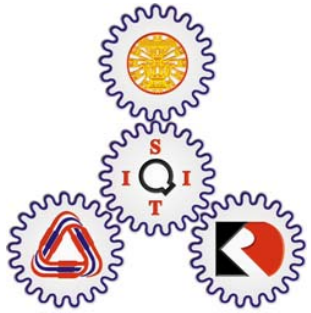


AIM

Introduction of energy scenarios in Thailand and future plan

15th AIM International Workshop, NIES, Japan

Feb 20, 2010

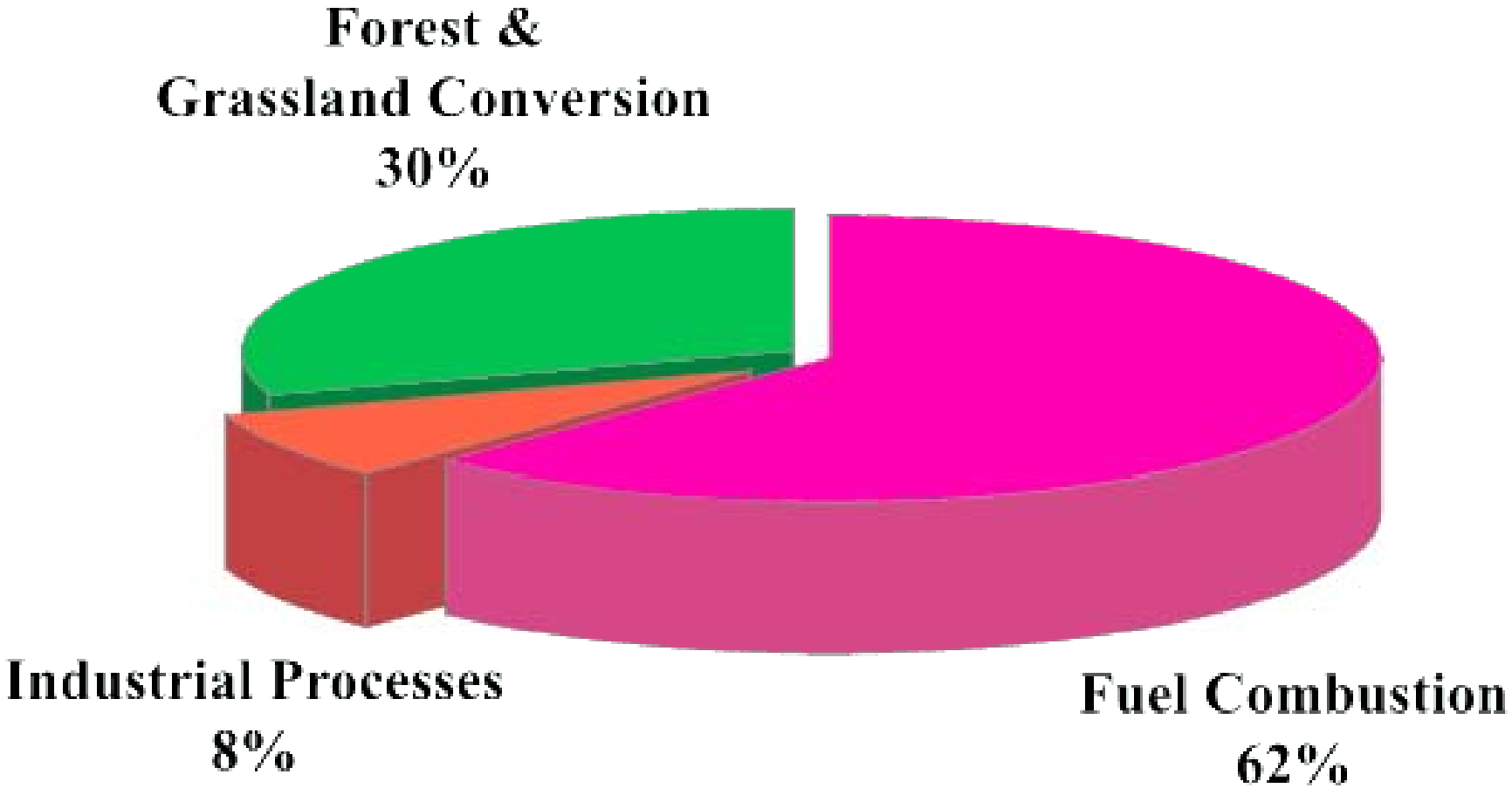
Bundit Limmeechokchai

Sirindhorn International Institute of Technology (SIIT)

Thammasat University (TU)

Thailand's GHG Inventory 1994

(Source: IPCC, Thailand NC1)



THAILAND

Area

- Total 513,115 km^2 (50th) or 198,115 sq mi
- Water (%) 0.4 (2,230 km^2)

Population

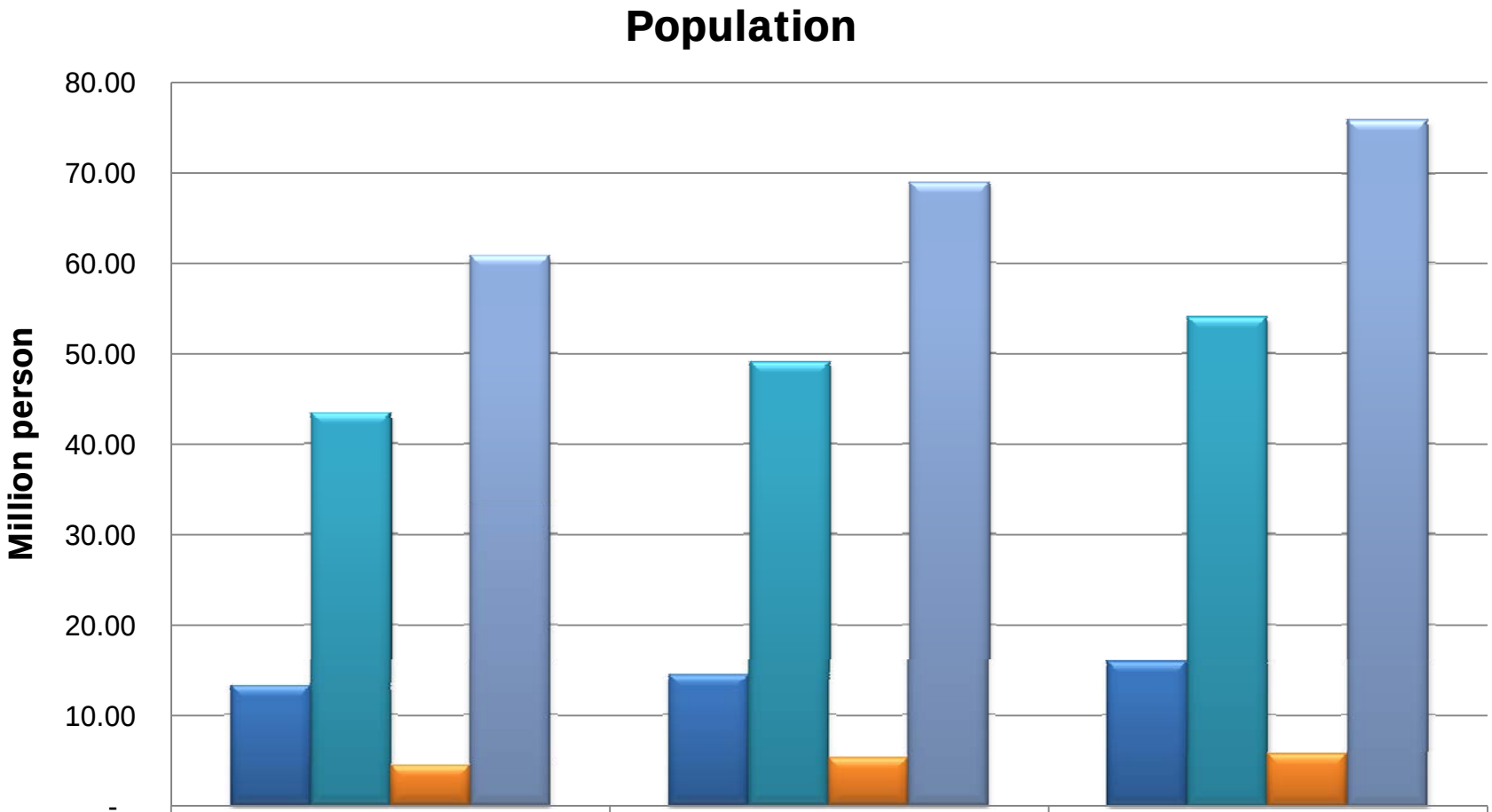
- 2010 estimate 63,723,953 (21st)
- 2000 census 60,606,947
- Density 132.1/km^2 (85th) or 342/sq mi

GDP (PPP) 2008 estimate

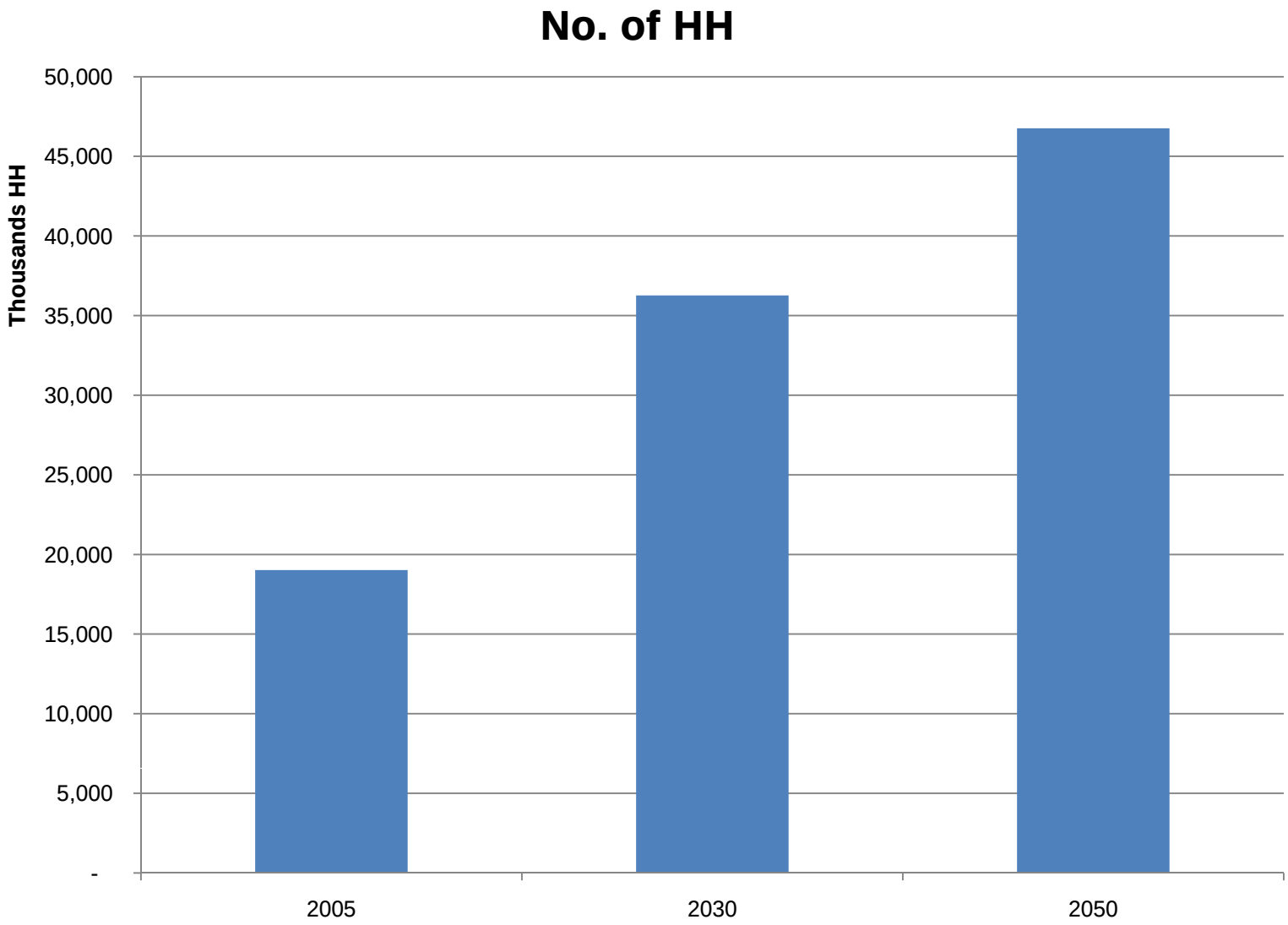
- Total $547.060 billion (24th)
- Per capita $8,239 (86th)

