

THE ROYAL THAI GOVERNMENT
NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT BOARD

UPPER CENTRAL REGION STUDY

SECTOR REPORT Vol. 7:
ENERGY



A TRI-SECTOR BALANCED REGION:
Emerging from the Metropolitan Shadow

FINAL REPORT NOVEMBER 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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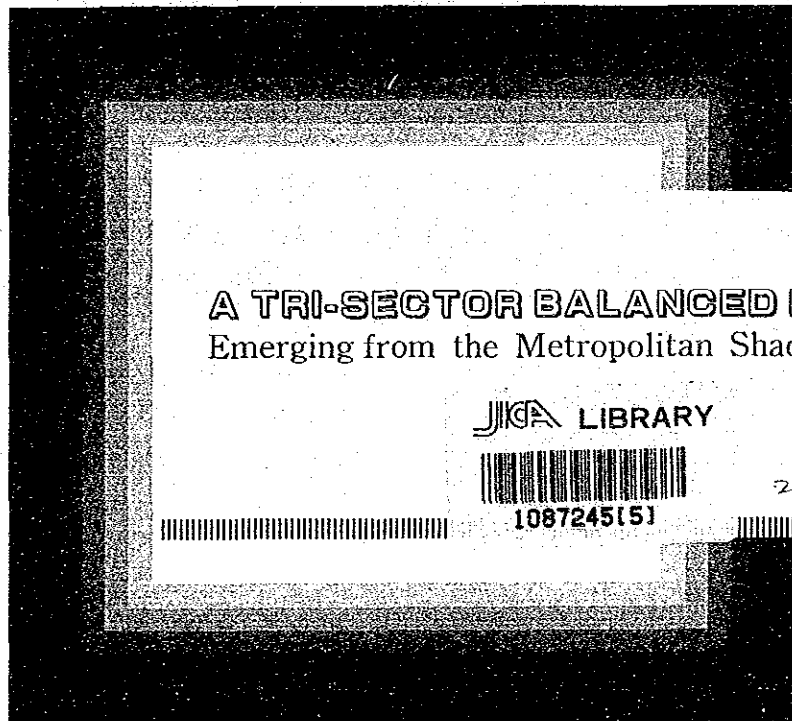
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PREFACE

In response to a request from the Government of the Kingdom of Thailand, the Japanese Government decided to conduct the Upper Central Region Study and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Thailand a study team headed by Mr. Jinichiro Yabuta, and composed of members from International Development Center of Japan and Pacific Consultants International Inc., from December 1988 to July 1990.

The team held discussions with concerned officials of the Government of the Kingdom of Thailand, and conducted field surveys. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of development in the said region and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Kingdom of Thailand for their close cooperation extended to the team.

November 1990



Kensuke Yanagiya

President

Japan International Cooperation Agency

ACKNOWLEDGEMENT

The impetus for this study was the intention of the Royal Thai Government to revitalize the Upper Central Region (UCR), which had been stagnant under the shadow of the growing Bangkok Metropolitan Region (BMR). The rationale was the need to adjust the agricultural-based economic and spatial structure of the UCR to the rapidly industrializing national economy, and thus to create the tri-sector balanced economy (agriculture, industry and services) in this region.

The main task of this study was to examine whether, and in what way, the UCR could respond to the national intent. The results of the study thus far are summarized in this report and suggest that the UCR will play an important role in the following aspects:

- Retaining the strategic agricultural and forestry space for food self-sufficiency and disaster control
- Decentralizing the BMR systematically for the economies of scale to be maintained
- Developing the agricultural-industrial linkages for high value resource utilization and diversified rural nonfarm employment opportunities

Under the proposed strategies above, the Study Team recommends the incorporation of four priority project packages, which include an Integrated Pasak River Basin Development, Agro-Industrial Linkage Development, the Greater Sara Buri Industrial Core (GSIC) Development, and Human Resource Development.

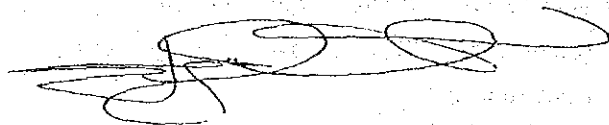
In order to be useful, these strategies need to be supported by continuous improvement in development administration. This effort for the UCR could accelerate an overall reform of regional development administration in Thailand, because the UCR is an early region which will address itself to the growing national need of balancing industry against

agriculture, development against environmental considerations, and urban development against rural development. Bearing this in mind, the Study Team recommends improvements in conventional development administration, with a focus on water resource management, environmental management, and urban management.

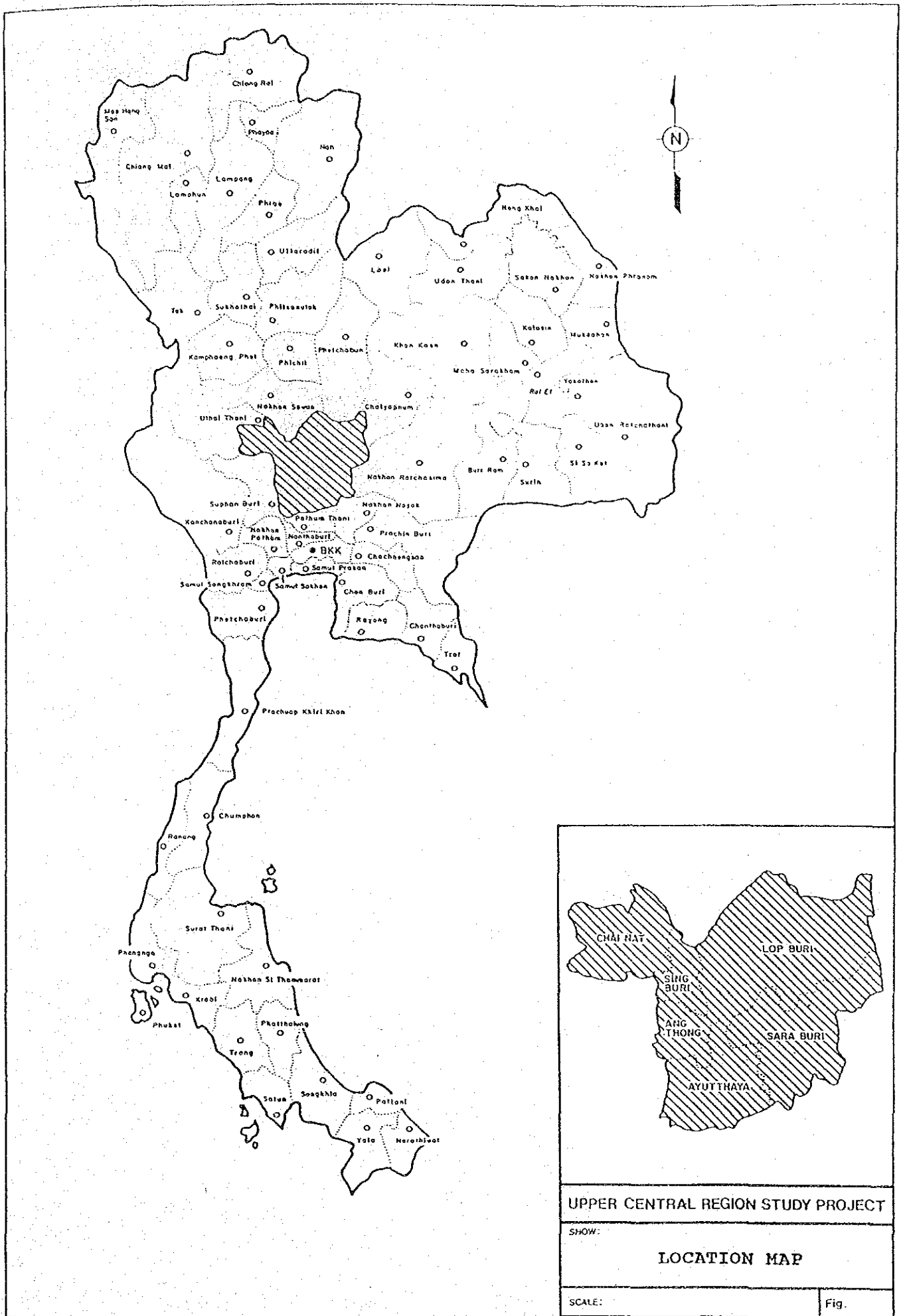
The Study Team acknowledges that its study has been guided by many past studies, such as the Bangkok Metropolitan Region Study by the National Economic and Social Development Board (NESDB), the Upper Central Region Planning Study by the Department of Town and Country Planning, the Road Development Study in the Central Region by the Japan International Cooperation Agency (JICA), and the Rural Industries and Employment in Thailand Study by The Thailand Development Research Institute. In preparing this report, the team was supported by the staff of the NESDB, other central ministries, and local authorities in the UCR throughout its stay in Thailand for nearly fourteen months. Equally important, the team benefited a great deal from cooperation extended by the officers in charge and the advisory committee members of the JICA and other concerned agencies of the Government of Japan. The team also wishes to recognize with gratitude the contributions of the participants in the National Seminar on the Upper Central Region Development: Policies and Programs, held on 28 and 29 July 1990 in Jomtien, Chonburi, to the wide-ranging discussions on the proposals contained in the draft final report of the Study Team.

We wish to add that we sincerely hope that this report will provide an important basis for planning and implementation in the Upper Central Region of Thailand.

