

**Institute of Energy
Vietnam**

ETSAP Annex IX Technical

Conference

Market Modeling in Vietnam

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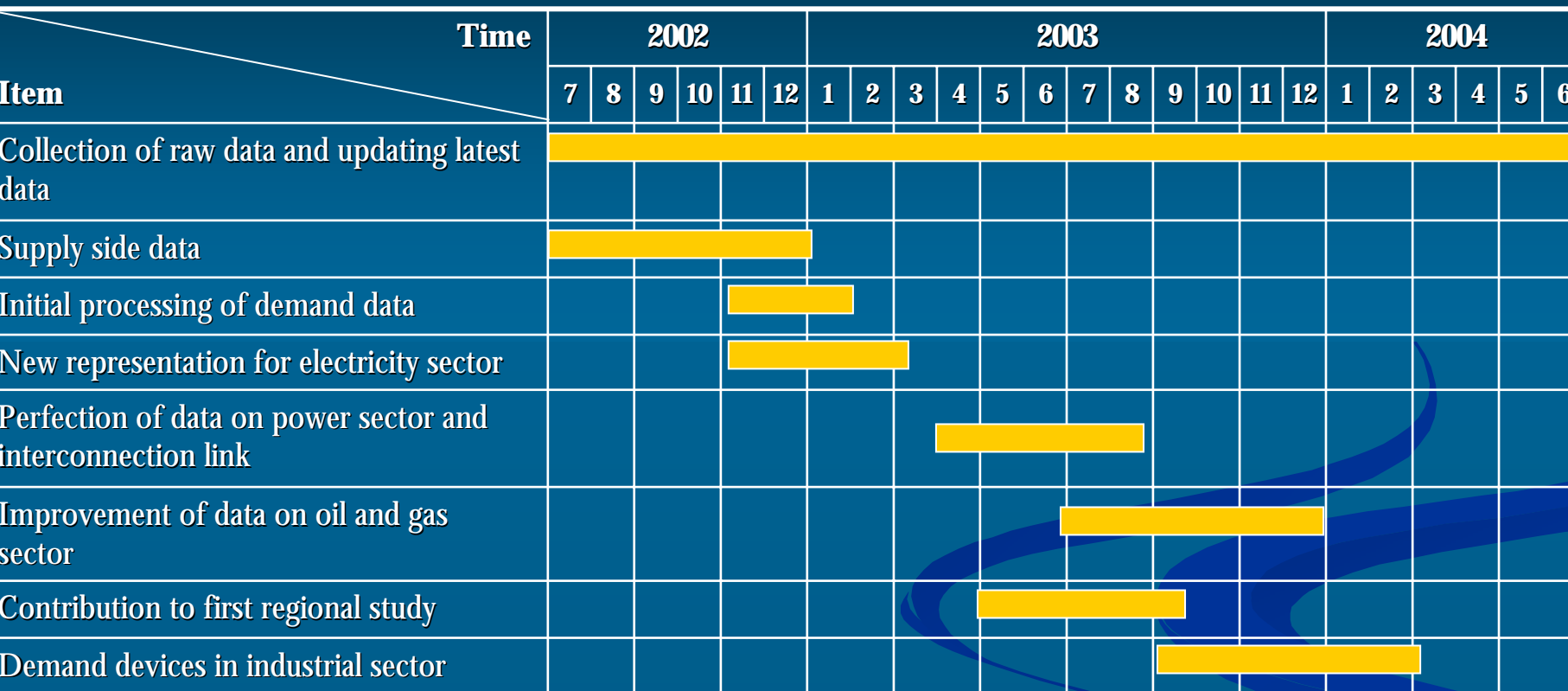
Progress of Working Schedule



Progress of Working Schedule (1)

1. NPT was established in July 2002
2. Collection and processing of raw data from various sources
3. Implementation of the first national policy study on power sector
4. Contribution to the first regional study
5. Implementation of the second national policy study
6. Contribution to the second regional study
7. Under working on the third national policy study

Progress of Working Schedule (2)



Basic Training Course, NPT establishment



1st AMC assistance



2nd AMC assistance



1st W/A to ACE



1st Regional Study



2nd W/A to Australia



2nd National Study



Indonesia-Viet Nam exchange



1st W/A to Australia



1st National Study



2nd W/A to ACE



3rd AMC assistance



W/A: Work Attachment

Progress of Working Schedule (3)

Item	Time		2004						2005										
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Collection of raw data and updating latest data	████████████████████																		
Contribution to third national study	██████████																		
Improvement of data on coal, oil, gas and electricity sector (taxes & prices)				██████████															
Implementation of the third national policy study and making report					████████████████														

