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Role of Cleaner Energy Options and Carbon Tax for a Low Carbon Society in Thailand

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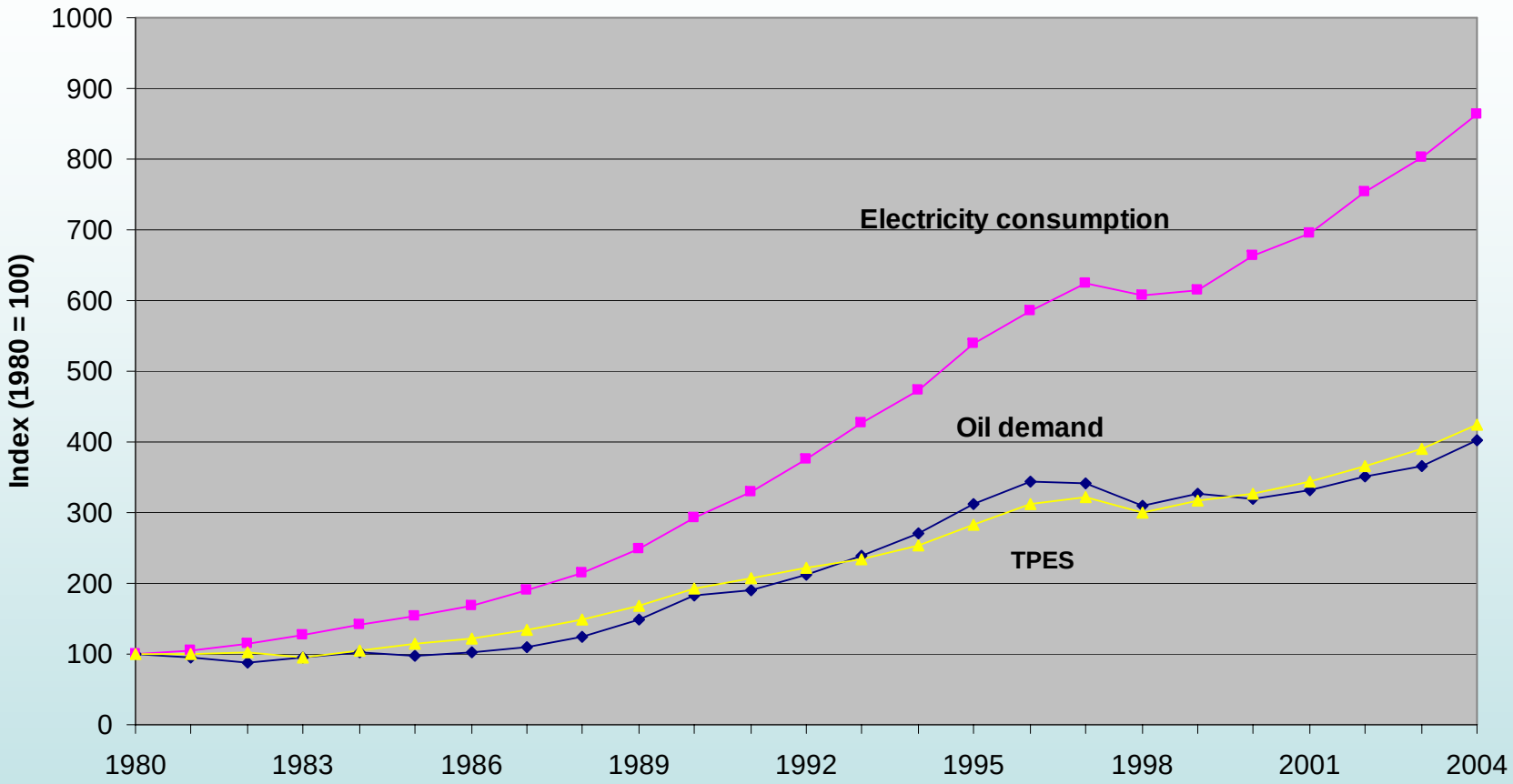
Thailand: Brief Background

- **Population:** 64.76 million
- **Population Density:** 126 people/km^2
- **GDP:** US $ 176 billion
- **GDP per capita:** US $ 2727 (year 2005)
- **Economy:** 2nd largest in ASEAN region
- CO2 emission: 179.9 MtCO2 (2004) – 2nd largest emitter in ASEAN
- High passenger vehicle ownership rate (Vehicles/thousand people: 324 in Bangkok and 100 (Thailand))
- Electricity generation mainly based on fossil fuels (gas, coal)

Growing Electricity consumption, Oil demand and TPES

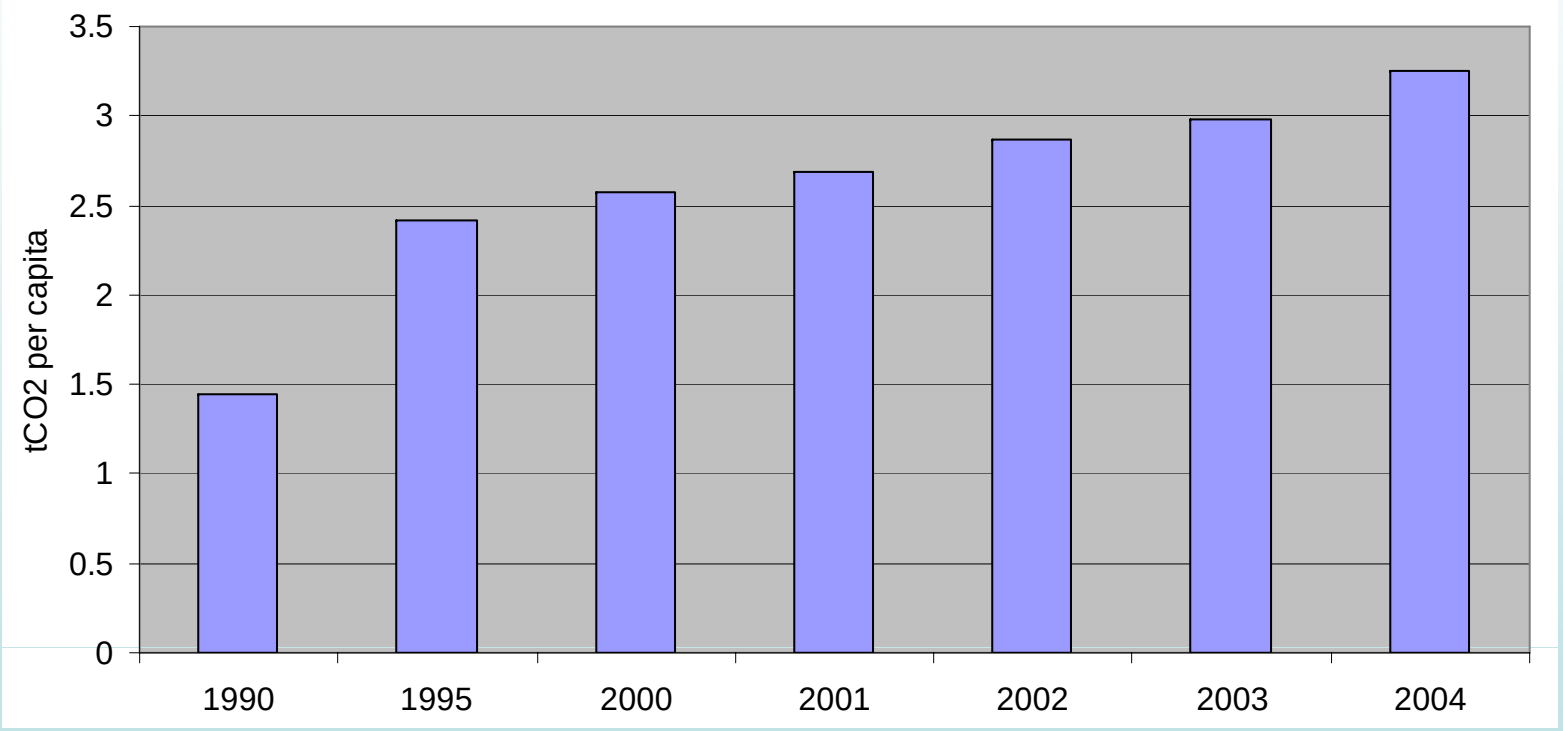


Source: IEA (2006)

