

Modelling for Energy Demand Forecasting in Nepal: an Econometric Approach

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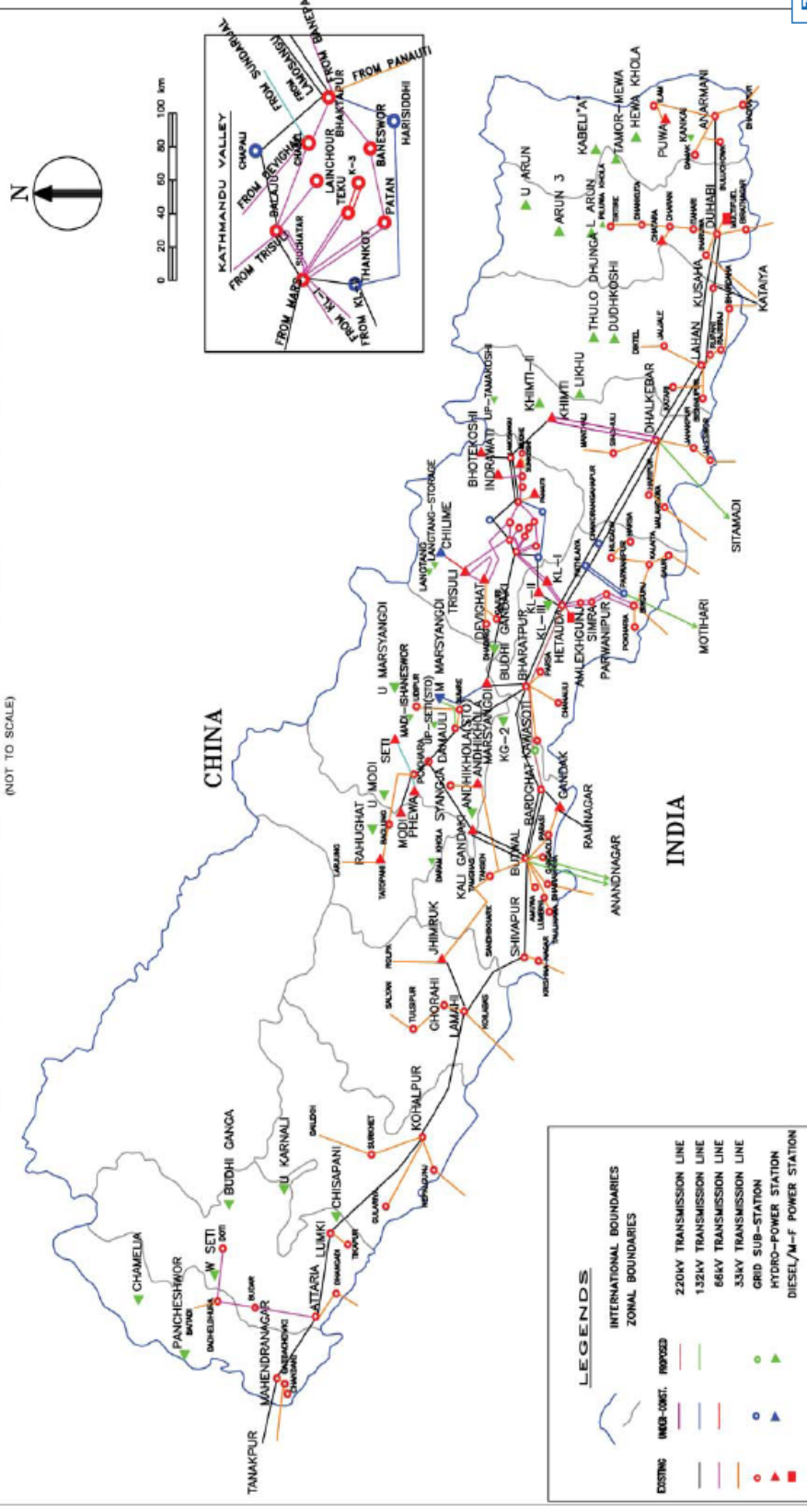
Outline of presentation

- **Background: Nepal**
- **Nepal Energy Sector**
- **Methodology**
 - **Model development for the energy consumptions**
 - **Limitations**
- **Summary Results/Policy Issues**
- **Conclusion**