2nd Regional Study



4th AMC assistance



3rd National Study



3rd W/A to ACE



3rd W/A to Australia



National Energy Policy Studies

FIRST ENERGY POLICY STUDY FOR VIET NAM

- **The Strategy Orientation for
Electricity Supply**

Outline of the 1st Report

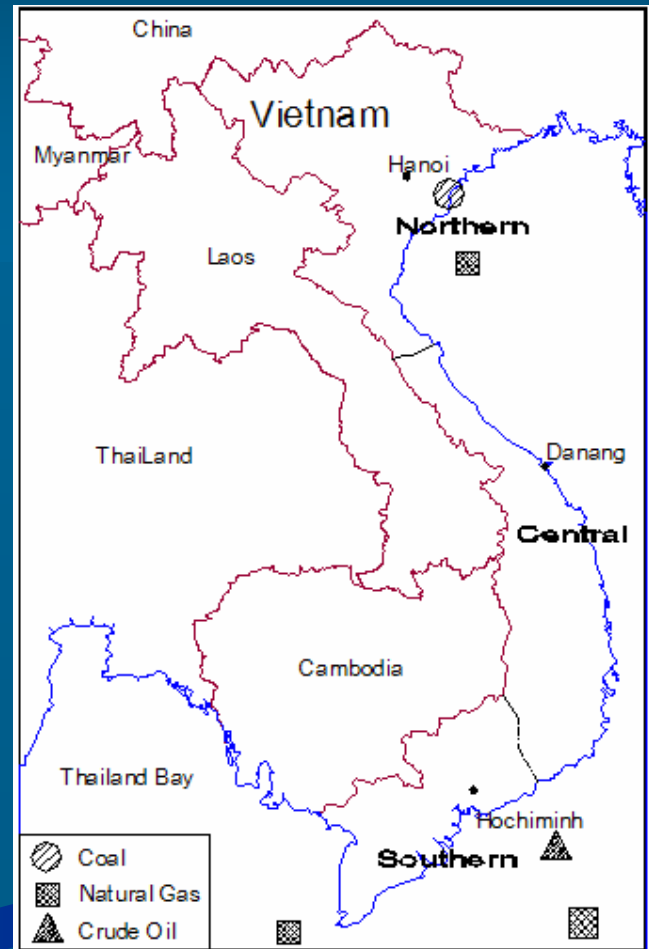
- Section 2 of this report discusses the policy issues that are currently receiving attention in Viet Nam.
- Section 3 describes recent and projected future power sector system development in Viet Nam.
- Section 4 summarizes future power development options that will be considered in the modeling.
- Section 5 describes the current MARKAL model for Viet Nam.
- Section 6 presents the analysis of the results, with conclusions for each case run.
- Section 7 presents the conclusions of the study and recommendations for further work.

Policy Issues for Vietnam

- **SECURITY OF FUEL SUPPLY**
- **ENERGY PRICING**
- **ENVIRONMENT**
- **POWER SECTOR REFORM**

Overview of Vietnam

- In the Northern region, the system is dominated by hydropower. There are also significant reserves of coal for power generation.
- The fast-growing Southern region has hydro capacity, but has still to rely on fuel oil-fired generation. Offshore gas fields provide the region natural gas for power generation.
- The Central region has the smallest population and limited installed capacity in hydro and diesel-fired generation.



Existing System

Installed capacity (MW) Vietnam in 2002

Sub-system	Hydro	Coal	Gas	Fuel Oil	Diesel Engine	Total
North	2028	1245			8	3281
Central	856				158	1014
South	1185		2322	573	328	4408
Total	4115*	1245	2322	573	494	8749
Share (%)	47	14.3	26.5	6.5	5.7	100

Electric Power Demand Forecast

Base case						
Year	2000	2005	2010	2020	Average	
Industry	9088	21951	43030	113590	13.46%	
Agriculture	428	630	910	1152	5.08%	
Household	10986	18606	31982	48315	7.69%	
Commercial/service	1084	2227	4308	9112	11.23%	
Others	811	1627	2754	6250	10.75%	
Total	22397	45040	82986	178418	10.93%	
Growth (%/ann.)	15.0%	15.0%	13.0%	8.0%		
Losses (exc. own use)	14.2%	13.4%	11.0%	8.0%		
Total Generation	26594	53438	96125	201367	10.65%	
Peak load (MW)	4890	9118	16033	32376	9.91%	
Consumption per cap. (KWh/cap.)	341	636	1064	1977	9.18%	
High case						
Industry	9088	23129	49787	142333	14.75%	
Agriculture	428	635	910	1446	6.28%	
Household	10986	19281	31982	57185	8.60%	
Commercial/service	1084	2293	4669	13108	13.27%	
Others	811	1748	3176	7739	11.94%	
Total	22397	47086	90524	221811	12.15%	
Growth (%/ann.)	15.0%	16.0%	14.0%	9.4%		
Losses (exc. own use)	14.2%	13.4%	11.0%	8.0%		
Total Generation	26594	55692	105008	250035	11.86%	
Peak (MW)	4890	9641	17853	40265	11.12%	

Future Options

Electricity supply options :

- **Northern region: coal fired TPP, hydro power plant**
- **Central region: hydro power plant, gas fired TPP, nuclear power plant**
- **South region gas fired TPP, hydropower plant, coal fired TPP**
- **Interconnection: power interconnection and Trans ASEAN gas pipeline**

Scenario and Case Definitions

Case	Scenarios Included	Scenario Description
BASE	BASE	Base case as per Master Plan V
CASE 1	BASE + SCEN_1	Low electricity growth rate
CASE 2	BASE + SCEN_2	Expanded capacity of nuclear plant
CASE 3	BASE + SCEN_3	Unlimited coal import
CASE 4	BASE + SCEN_4	Unlimited electricity import
CASE 5	BASE + SCEN_5	Unlimited natural gas import
CASE 6	BASE + SCEN_6	Expanded capacity of HV links
CASE 7	BASE + SCEN_7	Unlimited capacity of gas turbines
CASE 8	BASE + SCEN_8	Relocate nuclear plant from Central to Southern region
CASE 9	BASE + SCEN_9	Limited CO2 emission