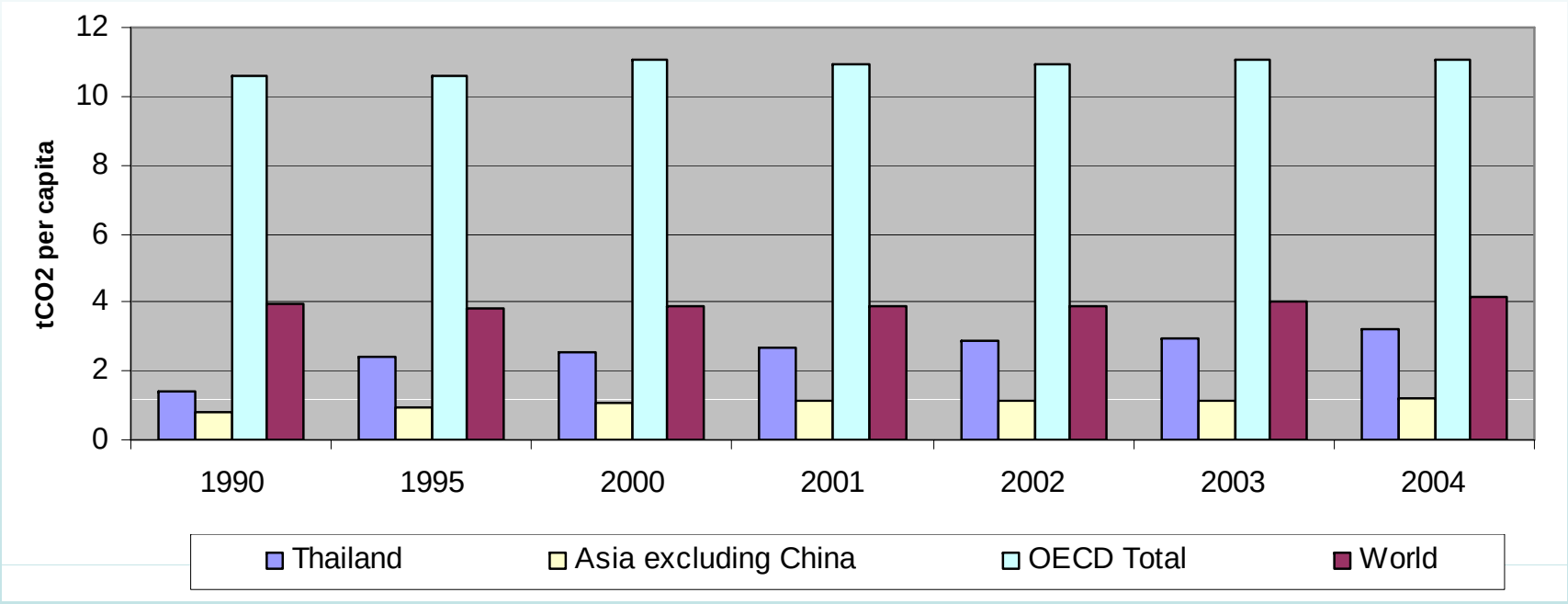
AAGR (1980-2005):

Electricity cons:	9.4%
Oil demand:	6.3%
TPES:	6.3%

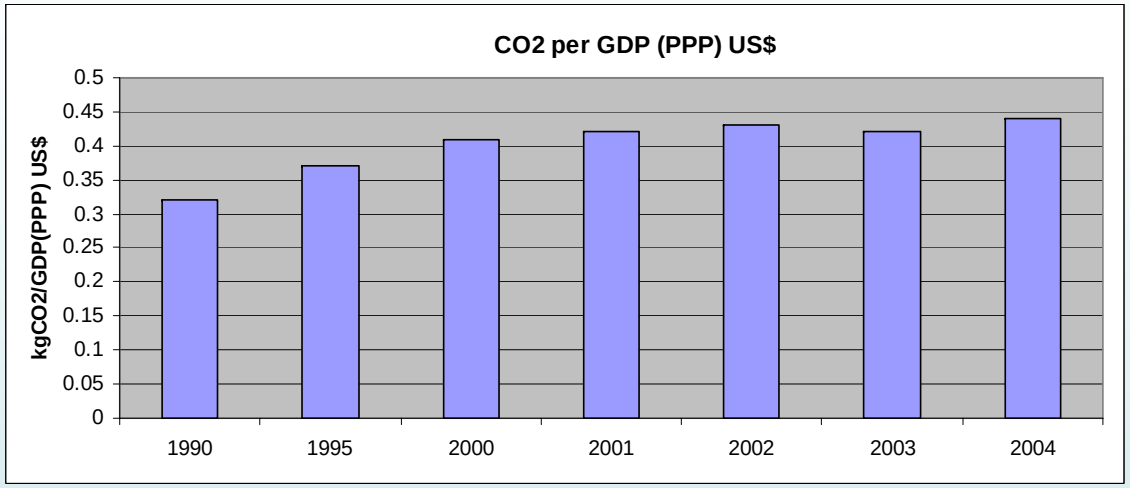
Increasing CO2 per capita in Thailand

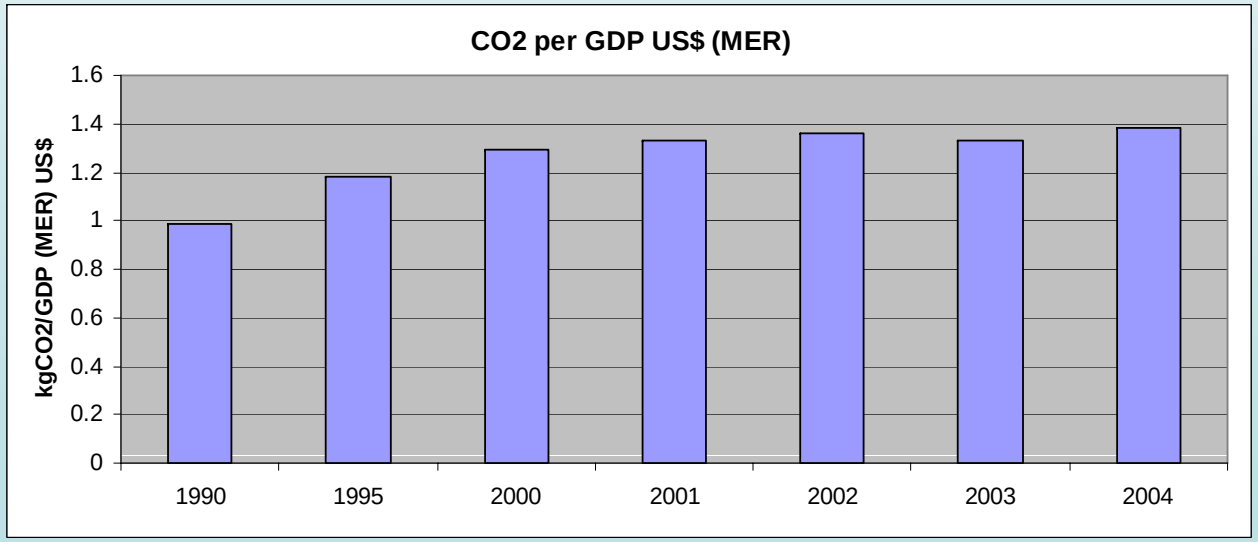


CO2 per capita in Thailand higher than the Asian average (except China)