November 20, 1990



Jinichiro Yabuta
Study Team Leader



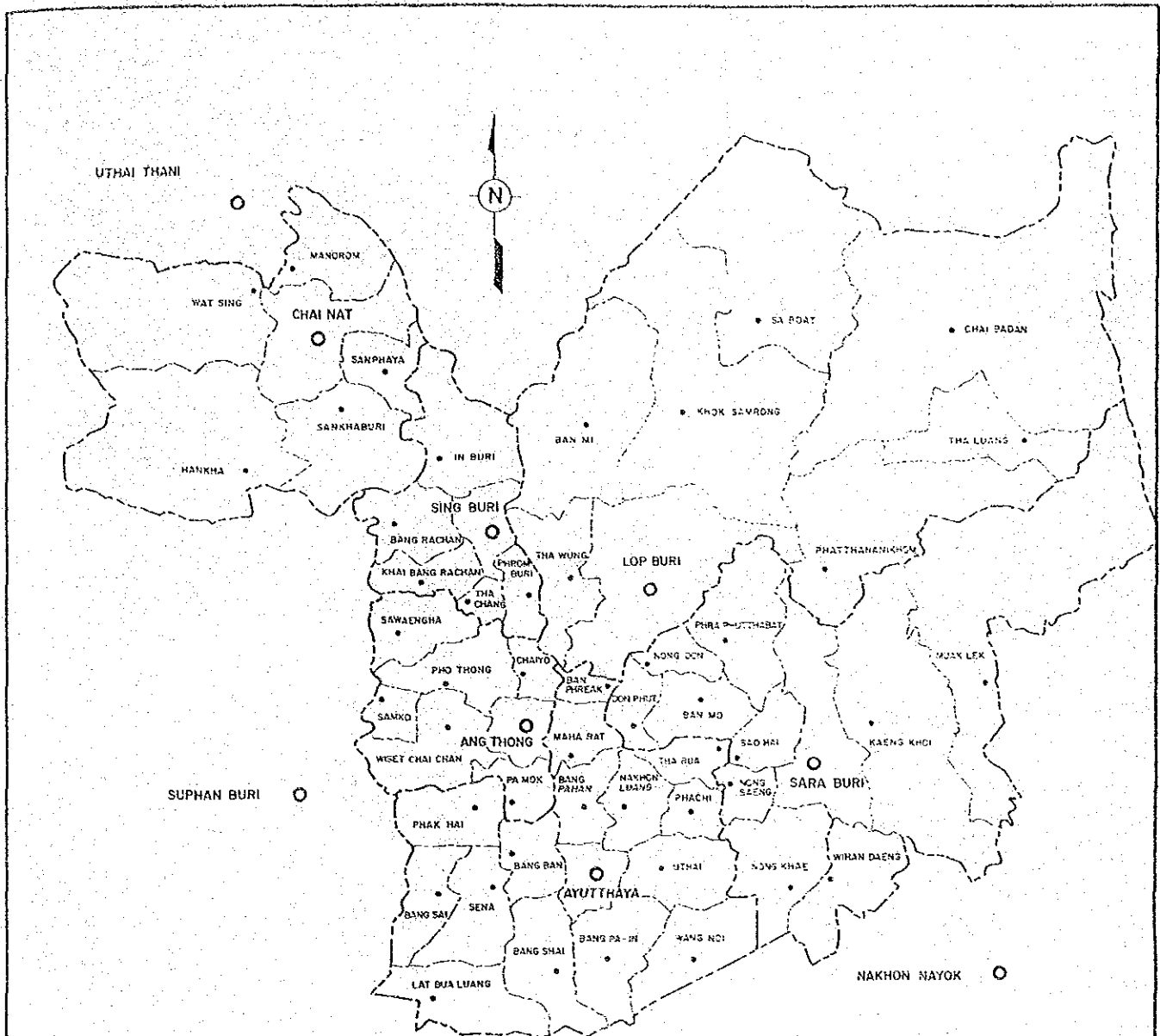
UPPER CENTRAL REGION STUDY PROJECT

SHOW:

LOCATION MAP

SCALE:

Fig.



- LEGEND:**
- CHANGWAT LOCATION
 - AMPHOE LOCATION
 - CHANGWAT BOUNDARY
 - AMPHOE BOUNDARY

UPPER CENTRAL REGION STUDY PROJECT	
SHOW:	
ADMINISTRATIVE BOUNDARY OF STUDY AREA	
SCALE:	Fig.

A Summary : Policies and Strategies

Upper Central Region Development

Why Upper Central Region (UCR)

Toward the year 2010, Thailand will have to get through the challenges of :

- (1) shifting export-led to domestic market-based growth,
- (2) balancing development and environment, and
- (3) smoothly transitioning rural to urban employment

In the national space, these challenges call particularly for :

- (1) decentralizing the capital region systematically, and
- (2) strengthening the linkages between ESB, SSB and other parts of the country, and
- (3) sustaining strategic agricultural and forestry space.

Under these national perspectives, it is the UCR that potentially plays a combined role of :

- (1) National Food Supply Center,
- (2) Subnational Distribution Center, and
- (3) A New Inland Industrial Base,

if this region can overcome :

- (1) the presently unstable rural sector,
- (2) the weak urban sector, and
- (3) consequent regional out-migration.

The UCR is at a crossroads between a tri-sector (agriculture, industry and services) balanced region or a mere transit region over-ridden by sporadic external industrial investments.

Development Policies & Strategies

Objectives of the UCR development are :

1. Maintaining and restoring the ecological environment,
2. Deepening and widening of regional economy, and
3. Enhancing regional human resource base to support the two objectives above.

Recommended policies and strategies are thus as follows:

Agriculture

1. Strengthen capability and willingness of rice farmers,
2. Rehabilitate upland agricultural environment, and
3. Promote linkages between production, processing and market

Industry

1. Build-up, step-by-step, an industrial development core at Sara Buri,
2. Intensify agro-industrial linkages within the UCR,
3. Foster local entrepreneurship of potential business men, and
4. Control rapidly dispersing industries in Ayutthaya.

Services

1. Develop secondary order centers
2. Develop extensive urban, technological and managerial supporting services at sub-regional urban centers,
3. Strengthen hierarchical system of agricultural distribution, processing and transport network, and
4. Promote tourism especially at Ayutthaya, Lop Buri and Chai Nat.

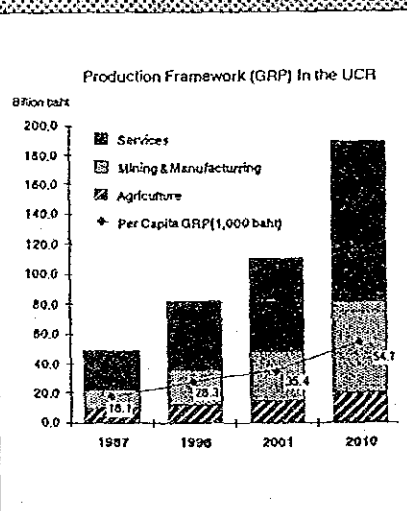
Development Target

Economic Growth: Toward 2010, it is targeted that per capita GPP growth of the UCR will be accelerated up to that of national average growth rate, 5% p.a. The GPP growth rate will be 6.1% p.a. toward 2010, and sector growth rates are: Agriculture : 1.3%; Manufacturing : 7.0%; and Services : 6.3%.

Population Growth: Population is targeted to growth at a rate of 1.0% so that the targeted per capita GPP will be attained. It will be 3.46 million in 2010, compared with 2.74 million in 1987.

Urbanization: Urban population will increase at a 2.5% growth rate, compared with 1.1% p.a. between 1981 and 1987. The urban population ratio will be 37.2% in 2010.

Employments: Additional 421 thousand job opportunities will newly be created, and a total will be 1.9 million in 2010. The employments in both manufacturing and service sectors shall increase by 588 thousand, while that in agriculture sector will decrease by 147 thousand.



Profile of Upper Central Region

The Upper Central Region (the UCR) consists of 6 Changwats: Ayutthaya, Sara Buri, Ang Thong, Sing Buri, Lop Buri and Chai Nat, having the population of about 2.7 million and the area of 16,6 thousand sq. km. The UCR is located in the Chao Phraya River Basin Area, an agricultural (particularly rice) advanced region in the Kingdom, and environmentally sensitive.

The UCR is on a frontage of the expanding Bangkok economy, and has been pressured by urbanization and industrialization. Thus, the UCR is a pioneer to the national challenge of agro-industrial coexistence by widening and deepening the UCR economy. For the second generation development of the Thai economy, the UCR's gateway function would be more significant.

Key Concepts for the Upper Central Region Development

Agricultural Diversification and Agro-Industrial Linkage

In order to stabilize income of the farmers, being the leading players in sustaining agricultural and ecological environment, a must is the agricultural diversification at the farmer level. With good access to the expanding and diversifying market in Bangkok, the agricultural diversification should be supported by the intensified linkages among crop production, livestock and processing networks as well as by the improved urban and transport infrastructures.

Industrialization for A New Industrial Base

The country will call in the UCR a strong magnet as (1) one of the centers to facilitate deconcentration of Bangkok, (2) a means to prevent extensive industrial pollution and agro-industrial conflicts, (3) a base to attain agro-processing agglomeration, and (4) an inland supporting base for the Eastern Sea-Board to maximize its spread effect.

Sara Buri offers the best seat of this magnet. Local infrastructure, urban and human resource development should be integrated in timely response to ongoing and forthcoming national projects.

Gateway as A Subnational Distribution Center

The UCR is situated at the gateway of Bangkok to the North and Northeast Regions. In other words, the UCR is in a best position to make use of development in other regions. In addition to traditional concentration of agricultural products, new transport and energy infrastructure inputs will boost various industrial and business opportunities.

Integrated Urbanization and Service Sector Encouragement

Urban and service sector encouragement is strategic to regional development especially in the UCR in order to (1) support externally dependent and thus unstable rural sector, (2) provide nonagricultural job opportunities for decelerating out-migration to Bangkok and (3) offset a missing link existing between foreign-investment-led industrial expansion and regional economic development.

Of particular importance are to meet Basic Urban Needs (BUNs), encourage local entrepreneurship and improve goods distribution functions in selected urban centers at regional level.

Human Resource Development

Focusing on (1) Middle level manpower for industries, (2) Community leaders for environmental management and (3) potential local entrepreneurs.

