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Energy Snapshots of Thailand 2000-2050

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Structure of Presentation

- Energy Situation in Thailand
- Energy Policy in Thailand
- Assumptions for ESS-TOOL
- Results and Discussions



Key economic indicators (2000)

	Thailand	East Asia [§]	South Asia [§]	OECD [§]	World
GDP (constant 1995 billion US\$ using exchange rate)	172	1,541	622	26,835	34,217
GDP per capita (constant 1995 US\$)	2,828	883	460	29,866	5,654
CO ₂ emissions (million tons)	199	3,553	1,220	12,449 [†]	22,995
CO ₂ emissions per capita (tons)	3.3	2.0	0.9	11.1 [†]	3.8
CO ₂ emissions intensity (kg per 1995 US\$ of GDP)	1.2	2.3	2.0	0.4	0.7
Energy use (million tons of oil equivalent)	72	1,467	631	5,316 [†]	9,935
Energy use (kg of oil equivalent per capita)	1,188	856	469	4,738 [†]	1,694
Per cent share macro-economic components of GDP					
Consumption	64	62	77	77	77
Export	57	39	15	24	27
Import	-46	-33	-16	-24	-27
Investment	25	32	24	23	23
Per cent sectoral share of GDP					
Agriculture	10	16	25	2	4
Industry	42	48	27	29	31
Service	48	36	49	68	65

Source: World Development Indicator (World bank, 2005) and Key Economic Indicators (ADB, 2005)

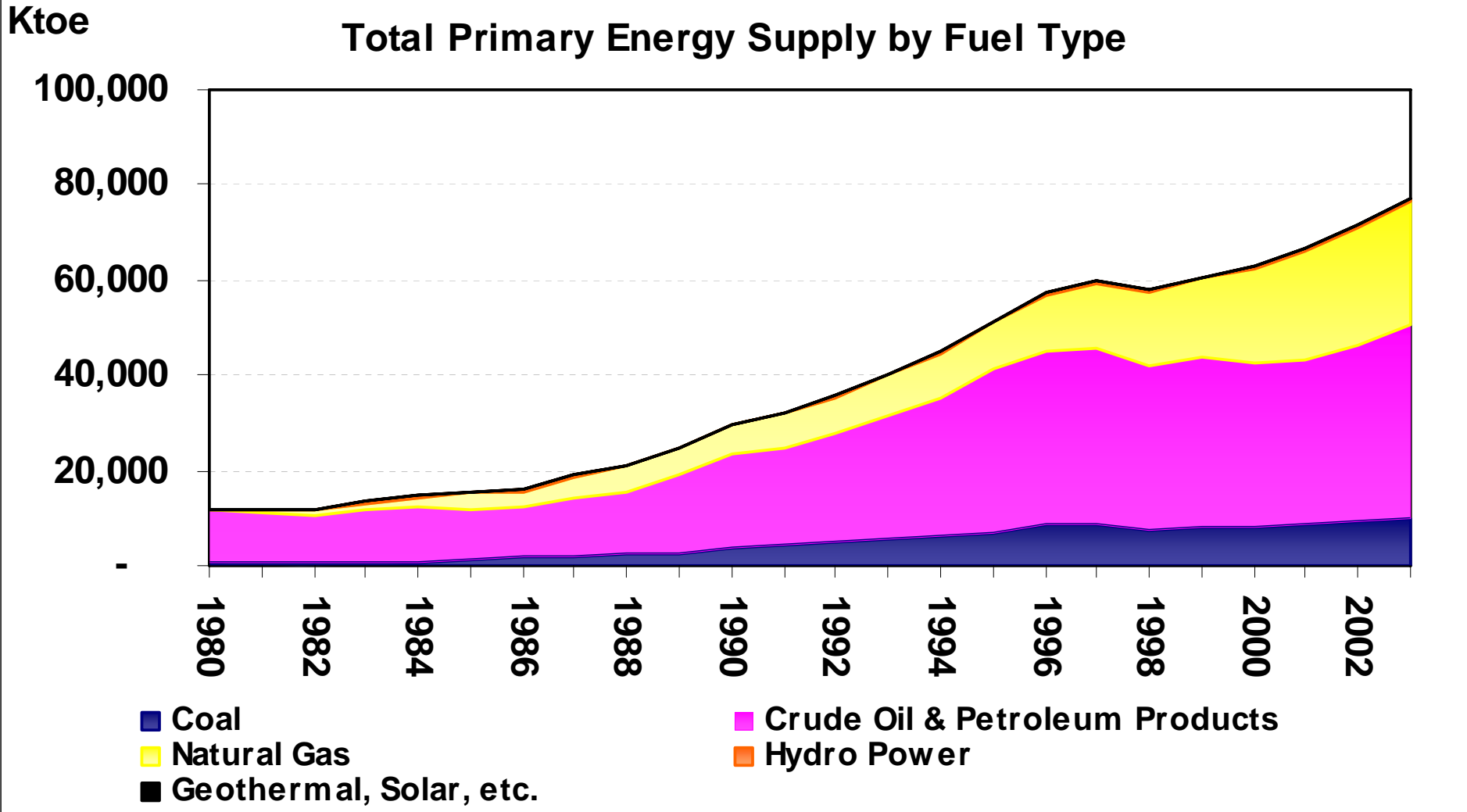


General Thailand Energy Policy

- Energy Supply Security
 - Diversification of energy resource
 - Regional energy trading hub
- Energy conservation & promotion of renewable energy development
 - Increase energy efficiency
 - Promoting renewable energy and Renewable Portfolio Standard (RPS) for power generation sector at 5% since 2011
 - NGV is targeted to substitute oil in transportation
 - Promote ethanol and bio-diesel plants
 - Encourage mass transit transportation i.e. road to rail