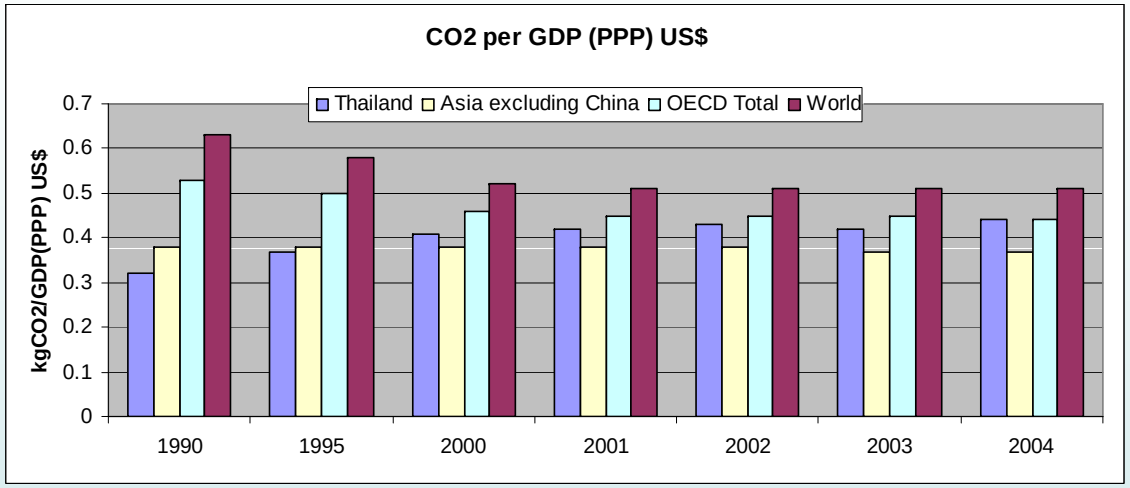


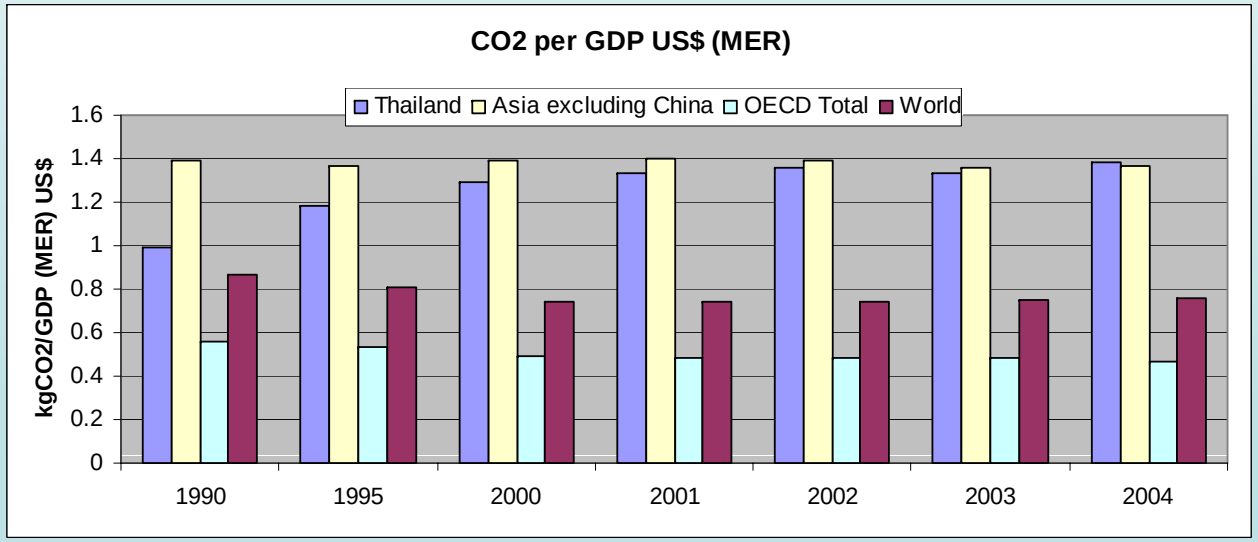
CO2 Intensity Increasing



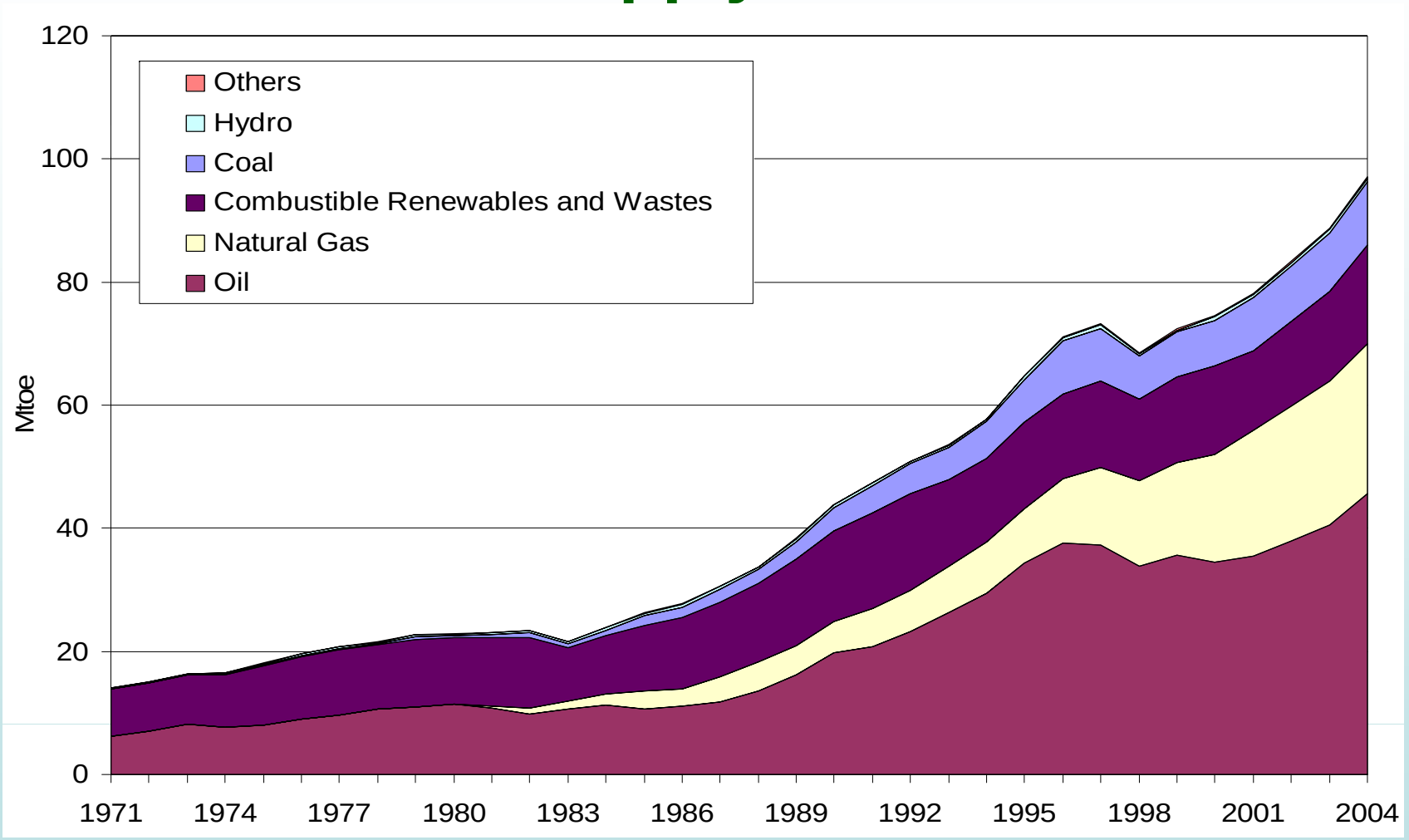


CO2 Intensity (PPP) Comparable to OECD figure



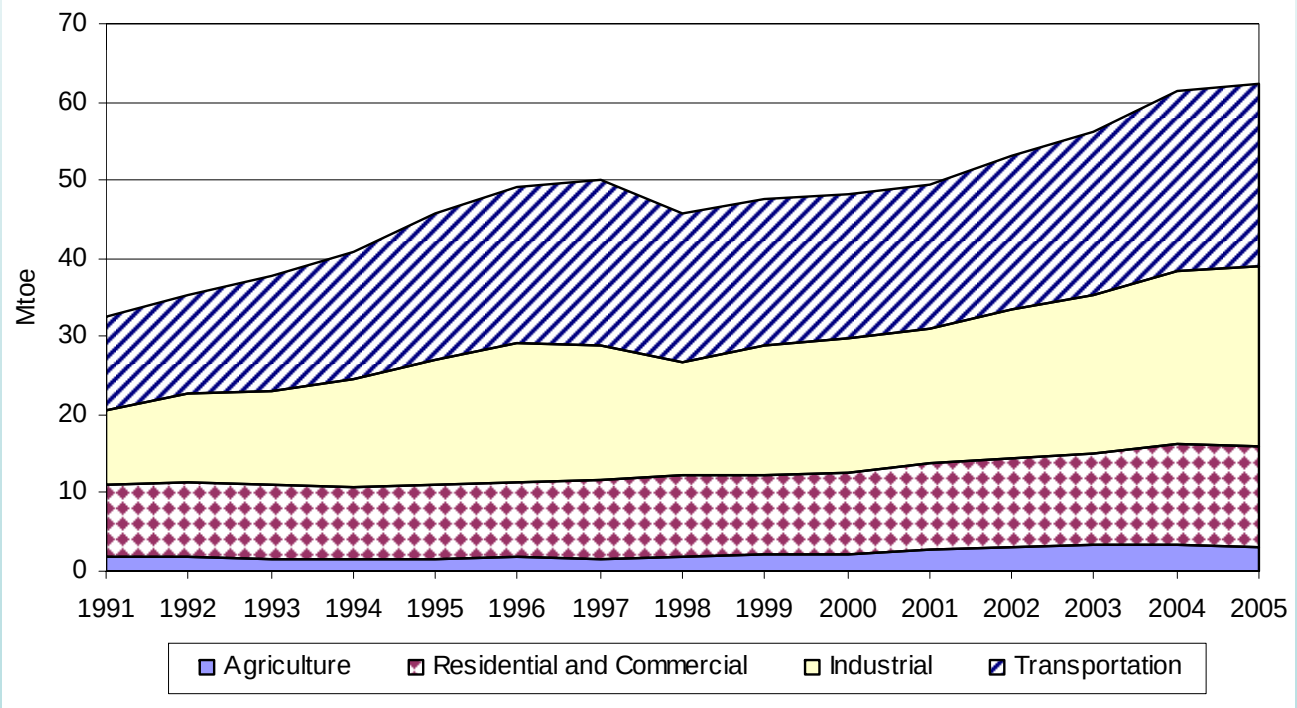


Dominance of Oil in Total Primary Energy Supply



Predominance of road transport

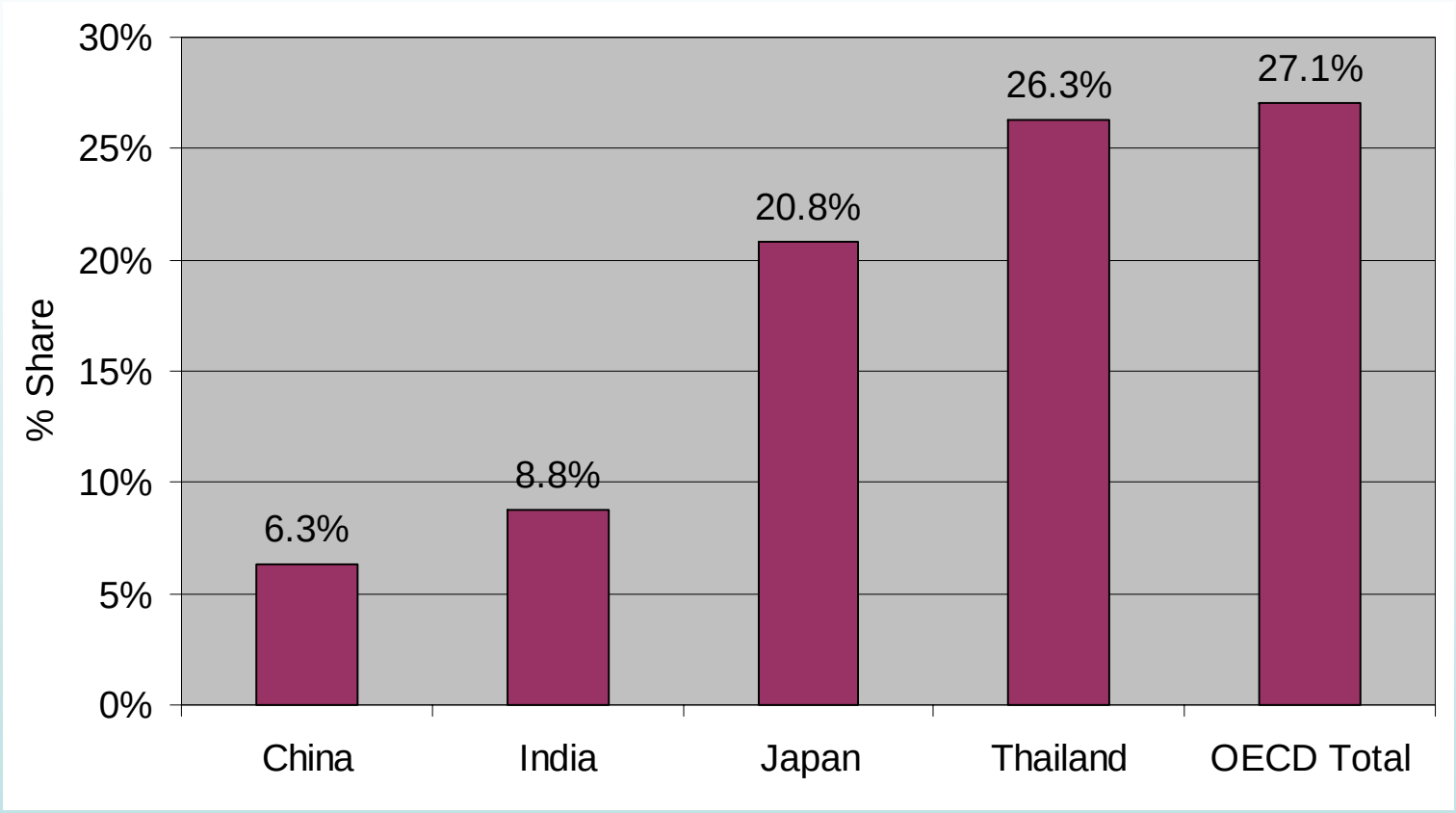
- Length of Highway: 64,000 km
- Length of Railways: Less than 5000 km
  (4070 km (1 m gauge railway line)
  - 294.63 km double track



Transport sector has the 2nd largest share (38.6% in 2005) in Total Energy Consumption.

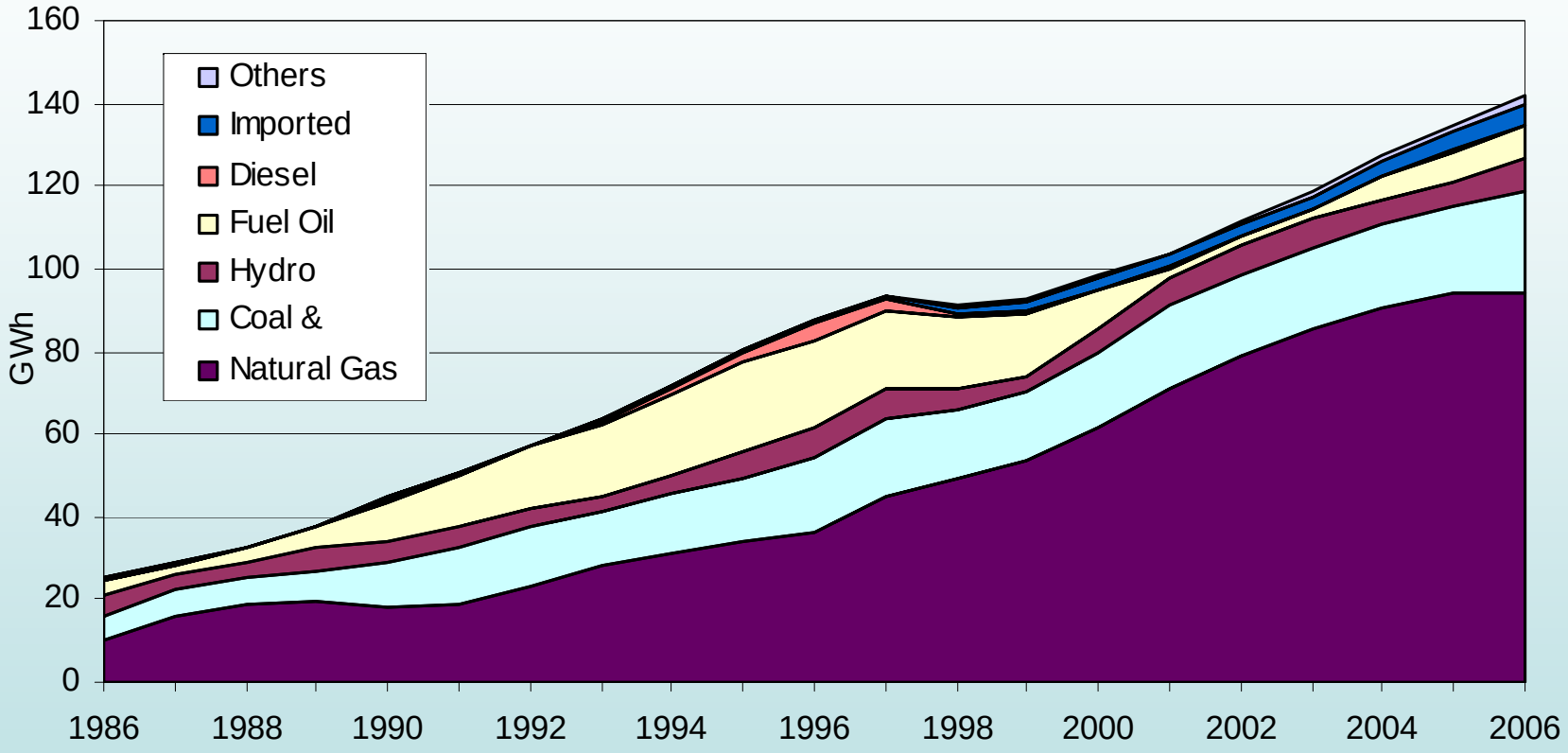
Source: DEDE (2006)

Relatively High Transport Sector share in total CO2 emission



In Thailand, transport sector has higher share in total CO2 emission.

Dominant Share of Natural gas in Power Generation in recent decades



Source: EGAT, 2007

- Natural gas has the dominant share in power generation.

Environmental Friendly Policy/Program Developments in Thailand

Some policies towards low carbon society

- Power Sector
  - PDP 2007 has a plan for nuclear and coal plants as future power generation
  - Nuclear power plants will be introduced by 2020 with a capacity of 2000 MW.
  - Additional nuclear power plants of 2000 MW capacity will be connected by 2021.
  - Power sharing deal/agreements with neighbouring countries:
    - Purchase of 5000 MW hydro from Union of Myanmar by 2015.
    - Purchase of 3000 MW power from China by 2017.
    - 6371 MW hydropower from Lao PDR by 2021.

- Transport Sector
  - To replace current diesel run train with electric locomotives with medium speed train (120-140 km/hr average)
  - To develop mass transit to replace private vehicles (813 km long double track trains)
  - To develop intercity electric trains to reduce private vehicles usage within city.