GDP (nominal) 2008 estimate

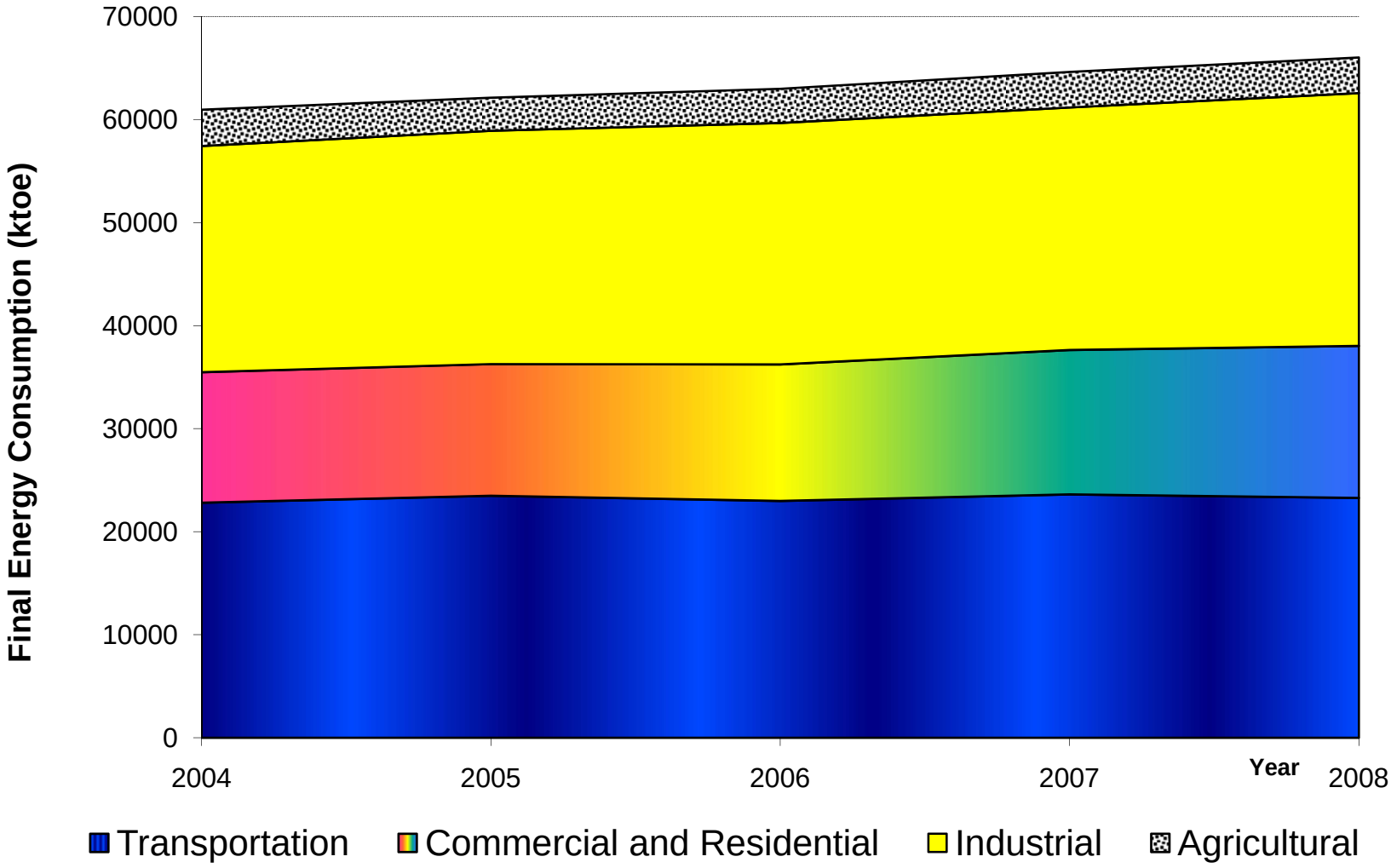
- Total $273.313 billion (33rd)
- Per capita $4,116 (92nd)



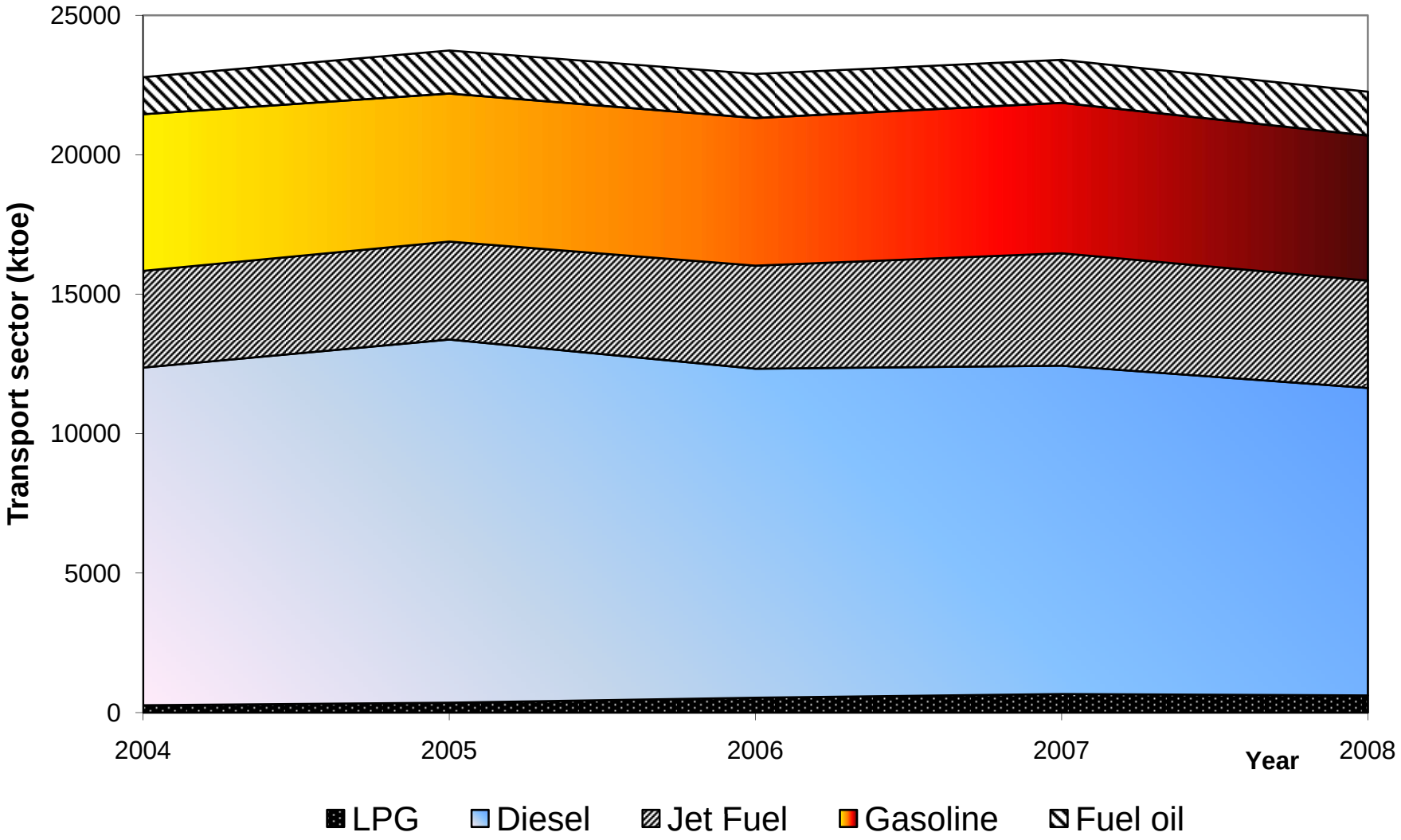
	2005	2030	2050
0-14	13.26	14.45	15.93
15-64	43.29	49.09	54.10
over 64	4.44	5.27	5.81
Total	60.99	68.82	75.84


No. of HH
Thousands HH
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
-
2005
2030
2050

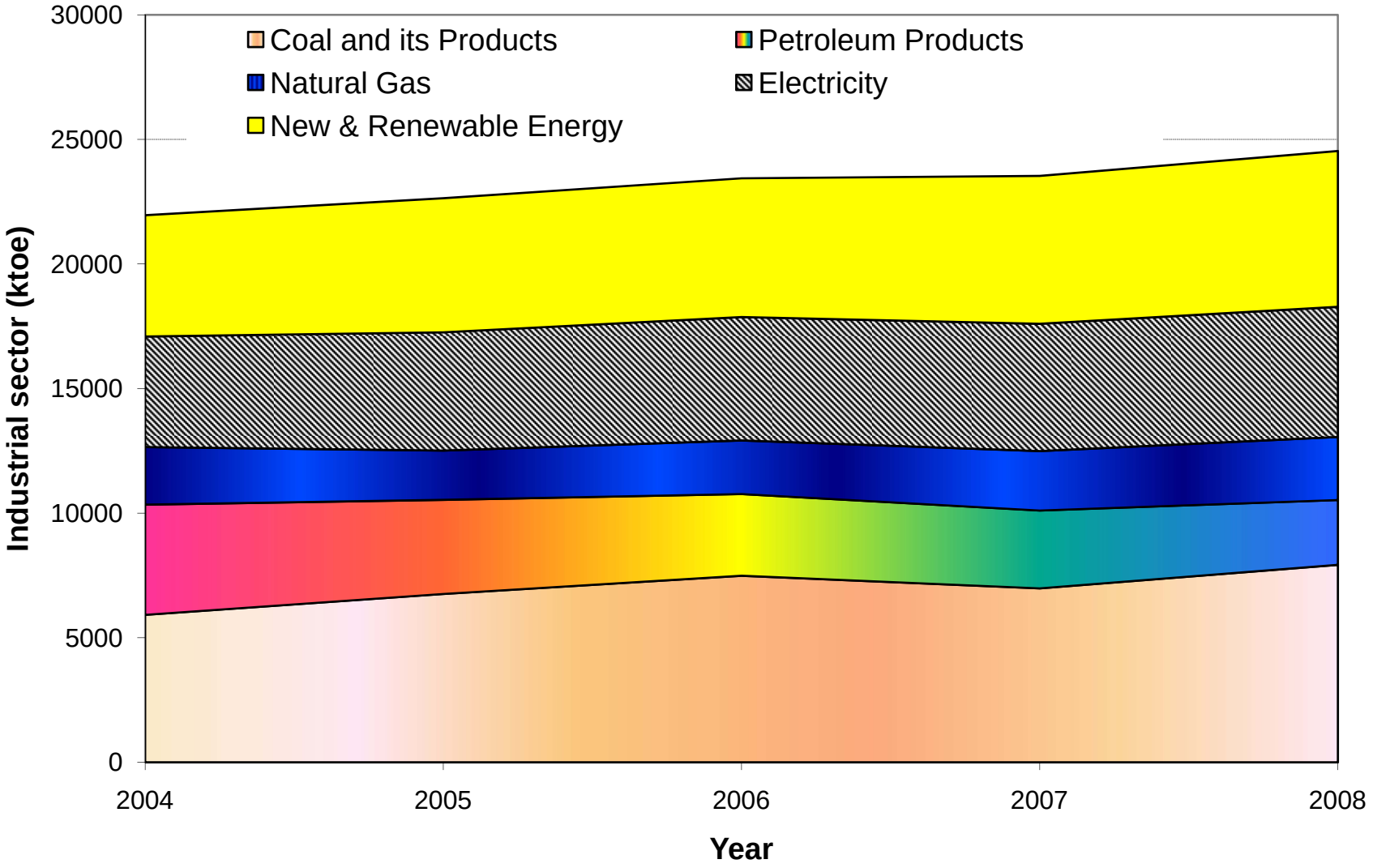
Final energy consumption (ktoe)