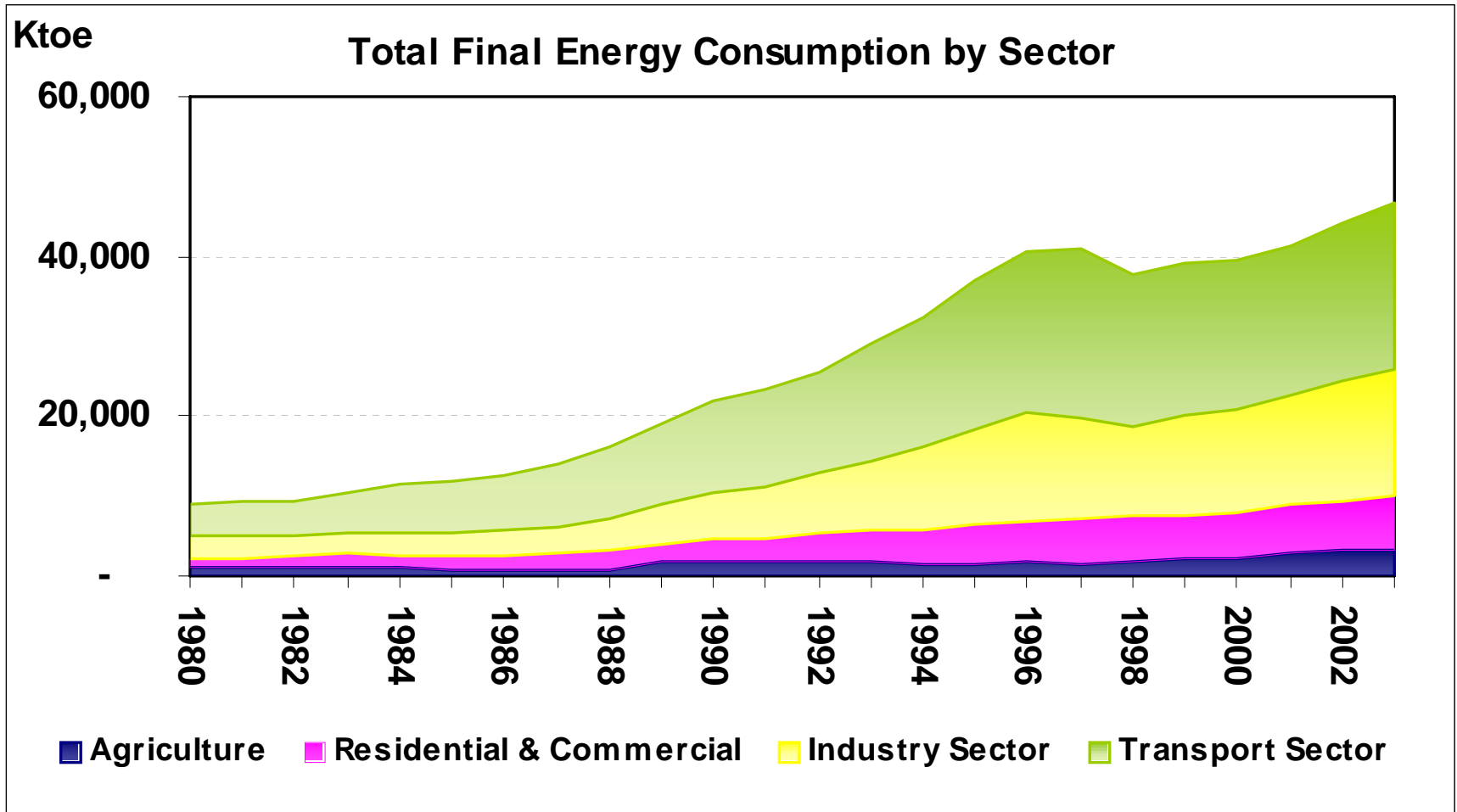
Thailand Energy Situation



Source: Asia Pacific Energy Center (APEC)



Thailand Energy Situation





Service Demand Projection



Service demand projection

The basis for projections of service demand in agriculture, commercial, industry and transport sectors is sub-sectoral value added

$$SD_{i,k,t} = SD_{i,k,0} \times \frac{VA_{i,k,t}}{VA_{i,k,0}}$$

- $SD_{i,k,t}$ = Service demand of sector i sub-sector k in year t
- $SD_{i,k,0}$ = Service demand of sector i sub-sector k in base year
- $VA_{i,k,t}$ = Value added of sector i sub-sector k in year t
- $VA_{i,k,0}$ = Value added of sector i sub-sector k in base year

The basis for projection of service demand in residential sector is population growth.

$$SD_{k,t} = SD_{k,0} \frac{Pop_t}{Pop_0}$$



Projection of Sectoral Value added

Sectors	2000 ¹	2010 ¹	2020 ²	2030	2040	2050
Agriculture	1.00	1.26	1.63	2.17	2.75	3.49
Industry	1.00	1.69	2.68	4.26	6.80	10.38
Food	1.00	1.45	2.12	3.17	4.74	6.76
Textile	1.00	1.46	2.07	2.94	4.19	5.69
Paper	1.00	1.73	2.82	4.51	7.21	10.99
Chemicals	1.00	1.84	3.20	5.45	9.27	15.09
Cement	1.00	1.85	3.26	5.62	9.69	15.94
Metals	1.00	2.21	4.34	7.91	14.44	23.98
Equipment	1.00	1.77	2.88	4.56	7.22	10.90
Other	1.00	1.76	2.77	4.39	6.95	10.49
Transport	1.00	1.63	2.77	4.68	7.92	12.78
Commercial	1.00	1.78	3.25	5.93	10.82	18.84
Total	1.00	1.61	2.61	4.27	6.80	10.32



Dual track scenario (Scenario A): Low Growth

This scenario is characterized by the Thai economy that is concentrated on the industries that have the comparative advantage in the world market. In this scenario, Thailand follows closely the national development plans and policies. The economic growth is **moderate** at 5% per year during 2000-2030 and it will slow down to 4% per year for the remaining twenty years of the scenario period.



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Global market integration scenario (Scenario B): High growth

It is characterized by Thailand being more and more integrated into global markets. The role of market forces is predicted to strongly lead to high economic growth and there is a faster transition of the economy towards industry- and commerce- based economy. The GDP is assumed to increase by 6% per year during the first thirty years (2000-2030) and by 5% per year in the remaining twenty years (2030-2050) reflecting the possible slowdown of the economic growth.



Industrial and Agriculture Sector – Counter Measures

DSM

Only measure electricity intensive industries are considered

- Scenario A (Low)- 10% reduction by 2050 (0.2% average annual growth)
- Scenario B (High)- 15% reduction (0.32% average annual growth)

Energy Efficiency Projection:

Thailand imports technologies. We have considered the same efficiency target as in the case of Japan. (0.3 to 0.5% per year)

Fuel Mix Projection

NG will substitute Fuel oil and coal. Fuel oil and coal share will be reduced by 50% in 2050. Electricity share will remain the same except some % increase in Agriculture.