Action Plan on Bio-diesel Utilization Promotion and Development

Community Scale development and B100 Specification Establishment

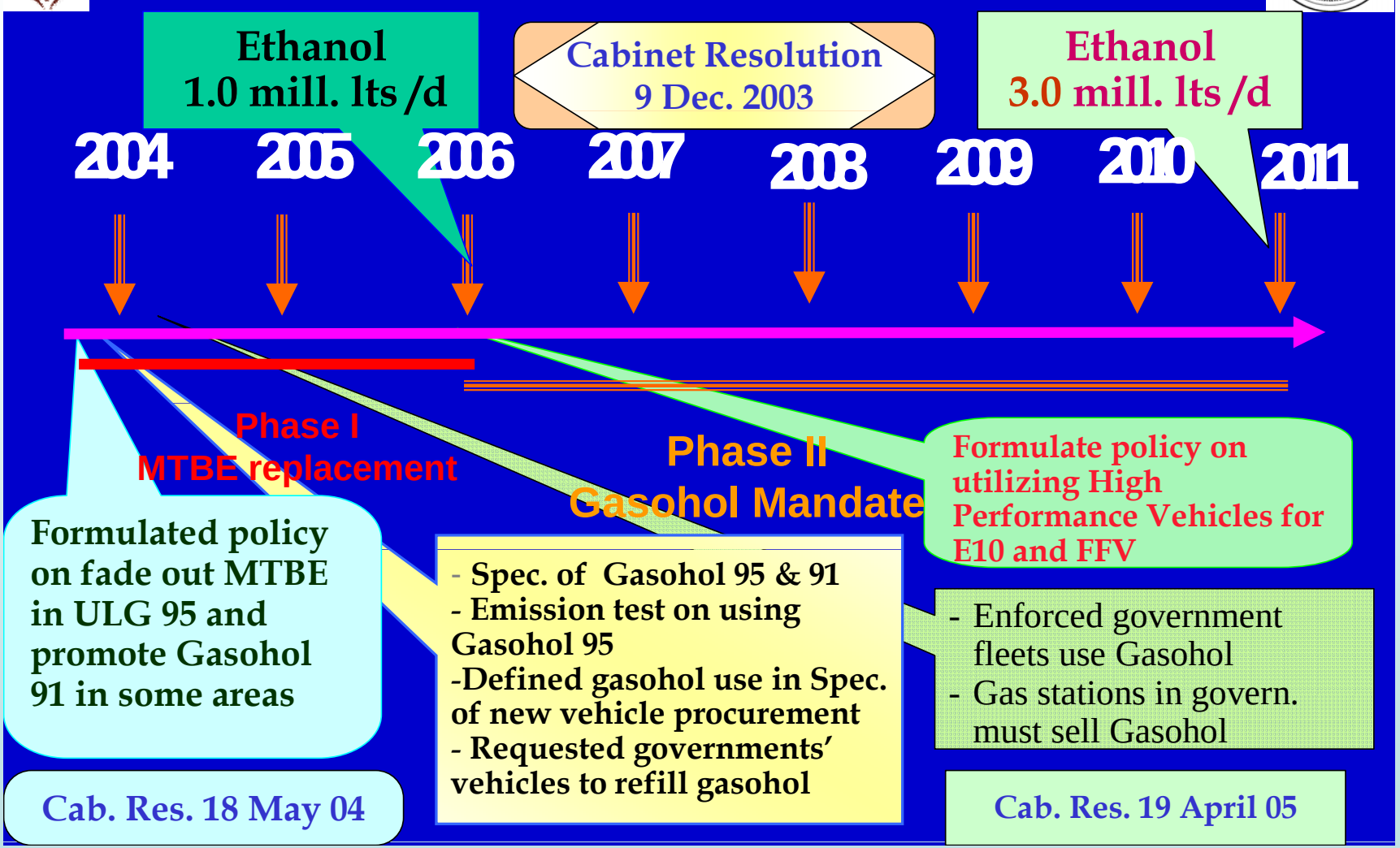
Commercial Scale of B100 Production and Utilization of B5 in the South and the Central Part of Thailand

Substitute B100 to 10% Diesel

	2005	2006	2007	2008	2009	2010	2011	2012
Raw Material	0.26	0.6	0.67	1.07	1.40			
	Expanding palm oil cultivation areas: 4 million Rai in Thailand and 1 million Rai in neighbouring countries							
	R&D on yield of palm oil (2.7 to 3.3 tonnes/Rai/year)							
	R&D on yield of Jatropha (0.4 to 1.2 tonnes/Rai/year)							
				Expanding Jatropha Cultivation Areas				
Bio-diesel Production (MLPD)	0.03	0.06	0.36	0.46	0.76	1.76	3.96	8.50
Utilization (MLPD)	0.6	1.2	7	9	15	35	79	85
	Community-based		Commercial-based					
R&D	Intensive R&D on enhancing values of by-products from bio-diesel production							

- Biodiesel target approx. 81 ktoe/day

Gasohol Strategic Plan

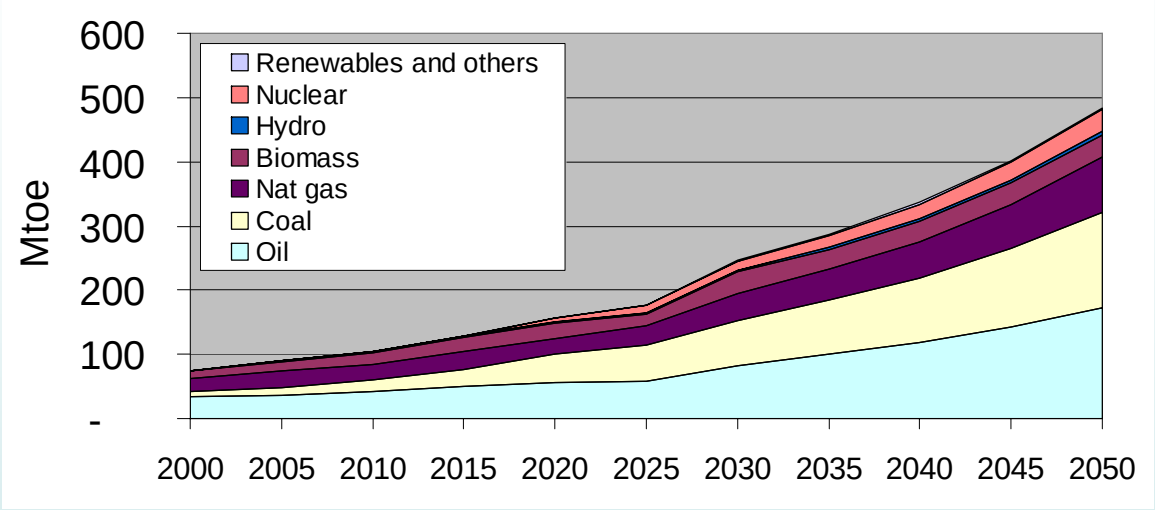


E10 target is approx 29 ktoe/day

Base Case

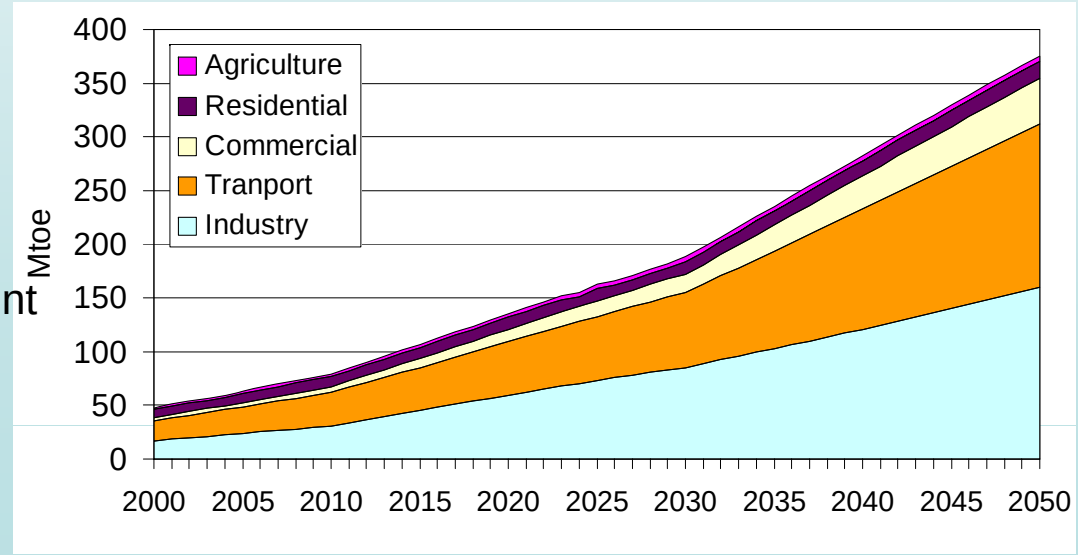
- Assumptions:
  - Hydro Import: 21 GW of hydropower import will be available by 2050
    - 4000 ktoe
  - Nuclear will be introduced by 2020:
    - 2500 ktoe (4000 MW)
  - Nuclear power generation: 12500 ktoe by 2050
  - Biodiesel (B10) will be available up to 40,000 ktoe by by 2050
  - Gasohol (E10) will be available up to 20,000 ktoe by 2050.

Structure of TPES and Final Energy Demand in Base Case



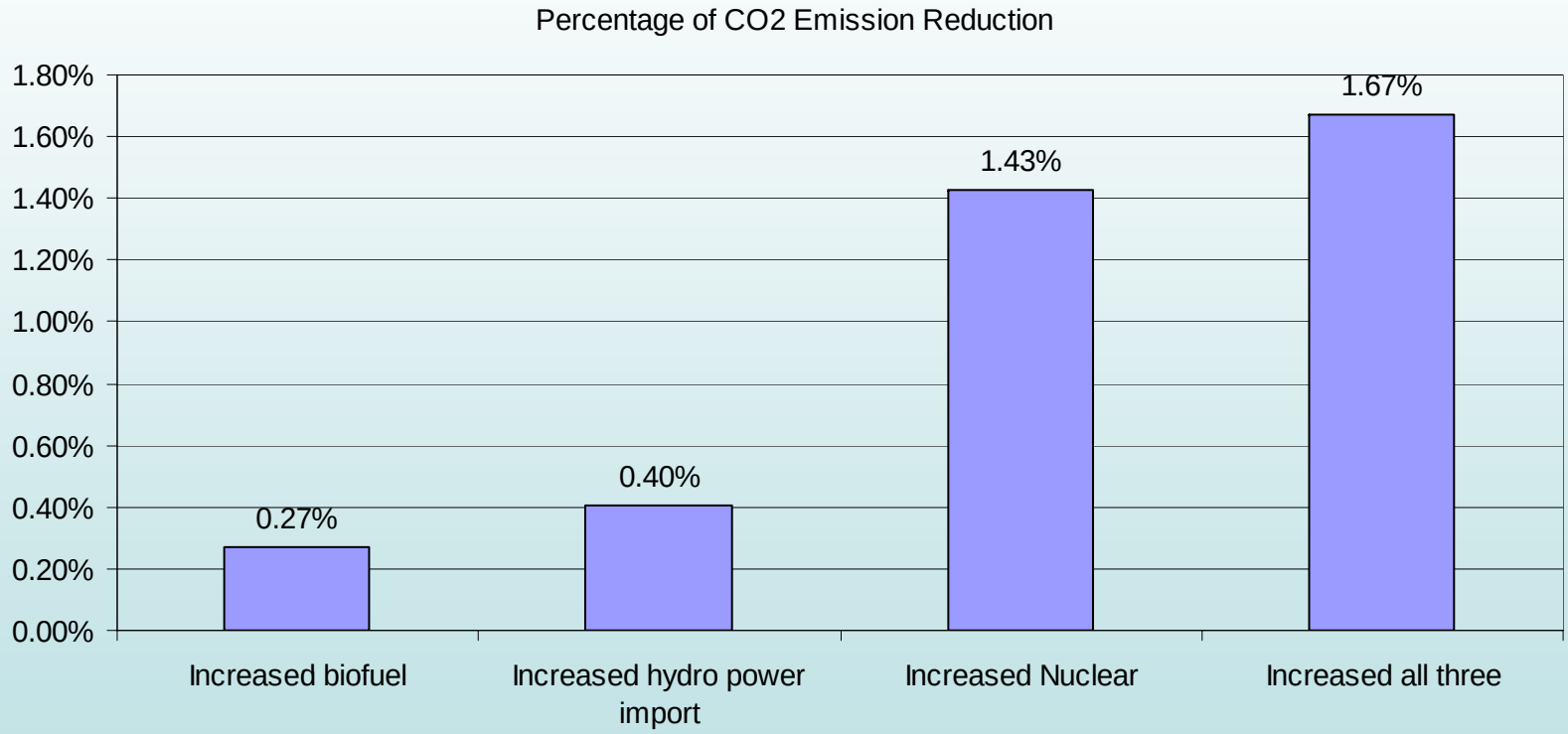
Total Primary Energy Supply:
- Fossil fuel dominance to continue till 2050

