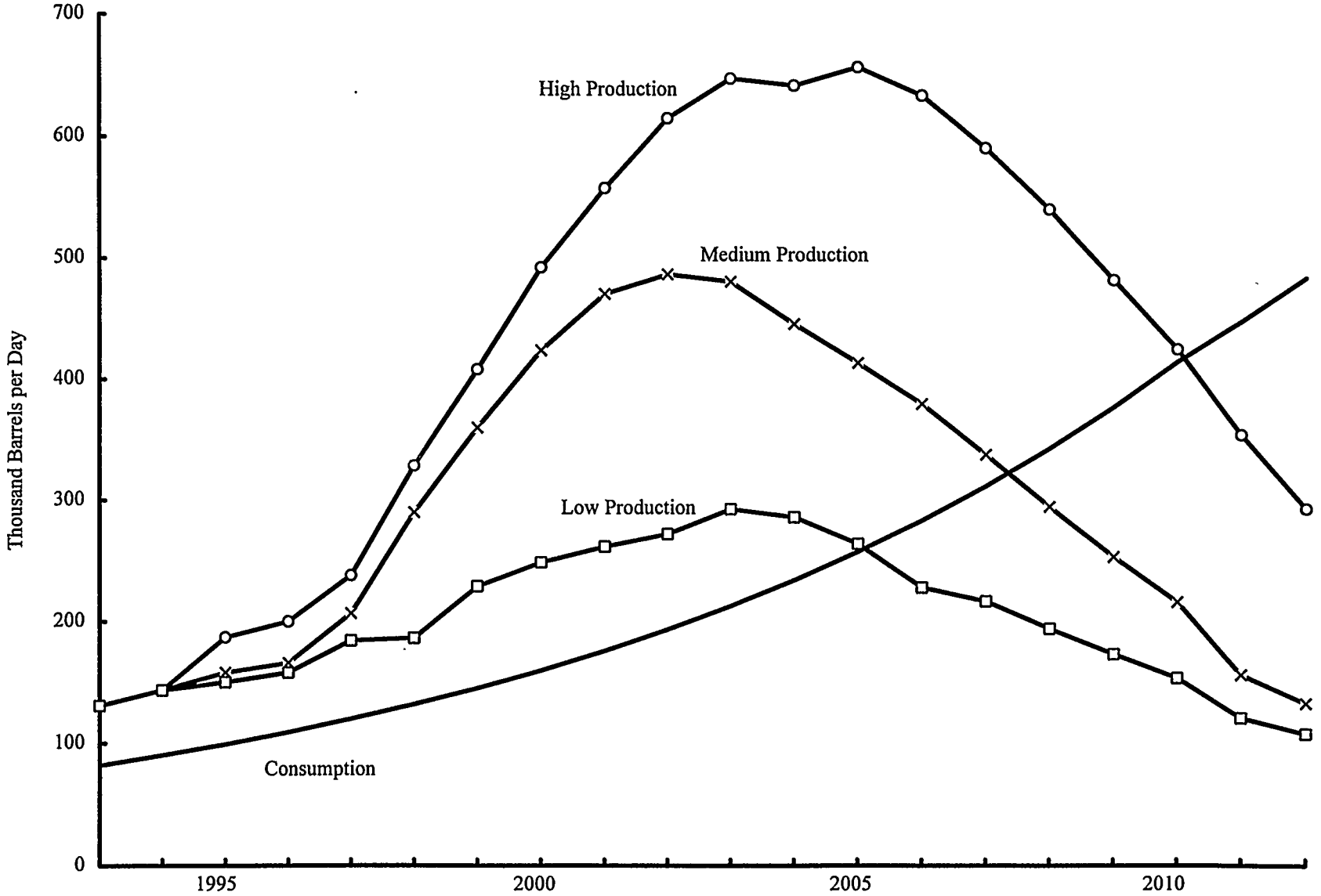
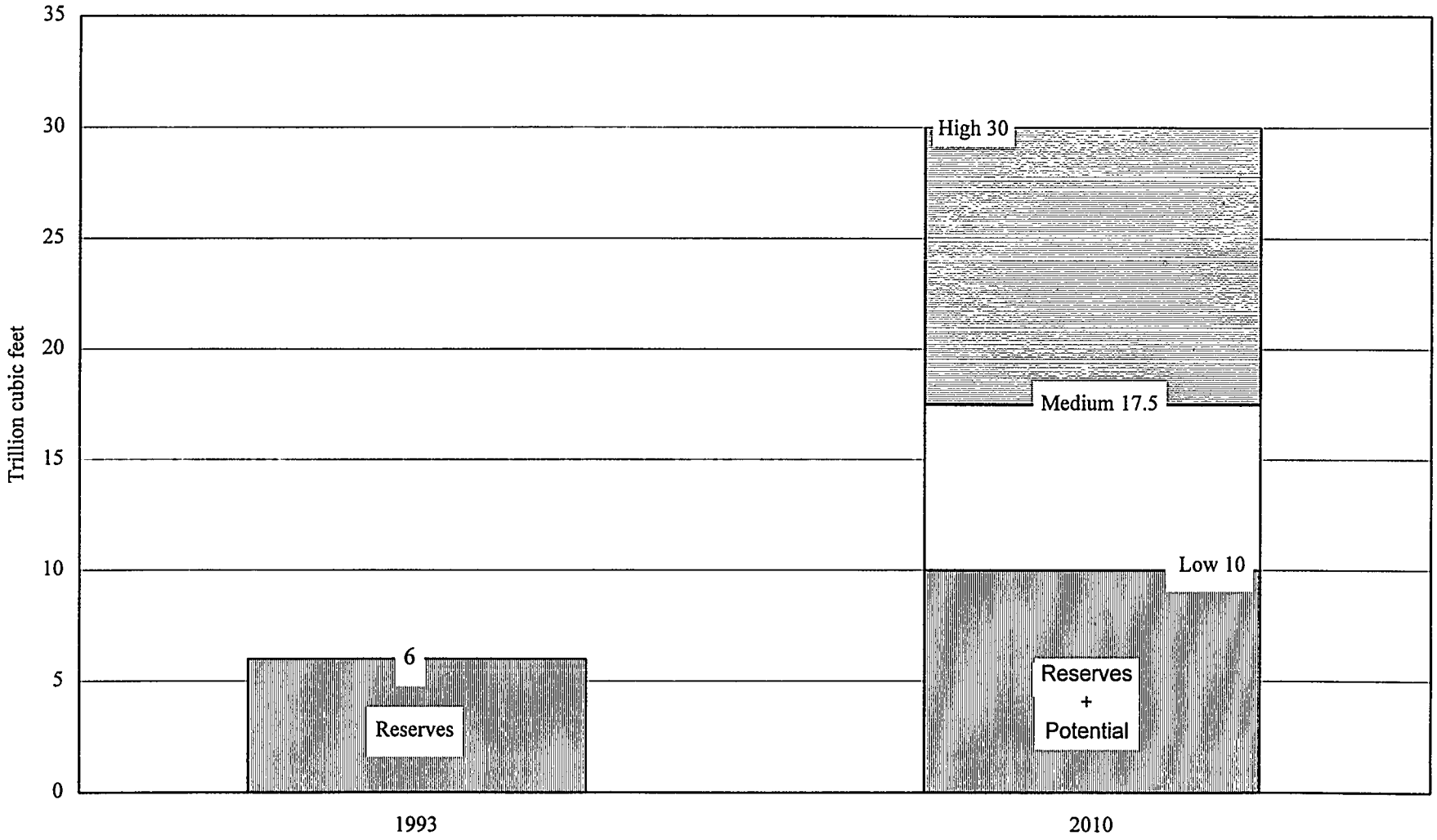