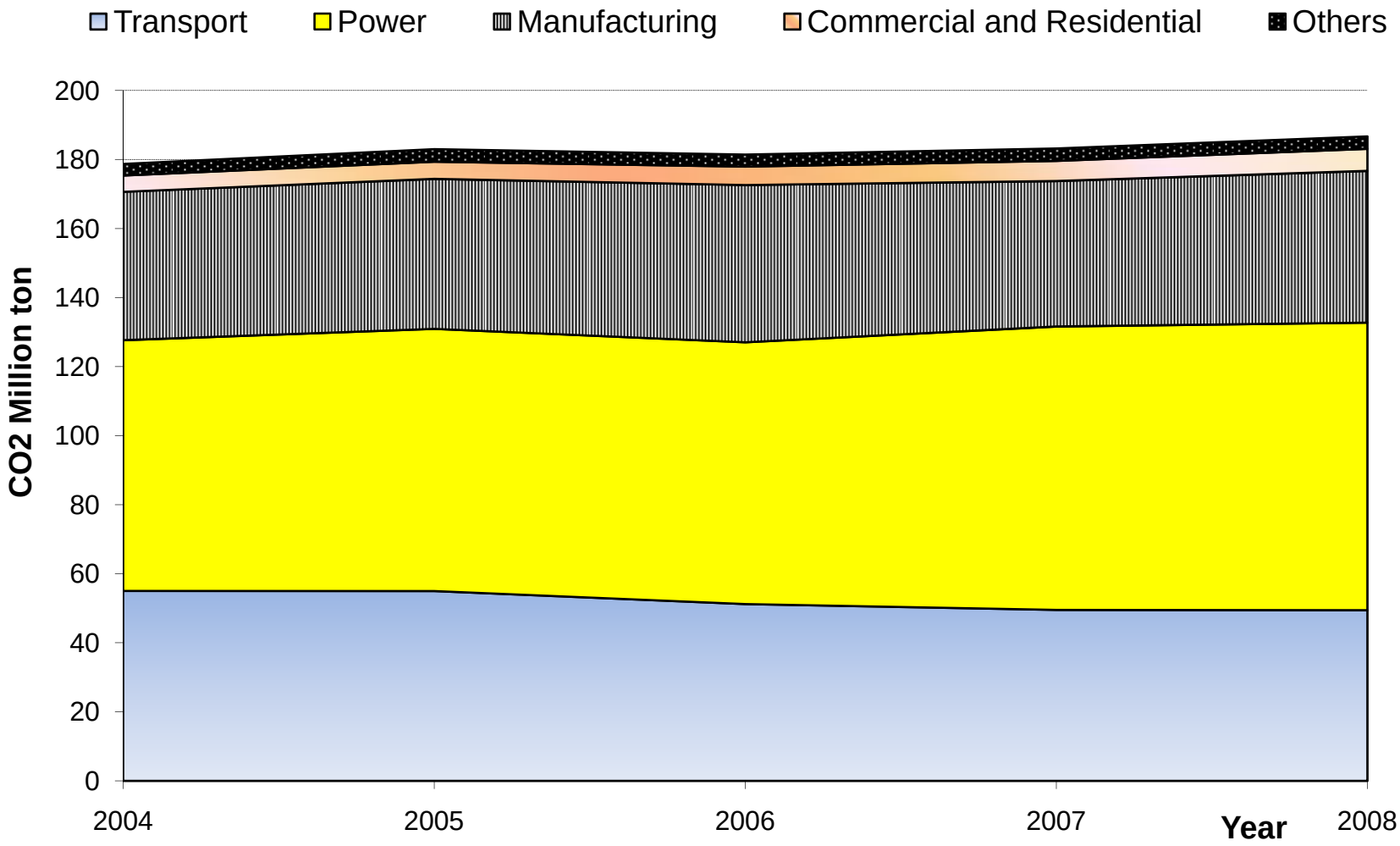
Energy consumption in the transport sector (ktoe)



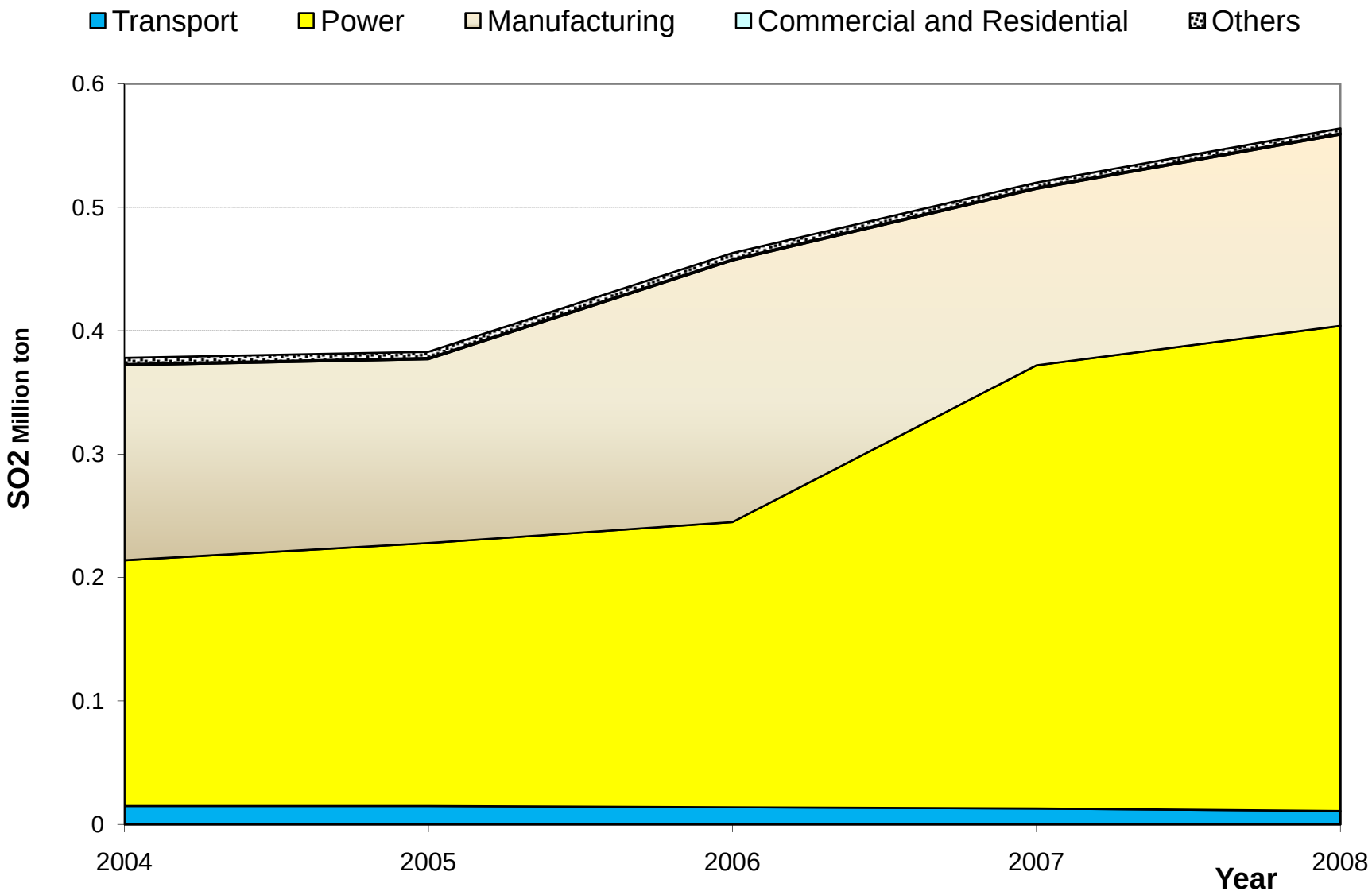
Energy consumption in the industrial sector (ktoe)



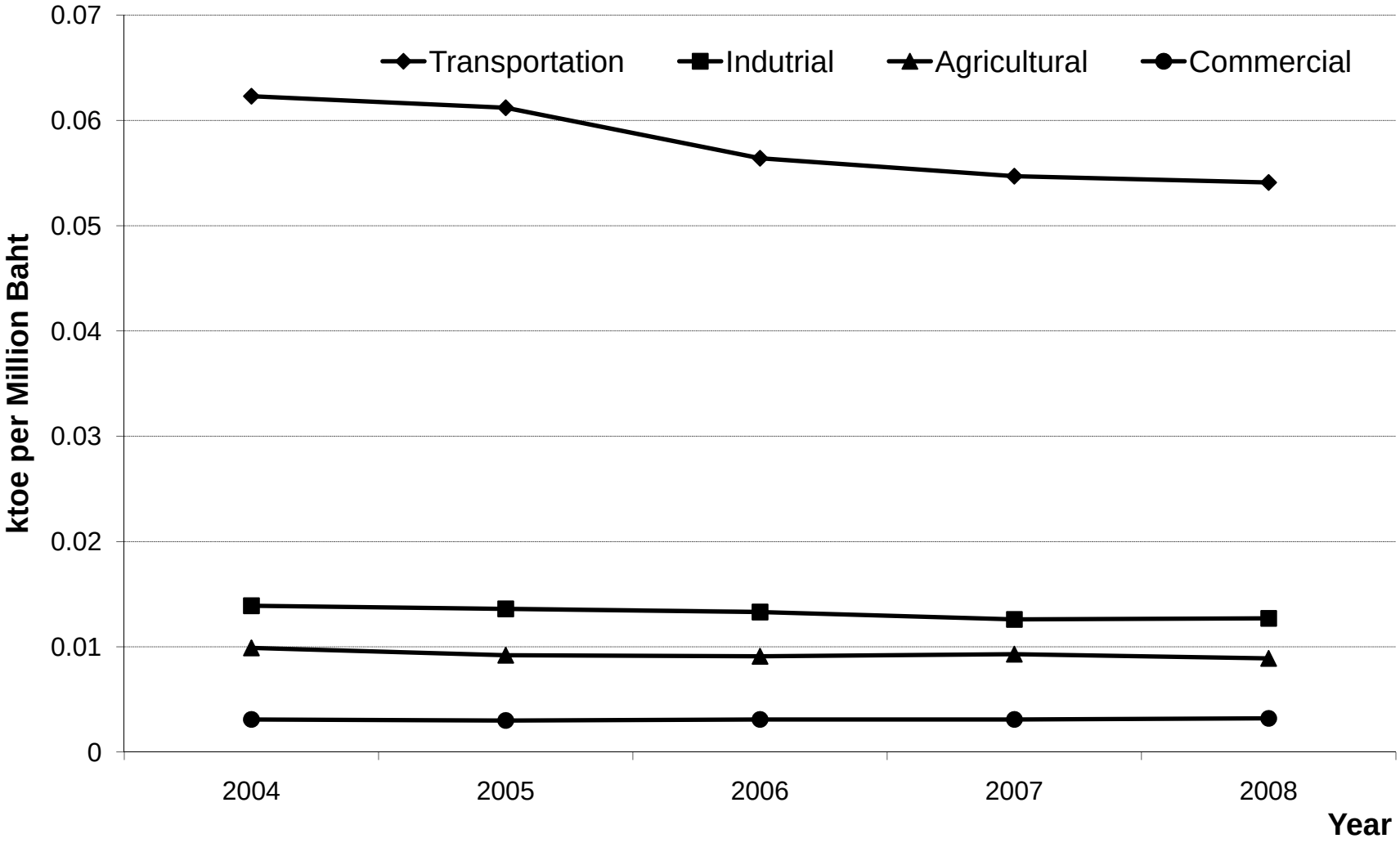
CO_2 emissions (Energy)



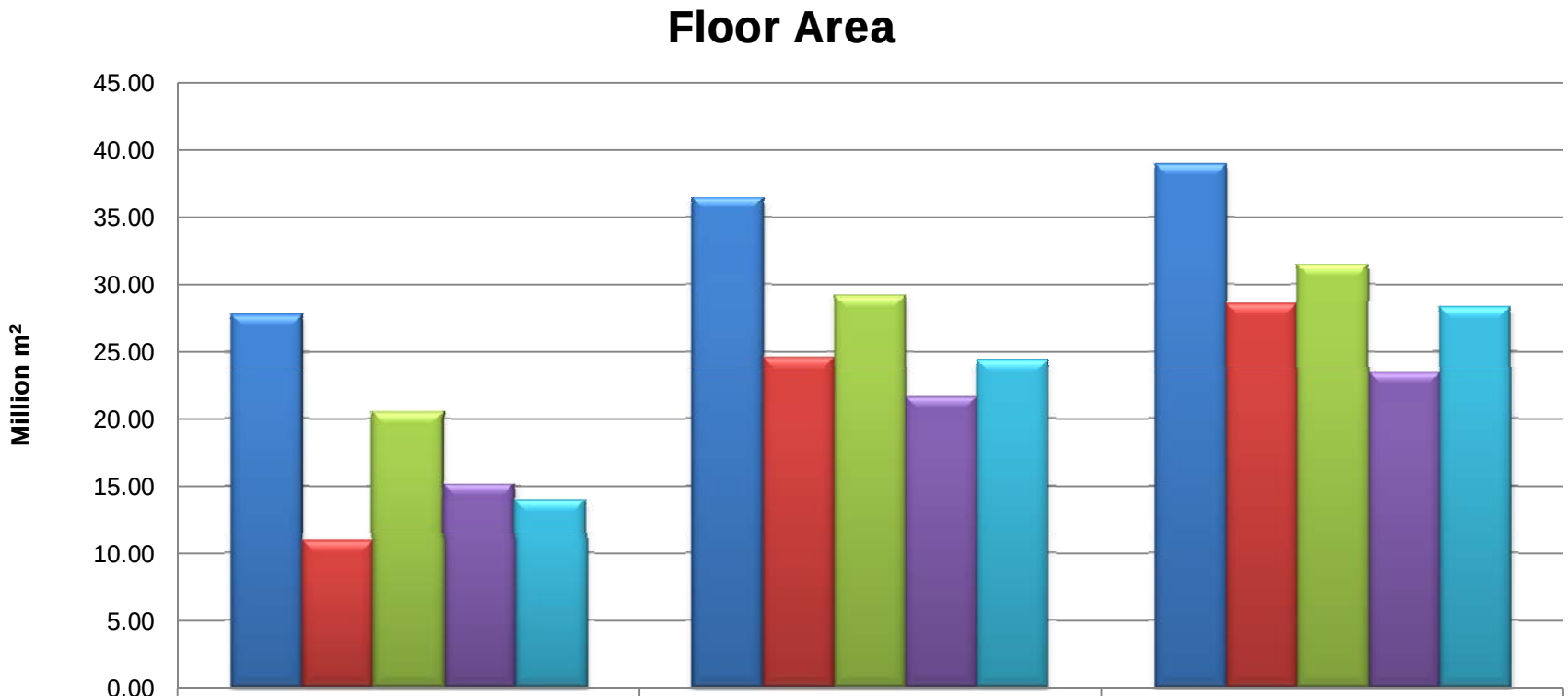
SO_2 emissions (Energy)