Environment and Water Resources Management

Special importance lies in (1) keeping the Chao Phraya River clean and conserving flood retarding areas for the survival of Bangkok and (2) maximizing water use efficiency and rehabilitating upland soils for the UCR's agriculture of national importance to be maintained. High priority should be given to (1) the integrated management of water and land use for two river basins of Chao Phraya and the Pasak and (2) the strengthened institutions at not only central but local levels to explore environmental control.

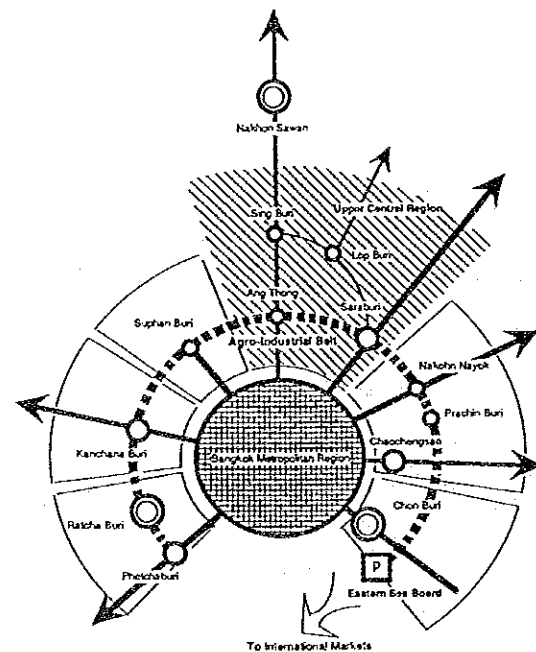
Implementation & Development Management Systems

Unlike the regional development triggered by intensive central government investments, the UCR development will need not only central initiative but effective management particularly at the local level. Of particular importance are (1) local planning system to meet the cross-boundary expansion of urban and industrial activities, (2) institutional measures to realize the scale of economy in urban services and (3) strengthened financial base of local authorities so as to encourage local initiatives in public investments and business promotion.

Spatial Setting

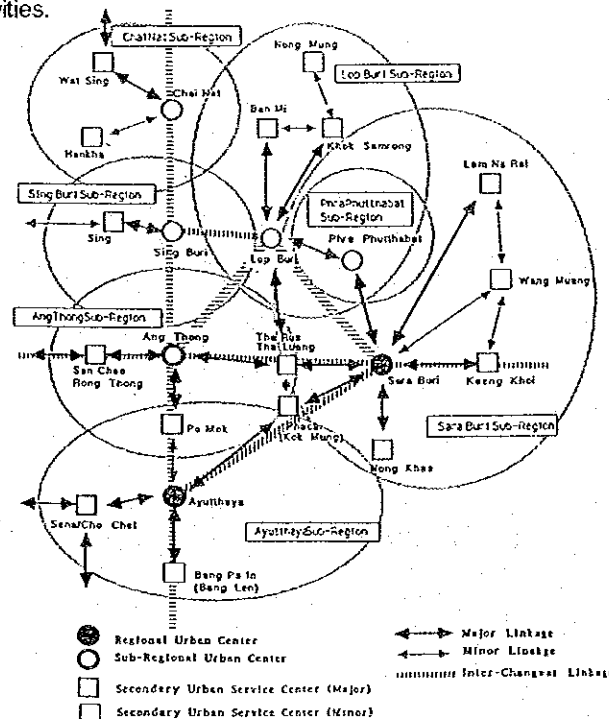
Macro-Spatial Framework

To assure effective economic links between major urban centers centering on Bangkok and the Eastern Sea-Board functions, a well organized macro-spatial network is necessary. The UCR may be situated in the Suburban Agro-Industrial Belt.



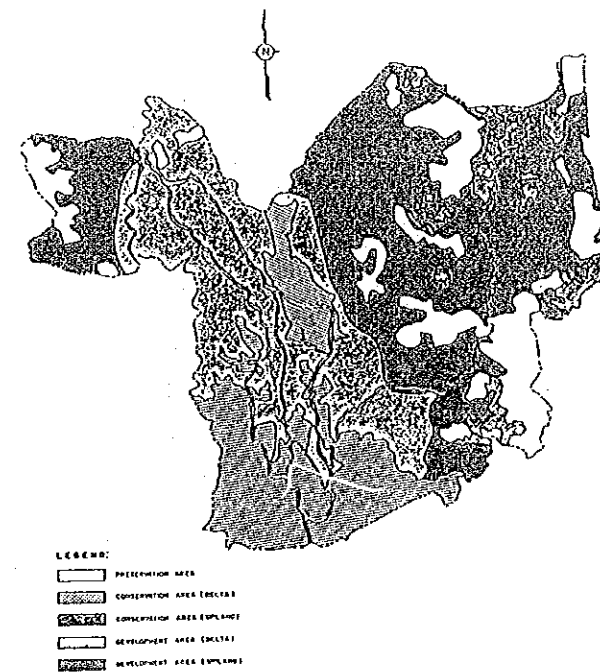
Human Settlement System

Sub-regional system with a urban center hierarchy should be formulated as a basis of regional development. This system assure relations between urban functions and their hinterland activities.



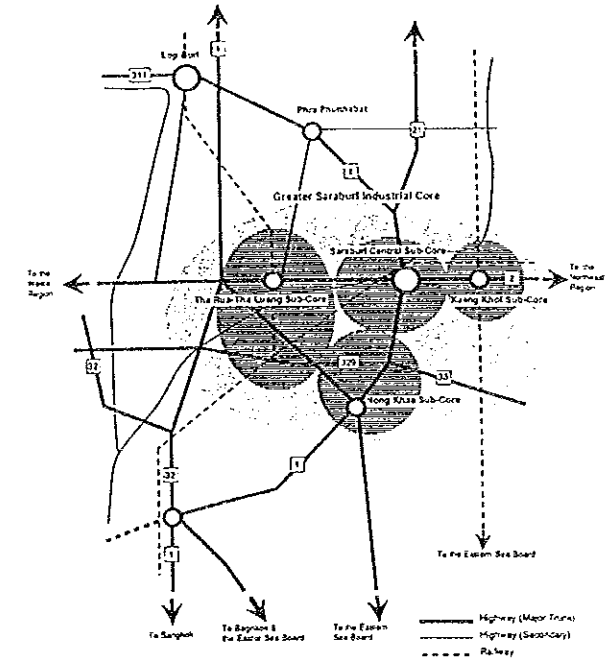
Appropriate Land Use

A clear-cut land use zoning system is essential for a balanced development with an appropriate use of natural environmental resources.