Figure 4. Vietnam's Gas Potential



Source: Projections by C. Johnson and Binsheng Li, February 1995.

The domestic gas market is in the early stages of development, and future consumption levels depend heavily on the timely implementation of an integrated gas development plan that makes sound commercial sense, and on assumptions about the future energy mix in the economy. Based on various scenarios of the energy mix for power plants, petrochemical facilities, and household use, a market requiring reserves of 5-10 Tcf is plausible over the next twenty years. The largest user of natural gas is likely to be the power sector, and electricity generation is projected to consume 50-70 percent of domestic gas supplies.

The gas potential is considerably larger than domestic market needs, and companies are examining possible export markets. The most promising export option is to pipe gas to the energy-short market in Thailand. Gas reserves of 4-5 Tcf are probably required before an 800 km or a 1,500 km pipeline to Thailand would be viable. The options are to construct an 800 km pipeline from Vietnam's Nam Con Son basin (in which the Dai Hung field is located), to connect with the existing Thai pipeline that extends out to the Bongkot field in the Gulf of Thailand. Alternatively, a 1,500 km pipeline could be constructed from the Nam Con Son basin to Bangkok.[2]

All countries surrounding Thailand are planning to export natural gas or electricity to Thailand, and there may be phasing problems, with more distant energy suppliers, such as Vietnam, being deferred until lower cost, closer energy supplies are committed.