Ktoe per GDP

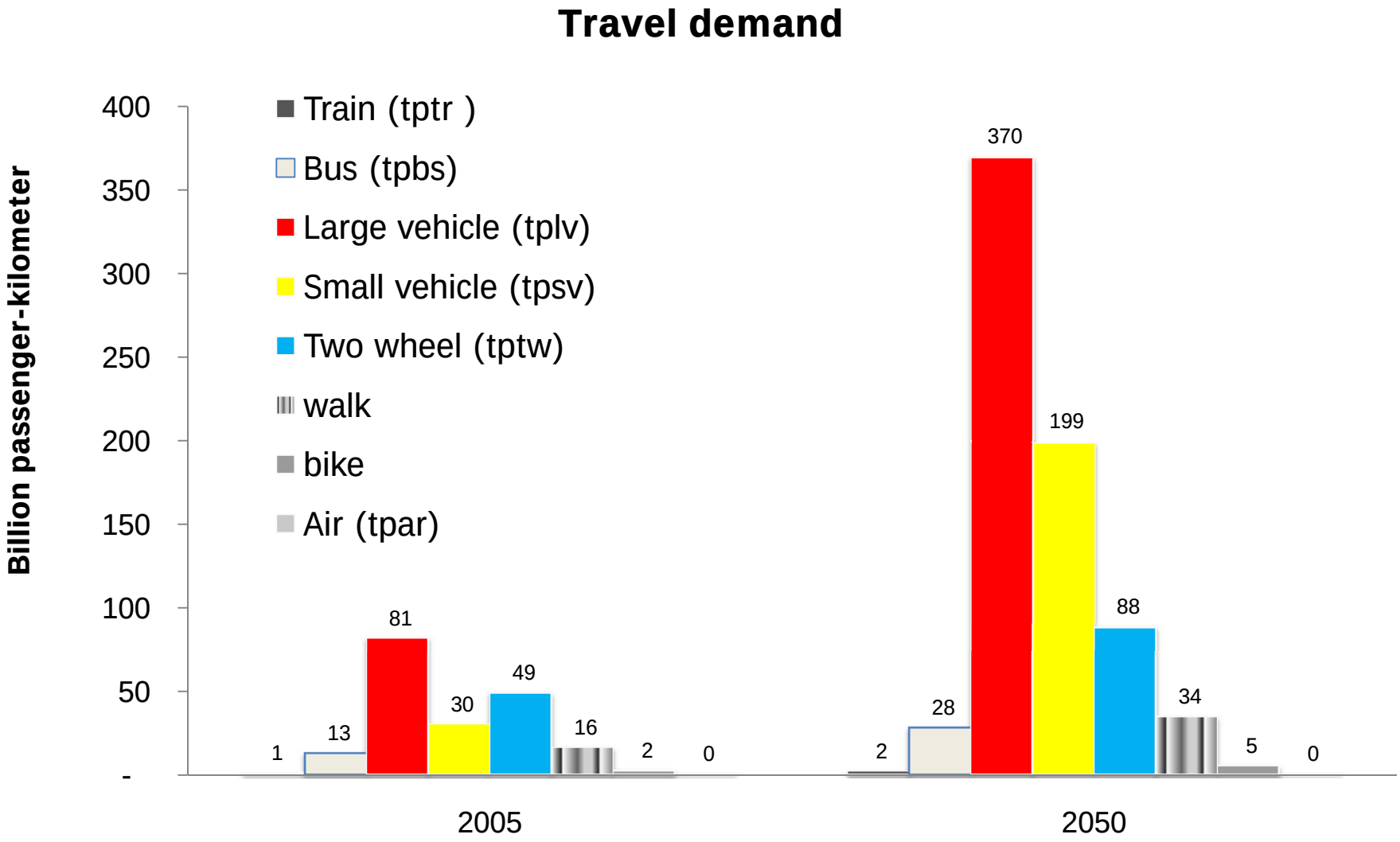

0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
ktoe per Million Baht
Transportation
Indutrial
Agricultural
Commercial
2004
2005
2006
2007
2008
Year