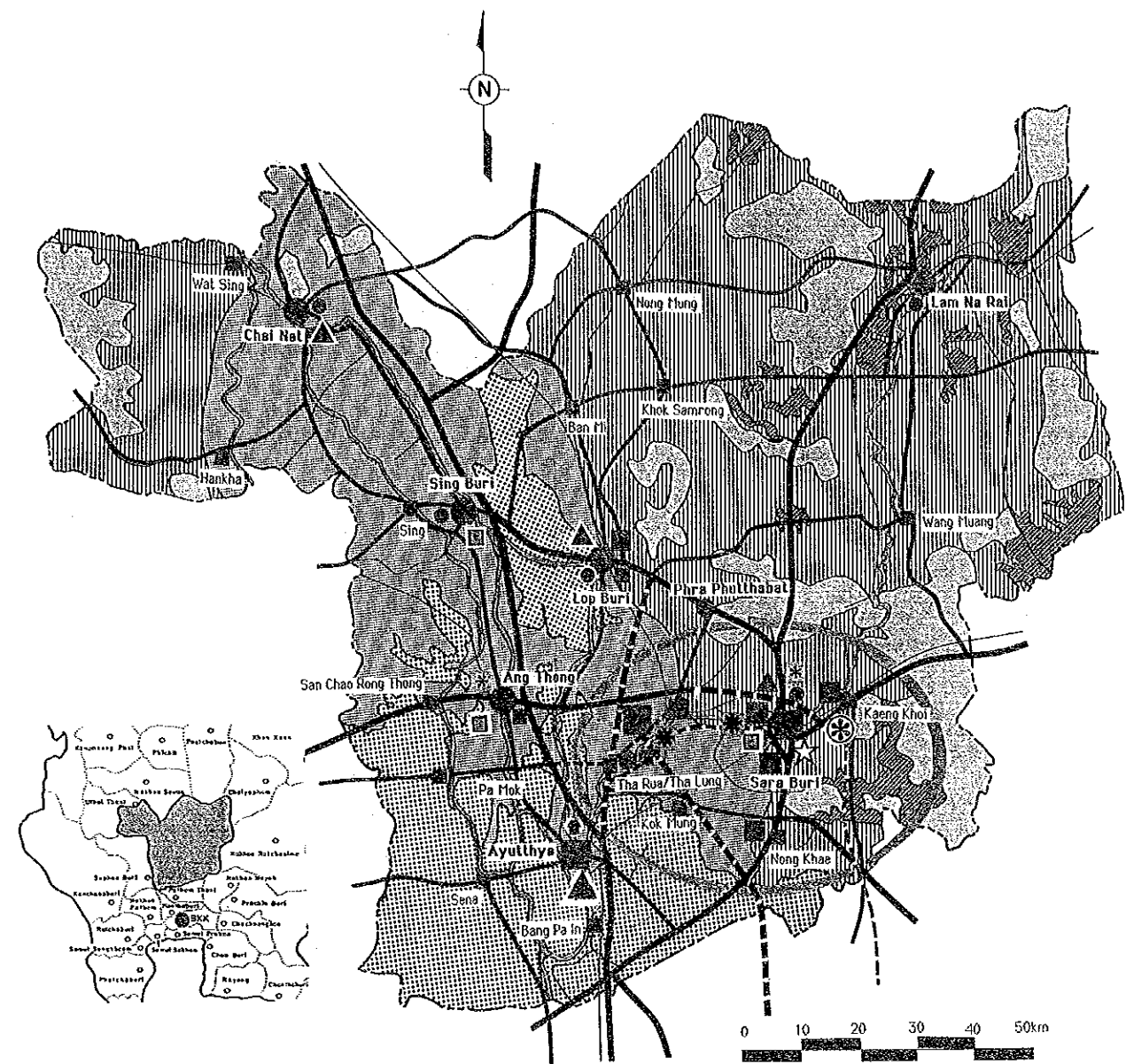
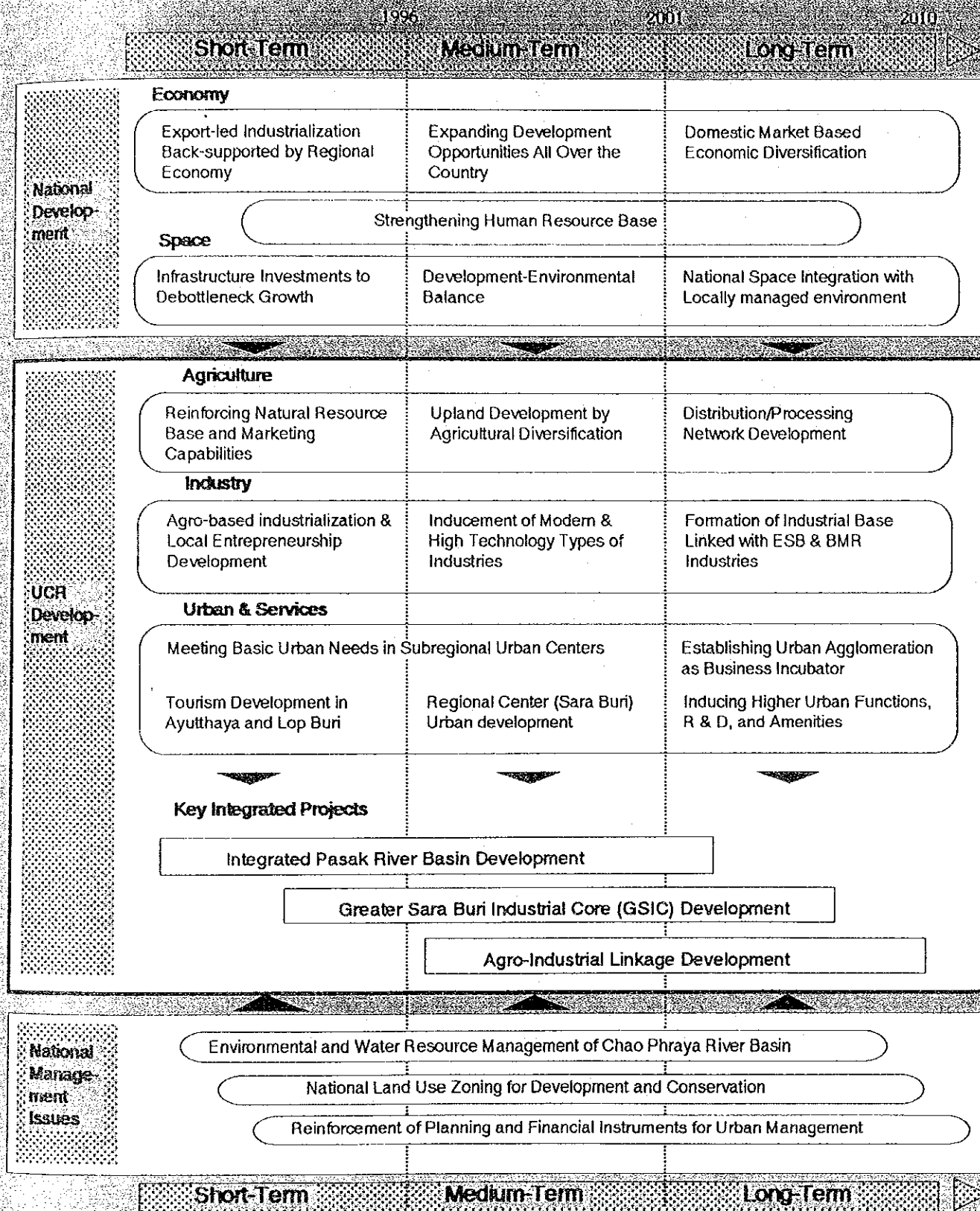


Greater Sara Buri Industrial Core (GSIC) Development

The GSIC development is recommended to receive the potential activities for industrialization and urbanization, being a new inland industrial basis linking with the sea-board development.



Development Strategies & Phasing



Legend

Land Use Zoning

- Development Area (Delta)
- Conservation Area (Delta)
- Development Area (Upland)
- Conservation Area (Upland)
- Preservation Area

Human Settlement Center

- Regional Urban Center
- Sub-Regional Urban Center
- Secondary Major Center

Transportation & Energy


- Arterial Road (Existing)
- Arterial Road (Proposed)
- Collector Road (Existing)
- Collector Road (Proposed)
- Railway (Existing)
- Railway (Planned)
- Goods Distribution Center
- Inter-Modal Transport Facilities (Container Yard & Inland Depot)
- Energy Center

Industrial and Urban Facilities

- Industrial Estates
- Agro-Industrial Park
- Business Incubator Center
- Agro-Tech Center
- Handicraft Promotion Center
- Wholesale Food Market
- Higher Educational Facility
- Regional Medical Center
- Regional Tourism Center
- Tourism Promotion Areas
- Greater Sara Buri Industrial Core

General Development Plan 2010 in the Upper Central Region

LIST OF FINAL REPORTS

(This volume is indicated by )

Executive Summary

Master Plan Report

Sector Reports:



- Vol. 1 Spatial Framework and Network for Development
- Vol. 2 Urban Management
- Vol. 3 Environmental Management
- Vol. 4 Water Resource Management, Agricultural Development and Land Use Management
- Vol. 5 Industrial Development
- Vol. 6 Distribution and Marketing
-   Vol. 7 Energy
- Vol. 8 Social Development in Rural Economies
- Vol. 9 International and National Economic Environment
- Vol. 10 Human Resource Development
- Vol. 11 Landsat Analysis

TABLE OF CONTENTS

	Page
Preface	
Acknowledgement	
A Summary: Policies and Strategies	
1. OVERVIEW OF ENERGY CONSUMPTION	1
1.1 Current Consumption Pattern	1
1.2 Historical Consumption Growth	2
1.2.1 Petroleum Products	2
1.2.2 Electricity	3
1.2.3 Natural Gas and Lignite	7
2. ENERGY INTENSITY AND FUTURE CONSUMPTION OUTLOOK .	12
2.1 Energy Intensity	12
2.2 Future Consumption Outlook	13
3. ISSUES AND STRATEGIC ELEMENTS FOR ENERGY SECTOR PLANNING	17
3.1 Issues	17
3.2 Strategic Elements for Energy Sector Planning	19
4. PROJECTS RECOMMENDED	22
4.1 Fossil Fuel Distribution	22
4.1.1 Petroleum Product Pipeline	22
4.1.2 Natural Gas Distribution System with Natural Gas Pipeline from Nam Phong	27
4.2 Power System Expansion	31
4.2.1 Background	31

4.2.2	Projects of Electricity Generating Authority of Thailand (EGAT)	32
4.2.3	Projects of Provincial Electricity Authority (PEA)	36
4.2.4	Recommendations on Salient Issues in Implementing Power Supply Expansion	38
4.3	Rice Husk Utilization (Power generation/production carbonized husk) toward Achievement of Natural Resource Recycling System	38
4.3.1	Background	38
4.3.2	Project Objectives/Feature	41
4.3.3	Scope of the Project	41
4.3.4	Salient Issues for Implementation	43
APPENDIX	1. Projection of National and Regional Energy Consumption	45
APPENDIX	2. List of Study Reports and Papers	49
APPENDIX	3. Staff Input	51

List of Tables

Table 1.1	Final Commercial Energy Supply-Demand Structure.....	2
Table 1.2	Data Base for Oil Projection.....	4
Table 1.3	Data Base for Energy Projection (Electricity).....	4
Table 1.4	Petroleum Product Consumption Pattern in 1988.....	5
Table 1.5	Oil Consumption in UCR.....	5
Table 1.6	UCR Electric Consumption by Province by Sector.....	6
Table 1.7	UCR Electric Consumption by Province by Sector.....	6
Table 1.8	Status of Electrification.....	8
Table 1.9	Direct Fuel Consumption Projection for Coal/Lignite.....	9
Table 2.1	Load Forecast for UCR (Energy).....	14
Table 2.2	Oil Demand Forecast.....	15
Table 2.3	Economic Frame for Energy Projection.....	16
Table A-1	Electricity Consumption Projection.....	45
Table A-2	Petroleum Products Consumption Projection.....	46
Table A-3	Direct Fuel Consumption Projection.....	47
Table A-4	Final Commercial Energy Consumption Projection.....	48

List of Figures

Fig. 1.1	Status of Electrification in 1988.....	8
Fig. 3.1	Existing and Proposed Energy Infrastructures of Whole Kingdom.....	21
Fig. 4.1	Energy Logistic System Highway Proposal.....	24
Fig. 4.2	Planned Power System in the UCR.....	35
Fig. 4.3	Typical Schematic Flow.....	42

LIST OF ABBREVIATIONS USED

BMR	Bangkok Metropolitan Region
CRH	Carbonized Rice Husk
DOH	Department of Highways
EGAT	Electricity Generating Authority of Thailand
ESB	Eastern Seaboard
GSIC	Greater Sara Bur Industrial Core
GWH	Gigawatt Hours
KWH	Kilowatt Hours
LPG	Liquid Petroleum Gas
MEA	Metropolitan Electricity Authority
MMSCFD	Million Standard Cubic Feet per Day
MOI	Ministry of Industry
NEPO	National Energy Policy Office
PEA	Provincial Electricity Authority
PTT	Petroleum Authority of Thailand
ROW	Right of Way
SRT	State Railway of Thailand
TCF	Trillion Cubic Feet
TDRI	Thailand Development Research Institute
UCR	Upper Central Region
VEP	Village Electrification Project

1. OVERVIEW OF ENERGY CONSUMPTION

1.1 Current Consumption Pattern

The final energy consumption structure in the Upper Central Region (UCR) comprises of variety of energy products, namely petroleum products, natural gas, lignite, imported coal, electricity, and the traditional energy such as charcoal and rice husks. The shares of respective energy products in the total commercial final energy use in the UCR are : the petroleum products 46%, the imported coal and lignite 42%, and electricity 11% in 1988. Meanwhile at the national level, the petroleum products occupy 80%, electricity 15%, and the other energy products for direct fuel use mere 5%.