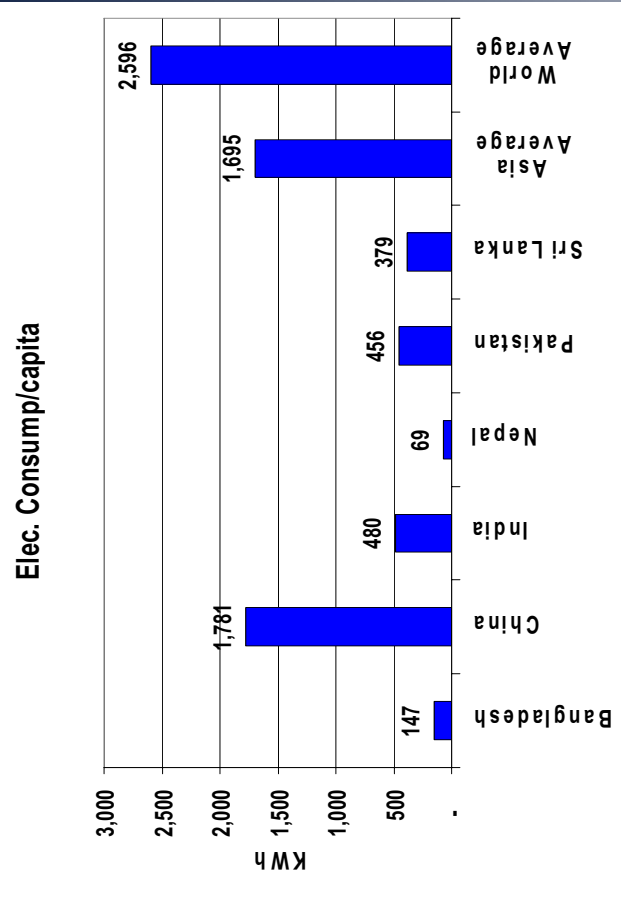
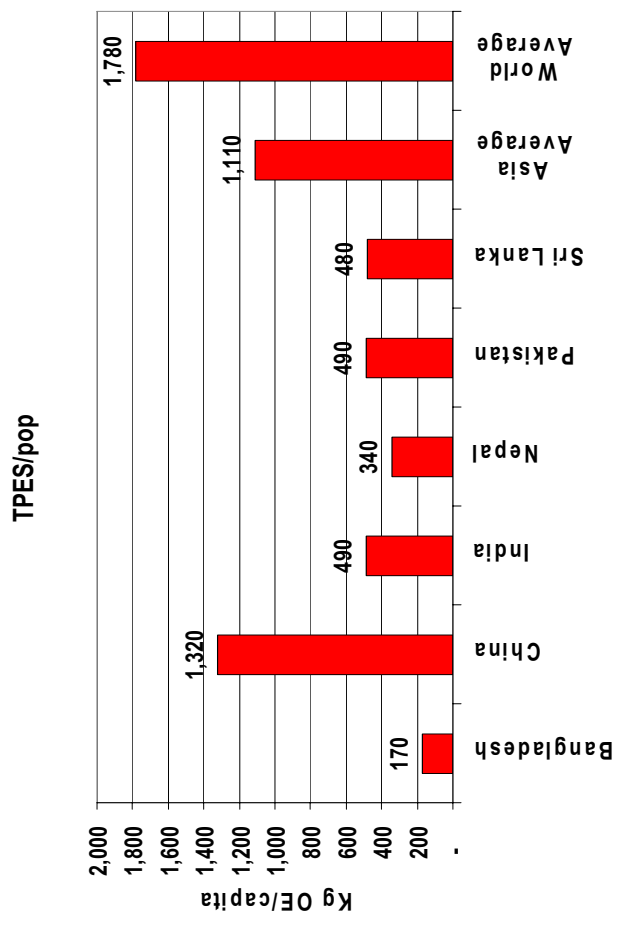
Map of Nepal