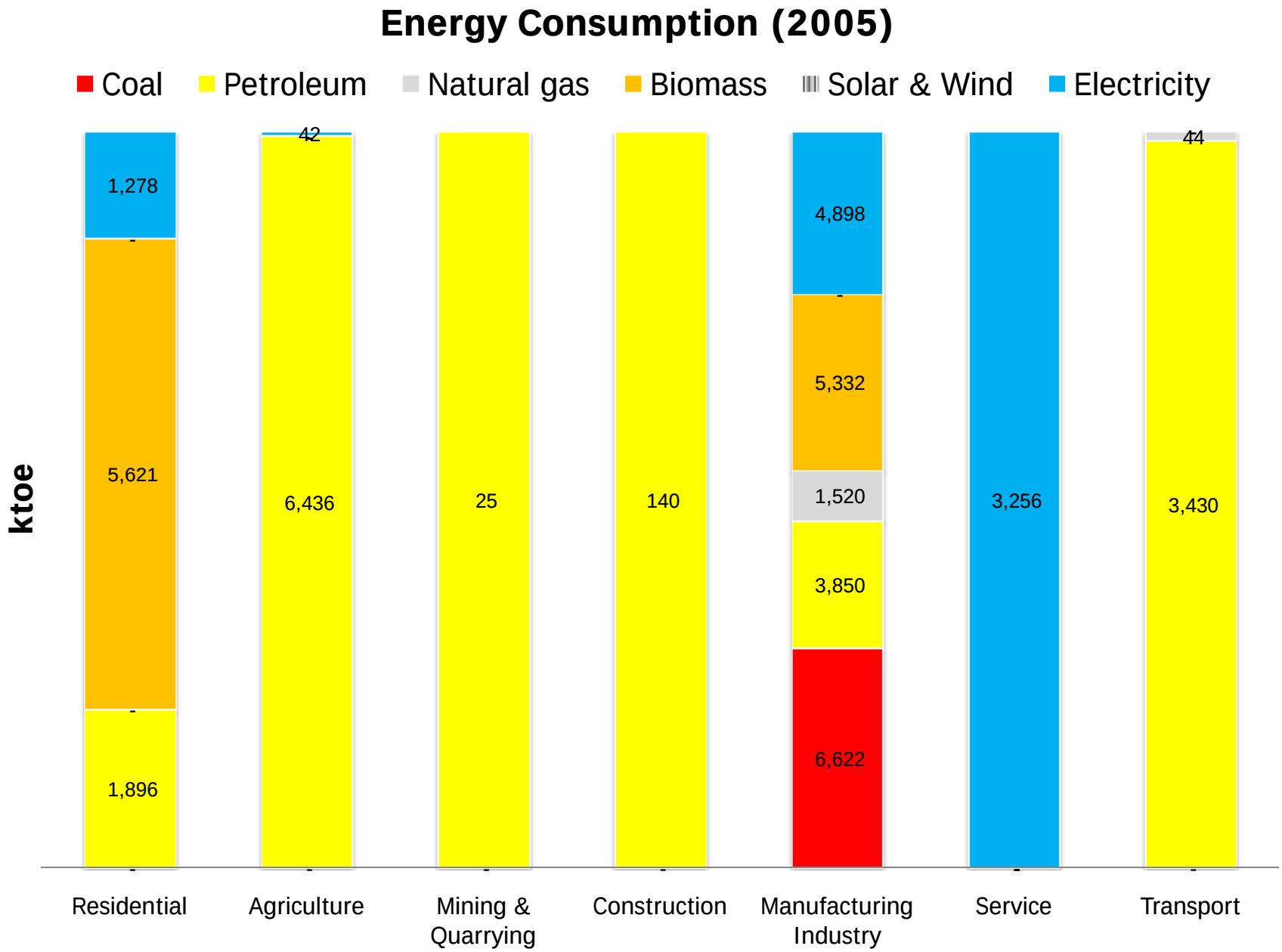
Estimation of floor area in buildings

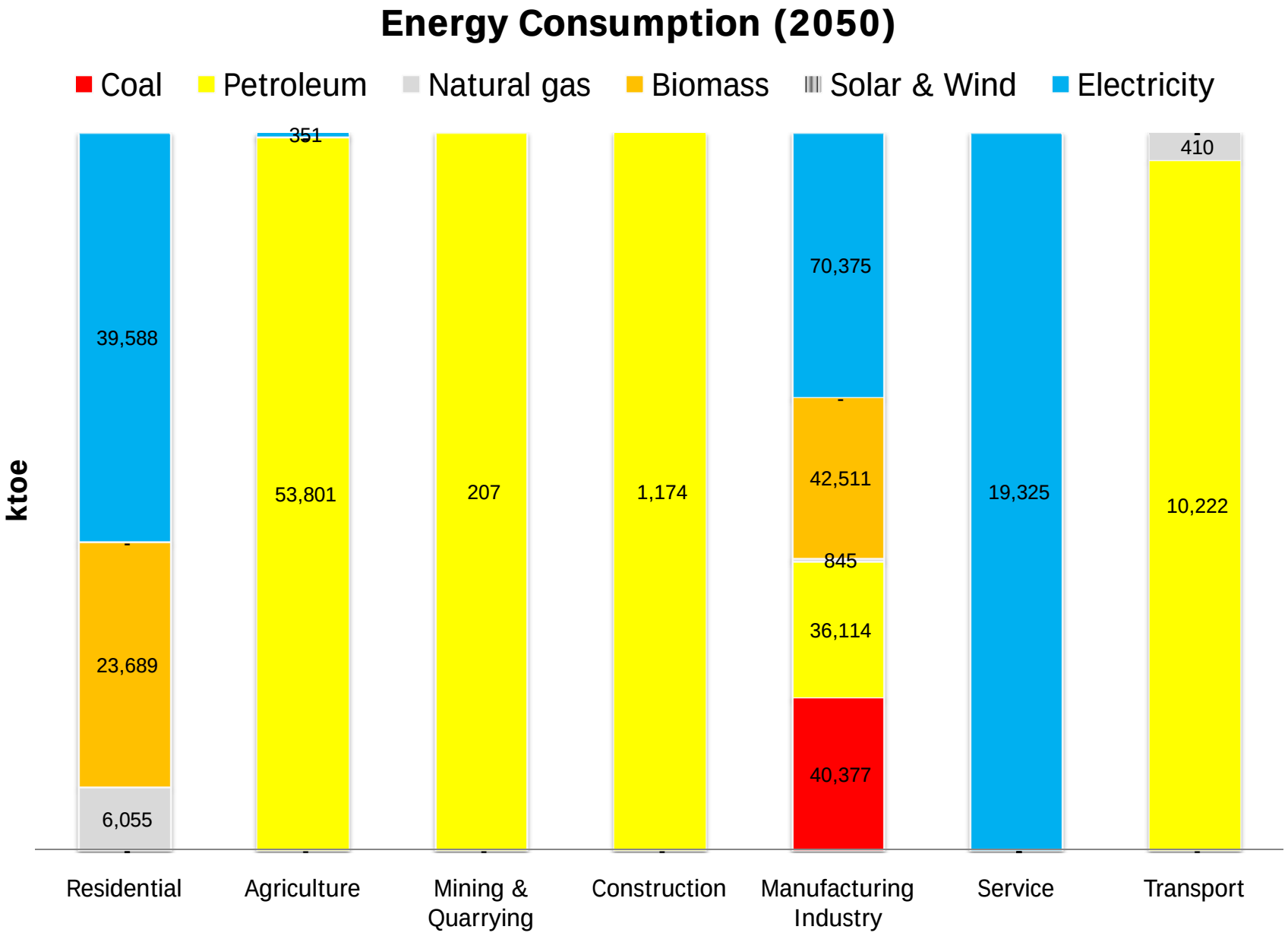


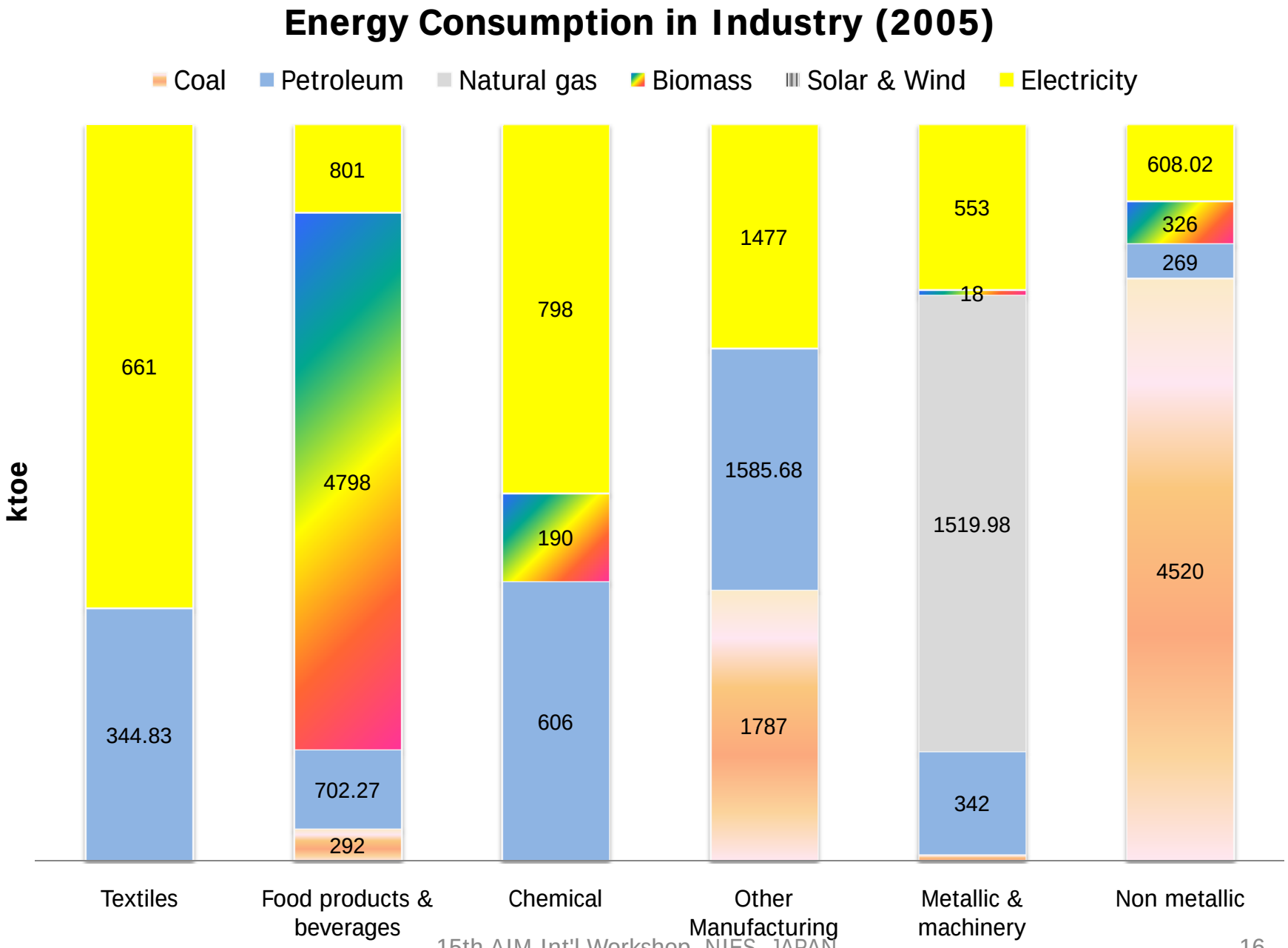
	2005	2030	2050
Office	27.68	36.44	38.94
Hospital	10.91	24.52	28.49
Hotel	20.54	29.08	31.46
Department	15.15	21.61	23.41
Education	13.97	24.34	28.35

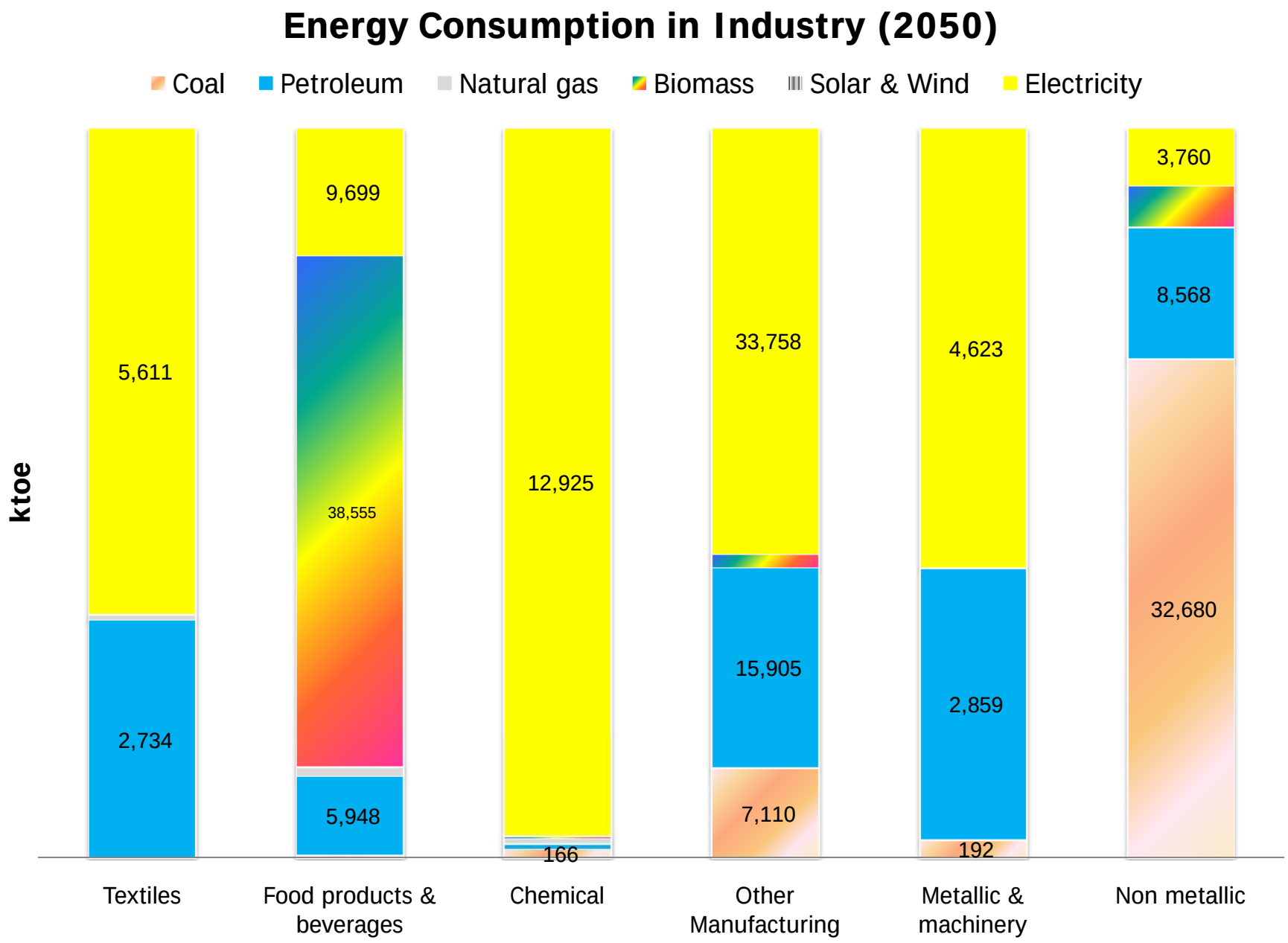
Transport Sector



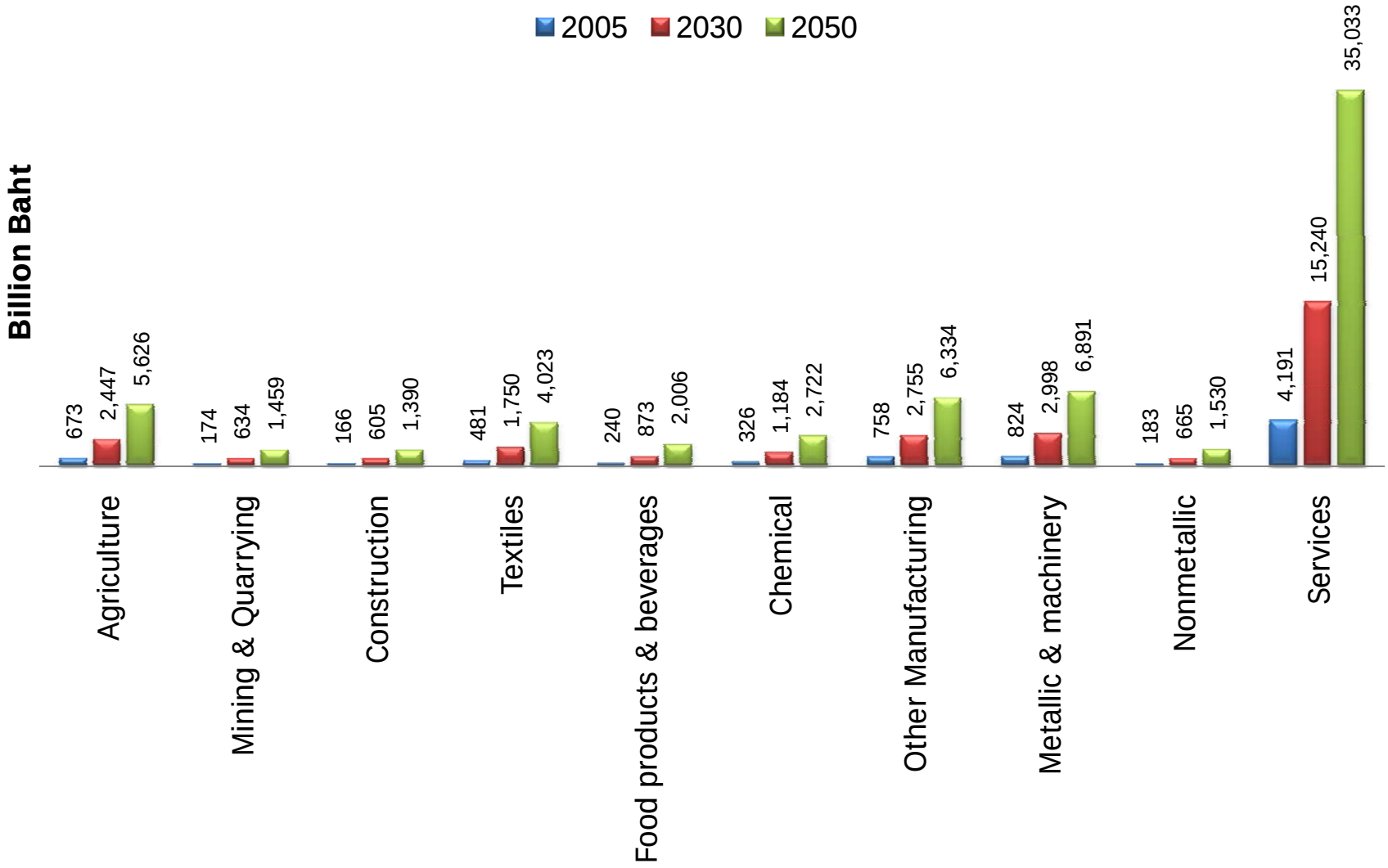

Energy Consumption (2005)
Coal
Petroleum
Natural gas
Biomass
Solar & Wind
Electricity
ktoe
1,278
5,621
1,896
42
6,436
25
140
4,898
5,332
1,520
3,850
6,622
3,256
44
3,430
Residential
Agriculture
Mining & Quarrying
Construction
Manufacturing Industry
Service
Transport


Energy Consumption (2050)
Coal
Petroleum
Natural gas
Biomass
Solar & Wind
Electricity
ktoe
39,588
23,689
6,055
351
53,801
207
1,174
70,375
42,511
845
36,114
40,377
19,325
410
10,222
Residential
Agriculture
Mining & Quarrying
Construction
Manufacturing Industry
Service
Transport


Energy Consumption in Industry (2005)
Coal
Petroleum
Natural gas
Biomass
Solar & Wind
Electricity
ktoe
661
344.83
801
4798
702.27
292
798
190
606
1477
1585.68
1787
553
18
1519.98
342
608.02
326
269
4520
Textiles
Food products & beverages
Chemical
Other Manufacturing
Metallic & machinery
Non metallic