Industrial and Agriculture Service Demand Projection

- Based on average industrial sector value added
- Scenario A- Moderate Growth:
 - 2000-2030- 5%
 - 2030-2025- 4%
- Scenario B- High growth rate
 - 2000-2030- 5%
 - 2030-2050 – 6%



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Residential Demand Projection

- Based on population growth
- Scenario A- Moderate Growth:
 - 2000-2050: 0.5% per year
- Scenario B- High growth rate
 - 2000-2030- 0.75%



Residential Sector –Counter Measures

DSM

- Scenario A (Low)- 10% reduction by 2050 (0.2% per year)
- Scenario B (High)- 15% reduction (0.32% per year)

Energy Efficiency:

- By 2050, Efficiency of all electrical appliance in an average will be
- improved by 10% and biomass based will be improved by 25%

Fuel Mix

- Solar-thermal will substitute biomass and electricity. Share of solar thermal in hot water application will be increased to 60% by 2050.
- In cooking, biomass will be substituted with LPG and Electricity. Share of biomass would be reduced to 50% by 2050.



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Commercial Sector Demand Projection

- Based on sectoral value added
- Scenario A- Moderate Growth:
 - 2000-2050- 5%
- Scenario B- High growth rate
 - 2000-2050 – 6%



Commercial Sector –Counter Measures

DSM

- Scenario A (Low)- 10% reduction by 2050 (0.2% per year)
- Scenario B (High)- 15% reduction (0.32% per year)

Energy Efficiency:

- By 2050, Efficiency of all electrical appliance in an average will be improved by 10% and biomass based will be improved by 25%

Fuel Mix

- In hot water application, Solar-thermal will substitute electricity. Share of solar thermal will be increased to 50% by 2050.
- In water pumping and lighting, solar PV will substitute grid electricity.
- The share of solar PV would be increased by 20% in pumping and 30% in lighting by 2050.



Transport Sector Demand Projection

- Based on sectoral value added
 - Scenario A- Moderate Growth:
 - 2000-2050- 1.5%
 - Scenario B- High growth rate
 - 2000-2050 – 2.2%



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Transport Sector –Counter Measures

DSM

- Scenario A (Low)- 10% reduction by 2050 (0.2% per year)
- Scenario B (High)- 15% reduction (0.32% per year)

Energy Efficiency:

Efficiency of oil, gas and electricity based vehicles will be doubled by 2050

Fuel Mix

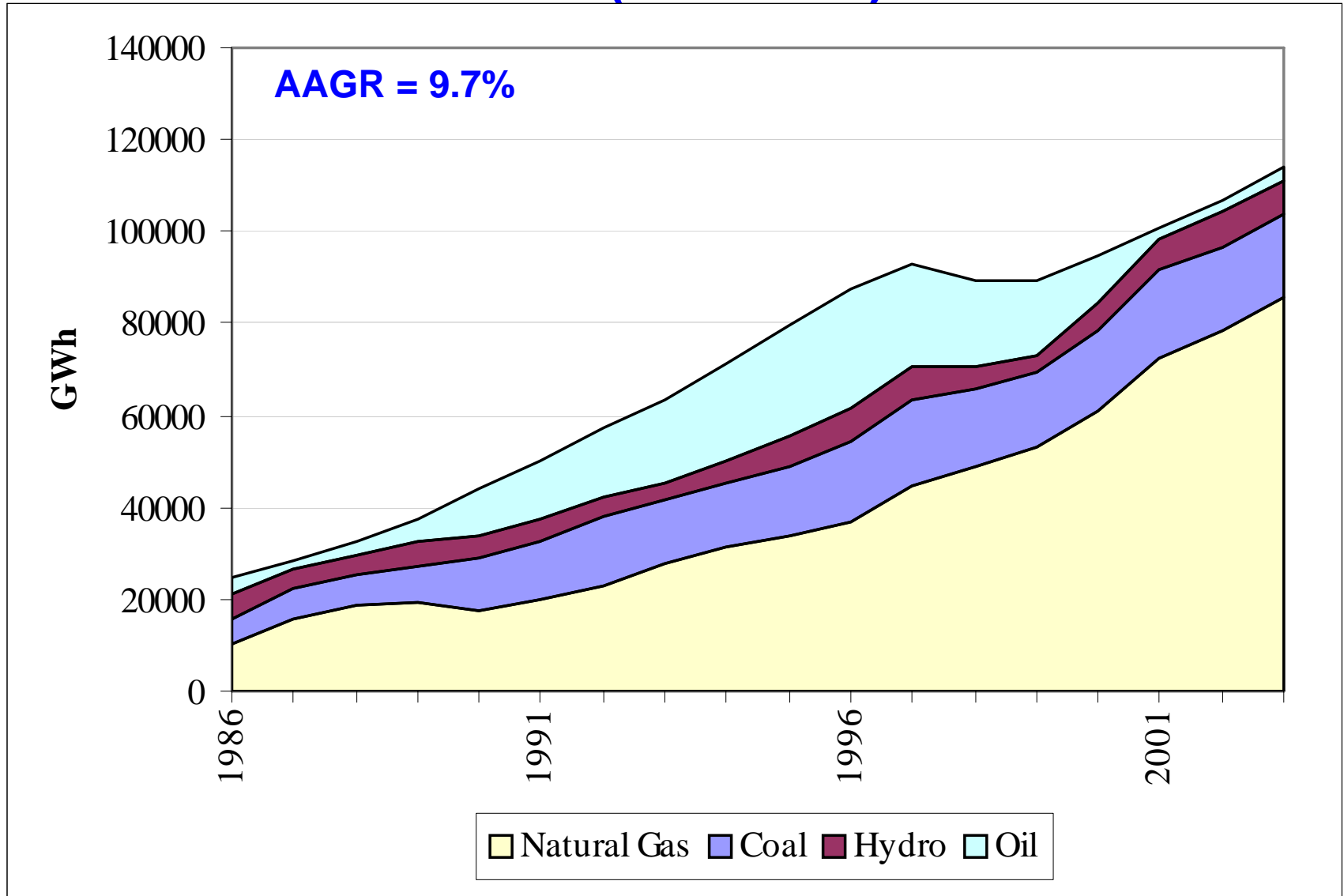
- In road transport, hydrogen will substitute oil by 20%.CNG will substitute oil by 25%.
- In rail transport, electricity will substitute oil by 50%.