POWER DEVELOPMENT MAP OF NEPAL MAJOR POWER STATIONS, TRANSMISSION LINES & SUBSTATIONS

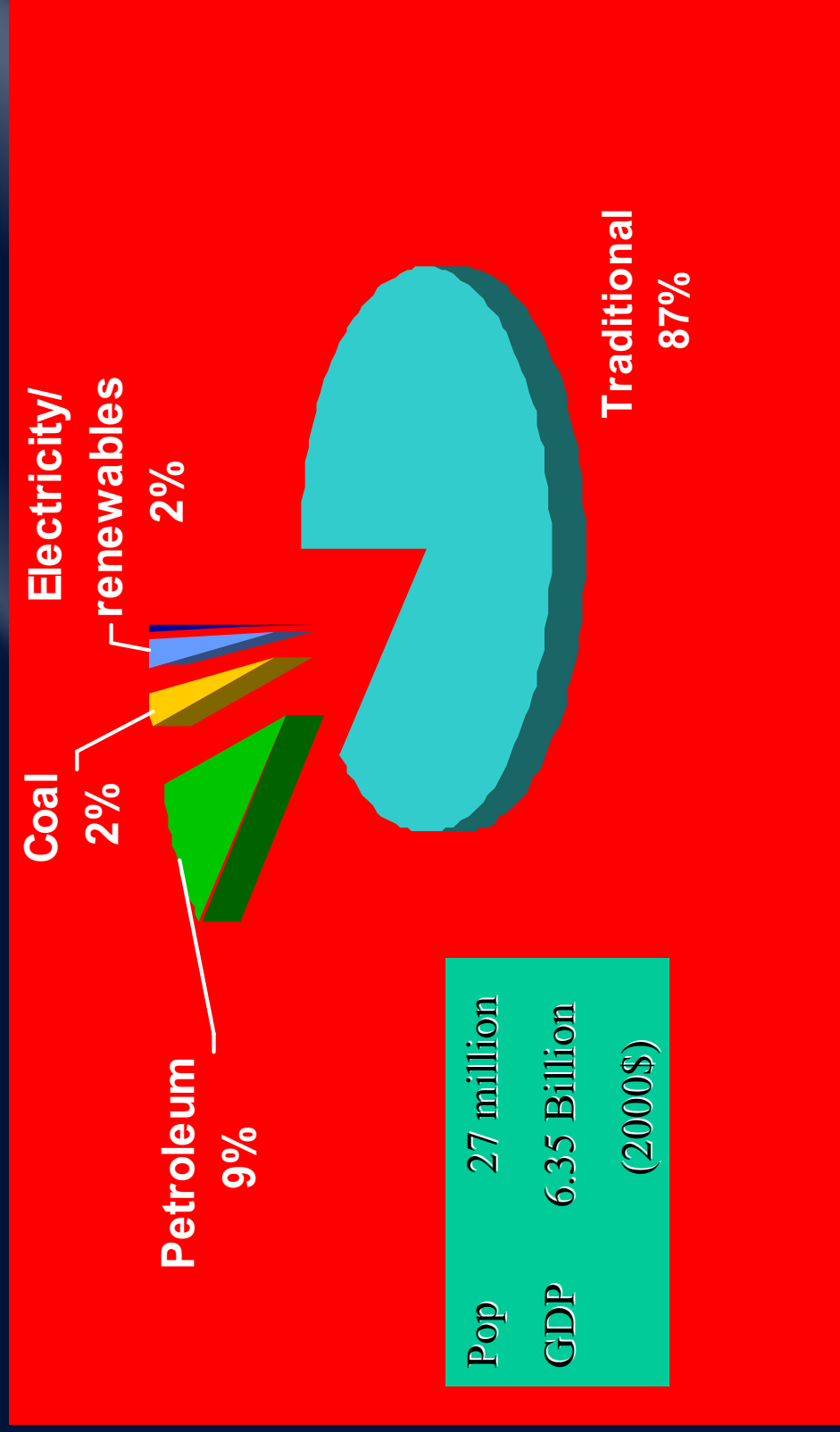
(NOT TO SCALE)