Final Energy Consumption:
Transport and Industry together account almost for 80% in 2050.



Role of Increased Avalability of Cleaner Resources/Technologies

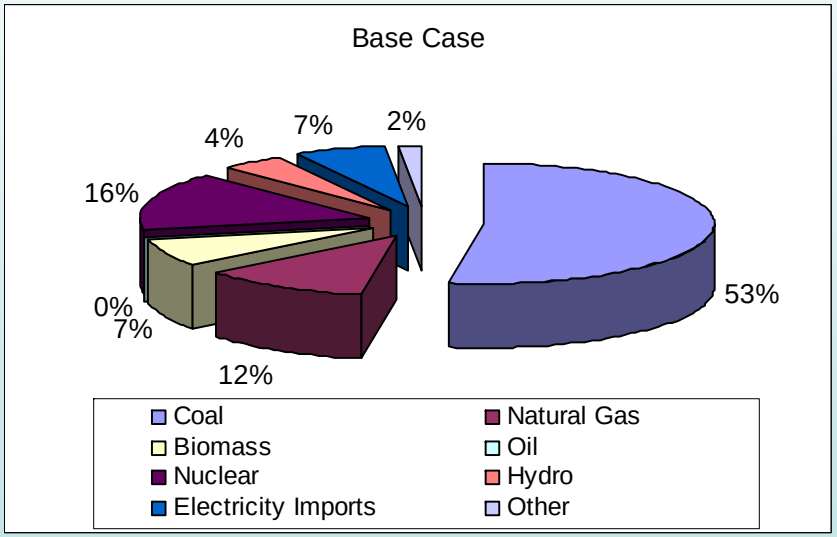
CO2 Emission Reduction in Various Resource Availability Scenarios during 2000-2050

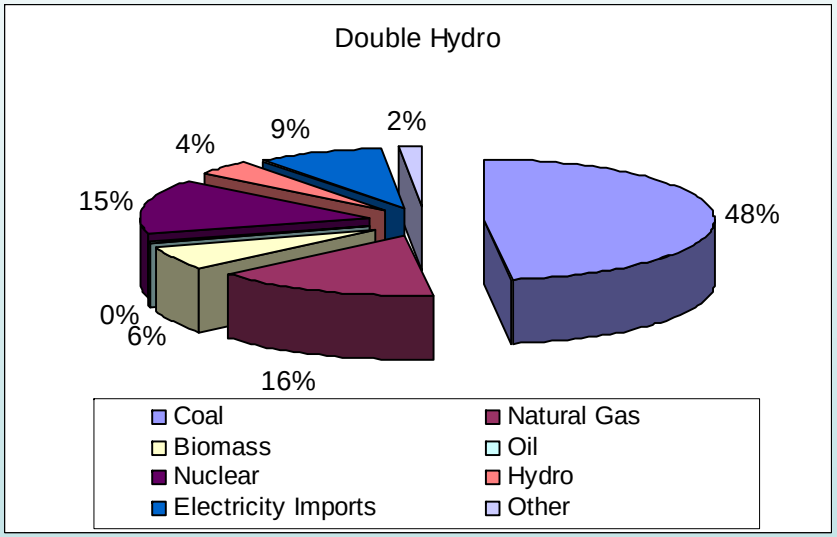


	Nuclear Energy, ktoe
Base Case	**12833**
Increased Nuclear Case	**28127**

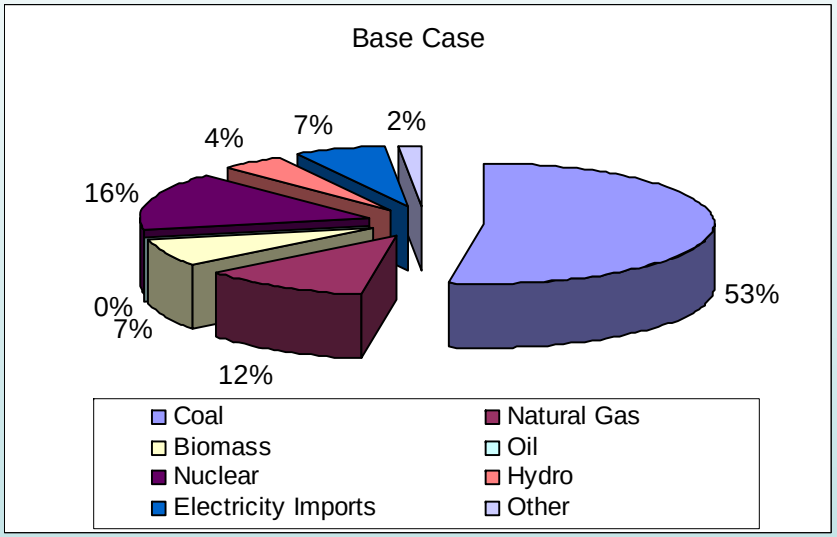
	Base Case	Increased Biofuels Case, ktoe
Biodiesel	**40000**	**76625**
Gasohol	**20000**	**24368**

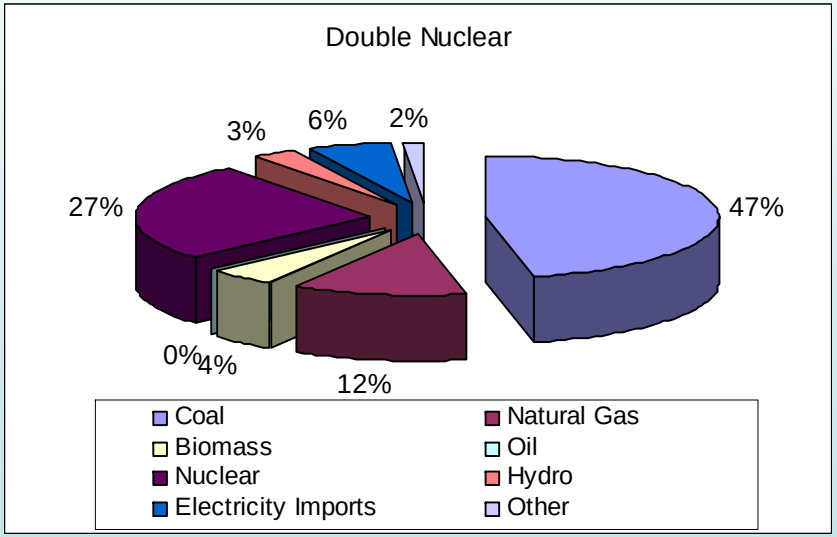
Structure of Power Generation under Increased Hydro Availability