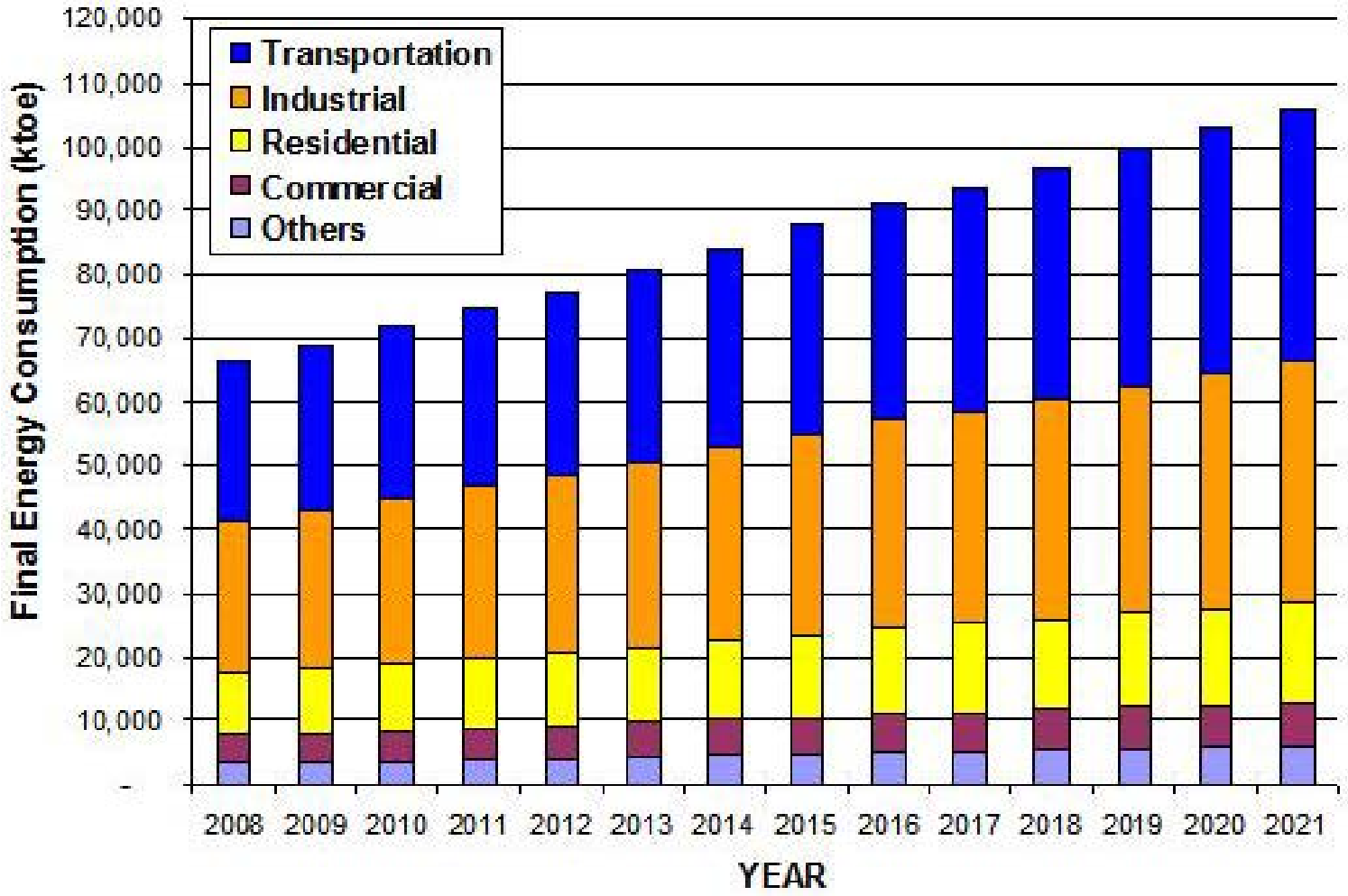

Energy Consumption in Industry (2050)
Coal
Petroleum
Natural gas
Biomass
Solar & Wind
Electricity
ktoe
5,611
2,734
9,699
38,555
5,948
12,925
166
33,758
15,905
7,110
4,623
2,859
192
3,760
8,568
32,680
Textiles
Food products & beverages
Chemical
Other Manufacturing
Metallic & machinery
Non metallic

Gross Domestic Product



Forecast of FEC

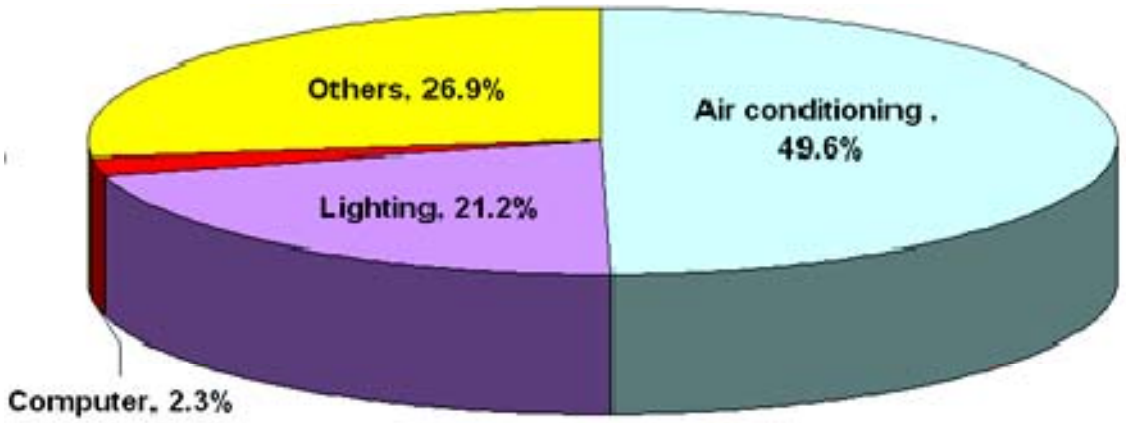
(Low GDP 3.5%)

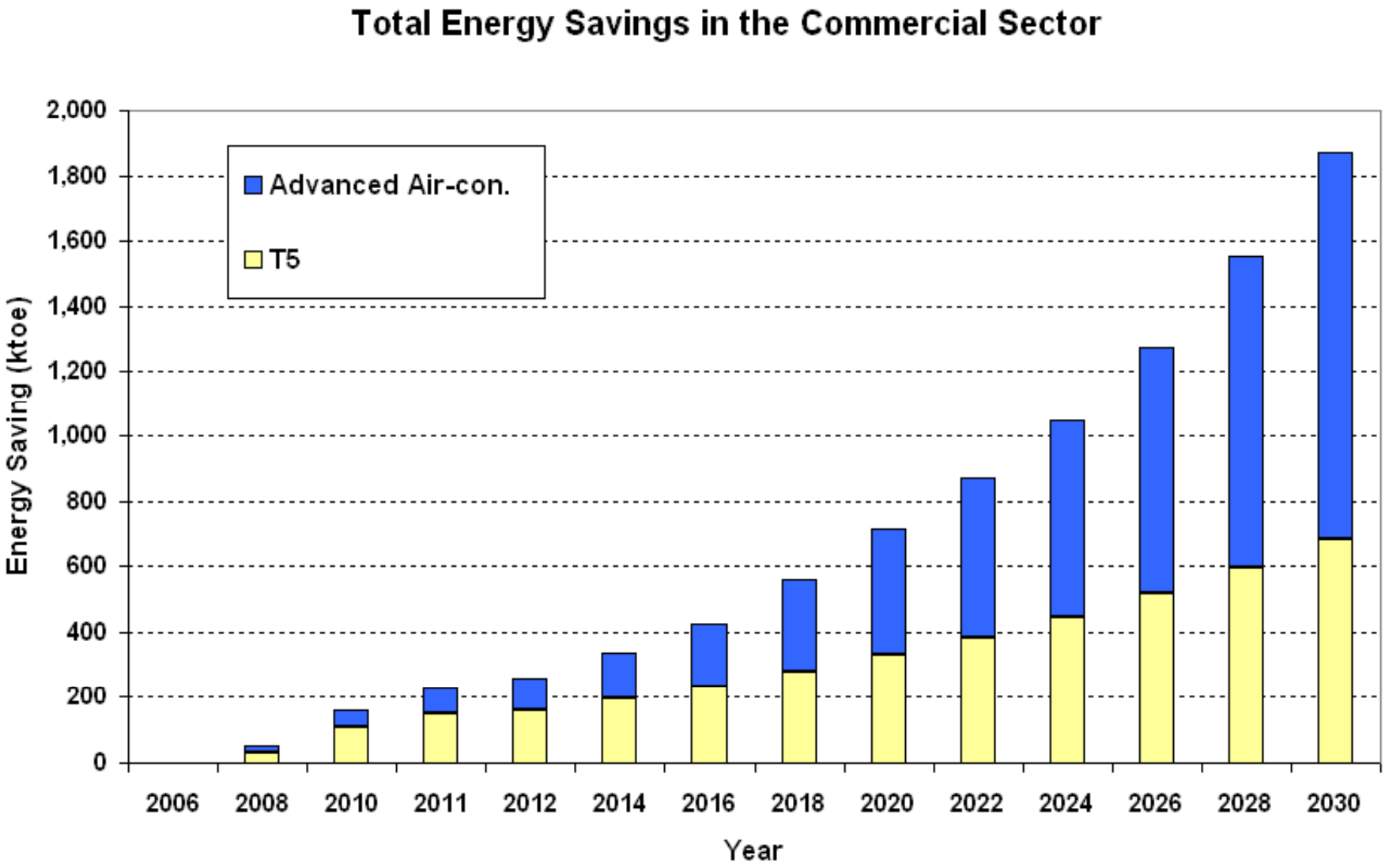


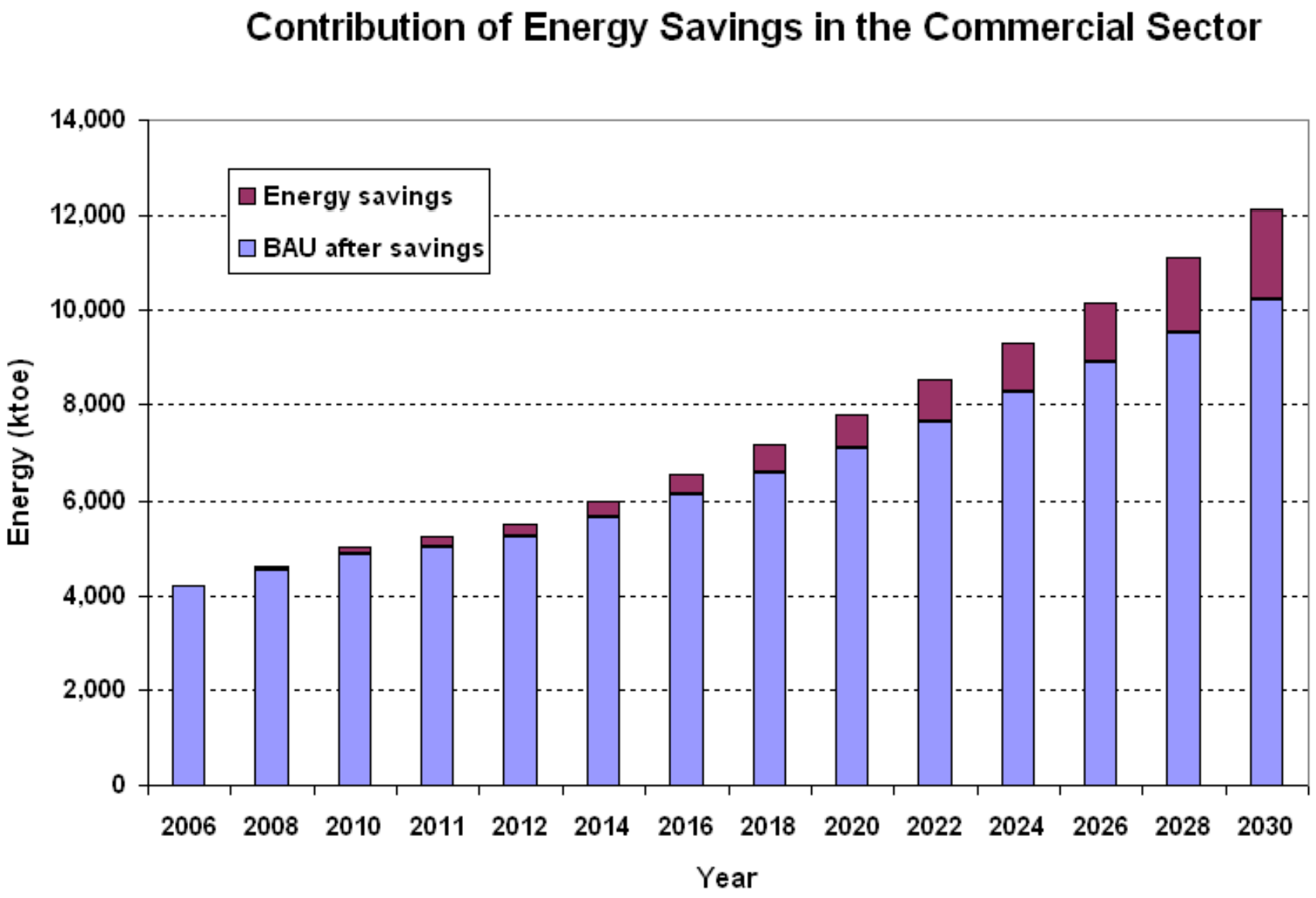
Share of energy types in industries (2005)