Per Capita Energy Consumption in South Asia & China



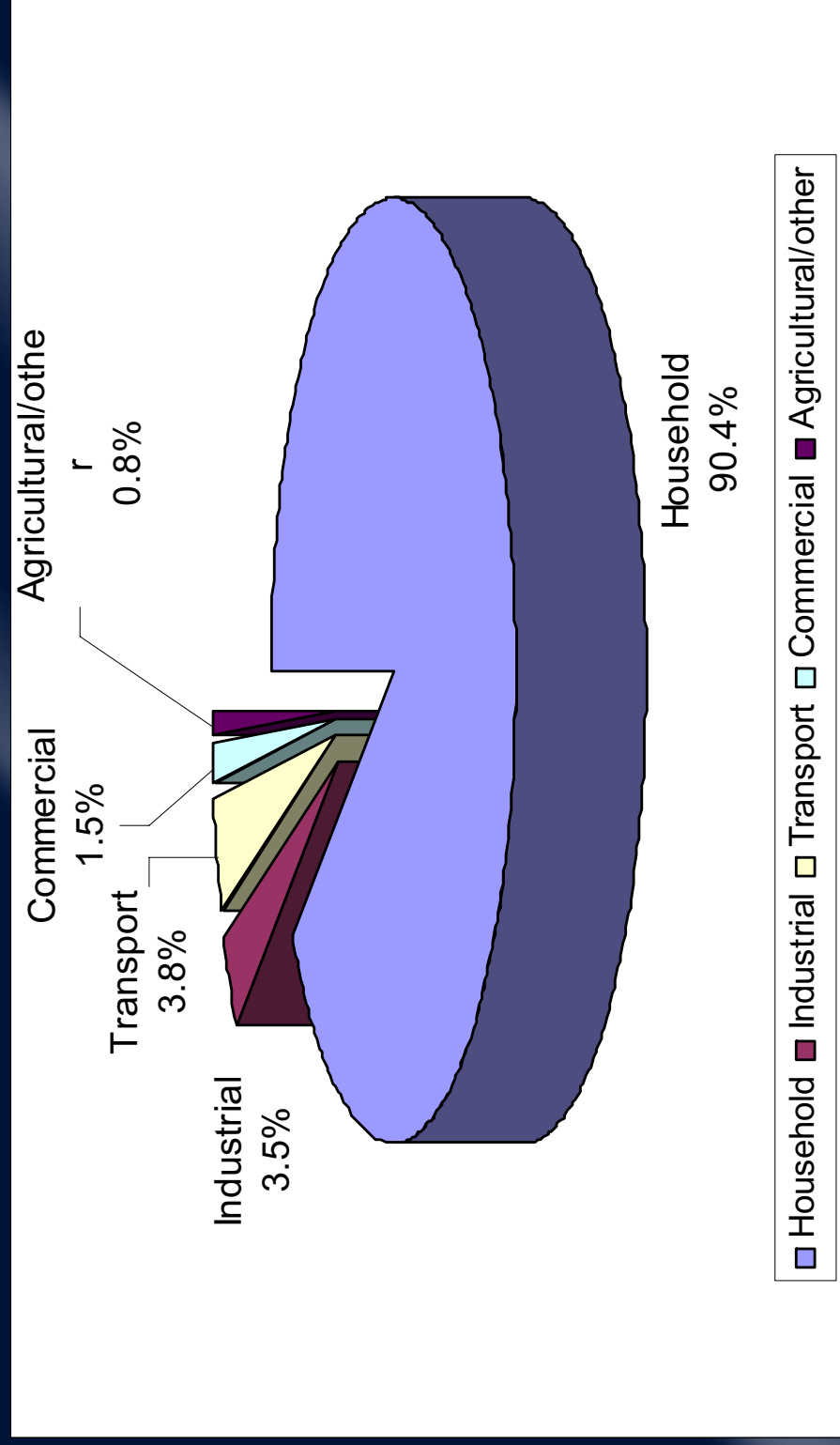
Energy Consumption in 2005



Total Energy Consumption 8.8 million TOE

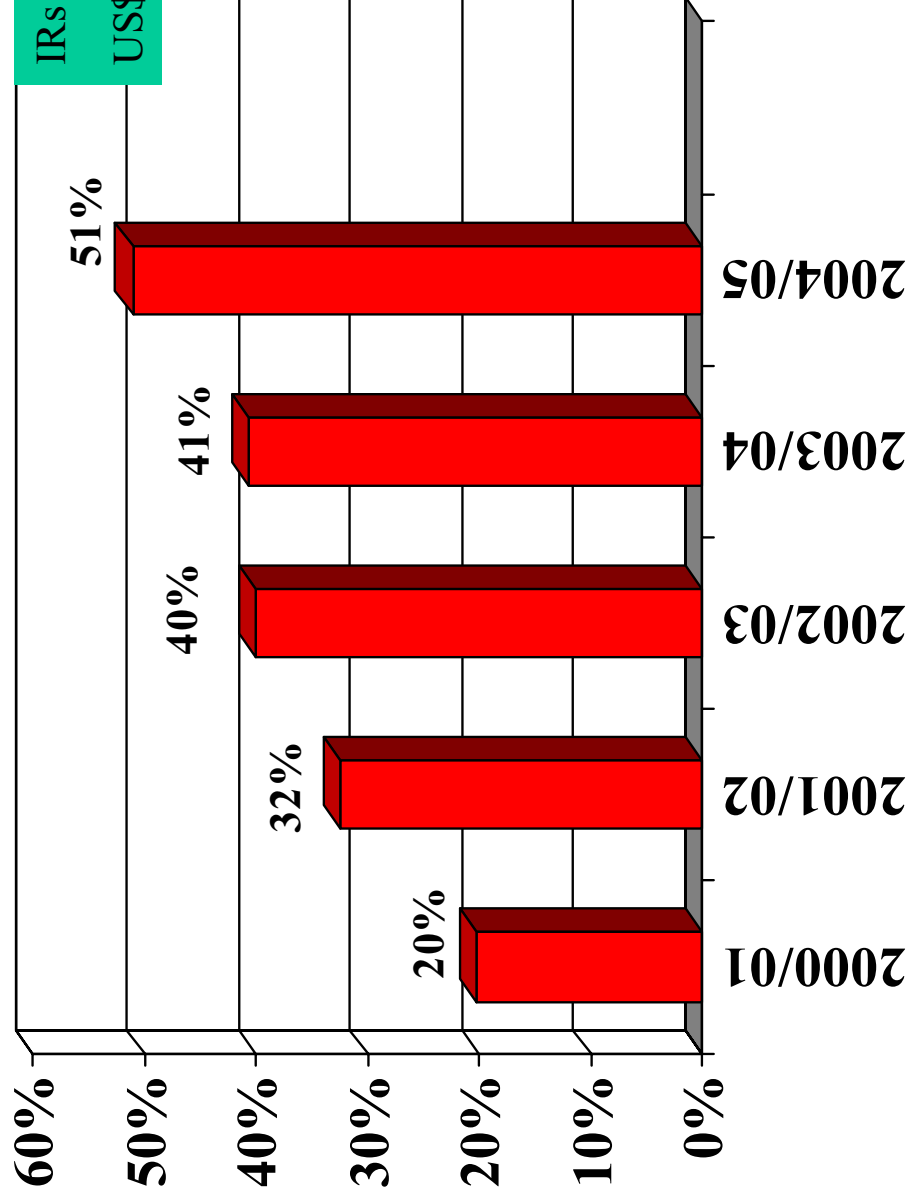
Economic Survey, 2006

End-use Consumption of Energy in Different Sectors in 2005



Total consumption: 8.8 million TOE

Import of Petroleum Products against Commodity Export



IRs 1 =NRs 1.60
US\$ 1=NRs 65.00

Commodity export in 2004/05 was NR 59 billion

Methodology

- **Model Development**
 - More than 25 variables were analyzed
 - 15 dependent variables were selected
 - 10 explanatory variables were selected
- **OLS models developed after conducting unit root test – Augmented Dickey-Fuller (ADF) test**
- **For dependent variables, which failed ADF tests, VAR models were selected.**

Model development

- Ordinary least square (OLS) log-linear form from Cobb-Douglas production function