The second export possibility is to pipe gas to energy-short southern China. This market might be particularly attractive if large gas deposits are discovered offshore northern Vietnam. The third possibility is to export gas as LNG to the growing LNG markets in Japan, Taiwan, and South Korea. Low cost reserves of at least 8-10 Tcf would need to be proven in the same area before this option would merit serious consideration.

[2] Preliminary estimates indicate that a pipeline would be a lower cost option for transporting the natural gas for distances up to at least 3,000 km and perhaps up to 5,000 km.

Pipeline options appear to have greater economic merit than LNG options, but strategic considerations of some Asian governments might enhance the prospects for LNG.

Active exploration for petroleum began in the early 1970s. Bach Ho, Vietnam's largest known oil and gas field, was discovered by Mobil in 1975. Mobil was drilling over the Dai Hung oil and gas structure when it terminated operations in Vietnam at the end of the Vietnam War. The Dai Hung oil and gas field was discovered in 1984 by Vietsovpetro, a joint venture between the governments of Vietnam and Russia. In 1985, the Rong field was discovered by Vietsovpetro, and in 1988, after further drilling, the Bach Ho field was reported as a major discovery by Vietsovpetro.

Figure 1 shows the location of the Bach Ho, Rong, and Dai Hung producing fields, and Figure 5 shows the approximate location of the exploration blocks in Indochina.

In 1987, the Vietnamese government announced its open door policies for foreign investment, and passed the Law on Foreign Investment. Since then the state oil company, PetroVietnam, has signed twenty-nine production sharing agreements (PSCs) with twenty-two oil companies. Under open door policies there have been about 100 wells drilled (1988 to early-1995), resulting in 11 oil and gas discoveries that are commercial or are likely to be declared commercial. Excluding the three pre-1988 commercial discoveries, there have been eight commercial discoveries for a drilling to discovery ratio of about 14:1. Recent drilling success ratios in the Mekong and Nam Con Son basins have been much higher.

Table 2 shows our assessment of the status of oil and gas exploration in Vietnam. Table 2 shows the 11 oil and gas discoveries that are expected to be proven commercial in the next two years. There is limited solid information upon which the commercial status of discoveries can be made, and the assessments in Table 2 could prove to be too optimistic. Table 2 also provides an update of who holds the blocks as of March 1995.