Traditional energy sources such as charcoal and rice husks, baggase, and firewoods are widely used in the UCR in both the households and industry sectors, but no reliable region-specific information has been obtained at this stage. At the national level, the traditional energy contributes 30% of the total final energy consumption in 1988. In view of such traditional resource availability and the existence of agro-industries in the UCR, the share of the traditional energy in the total final energy consumption is supposed to be at the level of 40% in the UCR. With this rather vague picture of the traditional energy, discussion in this paper necessarily focuses on the commercial energy. In addition, the least to non commercial energy endowments with no significant power generation facilities in the UCR also limits the discussion to the final commercial energy energy use i.e., consumption and distribution aspects.

The final commercial energy consumption pattern at the national level illustrates a large dependence of the country on petroleum products. In contrast to the national picture, the UCR holds a diversified energy structure, where lignite and coal play a significant role due to the concentration of the cement industry in the region (84% of the national total cement production capacity are located in the UCR). The Table 1.1 clearly points out such difference.

Table 1.1 Final Commercial Energy Supply-Demand Structure

Unit : 000 TOE,%

	1988	1988
TOTAL NATION		
Petroleum Products	12,747	79.3%
Lignite	568	3.5%
Imported Coal	240	1.5%
Natural Gas	60	0.4%
Direct Fossil Fuel	13,615	
Electricity	2,459	15.3%
Total Final Energy	16,074	100.0%
UCR		
Petroleum Products	674	45.9%
Lignite	390	26.6%
Imported Coal	223	15.2%
Natural Gas	18	1.2%
Direct Fossil Fuel	1,306	
Electricity	162	11.0%
Total Final Energy	1,468	100.0%

In terms of consumption volume, 816 million liters of petroleum products, 1 million tons of lignite, 0.36 million tons of imported coal, and 1,904 Gigawatt Hours (GWH) of electricity were consumed in 1989. These energy commodities total to 1.5 million Tons of Oil Equivalent (TOE), accounting for about 9% of the national total in 1988, while the relative share of the UCR's population and GRP are 5% and 4.2%, respectively. This energy intensive nature of the region is further analyzed in the next chapter of this report.

The per capita energy consumption in petroleum and electricity also shows relatively energy intensive nature of the UCR. The per capita petroleum consumption in the UCR is 294.4 liters, while it is 280.5 liters on the national average. As for electricity, the UCR shows 641.6 Kilowatt Hours (KWH) per capita over 514 KWH per capita of the national average.

1.2 Historical Consumption Growth

1.2.1 Petroleum Products

During the period 1985 to 1988, in which data for the UCR are available, the petroleum product consumption grew at 14.2 percent per annum, while the national gross consumption of petroleum products recorded an annual growth

rate of 10.2 percent. A main contributor to this rapid growth was booming Thai economy and softened international oil market condition.

The petroleum product consumption pattern has been relatively stable during the last 4 years and its regional pattern is almost the same as the national one (see Tables 1.2, 1.3 and 1.4), except that the UCR does not consume aviation fuels.

In the UCR consisting of 6 Changwats, Sara Buri and Ayutthaya are the main consumers of petroleum products and these two Changwats together consume 71% of the regional petroleum consumption in 1988 (Sara Buri 40%, Ayutthaya 31% ; see Table 1.5). Historically, Sara Buri has been a petroleum consumption center with nearly 50% share of the total regional consumption, while the share of Ayutthaya climbs up to over 30% from previous 20% of the regional total with a recent consumption volume increase of 70%. New industrial activities are the main cause of this change.

1.2.2 Electricity

The annual average growth rate of electricity consumption in Thailand as a whole recorded 10.3% during the last eight years, while it recorded 13.5% in the UCR.

As for electricity consumption by economic sector, industrial sector is a main consumer with 70% share of the total electricity consumption in 1988. The average annual growth rate in this sector is the fastest with the speed of 16% per annum during the period 1980 to 1988. The second largest energy consuming sector is the residential with 17% share of the total consumption and 10% growth rate per annum. The third one is the commercial with 13% share and 8.5% growth rate per annum. Agricultural use occupies more 0.3% of the consumption in 1988 with annual average consumption growth rate of 2.7%. These sectoral consumption-mix has not changed significantly since 1980 except the industrial consumption growth (see Tables 1.6 and 1.7).

Table 1.2 Data Base for Oil Projection

YEAR	P. PRODUCT		INTENSITY		PER CAP CONSUMPTION		
	UCR MM LITER	NATION	BMR L/1000B	UCR	NATION	BMR L/CAP	UCR
1979		35.8			215.1		
1980		32.9			204.9		
1981		30.1			200.6		
1982		28.7			195.0		
1983		30.0			215.4		
1984		30.1			226.6		
1985	547.9	29.2	36.0	29.7	222.3	1150.3	205.1
1986	590.0	29.8	36.5	32.0	231.3	1239.4	218.3
1987	680.2	30.7	33.6	35.7	254.0	1296.3	249.2
1988	815.8	31.1	35.0	39.4	280.5	1500.9	294.4
GROWTH RATE	14.19%	-1.55%	-0.96%	9.87%	2.99%	9.27%	12.80%

Table 1.3 Data Base for Energy Projection (Electricity)

YEAR	UCR GRP		INTENSITY		PER CAP CONSUMPTION		
	MM BHAT	NATION	UCR KWH/1000B	BMR	NATION	UCR KWH/CAP	BMR
GROWTH R	3.46%	3.96%	8.30%	0.73%	8.49%	11.91%	6.60%
1979		44.90					
1980		44.90			280.0	254.3	1,622.5
1981	15,513	43.45	49.17	53.90	289.2	297.4	1,597.3
1982	15,914	45.37	53.28	57.07	307.8	329.0	1,623.2
1983	16,361	47.57	58.26	57.59	342.0	365.5	1,767.0
1984	17,954	48.78	59.90	59.16	367.2	407.5	1,893.8
1985	18,431	50.83	63.95	59.39	386.8	441.3	1,896.1
1986	18,412	53.51	78.25	58.37	416.0	533.0	1,984.1
1987	19,027	55.77	75.10	57.33	462.1	521.3	2,214.8
1988	20,694	57.03	85.91	56.71	514.0	641.6	2,431.8

Table 1.4 Petroleum Product Consumption Pattern in 1988

	T. NATION	BMR	UCR
LPG	8.8%	8.5%	8.8%
Premium Gasoline	7.6%	9.6%	3.9%
Regular Gasoline	10.0%	5.6%	12.1%
Aviation Fuel*2	11.3%	21.2%	
Kerosene	0.8%	0.5%	0.7%
High Speed Diesel	43.8%	29.8%	47.3%
Low Speed Diesel	0.6%	1.0%	0.2%
Fuel Oil	17.2%	24.0%	27.0%
<i>Total</i>	100.0%	100.0%	100.0%
<i>Total CON. VOLUME</i>	16,225.5	8,562.0	815.8

SOURCE : NEA

Table 1.5 Oil Consumption in UCR

	UNIT : MILLION LITER								
	LPG	GASOLINE	KEROSENE	DIESEL	AV. GAS	JP-1/4	FUEL OIL	RGN TOTAL	SHARE
1985									
AYUTTHAYA	6.75	20.76	2.92	52.66	0.00	0.00	7.80	90.89	16.6%
SARABURI	27.14	18.03	6.87	78.41	0.00	0.00	140.81	271.26	49.5%
LOPBURI	5.21	9.82	0.54	40.60	0.00	0.00	0.00	56.17	10.3%
ANGTHONG	2.65	6.17	0.76	21.87	0.00	0.00	8.99	40.44	7.4%
SINGBURI	8.50	8.20	0.33	37.00	0.00	0.00	0.02	54.06	9.9%
CHAINAT	1.95	7.27	0.56	25.05	0.00	0.00	0.19	35.03	6.4%
TOTAL PRDCT	52.20	70.26	11.98	255.60	0.00	0.00	157.81	547.85	100.0%
PRODUCT MIX	9.5%	12.8%	2.2%	46.7%	0.0%	0.0%	28.8%	100.0%	
1986									
AYUTTHAYA	7.57	33.28	2.95	67.40	0.00	0.00	8.04	119.24	20.2%
SARABURI	26.10	18.32	8.16	78.54	0.00	0.00	154.90	286.02	48.5%
LOPBURI	3.73	10.66	2.20	43.40	0.00	0.00	0.14	60.13	10.2%
ANGTHONG	2.33	6.06	0.77	19.65	0.00	0.00	9.24	38.06	6.4%
SINGBURI	12.28	8.36	0.27	32.17	0.00	0.00	0.06	53.15	9.0%
CHAINAT	1.60	8.17	0.42	22.80	0.00	0.00	0.47	33.45	5.7%
TOTAL PRDCT	53.61	84.85	14.78	263.95	0.00	0.00	172.85	590.04	100.0%
PRODUCT MIX	9.1%	14.4%	2.5%	44.7%	0.0%	0.0%	29.3%	100.0%	
1987									
AYUTTHAYA	6.45	48.15	3.02	83.34	0.00	0.00	8.66	149.63	22.0%
SARABURI	22.96	20.13	4.76	83.80	0.00	0.00	206.61	338.26	49.7%
LOPBURI	5.12	12.34	0.76	39.87	0.00	0.00	0.61	58.71	8.6%
ANGTHONG	1.67	6.47	0.78	18.58	0.00	0.00	8.04	35.53	5.2%
SINGBURI	21.35	8.66	0.25	31.33	0.00	0.00	0.00	61.59	9.1%
CHAINAT	0.97	10.61	0.37	24.44	0.00	0.00	0.07	36.45	5.4%
TOTAL PRDCT	58.52	106.35	9.95	281.36	0.00	0.00	224.00	680.18	100.0%
PRODUCT MIX	8.6%	15.6%	1.5%	41.4%	0.0%	0.0%	32.9%	100.0%	
1988									
AYUTTHAYA	8.50	65.55	2.07	162.26	0.00	0.00	17.84	256.22	31.4%
SARABURI	20.73	21.13	2.58	92.07	0.00	0.00	189.38	325.89	39.9%
LOPBURI	8.00	15.54	0.40	44.12	0.00	0.00	0.47	68.53	8.4%
ANGTHONG	4.59	6.54	0.82	18.82	0.00	0.09	12.75	43.60	5.3%
SINGBURI	29.21	10.01	0.25	38.32	0.00	0.00	0.02	77.81	9.5%
CHAINAT	1.09	11.98	0.29	30.36	0.00	0.00	0.00	43.73	5.4%
TOTAL PRDCT	72.13	130.75	6.42	385.94	0.00	0.09	220.46	815.78	100.0%
PRODUCT MIX	8.8%	16.0%	0.8%	47.5%	0.0%	0.0%	27.0%	100.0%	