$$\ln y_t = \alpha \ln x_{1t} + \beta \ln x_{2t} + u_t$$

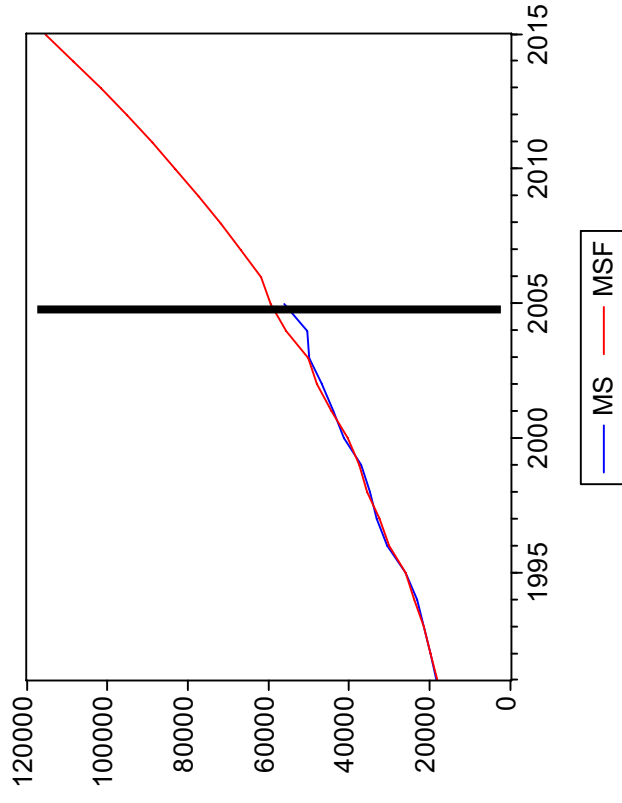
- General vector autoregressive (VAR) models

$$y_t = \beta_0 + \beta_1 x_t + \gamma_1 y_{t-1} + \beta_2 x_{t-1} + \varepsilon_t$$

Motor Spirit

Source: This OLS model selected as logMS & logCAR are I(1) and their residual is I(0). The model is super-consistent (Stock, 1987).

Explanatory variable; logCAR projected as as per growth of car. The car number is Regressed with the real GDP growth BAU NPC, 2002.



$$\log MS_t = 1.042718 \log CAR_t - 0.755922$$

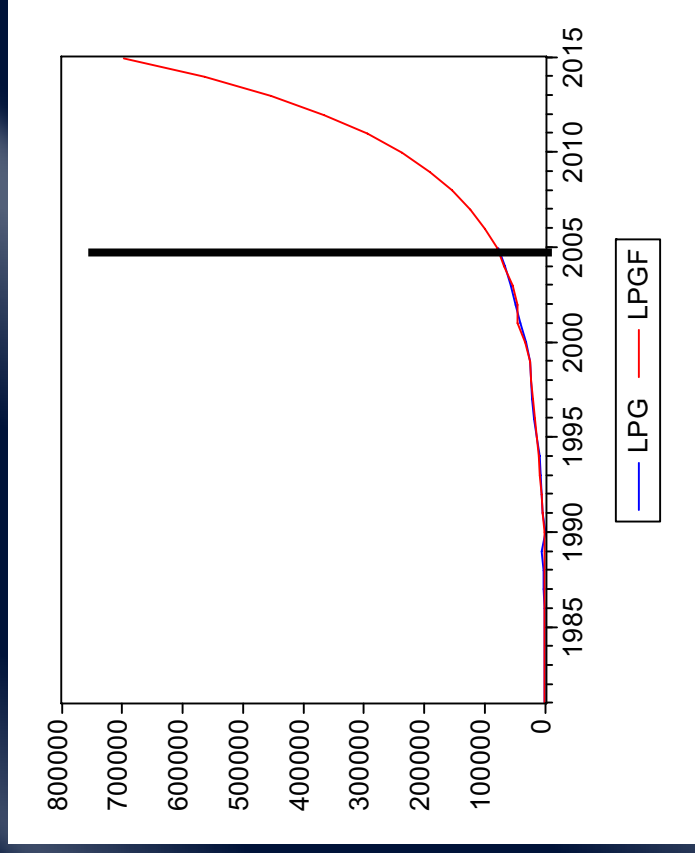
(0.023201) (0.244309)

R²=0.996 [44.94359] [-3.094126]

Liquefied Petroleum Gas

Source: OLS model tried out.
as per lowest AIC (Asteriou,2006).