Summary of Conclusions of the 1st Report (1)

- **The most suitable location of nuclear power plant is in the central region. Because, apart from hydropower, there is no other significant natural resource for power generation in that region.**
- **With a 10% of decrease in electricity demand, power sector investment is reduced by 15%. This is very important to Vietnam, which lacks investment capital.**
- **Domestic coal plays an important role in power sector development.**

Summary of Conclusions of the 1st Report (2)

- **Natural gas will be the strategic fuel for electricity generation in the future. Combined cycle is the most attractive technology consuming natural gas.**
- **Natural gas import via TAGP is very important in the future. It will enhance the cooperation among countries in ASEAN and strengthen security of fuel supply.**
- **Links between the North-Central and Central-South is to consolidate the security supply of electricity in each region.**

The Second Study

The Second Energy Policy Study for Vietnam is entitled

- **“Analysis of Power Development Strategies in Compliance with Energy Security and Environmental Issues”**

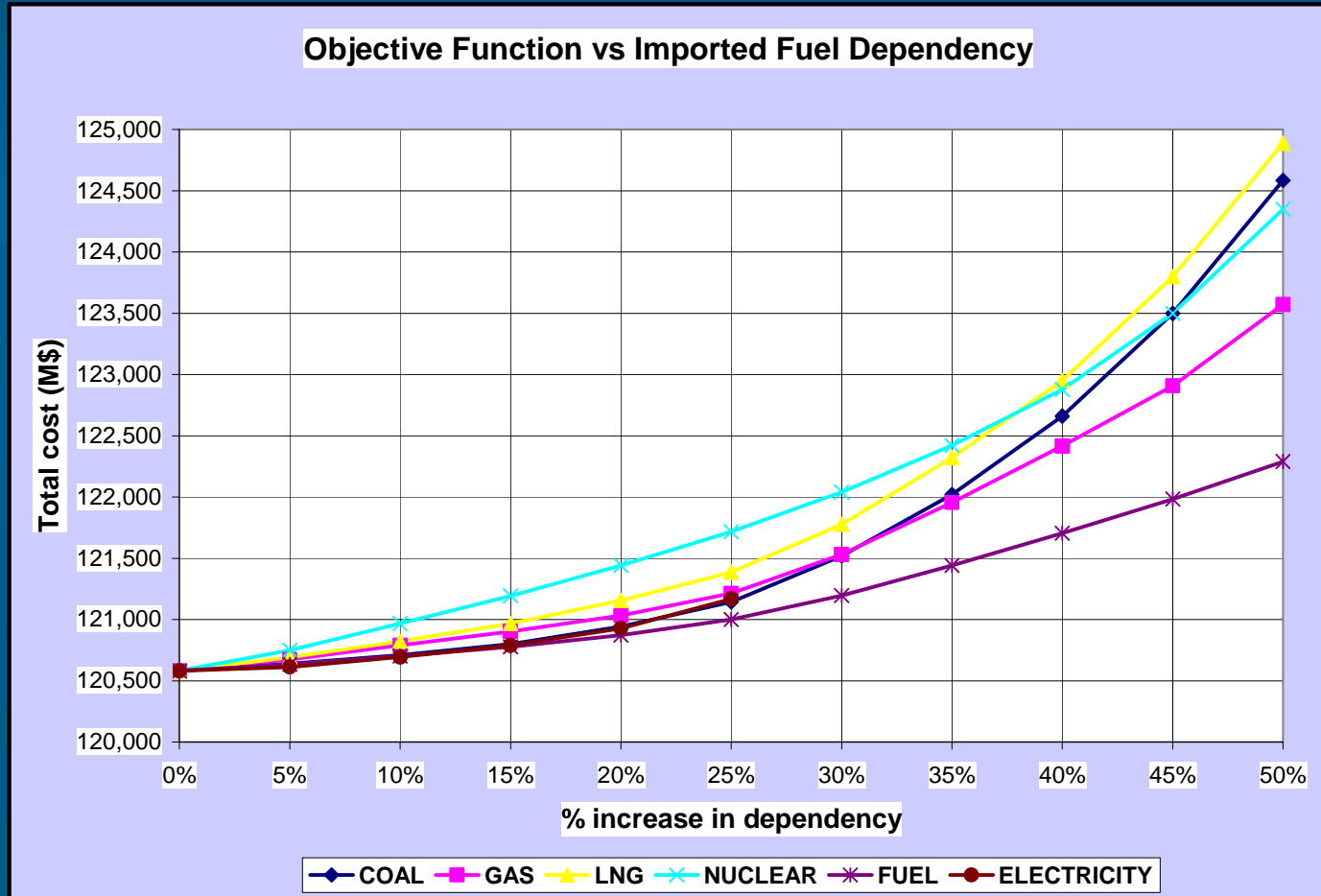
Objectives of the Study

- **To ensure the provision of adequate, secure and effective electric power supply by developing indigenous energy resources, applying advanced technologies, enhancing regional cooperation and diversifying energy sources**
- **To ensure that factors pertaining to environmental protection are not neglected**