Power Sector (Transformation)

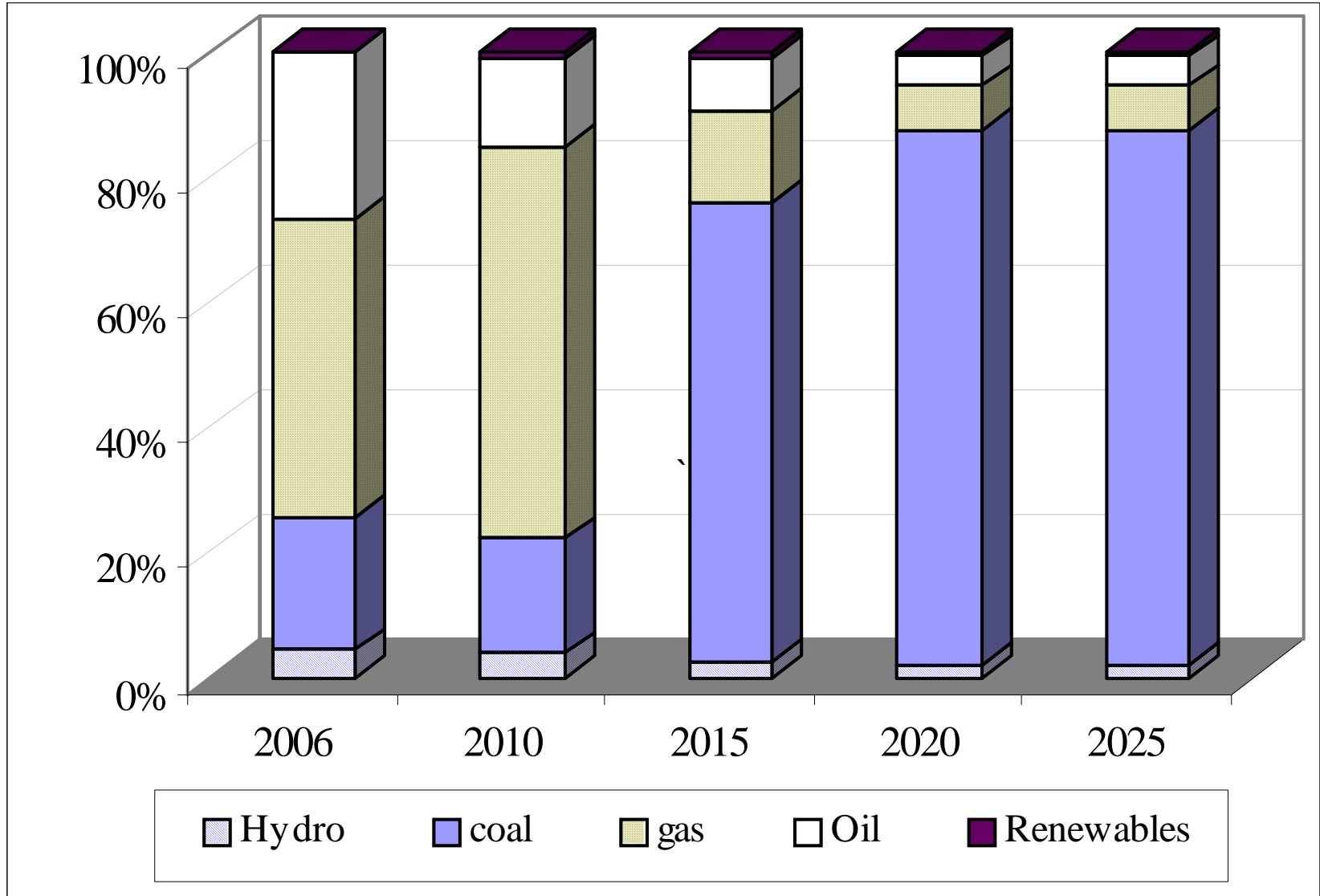


Fuel Mix in Electricity generation (1986-2003)





Least cost electricity generation mix (2006-2025) without policy interventions





Power Sector Assumptions

- **Transmission and Distribution losses would be decreased from 8% to 5%**
- **Own use (in the range of 0.5% in hydro to 6% in coal)**
- **Efficiency improvement:**
 - **Coal fired plant from 37% to 48%**
 - **Oil from 37% to 40%**
 - **Gas from 41.1% to 55%**
 - **Biomass from 34% to 40%**
- **Generation Mix:**

Scenario A :

- **Coal will be the dominant sources of fuel (55%).**
- **Natural Gas (35%) rest will be from renewables (Hydro, biomass and solar PV)**

Scenario B:

- **25% of total generation from Nuclear substituting coal.**

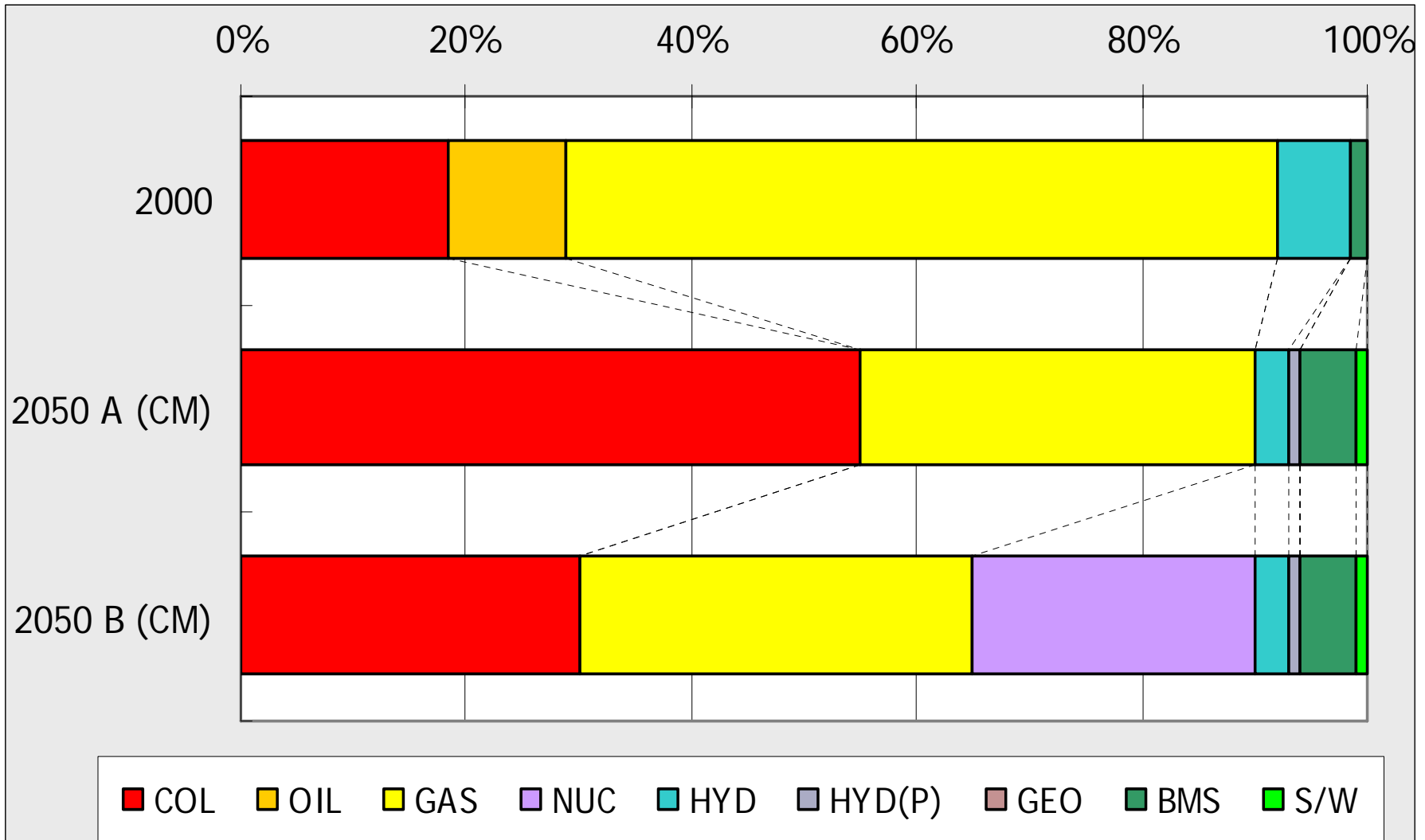


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SNAPSHOTS

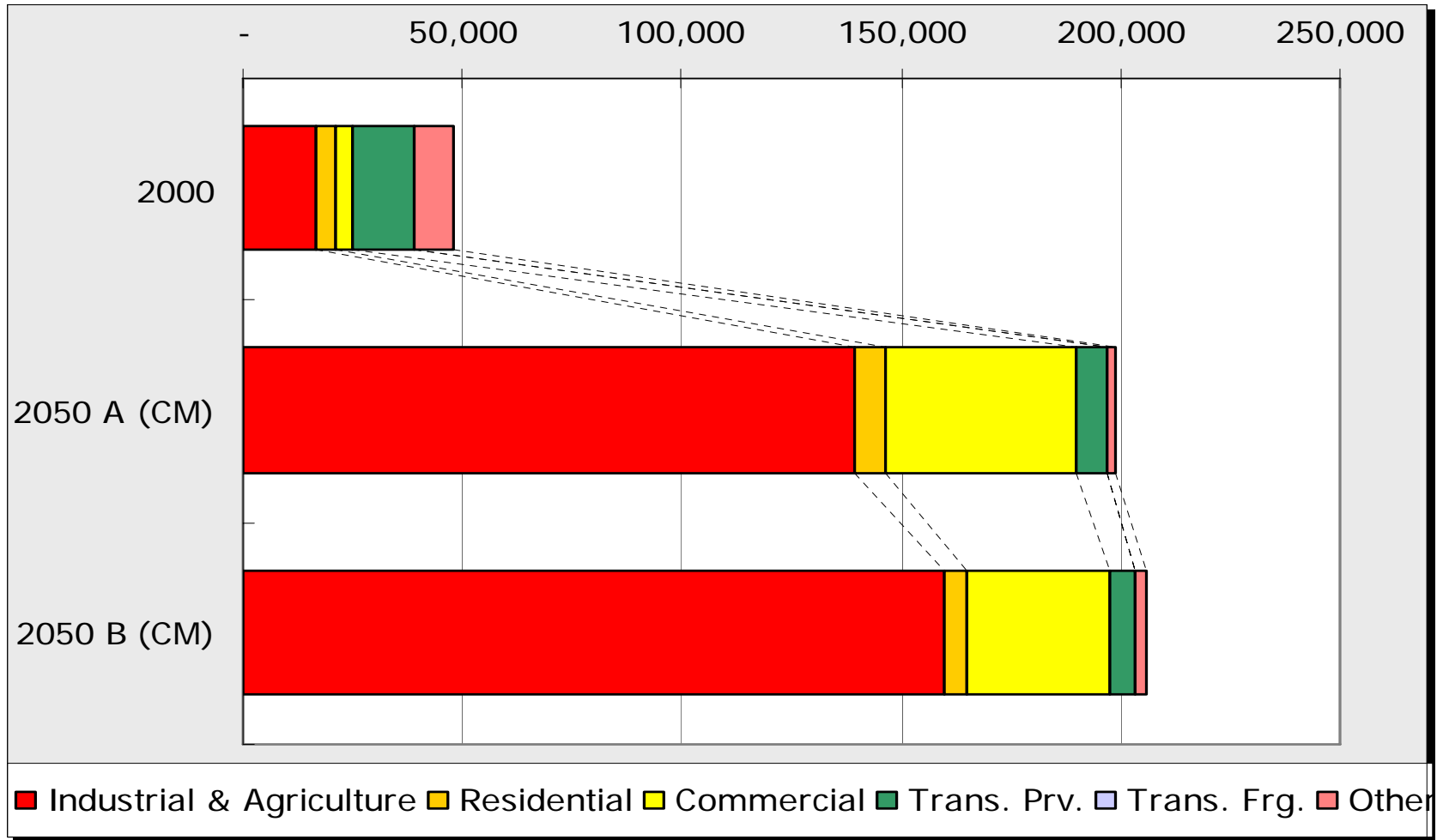


Generation Mix in 2000 and 2050





CO2 emission by sector in 2000 and 2050 (Nuclear option in Scenario B)