Table 1.6 UCR Electric Consumption by Province and by Sector

	1980	1981	1982	1983	1984	1985	1986	1987	1988
<i>SECTORSHARE</i>									
Residential	21.0%	20.2%	21.2%	21.1%	21.3%	22.0%	26.2%	21.5%	16.6%
Commercial*1	18.2%	11.2%	10.9%	10.9%	10.5%	9.9%	9.3%	12.2%	12.7%
Industrial	59.1%	67.2%	66.0%	66.5%	66.7%	66.5%	63.3%	65.6%	70.0%
Agriculture	0.8%	0.8%	1.1%	0.8%	0.8%	0.8%	0.6%	0.5%	0.3%
St. Lighting	0.5%	0.4%	0.5%	0.4%	0.4%	0.4%	0.4%	0.0%	0.0%
Others	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<i>CHANGWATSHARE</i>									
AYUTTHAYA	21.4%	22.5%	21.4%	20.1%	22.1%	24.3%	20.1%	23.7%	25.5%
SARABURI	50.6%	52.3%	53.4%	55.8%	54.7%	52.8%	60.3%	54.3%	55.8%
LOPBURI	12.1%	10.8%	10.6%	10.4%	10.2%	10.3%	9.0%	10.0%	9.0%
ANGTHONG	8.5%	7.4%	7.5%	6.6%	6.2%	5.9%	5.1%	5.7%	4.4%
SINGBURI	4.0%	3.8%	3.9%	3.8%	3.7%	3.7%	2.7%	3.1%	2.7%
CHAINAT	3.4%	3.3%	3.3%	3.3%	3.1%	3.0%	2.7%	3.1%	2.6%

Note: *1 Note: *1 Included street lighting since 1987
 Data Source: Energy Statistic Section
 National Energy Administration

Table 1.7 UCR Electric Consumption by Province and by Sector

UNIT : GWH

	1980	1981	1982	1983	1984	1985	1986	1987	1988	Growth Rate 80/88
<i>ELECTRICITY CONSUMPTION BY ECONOMIC SECTOR</i>										
Residential	135.67	154.25	179.78	201.45	228.86	258.88	376.77	307.12	295.46	10.22%
Commercial *1	117.48	85.08	92.70	103.62	112.68	116.87	133.80	174.95	225.97	8.52%
Industrial	381.95	512.34	559.81	633.80	716.82	784.35	911.60	936.88	1,245.00	15.92%
Agriculture	5.04	5.90	8.99	7.36	8.90	9.85	8.81	7.40	6.22	2.66%
St. Lighting	3.19	2.96	3.84	4.14	4.54	5.07	5.70	0.00	0.00	
Others	2.51	2.18	2.79	2.78	3.66	3.66	4.09	2.64	5.20	9.53%
TOTAL	645.84	762.71	847.91	953.15	1,075.46	1,178.68	1,440.77	1,428.99	1,777.85	13.49%
<i>ELECTRICITY CONSUMPTION BY PROVINCE</i>										
AYUTTHAYA	138.27	171.40	181.41	191.37	237.38	286.11	288.93	339.29	453.27	16.00%
SARABURI	326.93	398.86	452.75	532.23	588.56	622.28	869.23	776.21	992.81	14.90%
LOPBURI	77.95	82.15	89.62	99.05	109.87	121.98	130.07	143.49	159.69	9.38%
ANGTHONG	54.64	56.45	63.77	62.89	66.35	69.21	74.03	81.71	79.09	4.73%
SINGBURI	25.90	28.91	32.67	36.33	39.99	44.09	39.06	44.56	47.27	7.81%
CHAINAT	22.15	24.94	27.69	31.28	33.31	35.01	39.45	43.73	45.72	9.48%
TOTAL	645.84	762.71	847.91	953.15	1,075.46	1,178.68	1,440.77	1,428.99	1,777.85	13.49%

Note: *1 Note: *1 Included street lighting since 1987
 Data Source: Energy Statistic Section
 National Energy Administration

Spatial consumption pattern within the UCR also stays more or less the same during the same period and provides the same picture as the petroleum consumption. Sara Buri is the largest and represents 56% of the total electricity consumption in 1988 with annual average growth rate of 15%, followed by Ayutthaya and Lop Buri with consumption share of 26% and 9% respectively. The per annum consumption growth rates for those two Changwat are 16% for Ayutthaya and 90% for Lop Buri. (Also see Tables 1.6 and 1.7)

As for electrification, almost all the villages of the UCR has access to the distribution network of Provincial Electricity Authority (PEA). In 1988, village electrification rate is 94% and it is planned that over 95% of all villages in the UCR are connected to the PEA distribution network in 1989. In view of a total national electrification rate of 94%, the whole nation, including the UCR, is nearly completing electrification.

In terms of individual households, however, electrification progress shows a different picture, where more efforts are required (Table 1.8 and Fig. 1.1).

In the UCR, the average electrification rate at the household level is estimated at 63% in 1988 (see Table 1.8 and Fig. 1.1), which is the average level attained in the whole PEA area. Since the system has already been laid out, some measures to accelerate new hook ups are deemed necessary.

1.2.3 Natural Gas and Lignite

Direct use of the fuel other than petroleum products has started in 1983 by the use of natural gas in the cement industry in this region. In 1985, the total consumption of natural gas went up to 20 Million Standard Cubic Feet per Day (MMSCFD), which was 7% of the total national natural gas supply and demand volume. However current natural gas use decreases to 6.8 MMSCFD comprising 2.07 MMSCFD for ceramic and the rest for cement industries. Incidentally, the ceramic industry started to use natural gas in 1986.

The reason for this decline stems merely from the financial cost consideration by cement industries. Cement industry is energy intensive and its energy cost accounts for 60 to 70% of the direct production costs. Current pricing structure of energy products compels the industry to use domestic lignite as

Table 1.8 Status of Electrification

VILLAGE BASE									
PROVINCE	1987			1988			1989		
	Total Ves	electrified	STATUS	Total Ves	electrified	STATUS	Total Ves	electrified	STATUS
Ayutthaya	1,458	1,422	97.5%	1,457	1,440	98.8%	1,456	1,443	99.1%
SaraBuri	932	862	92.5%	942	885	93.9%	943	895	94.9%
AngThong	502	500	99.6%	502	501	99.8%	502	501	99.8%
LopBuri	1,029	850	82.6%	1,042	866	83.1%	1,044	924	88.5%
SingBuri	352	352	100.0%	353	353	100.0%	353	353	100.0%
Chainat	409	356	87.0%	414	364	87.9%	417	377	90.4%
Total UCR	4682	4342	92.7%	4710	4409	93.6%	4715	4493	95.3%

HOUSEHOLD BASE						
PROVINCE	1987			1988		
	TotalHids	electrified	STATUS	TotalHids	electrified	STATUS
Ayutthaya	134,120	82,946	61.8%	135,729	96,180	70.9%
SaraBuri	102,347	56,358	55.1%	103,576	60,237	58.2%
AngThong	57,005	39,590	69.5%	57,632	43,687	75.8%
LopBuri	150,123	72,438	48.3%	152,525	76,625	50.2%
SingBuri	46,823	34,914	74.6%	47,431	35,975	75.8%
Chainat	71,742	39,878	55.6%	72,244	46,900	64.9%
Total UCR	562,160	326,124	58.0%	569,137	359,604	63.2%

Source : PEA & Total Household Share by Team Estimates based on NSO Data

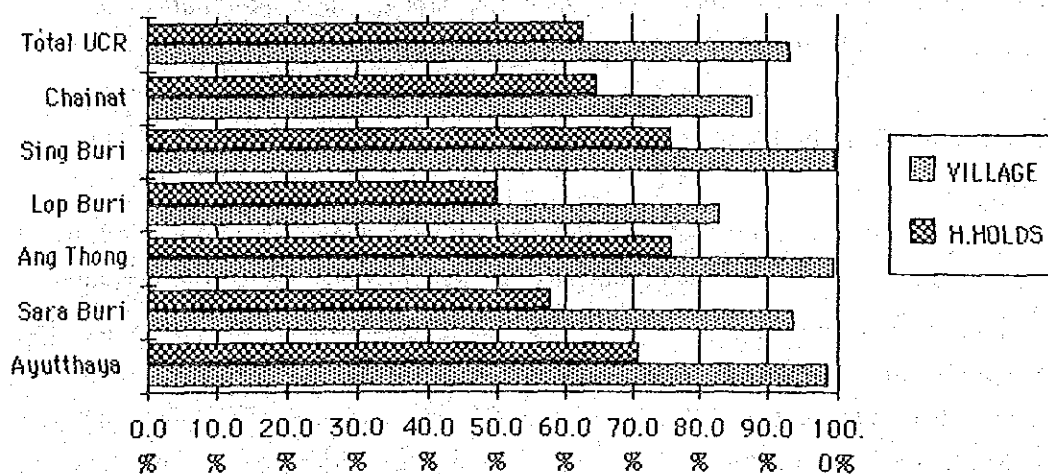


Fig. 1.1 Status of Electrification in 1988

much as possible. Although the price for a ton of lignite obtained through an official of the industry is too low (500 baht per ton) even considering the expensive transportation cost, there seems to be a certain cost advantage of lignite over natural gas.