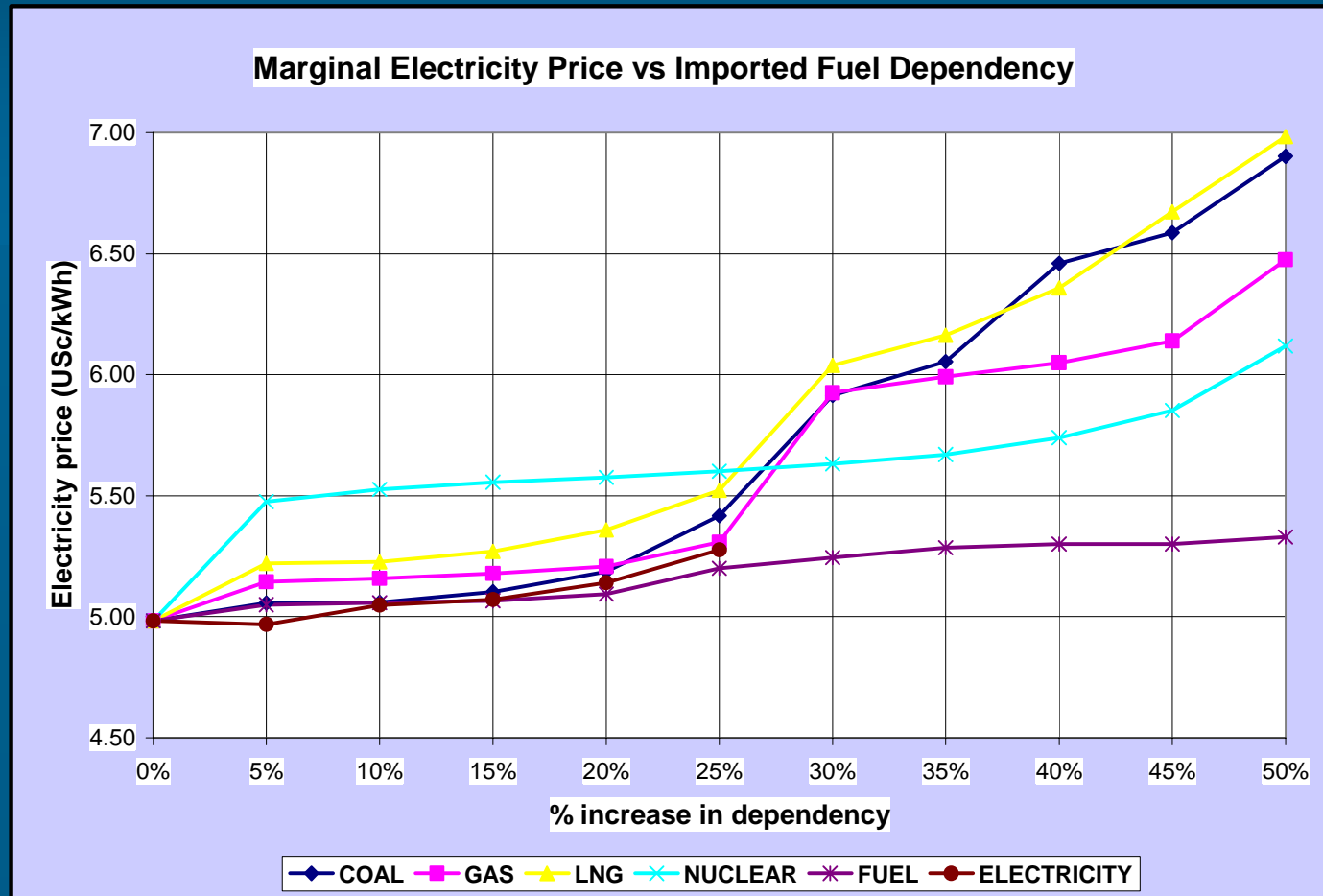
Results of the Study

- **Suitable level of dependency on imported fuels for power generation until 2035**
- **Most suitable technologies for power generation**
- **Capability of the power sector in mitigating air pollutions (CO₂, NO_x, SO_x)**