INDUSTRY	Electricity (%)	Heat (%)
Food & Beverage	13	87
Textile	71	29
Wood & Furniture	70	30
Paper	23	77
Chemical	32	68
Non Metallic	8	92
Basic Metal	43	57
Fabricated Metal	70	30

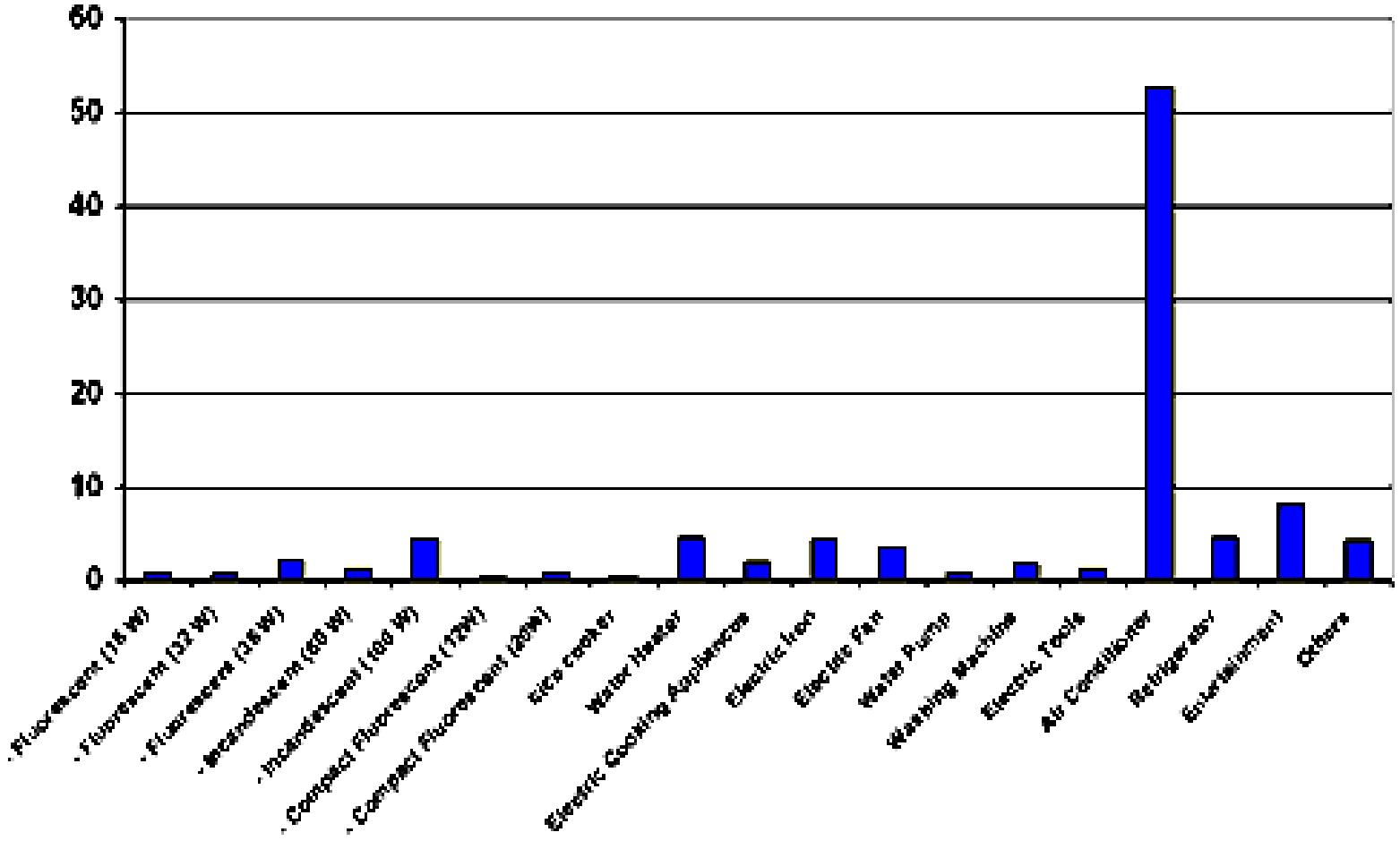
Breakdown of energy consumption in Thai commercial buildings



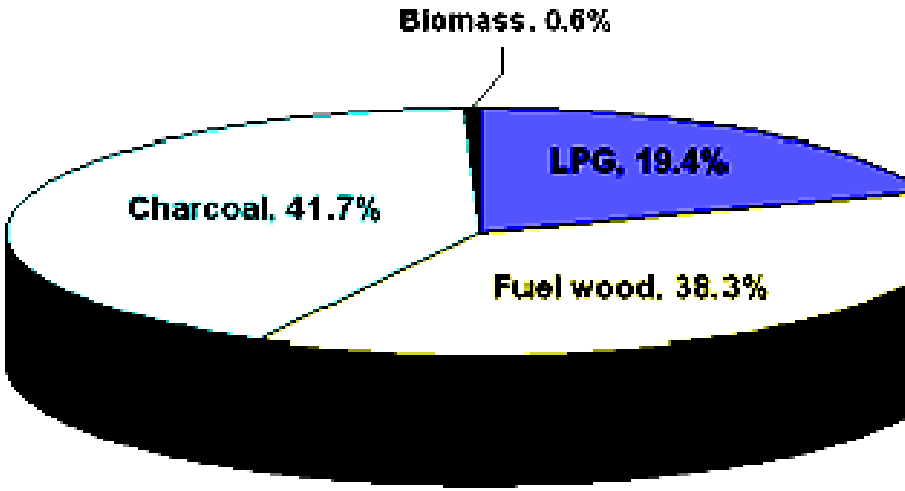

Total Energy Savings in the Commercial Sector
Advanced Air-con.
T5
Energy Saving (ktoe)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2006
2008
2010
2011
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Year

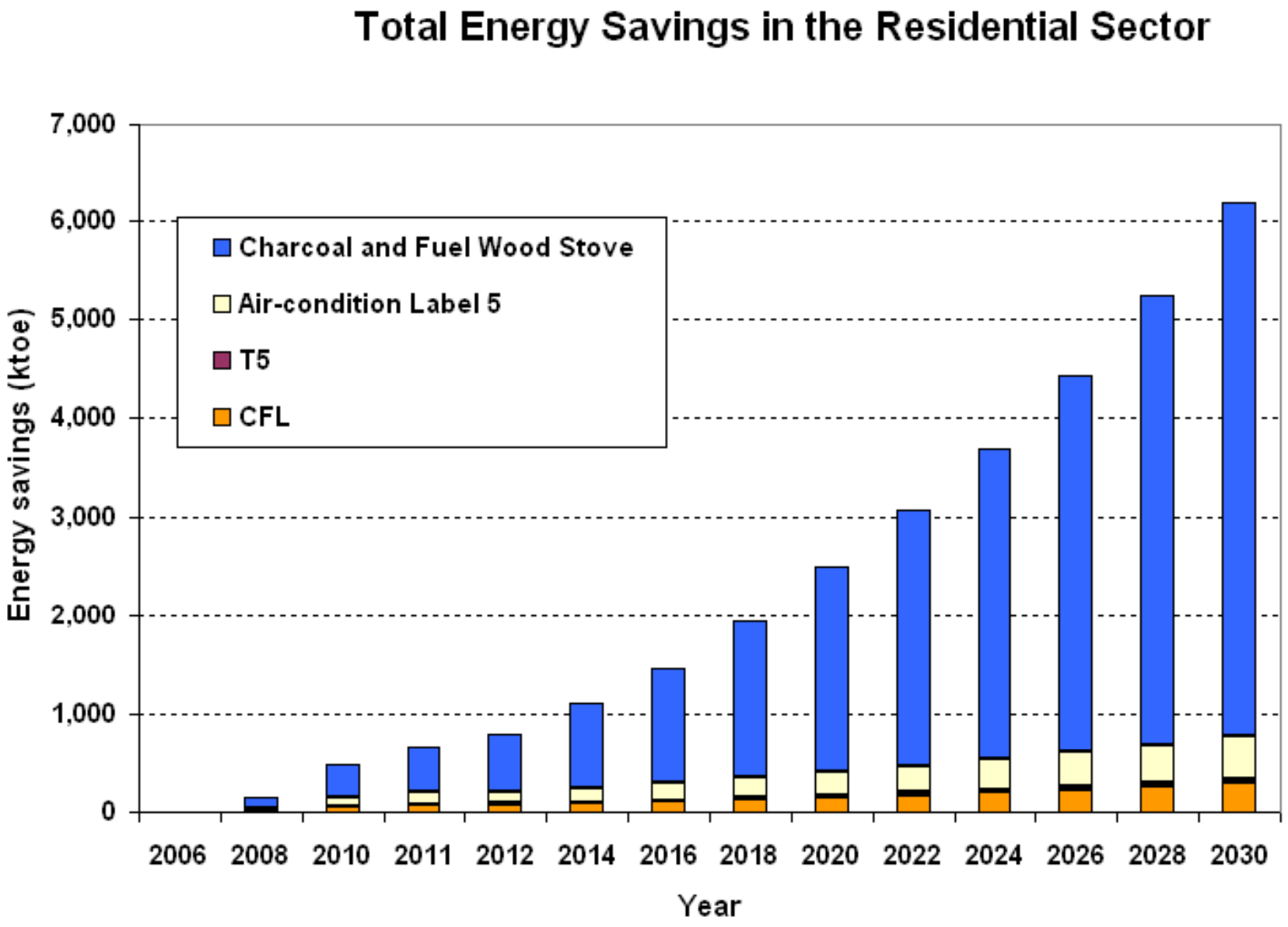

Contribution of Energy Savings in the Commercial Sector
Energy savings
BAU after savings
Energy (ktoe)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
2006
2008
2010
2011
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Year

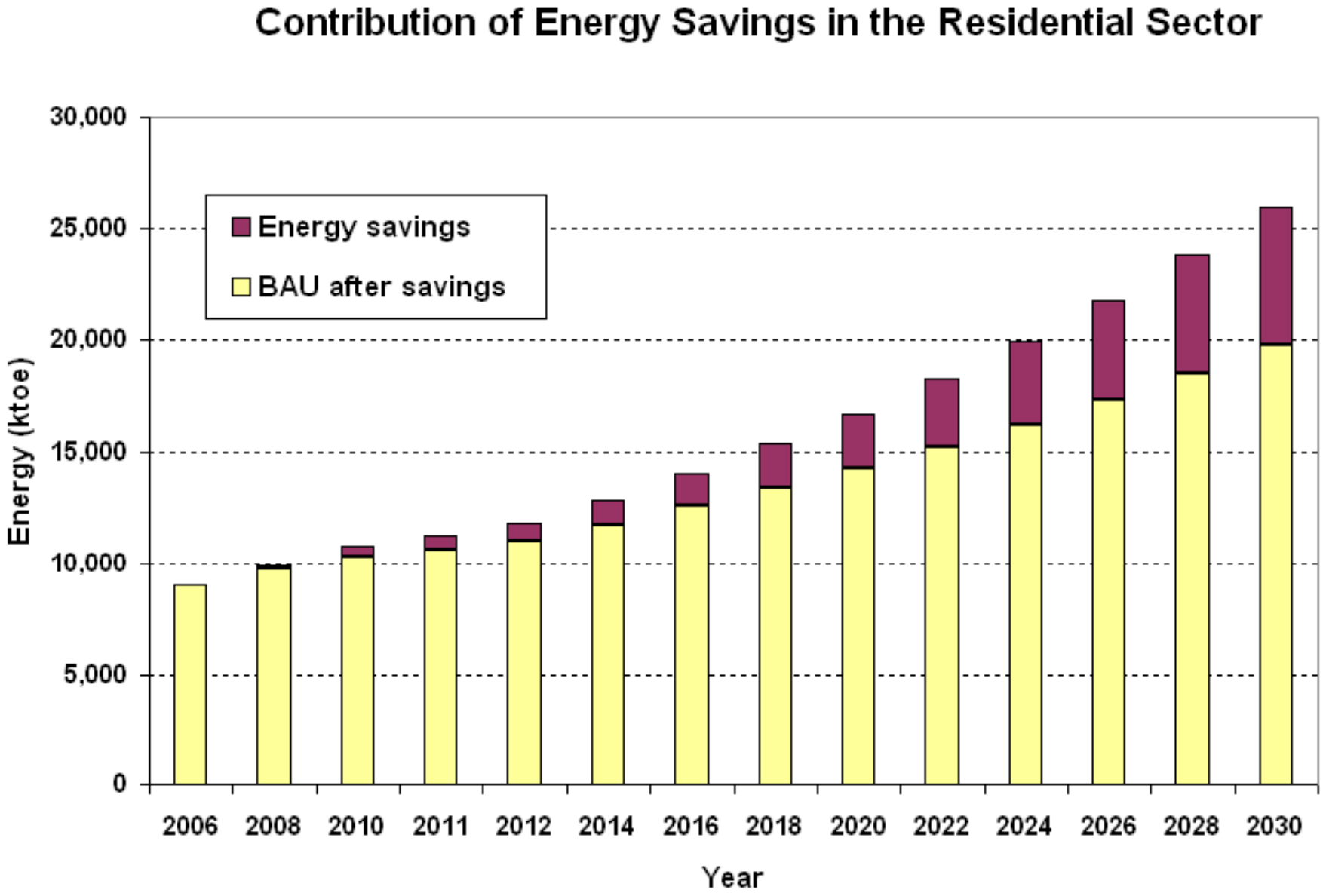
% Share of electricity used in Thai residential