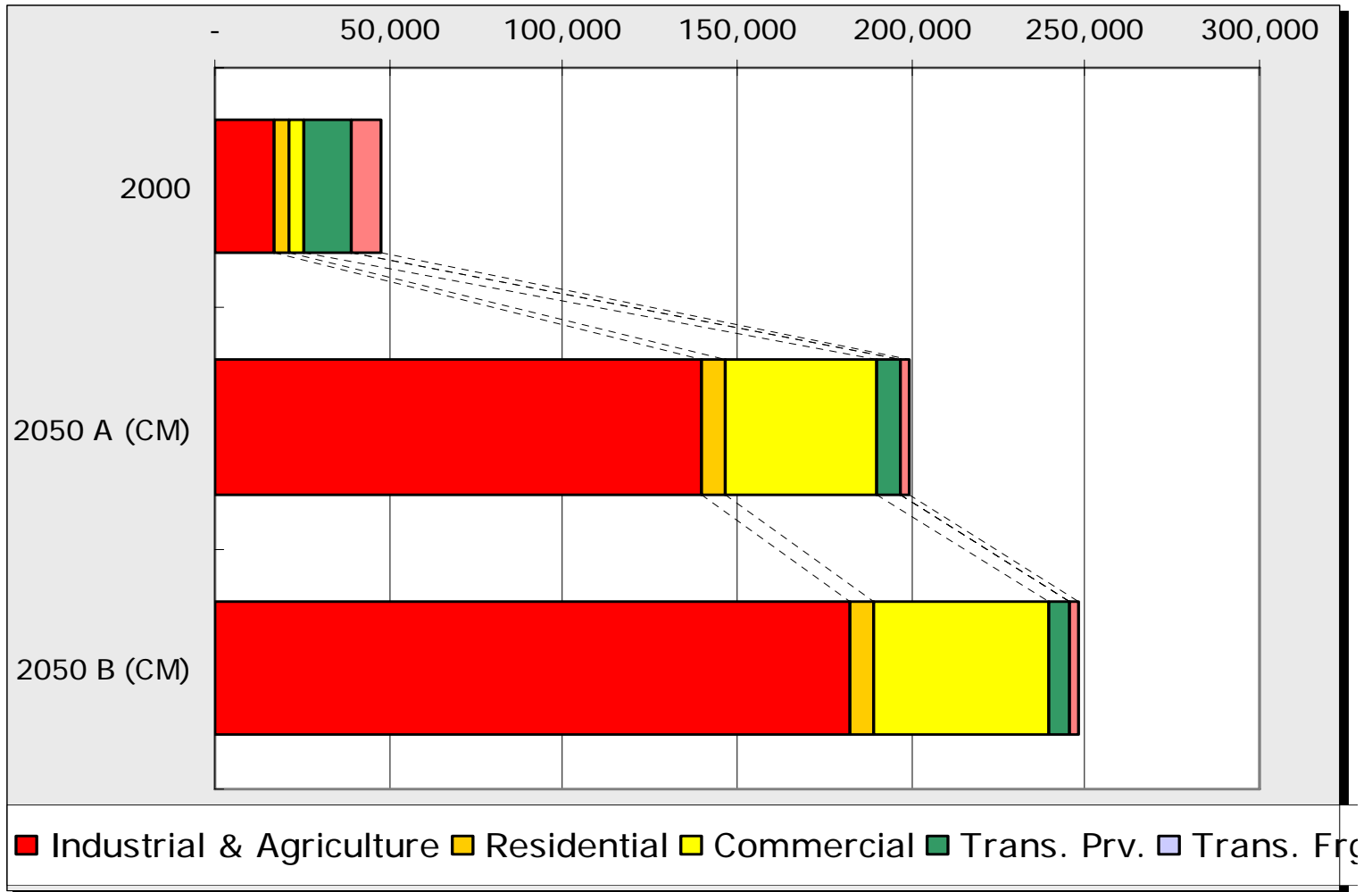


2000 CO2 emissions balanced with EIA figure



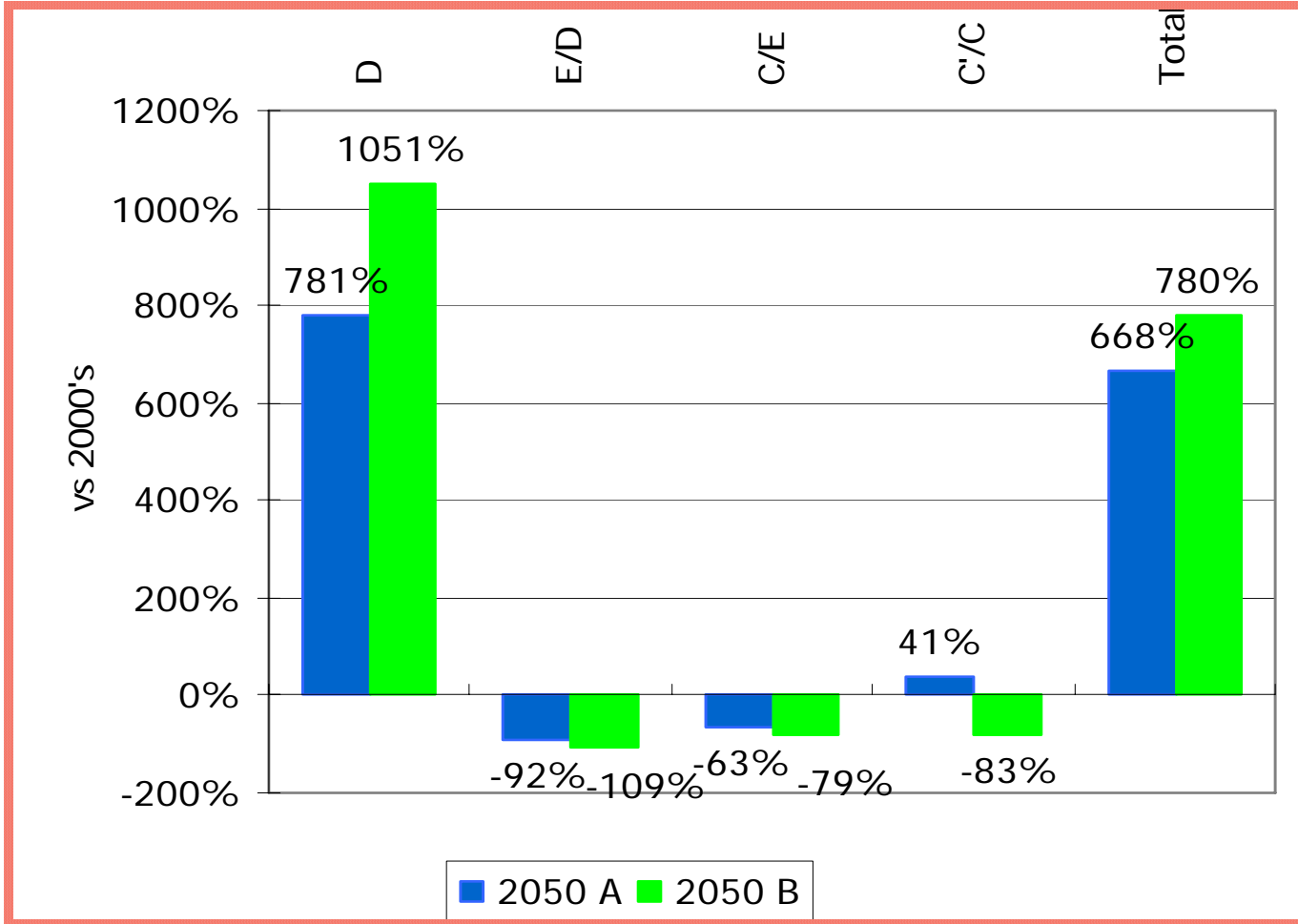
What if ?