Objective function changes caused by increasing imported fuel dependency



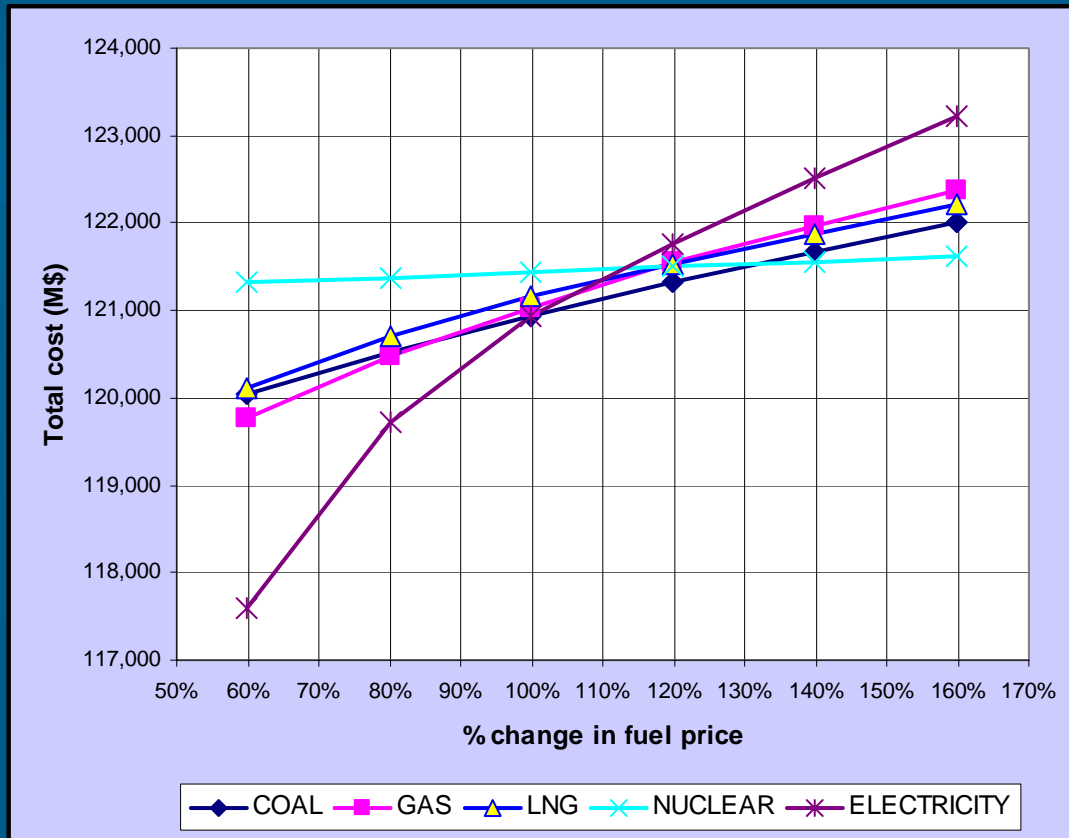
Changes in electricity price caused by increasing imported fuel dependency



Changing fuel prices

- **Change prices of each fuel option in turn by the same percentages of base price**
- **Increase level of dependency on each imported fuel by 20%**
- **Find out the impacts of changing fuel prices on total cost and electricity price**

Changes in objective function caused by changing fuel prices



Topic of the third study

**"Energy pricing and its
implication for environment"**

Objectives of the Study

1. **Develop an energy pricing database by using MARKAL**
2. **Identify pricing policy implications in relation to environment**

Outputs of the Study

1. **Energy pricing policies focusing on natural gas, coal, oil and electricity sector**
2. **Database covering energy sources (oil, gas, coal and power)**
3. **A set of appropriate environmental tax on GHG emissions**

Assumptions

Assumptions for the base case are:

- **Crude oil price \$40/bbl**
- **Hard coal import (used in Industry) \$43/ton**
- **Steaming coal transported from the North \$34/ton**
- **No natural gas imports**
- **Gas reserves based on mid-case definition**
- **Nuclear allowed in the South (2020) and Central (2030)**

Assumptions (cont.)

Electricity import:

- **Import of 40 MW from China at 110 kV into the North. Price is \$43/MWh**
- **From 2010 import of 800 MW from Laos at 220 kV into the North (400 MW) and the Central (400 MW)**
- **Export of 200 MW to Cambodia at 220 kV by 2010 (from the South)**

From 2020:

- **A possible extra 1200 MW from Laos into North (600 MW) and Central (600 MW)**
- **A possible extra 1000 MW imported from China into the North**
- **A possible 1000 MW imported from Cambodia into South**