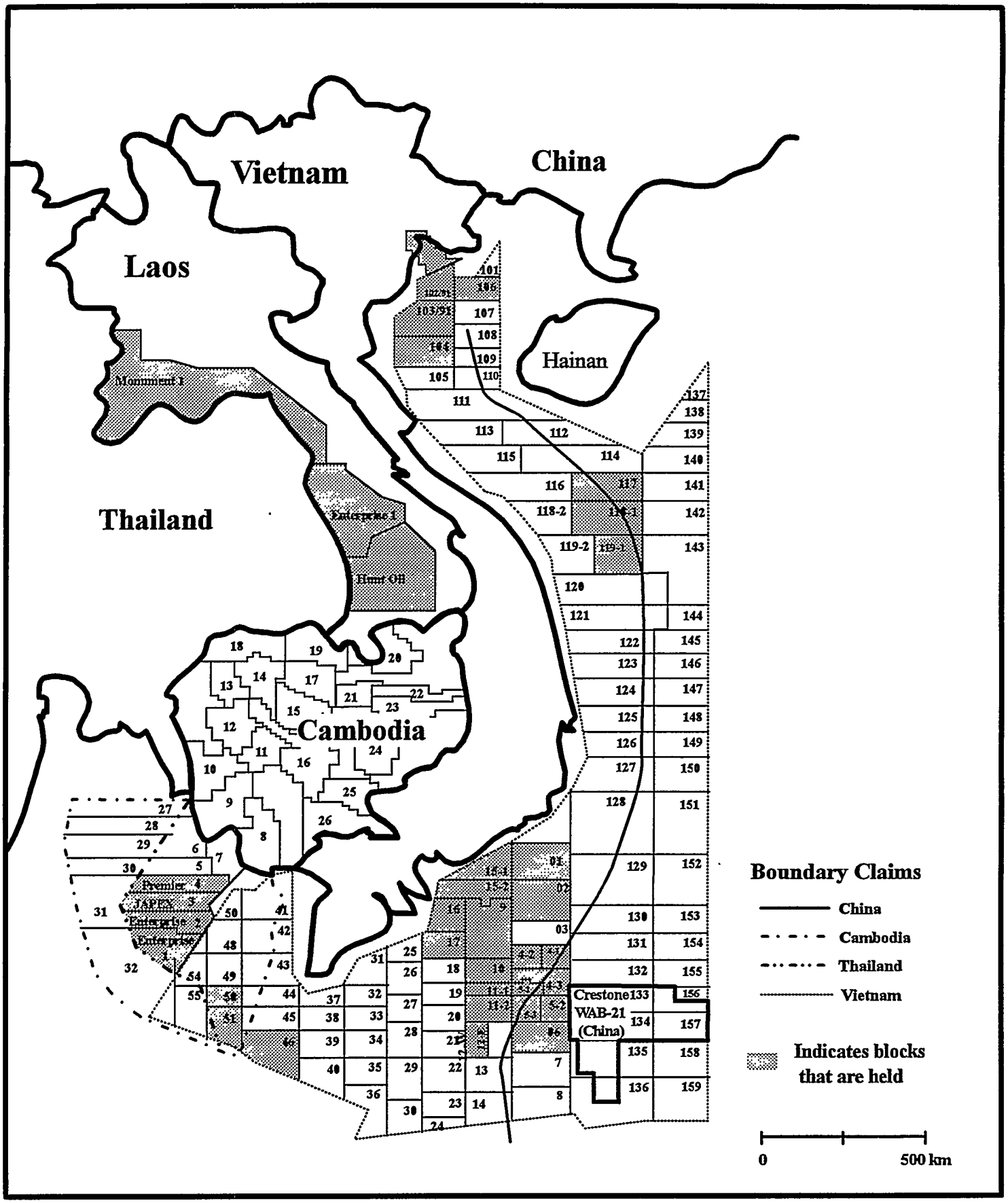


Figure 5. Exploration Blocks in Indochina

Note: Blocks are not drawn to exact scale. The international boundary claims are approximate and may not reflect official versions.

Table 2. Status of Oil and Gas Exploration in Vietnam

Block	Name of Field or Structure	Company/Consortium	Reported Discoveries[1]		Probable Commercial Reserves[2]	
			Oil	Gas/Condensate	Oil	Gas
01	Ruby	Petronas Carigali	*	*	M	S
02	Jade	Petronas Carigali	*			
03		PetroCanada, Husky Oil Int., Kufpec (relinquished)				
04-1		British Gas, ARCO		minor		
04-2	Flying Horse	Lasmo, CIECO Con Son Inc., Union Texas Asia Corp.		*		
04-3		Occidental, APN Petrol		*		
5-1A	Dai Hung (P)	BHP, Petronas Carigali, PetroVietnam, Total, Sumitomo	*	*	L	M
05-1B	Blue Dragon	Mobil, Japan Petroleum Expoloration, Indonesia Petroleum, Japan National Oil Co., Zarubezhneft, PetroVietnam, Nissho Iwai				
05-2	Kim Cuong Tay, Bac	BP, Statoil	*	*	M	M
05-3	Moc Tinh	AEDC, Teikoku, Mobil, BP, Statoil	*	*		M
06-1	Lan Tay & Lan Do	BP, Statoil, ONGC	minor	*		L
06-2	Dua	BP (reliquished)				
09	Bach Ho (P)	Vietsovpetro, PetroVietnam	*	*	L	L
09/16	Rong (P)	Vietsovpetro	*	*	M	M
09/16	(Rong-14)	Vietsovpetro	*	*	M-L	M-L
10		Shell, Total				
11-1		Total, Shell, Marubeni, NorskHydro,OPIC	*	*	S-M	S-M
11-2	Rong Bay (Doi)	Pedco, Shell	*	*	M	M
12-E		BP, Statoil, ONGC (relinquished)				
12-W		Canadian Occidental				
15-1		Bidding Underway; attractive block				
15-2	Rang Dong	Mitsubishi, Japan National Oil Co.	*	*	L	M
17		Enterprise, Cairn Energy plc	*			
20		PetroCanada, Husky Oil Int., Kufpec (relinquished)				
21		Enterprise, CEP (relinquished)				
22		Kerr-McGee Corp., Cairn Energy plc, Secab Ltd. (relinquished)				
46		FINA, Sodec, Japex, Norsk Hydro				
50		FINA, Sodec, Japex, Norsk Hydro		minor		
51		FINA, Sodec, Japex, Norsk Hydro		minor		