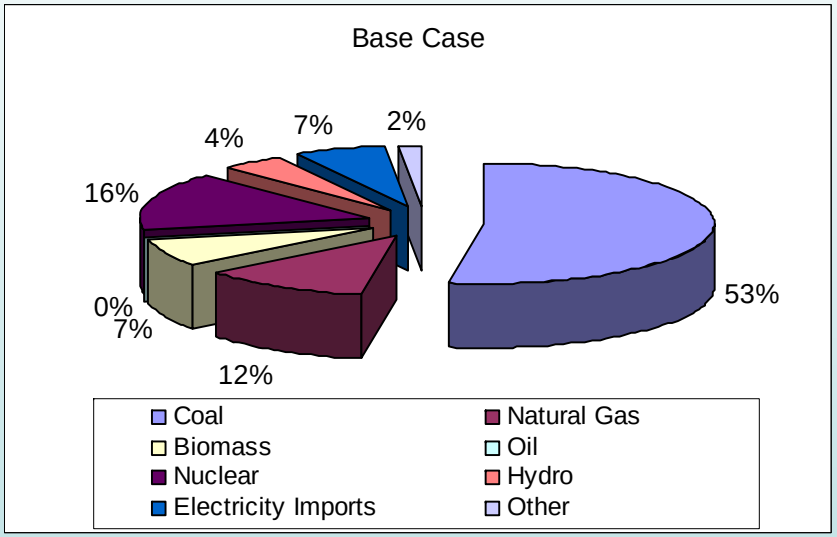


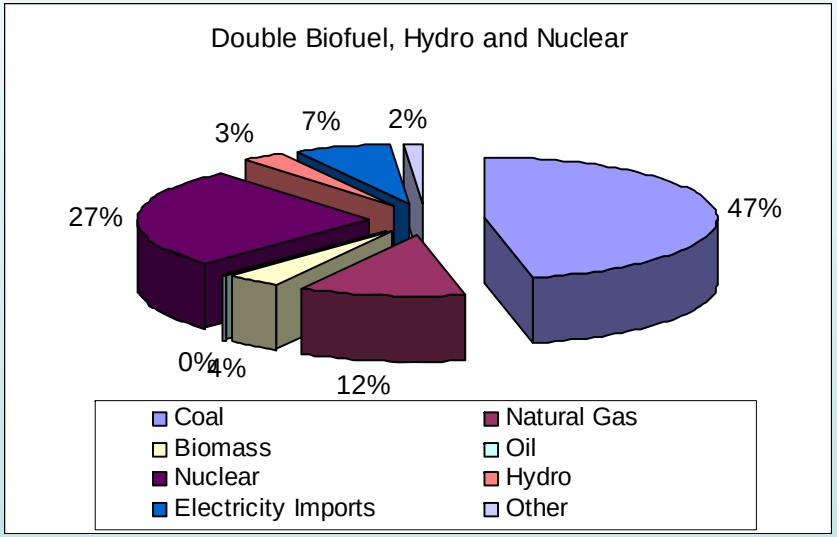
Structure of Power Generation under Increased Nuclear Availability





Structure of Power Generation under Increased Hydro, Nuclear and Biofuel Availability





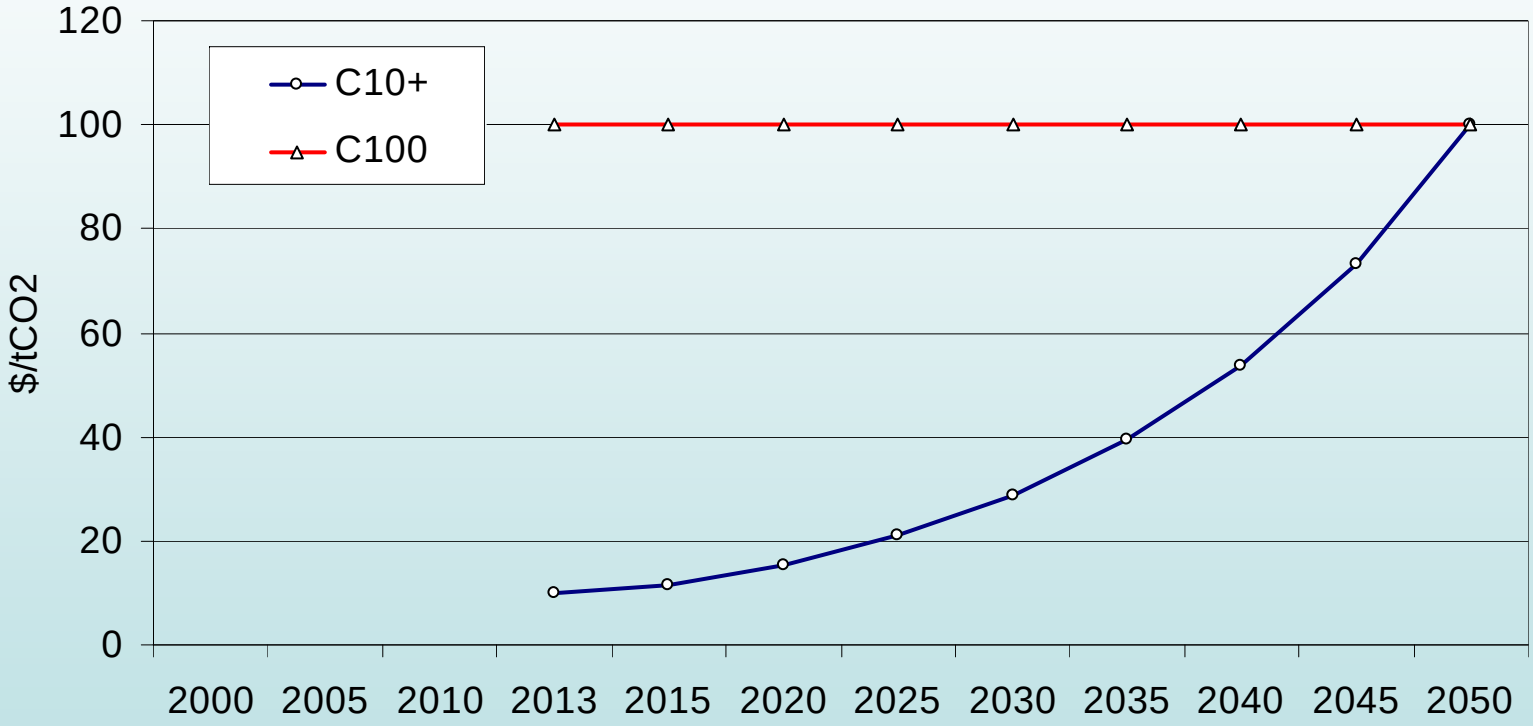
- Regional hydropower development would help reduce CO2 emission only marginally (less than 1%).

- Doubling the maximum permissible nuclear generation capacity by 2050 would not have a significant effect in CO2 reduction.

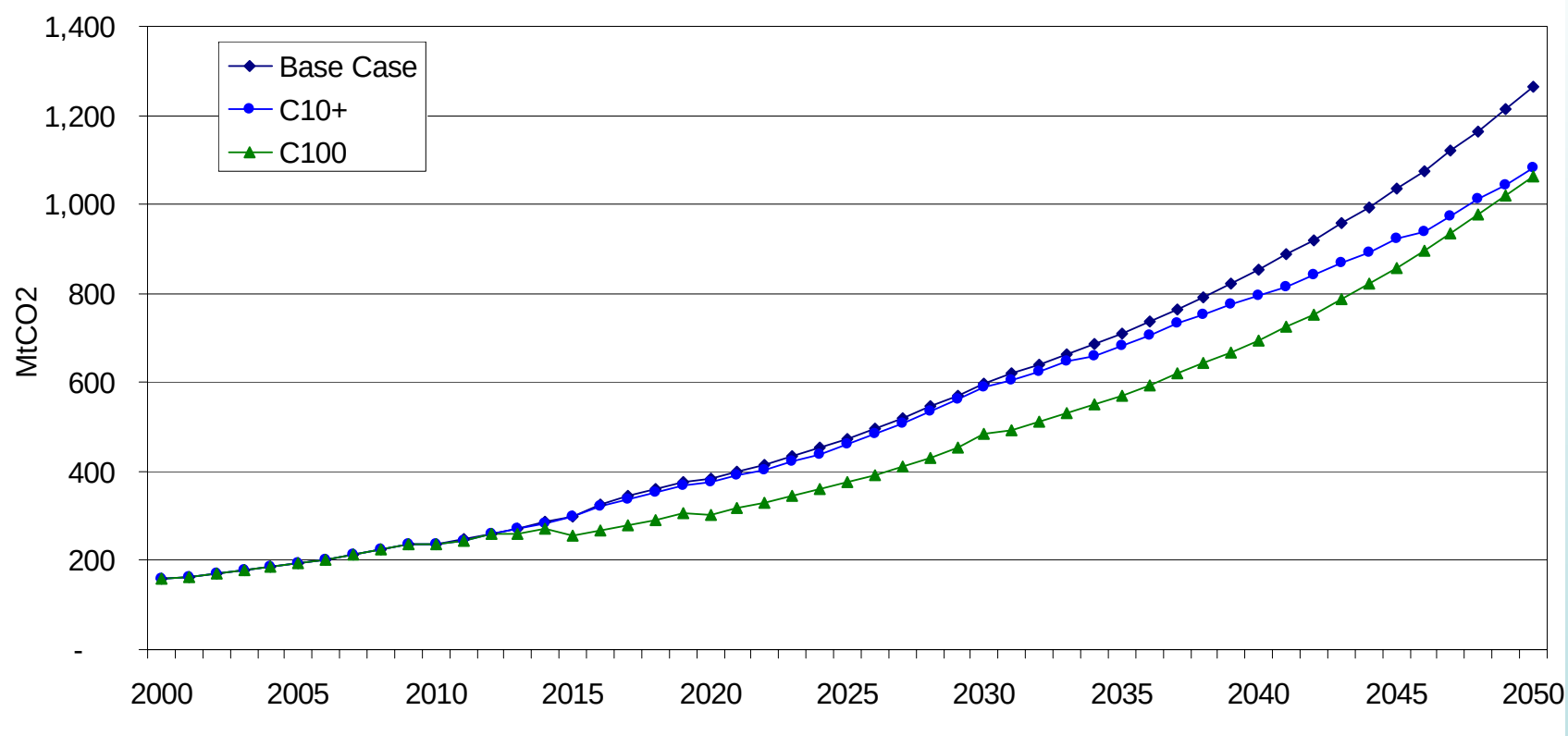
  (Reason: it would replace the imported hydro electricity in the absence of carbon constraint or carbon pricing and as a result CO2 emission is reduced by less than 2%.)