Results

Pricing Policy Development

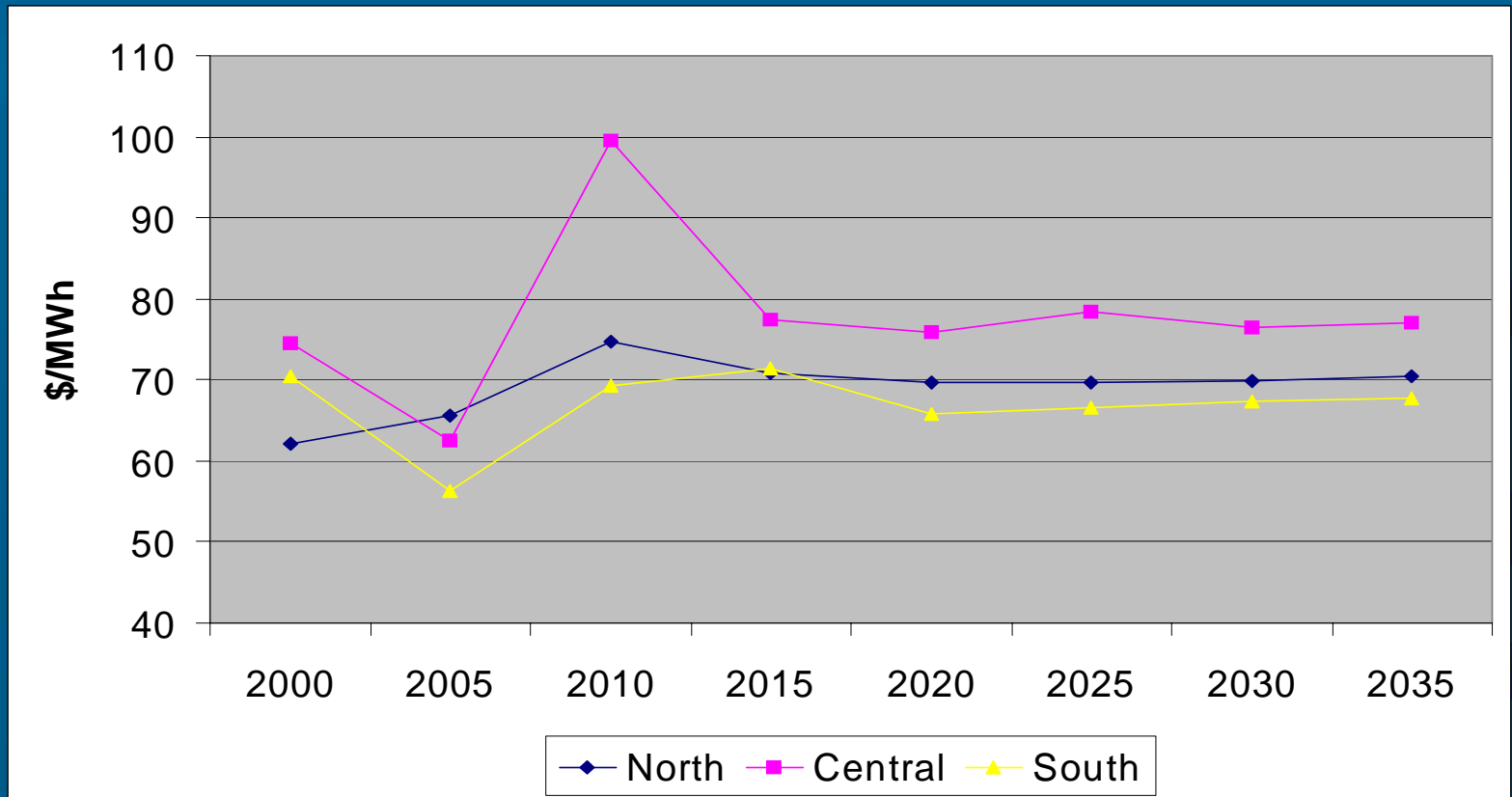
Electricity sector: Regional electricity price averaged over all cases (\$/MWh)

	2000	2005	2010	2015	2020	2025	2030	2035
North	62.02	65.67	74.65	70.85	69.74	69.58	69.77	70.42
Central	74.44	62.43	99.53	77.51	75.86	78.48	76.38	77.00
South	70.44	56.25	69.25	71.39	65.69	66.54	67.39	67.79

Results

Pricing Policy Development

Electricity sector: Regional electricity price averaged over all cases



Results

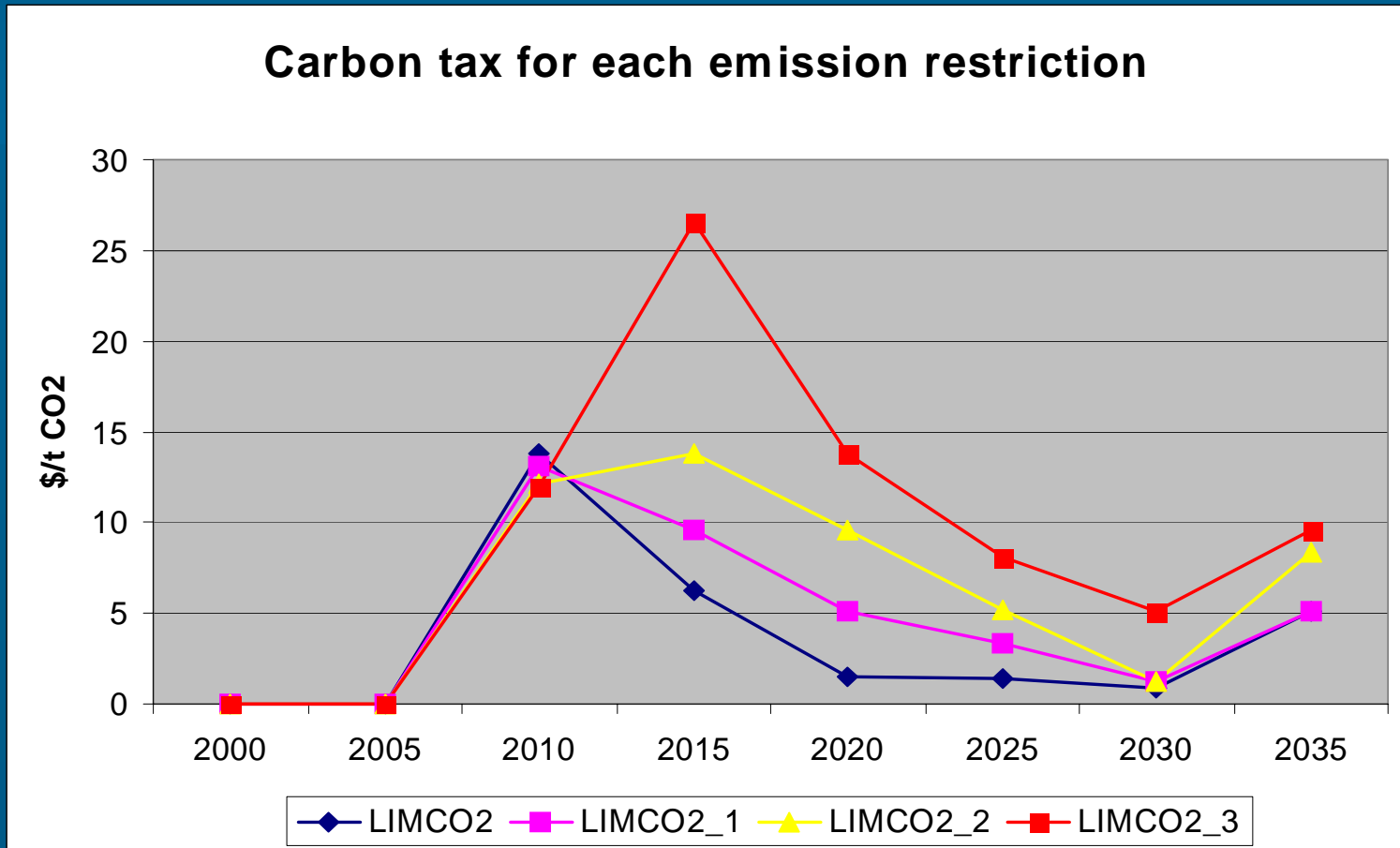
Pricing Policy Development Environmental tax