Table 2 (continued)

Block	Name of Field/ Structure	Company/Consortium	Reported Discoveries[1]		Probable Commercial Reserves	
			Oil	Gas/Condensate	Oil	Gas
102/91		Idemitsu				
103		Total (relinquished)				
104		OMV				
106		Total, Lasmo, Repsol (relinquished)		minor		
111		Sceptre (relinquished)				
112		Shell, FINA (relinquished)	discovery			
114		Shell, FINA (relinquished)	minor			
115		IPL, Clyde, Secab (relinquished)		c		
116		Shell, FINA (relinquished)	minor			
118	Bach Tuoc	BP, Statoil				
118	Ca Voi Xanh	BP, Statoil		c		
119	Ca Heo	BP, Statoil		c		
120		BHP, Itochu (relinquished)				
121		BHP, Itochu (relinquished)				
On Shore		Anzoil				

[1]There are numerous gas and oil shows that are not reported.

[2]These estimates of probable reserves include reserves that have been proven and those that are in the process of being evaluated.

* = discovery; P = producing; c = reportedly large discovery, but very high CO_2 content.

	Oil	Gas
S	< 25 MMbbl	< 0.25 Tcf
M	25-150 MMbbl	0.25-1.0 Tcf
L	> 150 MMbbl	> 1.0 Tcf

Source: Compiled by C. Johnson and Amy J. Lamke, East-West Center, 1995; projections are by C. Johnson.

Since the early 1990s, various consortiums of oil companies have indicated an interest in building and operating a refinery in Vietnam. At present, the consortium of Total, China Petroleum Corporation, and CIDC of Taiwan appears to be the leading contender for the first refinery in Vietnam. It will complete a feasibility study of a 130,000 barrel per day refinery in 1995.

International oil companies have suggested locating a refinery at Long Son Island near Vung Tau in the south or Van Phong in south-central Vietnam. However, the Vietnamese government has recently designated Quang Ngai in central Vietnam as the site of the first refinery. The government selected this site in order to establish a new hub of economic development, away from the high growth Ho Chi Minh City and Hanoi areas. The costs of developing a refinery at the remote Quang Ngai location are expected to be higher, and the viability of the project is questioned by international oil companies. The completion of a 130,000 barrel per day refinery at the remote Quang Ngai site is unlikely before 2000. A second refinery located in the north has been discussed, but is likely to take years of negotiations, and it will not come into commercial operation until well after 2000.

Vietnam's boundary disputes with neighboring countries are being peacefully resolved, with the possible exception of the dispute with China. China presently claims much of the South China Sea, including areas on the edge of Vietnam's continental shelf that are known to contain gas fields (See Figure 5).

In 1992, China issued an exploration license to a tiny oil company, Crestone, on the edge of the Vietnam's continental shelf. Vietnam has issued exploration licenses to BP and a Mobil-led consortium that overlap with the Chinese claim. The future course of this dispute is not fully predictable, however most governments in the region hope that a physical conflict can be averted. But, early resolution of the boundary dispute with China in Vietnam's southern offshore areas is unlikely. Discussions with senior Vietnamese officials lead to the conclusion that the disputed area with China off of south Vietnam is not open for discussion pertaining to shared oil and gas developments. However, there is

flexibility to discuss shared arrangements for areas away from the continental shelf around the Spratly Islands.

With respect to the Vietnam and China disagreement over the gas deposits on the edge of Vietnam's continental shelf, the possibility of developing a portion of these resources for pipeline export to southern China might reduce tension between the two countries. With this scenario, the issue of ownership is placed in the background, but China obtains long term gas supplies (at fair market prices) from these deposits.

CAMBODIA

Portions of the offshore area of Cambodia have high potential for commercial oil and gas as shown in Figure 1. Oil and gas exploration in the early 1970s resulted in no commercial discoveries. After a decade and a half hiatus, active exploration of the offshore area began with the award of six offshore blocks to foreign companies in 1991. In 1994, discoveries were reported in three offshore blocks—a Japanese consortium (Campex) in block 3, Premier Consolidated in block 4, and Enterprise Oil in block 2. It is probable that at least one commercial field exists in these three blocks.