Role of Carbon tax

Carbon tax cases



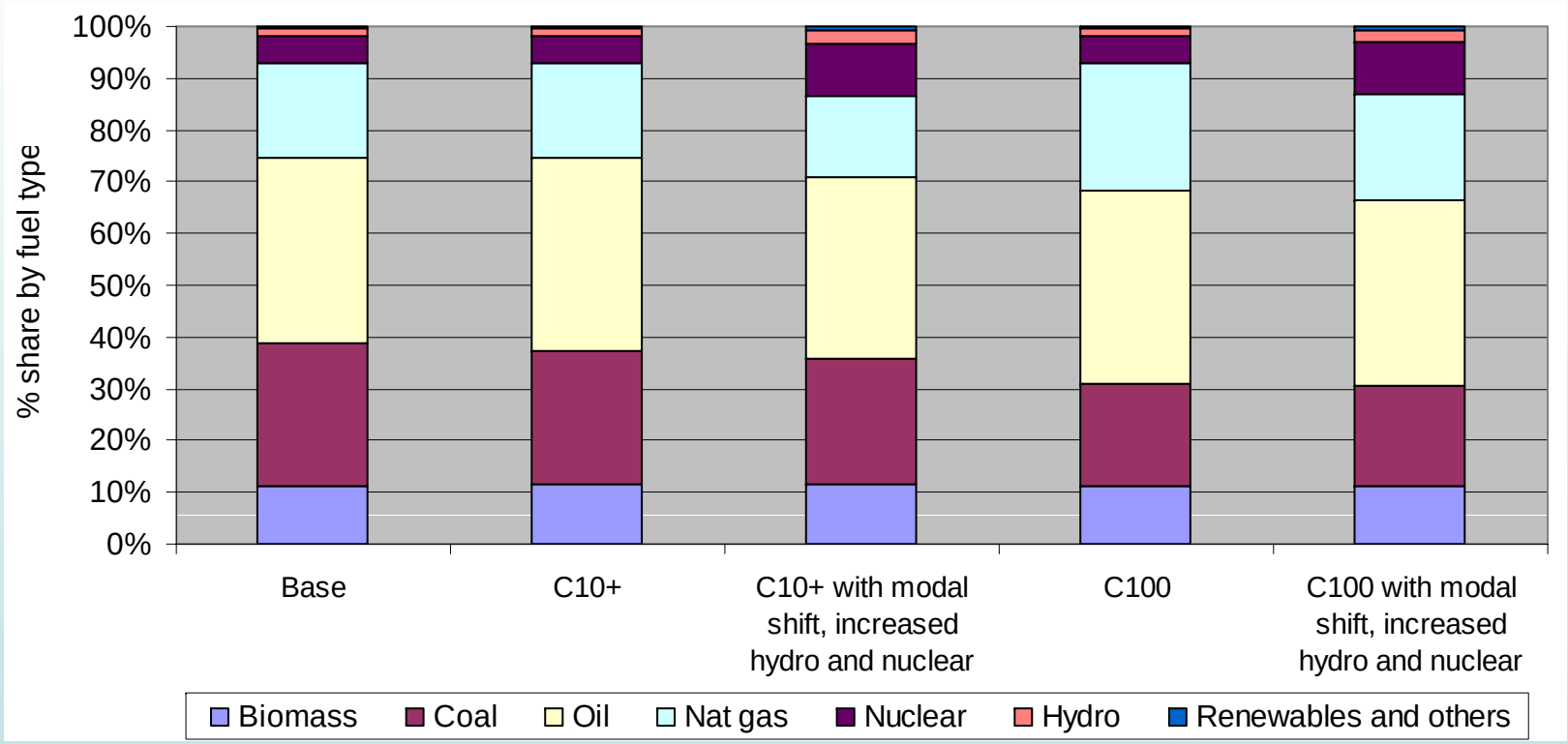
CO2 emission under different scenarios



CO2 emission reduction from Different Sectors

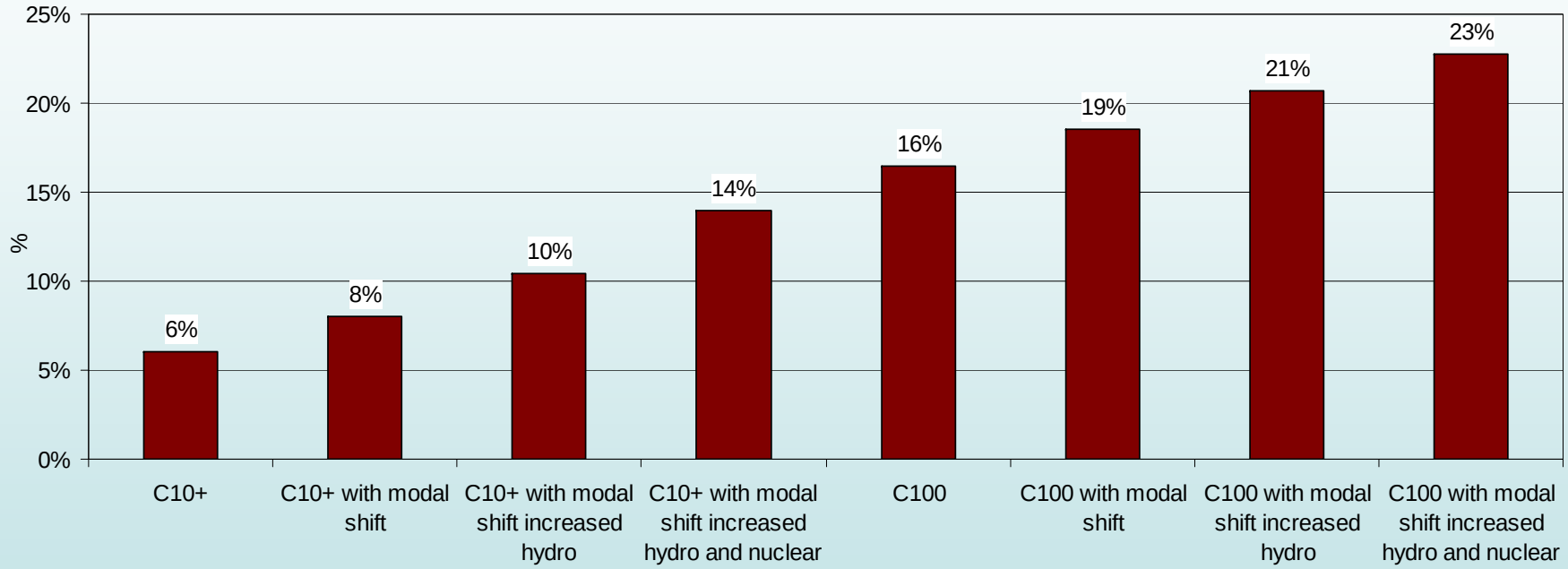
	Base case emission, MtCO2	CO2 emission reduction from the base case					
		C10+	C10+ modal shift	C10+ modal shift, increased hydro and nuclear	C100	C100+ modal shift	C100 + modal shift, increased hydro and nuclear
Agriculture	549	0%	0%	0%	0%	0%	0%
Commercial	712	0%	0%	0%	0%	0%	0%
Power	7725	68%	50%	72%	77%	68%	72%
Industrial	9201	10%	7%	3%	13%	11%	3%
Residential	405	0%	0%	0%	0%	0%	0%
Transport	9544	22%	43%	24%	10%	21%	24%
Total (MtCO2)	28137	1698	2259	3941	4633	5225	6403
% of Base Case		6%	8%	14%	16%	19%	23%

Share of fuel in TPES in during 2000-2050 in different cases



- In the case of C10+ and C100 with increased hydro and nuclear, the additional CO2 reduction is achieved through CCS.

CO2 emission reduction in carbon tax and other scenarios during 2000-2050



- Additional hydro and nuclear availability would be fully used under C10+ and C100 by 2050
- In addition more CCS based power generation would be required under C10+ and C100 cases to achieve higher CO2 reduction.

Concluding Remarks

- Biofuels have a limited role in CO2 reduction
- Regional hydropower development can help reduce CO2 emission by a relatively small percentage (less than 1%).
- In the absence of carbon tax or carbon pricing, increased availability of climate friendly resources and technologies may not be effective to reduce the carbon emission significantly. Thus in the absence of carbon pricing/tax,

  - Increased regional hydropower development can reduce CO2 emission only by a relatively small percentage.

  - Similarly, doubling the limit of nuclear generation capacity by 2050 would reduce CO2 emission by less than 2%.

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- In the absence of carbon tax or carbon pricing, increased availability of climate friendly resources and technologies may not be effective to reduce the carbon emission significantly. Thus in the absence of carbon pricing/tax,

  - Increased regional hydropower development can reduce CO2 emission only by a relatively small percentage.

  - Similarly, doubling the limit of nuclear generation capacity by 2050 would reduce CO2 emission by less than 2%.
- Modal shift is a major option for carbon mitigation in countries like Thailand.
- Role of government in developing the necessary public transport infrastructure is crucial. However, modal shift alone cannot reduce CO_2 significantly in the absence of climate friendly policies and power sector development.
- Other demand side options (building energy management) need to be adopted for additional carbon emission reduction.

Thank You!