- **One of aims in this study is to examine an appropriate level of environmental tax on GHG emissions**
- **A number of cases have been run with different levels of CO₂ reduction**

Results

Pricing Policy Development

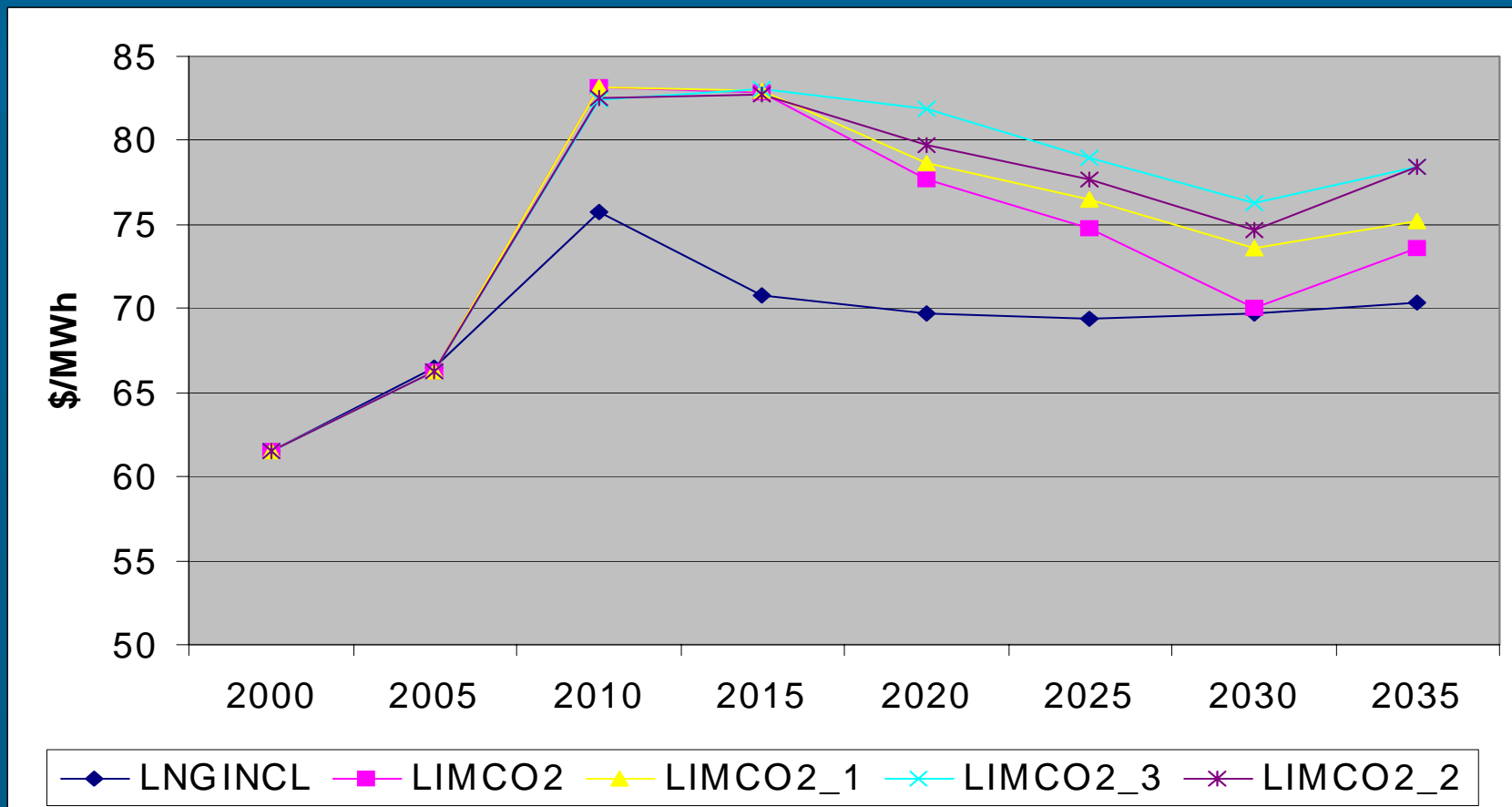
Environmental tax (5, 10, 15, 20% of CO₂ reduction)