The disputed area between Cambodia and Thailand (blocks 27-32 in Figure 5), contains a highly prospective basin for natural gas and perhaps oil. Since the early 1990s, agreement has been expected between the Thai and Cambodian governments on joint exploration and development of this disputed area. However, an agreement is now expected to be reached during the second half of the 1990s.

The combination of less potential for oil and gas in the onshore areas, risks from unexploded mines, and other security risks to personnel explain the limited past interest in onshore exploration. A moderately stable government and offshore exploration successes are bringing more attention to Cambodia, and onshore exploration is expected to proceed during the second half of the 1990s.

Total petroleum product demand in Cambodia is about 3 million barrels per year but is expected to grow rapidly over the next decade.

LAOS

The three large onshore exploration blocks shown in Figure 5, cover the main prospective basins in Laos. Three companies hold these blocks under PSCs, which have liberal fiscal terms. Exploration in Laos is lagging behind Vietnam and Cambodia, even though the first license with Hunt Oil was signed in 1989. As of early 1995, no drilling had been carried out. The slow rate of exploration is attributable to a number of factors, including the high costs of exploring in areas containing large numbers of unexploded bombs from the Vietnam War, and a downgrading of the oil and gas potential resulting from unfavorable drilling results on the Thai side of the basins. With three companies holding all of the best exploration areas under liberal exploration terms, there is less competition than in the surrounding countries of Vietnam, Thailand, and Cambodia, and consequently less pressure on companies to drill.

The oil and gas potential is highly speculative at present, but preliminary assessments indicate that less favorable conditions exist for large oil and gas reservoirs than in Vietnam and Cambodia. The expectation is for relatively small oil and gas fields, and high development costs.

Coal Resources

Figure 6 shows the distribution of the major reported deposits of anthracite and lignite quality coal in Indochina. The distribution of coal resources (excluding lignite) in the three countries is estimated as follows: Vietnam, 92 percent; Laos, 5 percent; and Cambodia, 3 percent. Lignite resources under the Red River Delta in Vietnam are very large but not considered economic. Laos has the only lignite deposits that may be developed on a large scale within a decade.

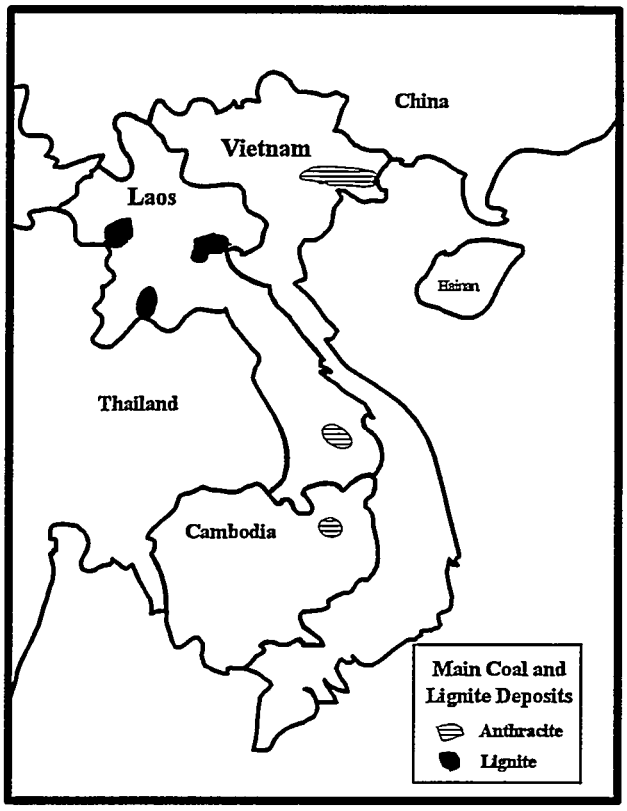


Figure 6. Main Anthracite and Lignite Quality Coal Deposits in Indochina

VIETNAM

Vietnam has about 6-7 billion tons of coal resources, mostly located in Quang Ninh Province, east of Hanoi as seen in Figure 6. Reserves, meeting the western definition of reserves, are speculative but probably less than 1.0 billion tons. Most of the coal is classified as anthracite quality and is not suitable coal for import-dependent Asian power plants. This coal is used primarily in the metallurgical industry and home heating markets. Annual production is 5-5.5 million tons, and there are plans to expand production to 10 million tons by 2000.