There would be no nuclear in 2050 ?





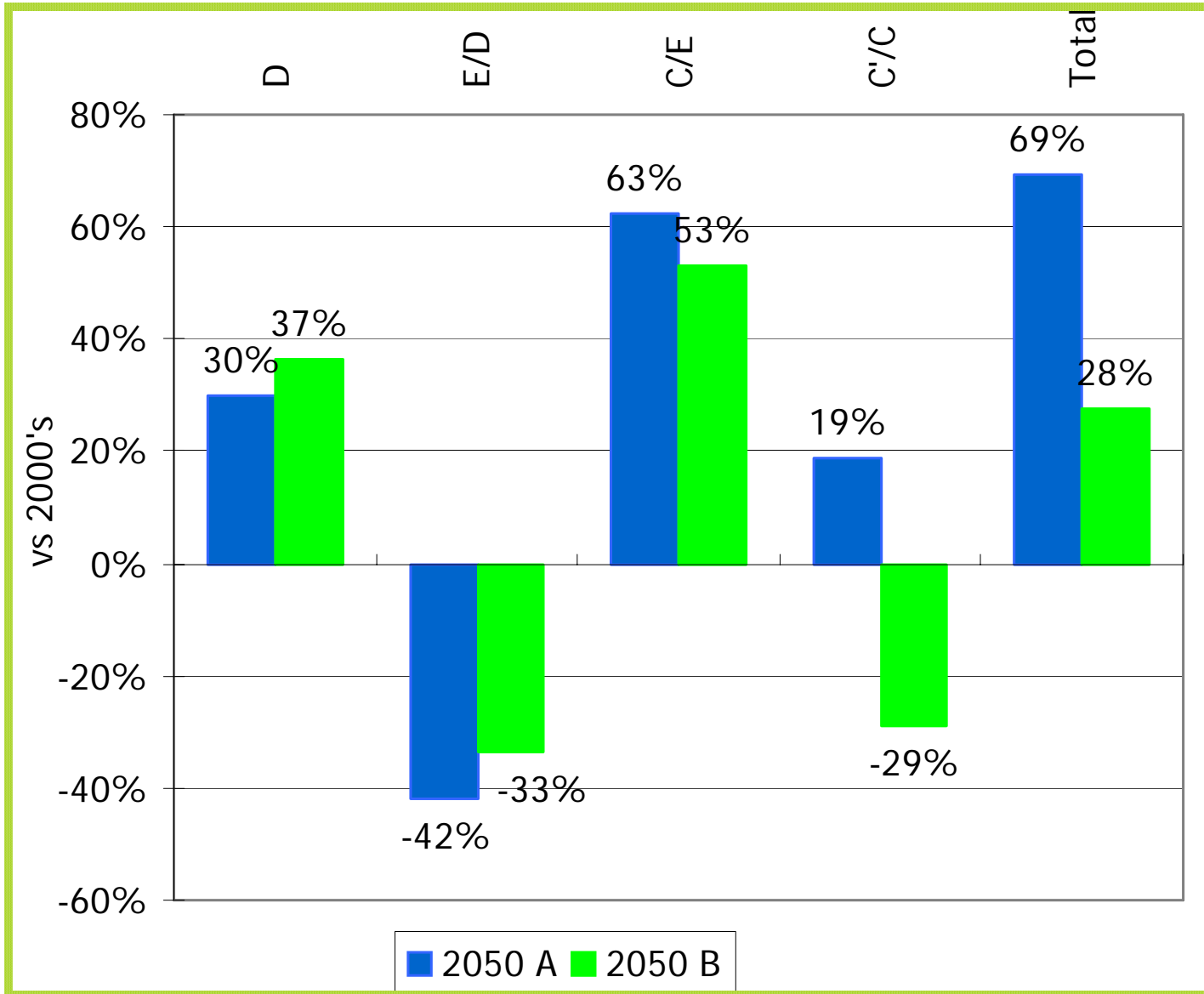
Factor Analysis: Industry



Effect of aggressive DSM in Scenario B in electricity intensive industries

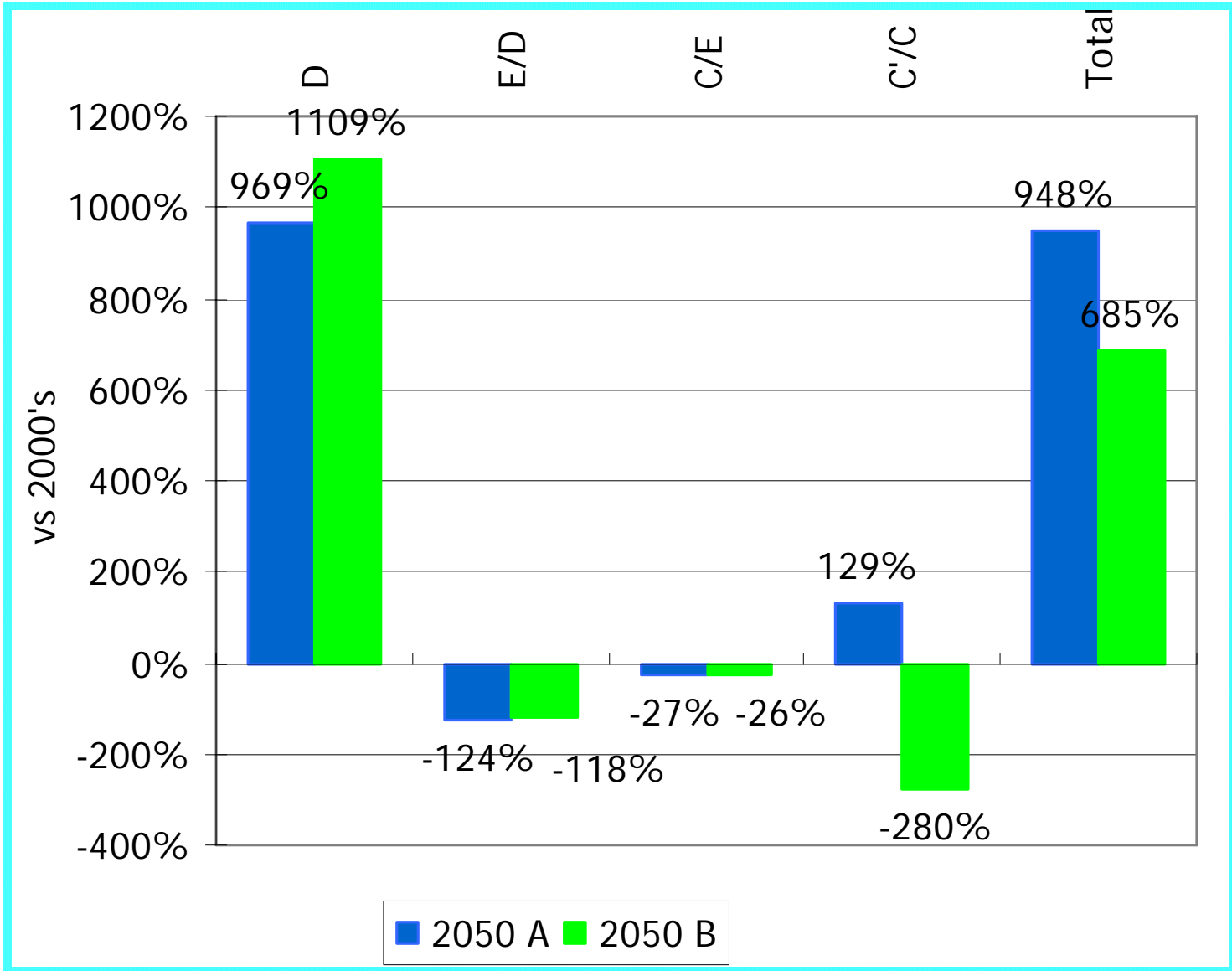