Based on the cement industry expansion plan and in view of the characteristics of the cement industry, probable lignite and coal use in the cement industry in the UCR is projected as shown in the Table 1.9.

Table 1.9 Direct Fuel Consumption Projection for Coal/Lignite

	1988/96	1996/2001	1988/2001	1988/2010	
Cement Prod. CAP	5.16%	6.55%	5.69%	5.65%	
LIGNITE					
<i>Kheng Khoi</i>	18.92%	4.94%	13.54%	10.13%	
<i>Tha Luang</i>	12.73%	0.00%	7.65%	6.83%	
<i>Tab Kwang</i>	6.76%	3.62%	5.54%	5.59%	
<i>Sub-Total</i>	11.26%	3.29%	8.13%	7.11%	
IM. COAL					
<i>Kheng Khoi</i>	-20.71%	6.34%	-11.23%	-4.68%	
<i>Tha Luang</i>	-25.01%	0.00%	-16.23%	-7.89%	
<i>Tab Kwang</i>	1.29%	3.04%	1.95%	3.45%	
<i>Sub-Total</i>	-18.03%	3.57%	-10.31%	-4.09%	

UNIT: '000 TON	1988	1996	2001	2010	6. Impact 2010/1988
Cement Prod. CAP 1)	11,100	16,600	22,800	37,230	3.4
LIGNITE 2)					
<i>Kheng Khoi</i>	220	880	1,120	1,837	
<i>Tha Luang</i>	230	600	600	984	4.3
<i>Tab Kwang</i>	640	1,080	1,290	2,116	3.3
<i>Sub-Total</i>	1,090	2,560	3,010	4,938	
IM. COAL 3)					
<i>Kheng Khoi</i>	160	25	34	56	
<i>Tha Luang</i>	170	17	17	28	
<i>Tab Kwang</i>	28	31	36	59	
<i>Sub-Total</i>	358	73	87	143	
N.GAS 4)					
UNIT: MMCF	757				

UNIT: '000 TOE	SOLID FUEL DIRECT USE PROJECTION			
LIGNITE	389.86	915.64	1,076.59	1,766.26
IM. COAL	223.46	45.57	54.30	89.09
N.GAS	18.32			

NOTES: 1) Figures 1) through 3) from 1996 to 2001 are from NESDB/WB (Coal Development and Utilization study, June 1989)
 2) Figures for 2010 are by Team estimates.
 3) Source: NEA
 4) Source: NEA

At this point, the role of natural gas in the total national energy structure should be mentioned in view of future natural gas use in the UCR. In Thailand, total natural gas reserve (proven plus provable reserves are estimated as 12.9 Trillion Cubic Feet (TCF), where off-shore reserve is 11.4 TCF and on-shore reserve is 1.5 TCF. Proven reserve is estimated as 3.7 TCF of which on-shore occupies 1.2 TCF, while that of provable being 9.2 TCF.

In 1989, natural gas represented 24% of the total national primary energy supply and demand, which amounts to 580 MMSCFD. At this consumption level, the reserve/ production ratio is 60 years for the total reserve and 17 years for the proven reserve.

The main consumer of the gas is Electricity Generating Authority of Thailand (EGAT) having consumed 74% of the total natural gas supply and demand volume. Regarding the future prospects of gas supply and demand structure, Petroleum Authority of Thailand (PTT) projects the supply and demand volume of 1,100 MMSCFD in 2006, in which, 80% are consumed by EGAT, 13% by feed stock industries and 7% as fuel by industries.

This scenario of natural gas utilization where EGAT being the main consumer, stems from primary energy requirement by the power sector. Imported coal and nuclear power utilization need quite a long lead time. In order to meet a rapidly growing power demand, therefore, readily available natural gas seems attractive. However, it is felt questionable that whether this way of natural gas use would bring the most efficient results in the future energy supply structure.

Analyses of the total economic benefits from the total national energy supply system should receive enough attention rather than analyses of the least costs for just power sector in certain time horizon. In other words, with long range primary energy supply options (such as imported coal and nuclear power) in relation to the consumption by sector and their spatial location should be considered. In this line of thought with possible change in the price structure of domestic energy products, the natural gas use as city gas, or as fuel in the industries might bring better results in achieving an efficient total national energy structure.

In addition, environmental consideration should be given to the use of natural gas as compared to lignite, particularly in the UCR. A prevailing idea to promote cement industry in Thailand is to give the highest priority in Sara Buri which is most productive and accessible to the major national cement consumption market. As such, continued dependence of the cement industry in Sara Buri on the lignite would entail intensified air pollution. This problem can be solved by the use of natural gas.

2. ENERGY INTENSITY AND FUTURE CONSUMPTION OUTLOOK

2.1 Energy Intensity

The energy and economic growth have certain relationship. One of the variables to demonstrate such relationship is energy intensity. The energy intensity indicates the amount of the energy required to generate per unit of GDP/GRP.

In exploring the economic theory a little further, the elasticity of energy to GDP (in view of GDP production function) is divided into two parts ; marginal productivity of energy and the energy intensity. Thus even assuming the same energy elasticity of GDP, there exists two movements. One is declining marginal energy productivity with increasing energy intensity, and vice versa. These points should carefully be considered when one utilizes the energy intensity for projection purpose.

Looking at the energy intensities in accordance with the phase of development, one can see that the energy intensity starts to increase at a significantly low level, then decreases and again shows an uprise followed by a declining trend in the latter part of development process. Stated differently, this movement of the energy intensity has a characteristic of decelerating trigonometric curve.

This decelerating cyclical movement of energy intensity implies the followings. At first the initial investment spurt results in increased volume of energy consumption without achieving efficiency in energy use. At the stage of completing the first import substitution-oriented industrialization, the efficiency in energy use is realized within this particular structure of the economy. The filtration of the investment spurt in conjunction with passage into the next stage of economic development is characterized by secondary import/export substitution, as being experienced in Thailand now resulting in

increases in energy demand and energy intensity. Finally, in the latter part of the development process, energy efficiency in all sectors is about to be achieved.

These historical experiences have been proven by empirical analyses and thus utilized in determining future energy consumption outlook of the UCR.

In 1988, final commercial energy consumption in the UCR is 71 liters of oil equivalent against the national average of 33.5 liters of oil equivalent. Both direct fuel (petroleum, natural gas, lignite and coal) and electricity intensity of the UCR considerably exceed their national average. Although the region has been characterized as agriculture-based, the UCR is one of the energy intensive regions in Thailand due to concentration of the cement industry.

In planning energy sector for the UCR, the readily existing energy system to support such energy intensive industry can be capitalized not simply for energy replenishment but also for future industrialization of the region.

2.2 Future Consumption Outlook

Based on the past experience of the country, the UCR, newly industrialized countries and Japan as well as in view of the process of industrialization envisaged for the UCR, Tables A-1 to A-4 at the last part of this report are prepared to show future energy consumption in the UCR.

During the period from 1988 to 2010, the total final commercial energy consumption in the UCR is estimated to increase by 3.3 times, while the national total consumption by 3.7 times. The UCR's energy intensive nature is still apparent in 2010, but the total energy intensity is projected to decrease at an average rate of 0.6% per annum against that of national average of 0.3%. In other words, the UCR will have energy intensive nature but achieve an efficient energy consumption structure within its economic structure.

Regarding electricity, consumption volume is projected to grow by 5.6 times in 2010, which is almost the same speed of growth in the nation. The speed of growth is calculated at 8.1% per annum on average during the period of 1988 to 2010 and the elasticity of electricity demand is estimated at 1.3.

Petroleum products consumption in the UCR shows a growth pattern being similar to that of whole energy consumption. The consumption will increase by 3.8 times until the year 2010 at an average annual growth rate of 6.2% from 1988 to 2010 and the petroleum consumption elasticity is calculated at .99.

Both the petroleum and electricity consumption in the UCR is projected to be lower than extrapolated results of the existing projection's (For reference, the original projections of National Energy Policy Office (NEPO) and PEA are presented on the Tables 2.1, 2.2(1) to 2.2(3) and the economic frame for the energy projection is also provided on the Table 2.3).