Vietnam's newly formed coal conglomerate, Vinacoal, optimistically projects that coal exports will double in 1995 to 2.5 million tons. This implies that production will increase to 6.0-6.5 million tons. However, the coal industry is plagued by poor management as well as inadequate mining, transport, and port infrastructure. Government subsidies to the coal industry currently equal about $4-5 per ton of coal produced and are projected to increase. The long term export potential is heavily dependent on a more fundamental restructuring of the industry to establish a non-state-controlled coal sector that can attract major foreign investors.

CAMBODIA

There are numerous indications of anthracite-quality coal in Cambodia. The largest reported deposit contains less than 10 million tons at the Ban Talat deposit shown in Figure 6. Coal exploration has been limited in the past. A reassessment of the coal potential of Cambodia appears warranted, and may reveal a wider range of coal qualities.

LAOS

Laos appears to have substantial lignite resources in the north and anthracite deposits in the south as shown in Figure 6. The economics of these deposits have yet to be proven, and comments on large scale commercial developments appear premature.

There are reports of plans to build a $1.0 billion lignite mine and power plant complex in northern Laos. The economics of this project have not been demonstrated, and the environmental consequences of the project have yet to be fully evaluated. The conclusion is that the proposed 600 MW lignite-fired plant is unlikely to be developed in the 1990s, even though there are some reports indicating commercial production by 2000 (*Power in Asia*, 23 January 1995).

Hydropower Resources

Figure 7 shows the distribution of hydropower resources in Indochina. Laos appears to have about half of the region's hydropower potential, with the remaining half split approximately equally between Vietnam and Cambodia. The World Bank (1993) lists about 8,000 MW of potential commercial hydropower projects in Vietnam. The Lao government estimates the hydropower potential of the country at 18,000 MW, and Cambodia reportedly has about 8,000 MW. None of these estimates are based on extensive feasibility studies, and therefore they should be used with caution.

Vietnam has developed about 2,600 MW. Laos has developed 200 MW, and the generation from 50 percent of this capacity is exported to Thailand. Cambodia has no significant hydropower developments. Major hydropower projects are planned or being discussed in all three countries.

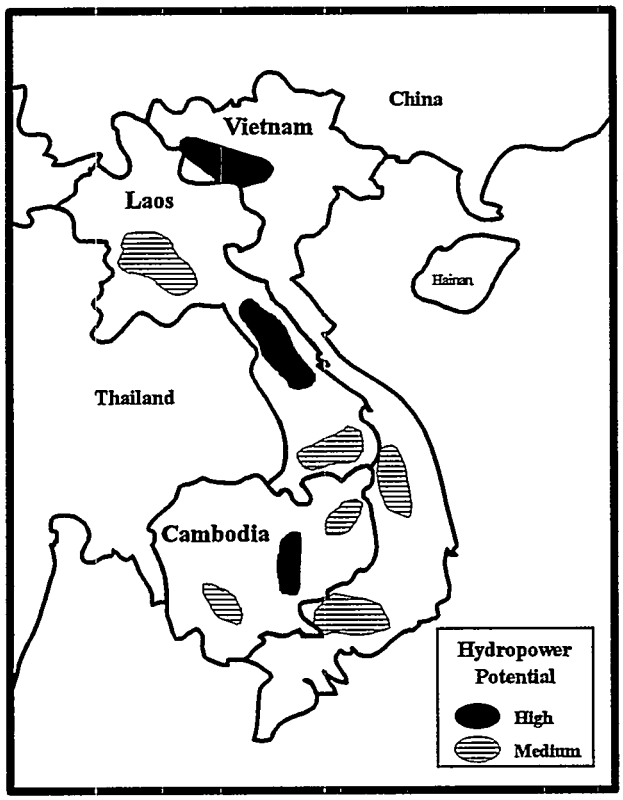


Figure 7. Distribution of the Main Hydropower Resources in Indochina

VIETNAM

Hydropower is the dominant source of electricity generation in Vietnam. The distribution of Vietnam's hydropower resources is shown in Figure 7, with more than two-thirds of the potential in the north. Approximately 2,600 MW of hydroelectricity is operating, with 800 MW under construction, and about 6,000 MW at various stages of planning, for a total potential of 9,000 to 10,000 MW. The largest operating plant is the 1,920 MW Hoa Binh project, completed in early 1994.