RGDP_NAGR and UPI are projected as
per NPC and CBS growth rates as BAU.



$$\log LPG_t = 3.192711 \log RGDP_NAGR_t + 1.5162226 \log UPI_t - 22.9512$$

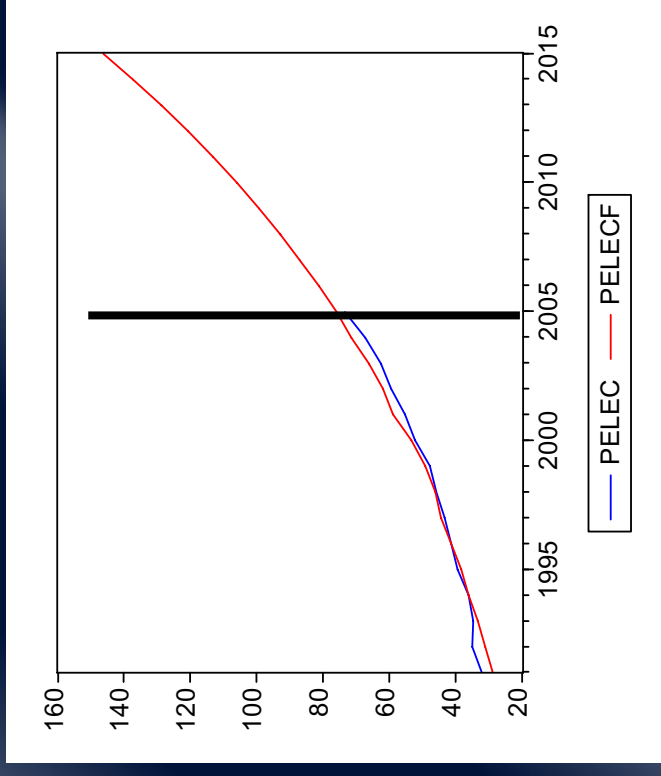
(0.518257)	(0.53129)	(6.944936)
[6.160476]	[2.853859]	[-3.30474]

$$R^2=0.994$$

Per Capita Electricity Consumption

Source: This OLS model selected as logPELEC & logPRGDP are I(1) and their residual is I(0). The model is super-consistent (Stock, 1987).

Explanatory variable; logPRGDP and log UPI projected as NPC BAU.



$$\log PELEC_t = 1.476488 \log UPI_t + 0.554646 \log PRGDP_t + 2.069591$$

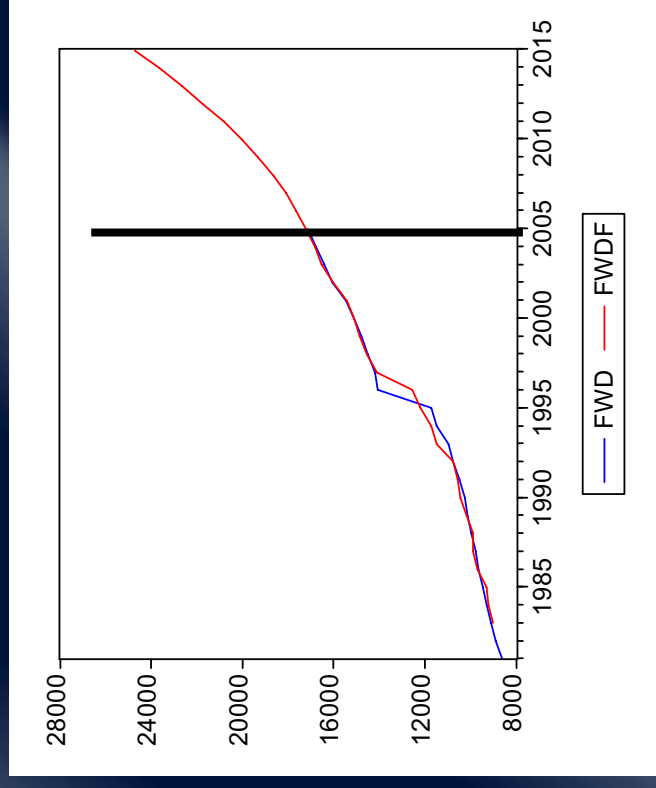
(0.217436) (3.547734)
[6.790459] [0.583356]

R²=0.964

Fuel-wood Consumption

Source: This VAR model among logFWD, logRGDP & logRPI selected from (Asteriou,2006).