Results

Pricing Policy Development

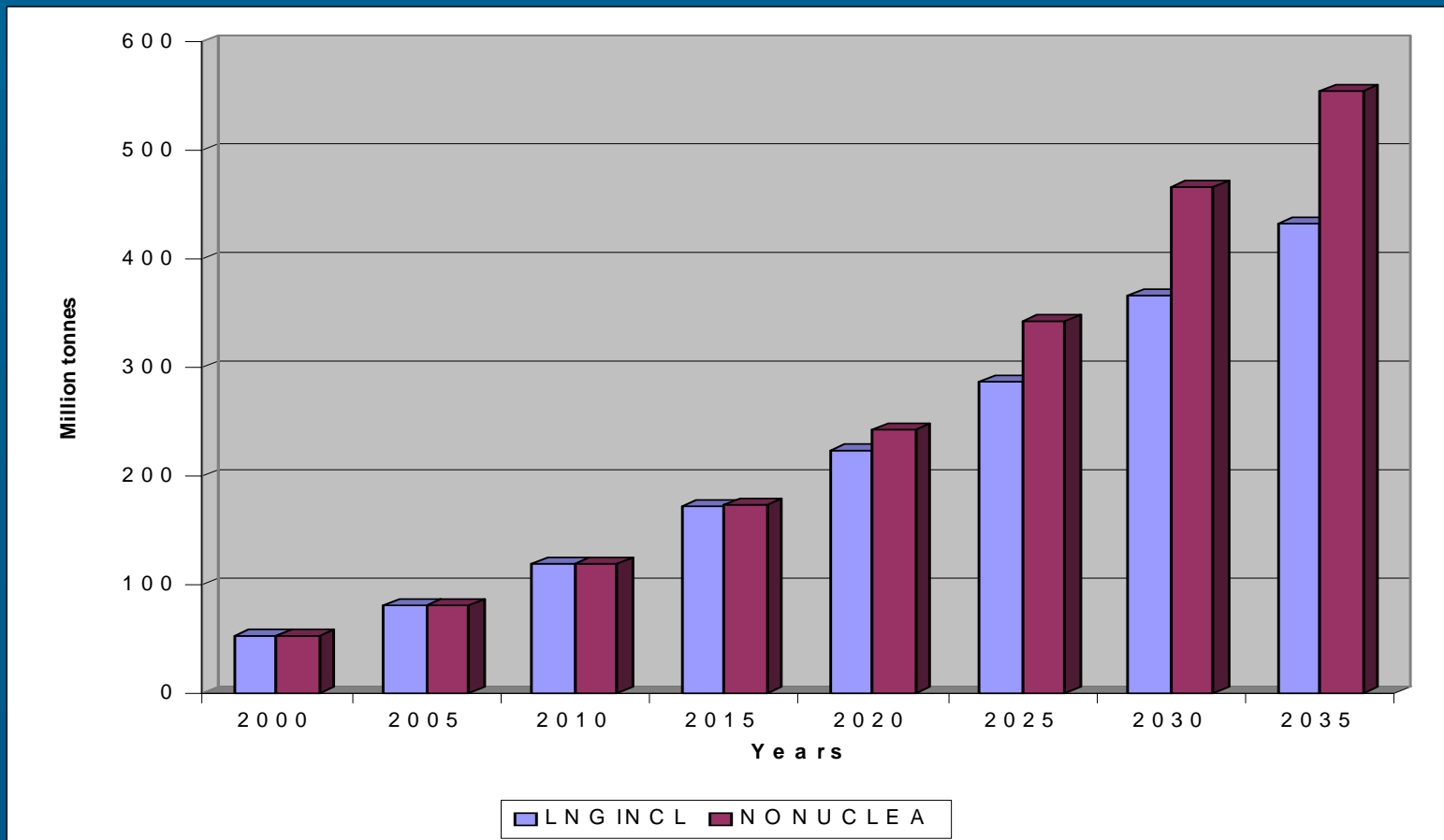
Impact on electricity price of carbon tax in the North



Results

Pricing Policy Development

CO₂ emission with and without nuclear power option



Recommendations

Electricity sector

Prices should be differentiated in the three regions for the longer term

- **The highest price is in the Central.**
- **The difference in prices between seasons is highest in the North where the dry season price exceeds the wet season price by \$15 – 30/MWh.**
- **The seasonal price difference in the North will be reduced by 2020.**

Recommendations

Environmental tax

With nuclear power as an option:

- Reduction of CO₂ emissions should be less than 15% of total emission in the base case
- Carbon tax will significantly decrease when a nuclear power plant put into operation
- It is suggested that the impact of CO₂ tax on electricity price will be affected in period 2010 – 2015.

Without the nuclear option:

- Emissions are at a significantly high level after 2020

Future study with Markal

**Master Plan Study on
National Energy Development**

Thank you !