The weighted average capital cost of planned capacity is $1,100 per kW (World Bank, 1993). Given the recent large discoveries of gas in southern Vietnam, and the relatively high costs and long lead times for hydropower projects, it is likely that gas will become the major fuel for electricity generation in southern Vietnam over the next decade. Consequently, Vietnam's ambitious plans for expanding hydropower generation are expected to be scaled back.

CAMBODIA

Figure 7 shows the main hydropower sites in Cambodia. There are various estimates of the hydropower potential, with a recent estimate of about 8,000 MW by the Mekong Secretariat. Until recently there were no plans for large-scale hydropower development in Cambodia. Thailand recently proposed to Cambodia a 470 MW project that would divert water from Cambodia to a power plant on the Thai side of the border. The water would come from the Strung Nam, which is not a tributary of the Mekong. Therefore, the project would not fall under the jurisdiction of the Mekong River Commission and would not be complicated by the unresolved Mekong River water-rights problem.

LAOS

Laos reportedly has over 18,000 MW of hydropower potential; however, a much smaller potential is likely to meet commercial criteria. This distribution of major hydropower sites is shown in Figure 7. The governments of Thailand and Laos signed a memorandum of understanding in 1993 to develop 1,500 MW of hydropower capacity by 2000, primarily to export electricity to Thailand.

Table 3 lists some of the more important power projects being considered in Laos. However, priorities among hydropower projects continue to change. The most advanced project appears to be the 210 MW Nam Theun-Hinboun project that will be completed about 1998. The present hydropower capacity of Laos is about 200 MW (150 MW at Nam Ngum), and the generation from about 100 MW of this capacity is exported to Thailand.

Electricity

Currently, the countries of Indochina do not have a large demand for electricity. The region's total capacity is about 4,300 MW. However, because Vietnam and Cambodia do not have adequate generating capacity, electricity shortages have occurred. Most of the electricity that Laos produces is exported to Thailand, and much of the additional capacity to be installed there will be exported as well.

Vietnam

Vietnam has about 4,000 MW of operational electricity generating capacity, of which about two-thirds is hydroelectric. The growth in electricity supplies during the previous decade averaged just under 10 percent per year, and substantial shortages occurred—particularly in the south.

Table 3. Partial List of Existing and Proposed Hydroelectric Projects in Laos

Plant Name	Capacity	Status
Nam Ngum 1	150 MW	operating
Se Set (also spelled Xe Set)	48 MW	operating
Selabam	5 MW	operating
Nam Theun Hinboun	210 MW	1997
Houai Ho	150 MW	1999
Nam Hai	800 MW	planned
Nam Nhiep 2	440 MW	planned
Nam Ngum 2	420 MW	planned
Nam Ngum 3	400 MW	planned
Se Kong 4	346 MW	planned
Xe Kamen	255 MW	planned
Nam Tha 1	220 MW	planned
Nam Theun 3	200 MW	planned
Nam Bak I and II	190 MW	planned
Nam Khan 2	145 MW	planned
Sepone	100 MW	planned
Nam Mang 3	30-50 MW	planned
Nam Theun 2	600 MW	n.a.
Nam Ngum 4	290 MW	n.a.
Nam Theun 1	210 MW	n.a.
Total	5200 MW	existing and planned

Note: n.a. means not available.

Electricity production is projected to grow at an average of 8-12 percent per year over the 1995-2010 period. Electricity prices vary from about US$0.045/kWh for small users to US$0.09/kWh for enterprises with foreign invevestment. The government has indicated that private power will play an important role in future power plant expansions, however, the scope of private power participation is yet to be defined.

Cambodia

Present capacity in the country is a tiny 70-80 MW of diesel generators. However, operational capacity is much less. Almost all of this capacity is in Phnom Penh. Recently, 18 MW was ordered for Phnom Penh to help alleviate the electricity shortage. Demand in Cambodia is reportedly much greater than the total available electricity supplies, and double digit growth in consumption is likely if supplies become available.

Laos

Laos's current capacity of 200 MW is all hydropower. Of this 200 MW, the generation from 50 percent is exported to Thailand.

Present demand for electricity is small, owing to the combination of a small population of about 4.5 million, a largely rural population, and an insignificant manufacturing base. The generation from nearly all of the planned capacity in Laos will be exported to Thailand and perhaps to other countries in the region.

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