RGDP and RPI are projected as NPC BAU.



$$FWD_t = 0.790884 \log FWD_{t-1} + 0.027986 \log RGDP_{t-1} - 1.295109 \log RPI_{t-1} + 1.543315$$

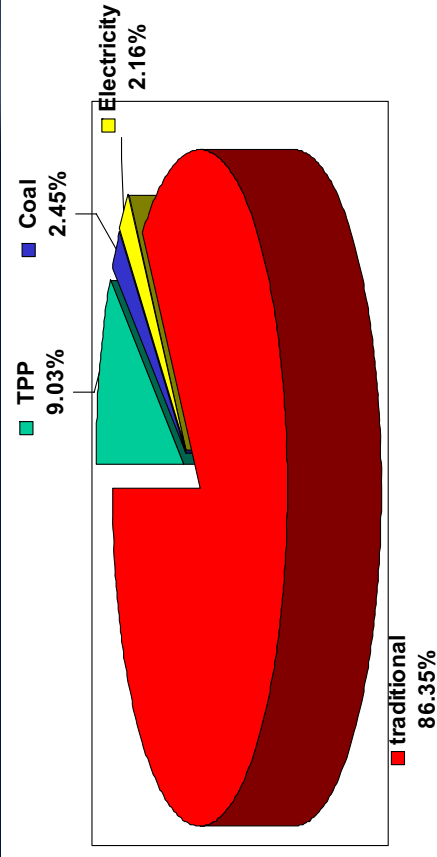
$R^2=0.98$

Summary model statistics

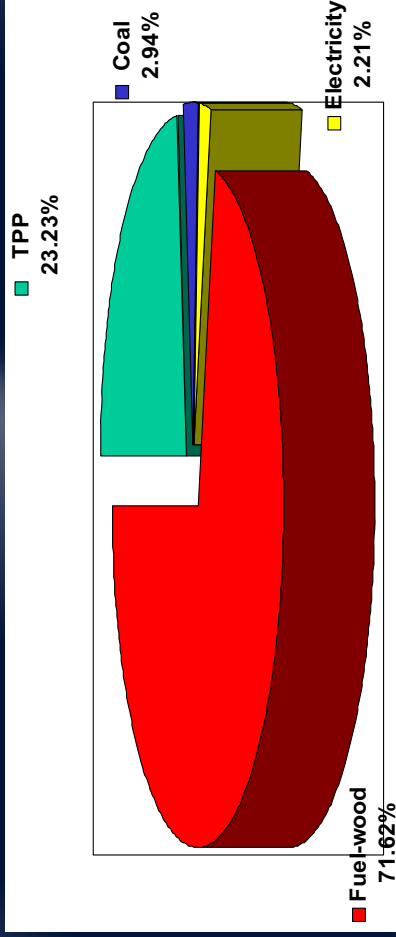
Variables	logMS	logHSD	logSKO	logLPG	logATF	logPELEC	logCOAL
logRGDP		2.1					1.094
logRGDP_AG R							
logRGDP_NA GR			1.66	3.19			
logPRGDP						0.554	
logPOP					4.295		
logUPI				1.516		1.476	
logTOURST					1.757		
logCAR	1.043						
Intercept	0.75	-12.51	-6.62	-22.95	-55	2.07	-0.38
t-statistics (ex. Var)	44.94	30.03	18.15	6.61*/2.85**	2.53*/1.97**	6.79*/1.55**	4.29
t-statistics (intercept)							
	-3.09	-15.58	-6.69	-3.3	-3.5	0.58	-0.14
R ²	0.996	0.98	0.95	0.994	0.6	0.96	0.44

Energy consumption mix in 2005/2015

2005



2015



8.8 million Toe in 2005

12.8 million TOE in 2015

Actual/forecast

Model Validation

- In sample validation with actual consumptions in 1996 – 2000
 - MAPE for petroleum prod. within 6%

Limitations

- **Non – availability of relevant and sufficient data on variables driving the energy sectors**
- **High uncertainty on targets set by National Planning Commission, GON**
- **Non-availability of relevant data on end –use process and equipment levels**

Policy Issues/implications

- **Growing Dependence on fossil fuels**
- **Energy Substitution**
- **Need for development of indigenous hydropower**

Conclusion

- An understanding of the econometric modelling
- A framework developed on the basis of the demand estimation in energy sector for energy planning and policy analysis
- Some vital policy issues that need to be looked into

THANK YOU !

1/9/2008

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