Table 2.1 Load Forecast for UCR (Energy)

	Unit: GWH											Growth Rate 88/98
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
	actual											
AYUTTHAYA	261.96	367.85	439.07	740.64	809.77	927.30	1,002.95	1,080.58	1,163.38	1,251.64	1,341.90	15.46%
ANG THONG	91.10	92.25	99.33	105.96	113.53	122.09	130.77	140.07	150.01	160.48	170.29	7.05%
SARABURI	883.87	1,092.18	1,233.19	1,362.31	1,469.17	1,628.66	1,784.51	1,942.05	2,021.94	2,103.86	2,175.43	7.96%
LOP BURI	144.75	178.89	198.93	226.48	256.57	289.27	312.80	338.03	365.31	394.31	421.58	9.99%
SING BURI	67.15	72.74	79.18	84.96	91.69	99.43	107.28	115.81	125.14	135.20	144.87	7.96%
CHAINAT	91.13	100.45	112.90	124.69	138.09	153.21	168.65	185.23	203.42	223.16	242.61	10.29%
TOTAL	1,539.96	1,904.36	2,162.60	2,645.04	2,878.82	3,219.96	3,506.96	3,801.77	4,029.20	4,268.65	4,496.68	10.02%
LOAD FORECAST FOR UCR. (DEMAND)												
	Unit: MW											
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
	actual											
AYUTTHAYA	44.92	72.72	90.15	134.95	146.76	167.15	179.93	192.94	206.73	221.34	236.18	13.98%
ANG THONG	18.74	22.02	23.50	24.86	26.42	28.17	29.92	31.79	33.78	35.85	37.76	6.18%
SARABURI	174.85	202.70	226.95	248.78	264.43	291.14	317.03	343.07	356.36	369.89	381.40	7.28%
LOP BURI	35.22	42.93	47.44	53.40	59.85	66.78	71.67	76.87	82.42	88.24	93.55	9.04%
SING BURI	16.64	17.48	18.83	20.00	21.36	22.93	24.49	26.18	28.01	29.97	31.80	6.88%
CHAINAT	20.50	22.48	25.07	27.48	30.20	33.25	36.32	39.60	43.16	47.00	50.72	9.46%
TOTAL	310.87	380.33	431.94	509.47	549.02	609.42	659.36	710.45	750.46	792.29	831.41	9.08%
LOAD FACTOR	56.5%	57.2%	57.2%	59.3%	59.9%	60.3%	60.7%	61.1%	61.3%	61.5%	61.7%	

Data Source :PEA

Table 2.2 Oil Demand Forecast (1)

UNIT: MMBL	1988	1996	2001	2010	G.RATE		
					1988/96	1996/2001	2001/2010
JET							
WHOLE NATION	1,829.10	3,466.10	4,600.00	7,479.66	8.32%	5.82%	5.55%
1 GREATER BKK	1,806.03	3,418.78	4,535.88	7,375.40	8.30%	5.82%	5.55%
2 CENTRAL							
3 EAST	1.28	3.49	5.02	9.20	13.36%	7.54%	6.98%
4 WEST							
5 LOWER NORTHEAST	0.10	0.14	0.17	0.23	4.30%	3.96%	3.57%
6 UPPER NORTHEAST	1.40	2.14	2.66	3.90	5.45%	4.45%	4.33%
7 LOWER NORTH	0.92	1.57	2.02	3.13	6.91%	5.17%	4.98%
8 UPPER NORTH	3.11	5.56	7.25	11.49	7.53%	5.45%	5.25%
9 LOWER SOUTH	10.43	19.67	26.08	42.33	8.25%	5.80%	5.53%
10 UPPER SOUTH	5.84	14.75	20.93	37.58	12.28%	7.25%	6.72%
TOTAL P. PRODU							
WHOLE NATION	15,255	28,550	36,768	56,690	8.15%	5.19%	3.42%
1 GREATER BKK	8,143	17,190	22,447	35,906	9.79%	5.48%	4.90%
2 CENTRAL	734	1,386	1,935	3,535	8.27%	6.90%	4.28%
3 EAST	1,173	2,043	2,502	3,544	7.17%	4.14%	2.97%
4 WEST	1,157	1,928	2,593	4,484	6.60%	6.10%	2.02%
5 LOWER NORTHEAST	595	799	928	1,221	3.75%	3.03%	2.24%
6 UPPER NORTHEAST	615	982	1,219	1,790	6.01%	4.42%	3.95%
7 LOWER NORTH	715	1,024	1,241	1,760	4.61%	3.91%	2.04%
8 UPPER NORTH	590	875	1,066	1,519	5.04%	4.04%	1.32%
9 LOWER SOUTH	667	985	1,177	1,610	4.99%	3.64%	0.74%
10 UPPER SOUTH	865	1,339	1,661	2,463	5.81%	4.40%	0.25%

SOURCE: NEPO

Table 2.2 Oil Demand Forecast (2)

UNIT: MMBL	1988	1996	2001	2010	G.RATE		
					1988/96	1996/2001	2001/2010
GASOLINE							
WHOLE NATION	2,921.27	5,232.92	6,945.10	11,585.59	7.56%	5.82%	5.85%
1 GREATER BKK	1,302.95	2,660.11	3,772.11	6,981.67	9.33%	7.24%	7.08%
2 CENTRAL	130.58	185.81	225.38	320.79	4.51%	3.94%	4.00%
3 EAST	228.31	375.75	438.22	565.32	6.43%	3.12%	2.87%
4 WEST	197.95	296.25	368.29	545.43	5.17%	4.45%	4.46%
5 LOWER NORTHEAST	139.55	226.23	280.62	410.96	6.23%	4.40%	4.33%
6 UPPER NORTHEAST	172.43	295.78	371.41	553.38	6.98%	4.66%	4.53%
7 LOWER NORTH	148.66	234.82	290.52	422.90	5.88%	4.35%	4.26%
8 UPPER NORTH	236.19	368.35	456.87	670.81	5.71%	4.40%	4.38%
9 LOWER SOUTH	179.29	281.32	348.48	509.02	5.79%	4.37%	4.30%
10 UPPER SOUTH	185.38	308.48	393.21	605.31	6.57%	4.97%	4.91%
DIESEL							
WHOLE NATION	7,316.95	13,060.17	17,331.25	29,033.11	7.51%	5.82%	5.90%
1 GREATER BKK	2,665.88	6,407.61	9,144.29	17,341.90	11.59%	7.37%	7.37%
2 CENTRAL	384.33	668.37	931.37	1,709.41	7.16%	6.86%	6.98%
3 EAST	818.06	1,133.97	1,424.34	2,183.24	4.17%	4.67%	4.86%
4 WEST	728.01	1,043.52	1,333.68	2,106.52	4.60%	5.03%	5.21%
5 LOWER NORTHEAST	429.13	523.62	579.77	692.88	2.52%	2.06%	2.00%
6 UPPER NORTHEAST	406.38	618.18	758.85	1,094.18	5.38%	4.19%	4.15%
7 LOWER NORTH	498.81	669.75	789.94	1,064.50	3.75%	3.36%	3.37%
8 UPPER NORTH	336.40	482.92	581.60	811.47	4.62%	3.79%	3.77%
9 LOWER SOUTH	460.03	662.21	777.98	1,025.78	4.66%	3.27%	3.12%
10 UPPER SOUTH	589.93	850.03	1,009.45	1,365.05	4.67%	3.50%	3.41%

Table 2.2 Oil Demand Forecast (3)

UNIT: MMH					G.RATE		
	1988	1996	2001	2010	1988/96	1996/2001	2001/2010
FUELOIL							
WHOLE NATION	3,062.07	6,607.06	7,675.03	8,297.33	10.09%	3.04%	0.87%
1 GREATER BKK	2,326.99	4,622.88	4,892.20	4,048.99	8.96%	1.14%	-2.08%
2 CENTRAL	212.64	521.10	765.27	1,485.73	11.86%	7.99%	7.65%
3 EAST	120.22	521.69	625.30	774.76	20.14%	3.69%	2.41%
4 WEST	217.80	572.75	873.65	1,811.52	12.85%	8.81%	8.44%
5 LOWER NORTHEAST	18.21	39.06	55.82	103.49	10.01%	7.40%	2.10%
6 UPPER NORTHEAST	29.25	55.91	74.18	121.75	8.44%	5.82%	5.66%
7 LOWER NORTH	53.88	103.32	142.05	249.53	8.48%	6.57%	6.46%
8 UPPER NORTH	8.74	11.12	13.10	17.78	3.06%	3.33%	3.45%
9 LOWER SOUTH	5.79	9.27	12.05	19.29	6.06%	5.39%	5.37%
10 UPPER SOUTH	68.55	149.95	221.40	439.27	10.28%	8.11%	7.91%
KEROSENE							
WHOLE NATION	125.57	183.66	217.09	293.82	4.87%	3.40%	3.42%
1 GREATER BKK	41.53	80.34	102.67	157.91	8.60%	5.03%	4.90%
2 CENTRAL	6.29	10.68	13.20	19.25	6.84%	4.33%	4.28%
3 EAST	5.56	7.61	8.79	11.44	4.00%	2.92%	2.97%
4 WEST	13.03	15.82	17.43	20.87	2.45%	1.96%	2.02%
5 LOWER NORTHEAST	8.20	10.21	11.37	13.88	2.78%	2.18%	2.24%
6 UPPER NORTHEAST	5.97	9.53	11.58	16.41	6.02%	3.97%	3.95%
7 LOWER NORTH	12.33	15.00	16.54	19.84	2.49%	1.97%	2.04%
8 UPPER NORTH	5.87	6.61	7.03	7.91	1.50%	1.24%	1.32%
9 LOWER SOUTH	11.58	12.34	12.77	13.65	0.80%	0.69%	0.74%
10 UPPER SOUTH	15.21	15.52	15.70	16.06	0.25%	0.23%	0.25%

Table 2.3 Economic Frame for Energy Projection

SCENARIO 1

GDP/GRP PROJECTION

GROWTH RATE

	1988/96	1996/2001	1988/2001	1988/2010
GDP	7.23%	5.64%	6.61%	6.56%
GREATER BKK	8.33%	6.77%	7.73%	7.10%
CENTRAL	6.79%	5.27%	6.20%	6.20%
	6.64%	6.01%	6.40%	6.28%

UNIT: 1972 REAL PRICE MMBARTS

	1988	1996	2001	2010
GDP	1) 495,374	865,878	1,139,063	1,924,423
GREATER BKK	2) 244,608	463,964	643,696	1,106,118
UCR (CENTRAL)	3) 20,694	35,002	45,253	77,785
UCR	4) 20,694	34,616	46,335	79,013

REGIONAL SHARE

	1988	1996	2001	2010
NATION	100.00%	100.00%	100.00%	100.00%
GREATER BKK	49.38%	53.58%	56.51%	57.48%
UCR	4.18%	4.04%	3.97%	4.04%
UCR	4.18%	4.00%	4.07%	4.11%

NOTES: Figures on the row 1) to 3) are from NESDB/NEPO
 Figures on the row 4) are estimates by the team