Factor Analysis: Residential



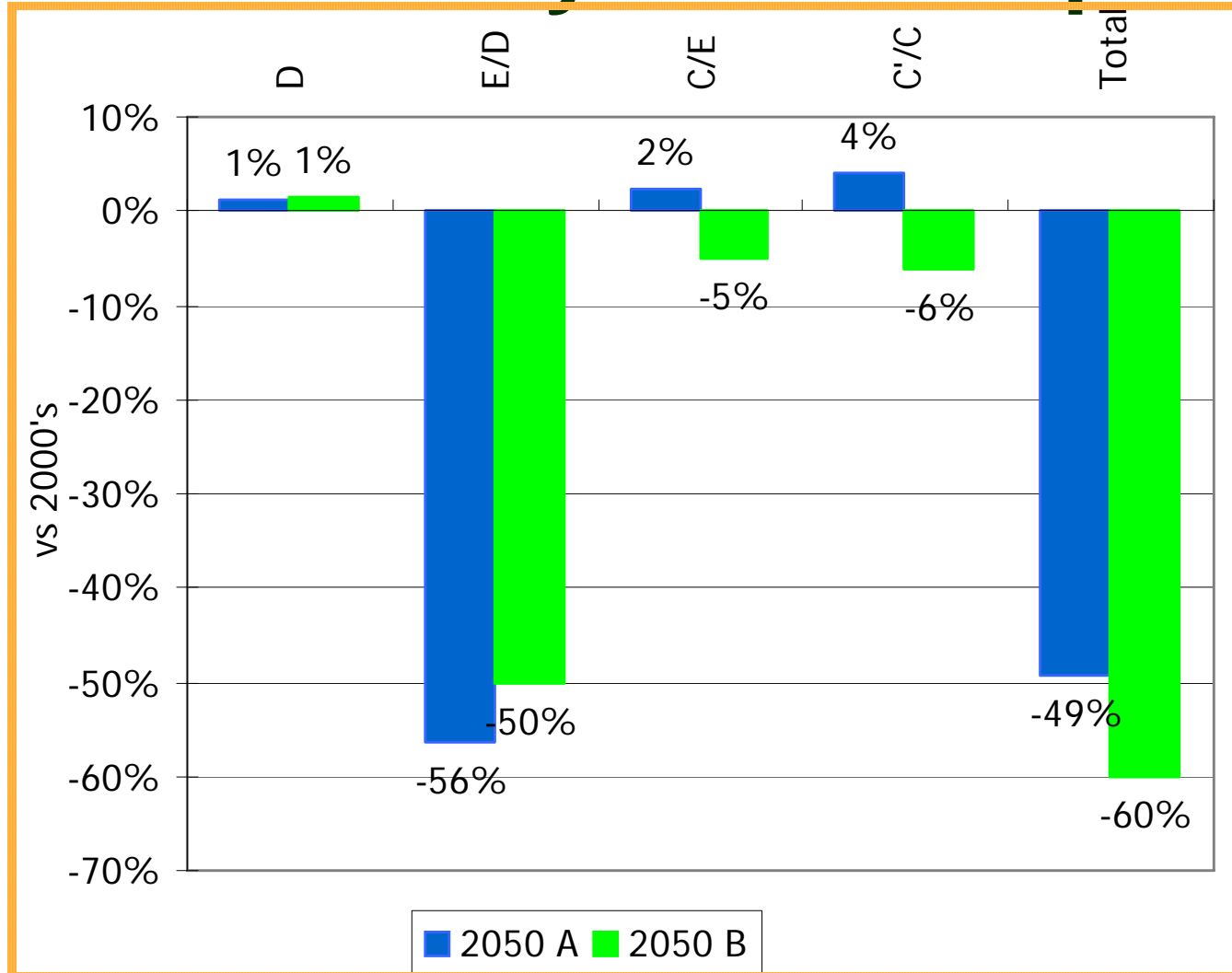


Factor Analysis: Commercial





Factor Analysis: Transport



Due to the substitution of oil by gas, hydrogen and electricity with substantial increase in energy efficiency