% Share of non-electricity used Thai residential

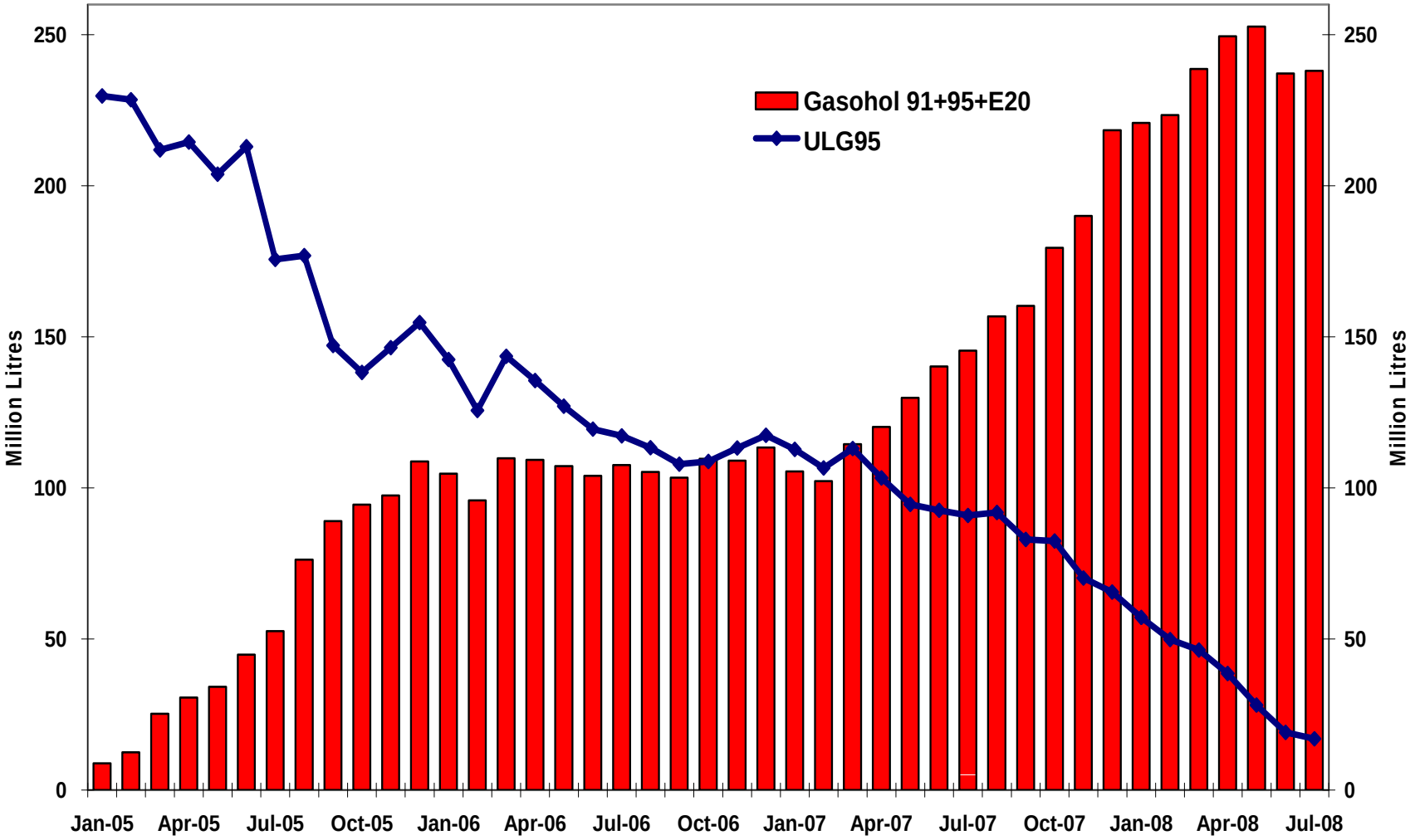



Total Energy Savings in the Residential Sector
Energy savings (ktoe)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Charcoal and Fuel Wood Stove
Air-condition Label 5
T5
CFL
2006
2008
2010
2011
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Year

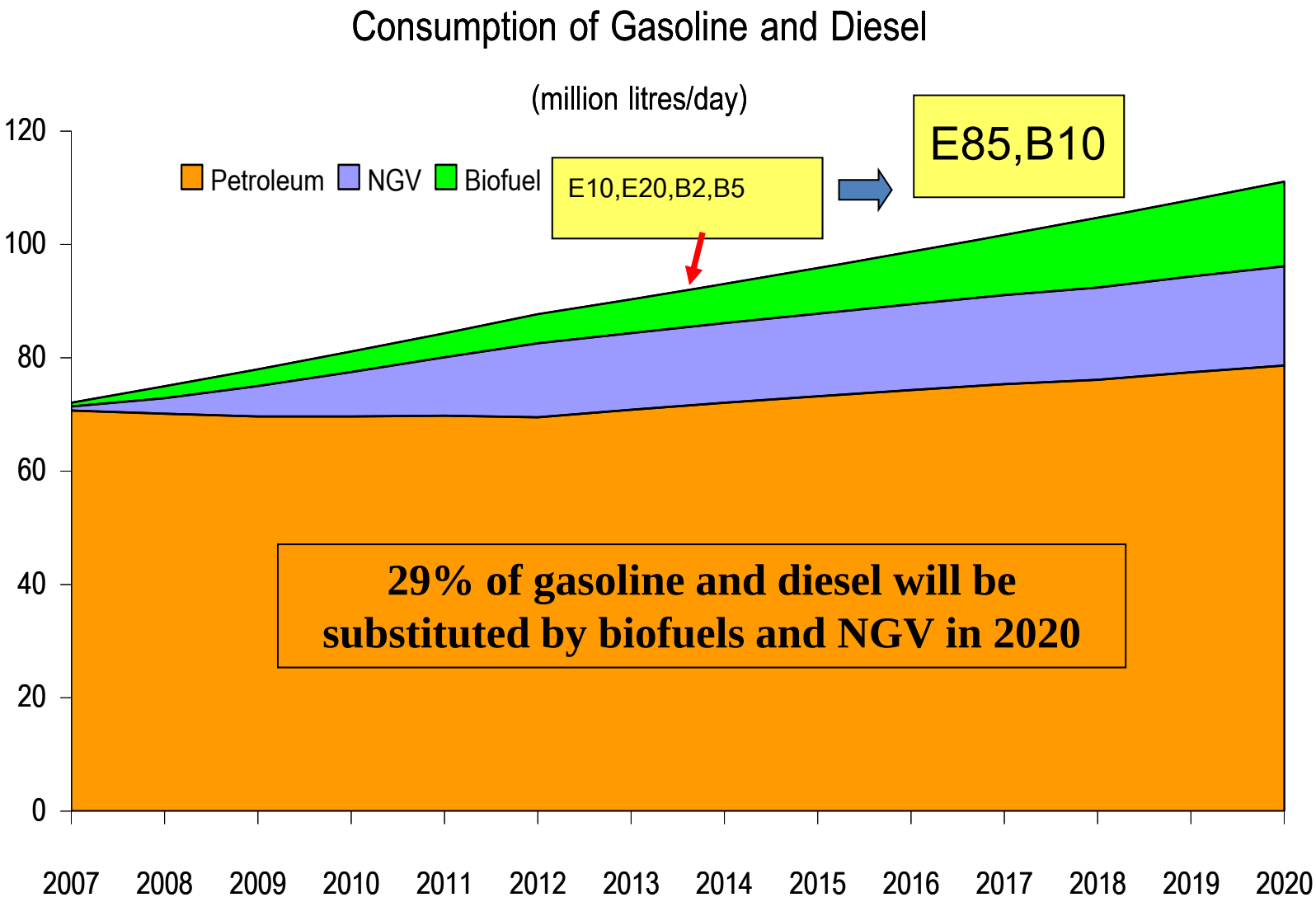

Contribution of Energy Savings in the Residential Sector
Energy savings
BAU after savings
Energy (ktoe)
30,000
25,000
20,000
15,000
10,000
5,000
0
2006
2008
2010
2011
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Year

Renewable Energy Development in Thailand: TRANSPORT SECTOR

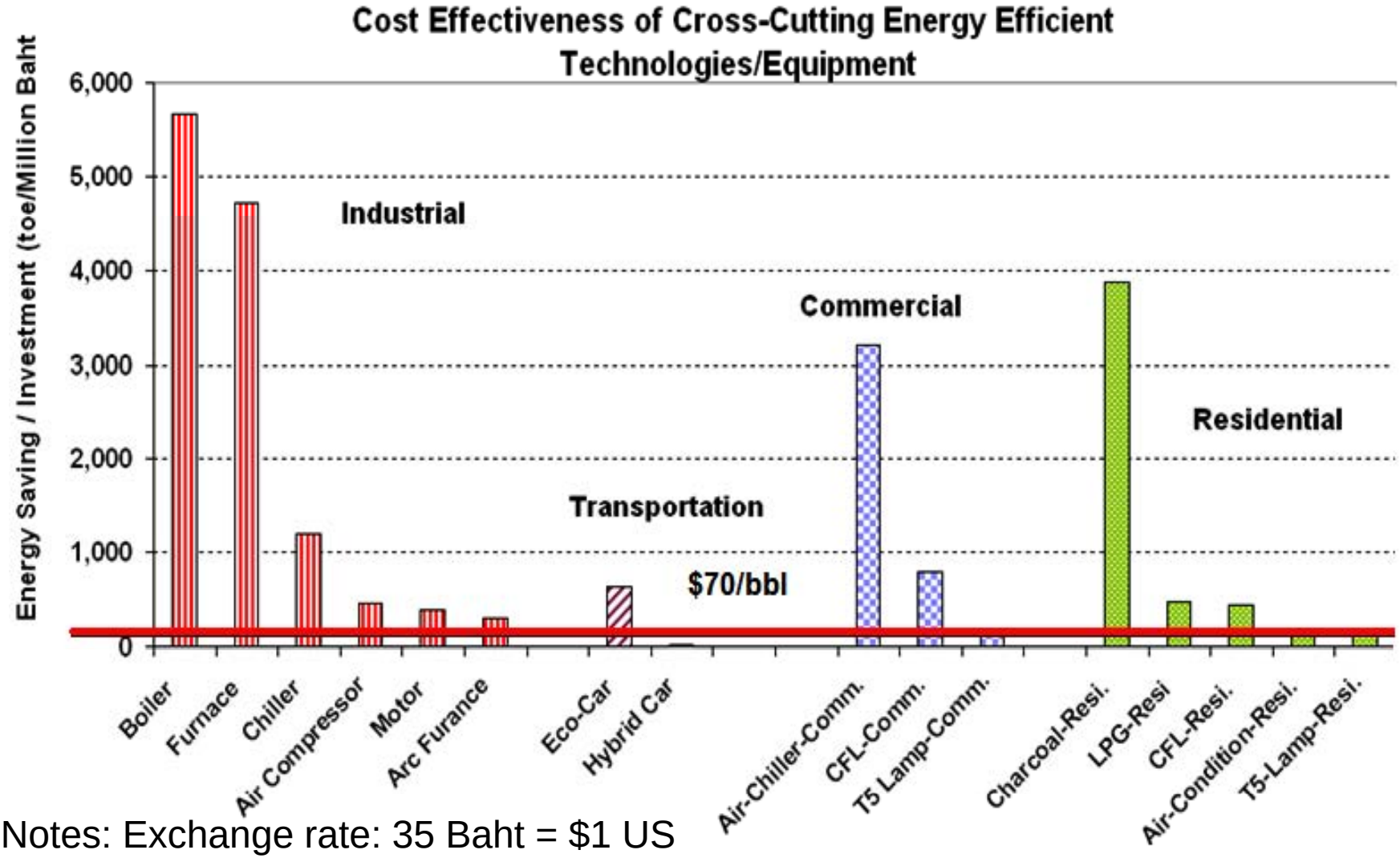
SALES OF GASOHOL AND UNLEADED GASOLINE 95



Renewable Energy Development in Thailand: TRANSPORT SECTOR

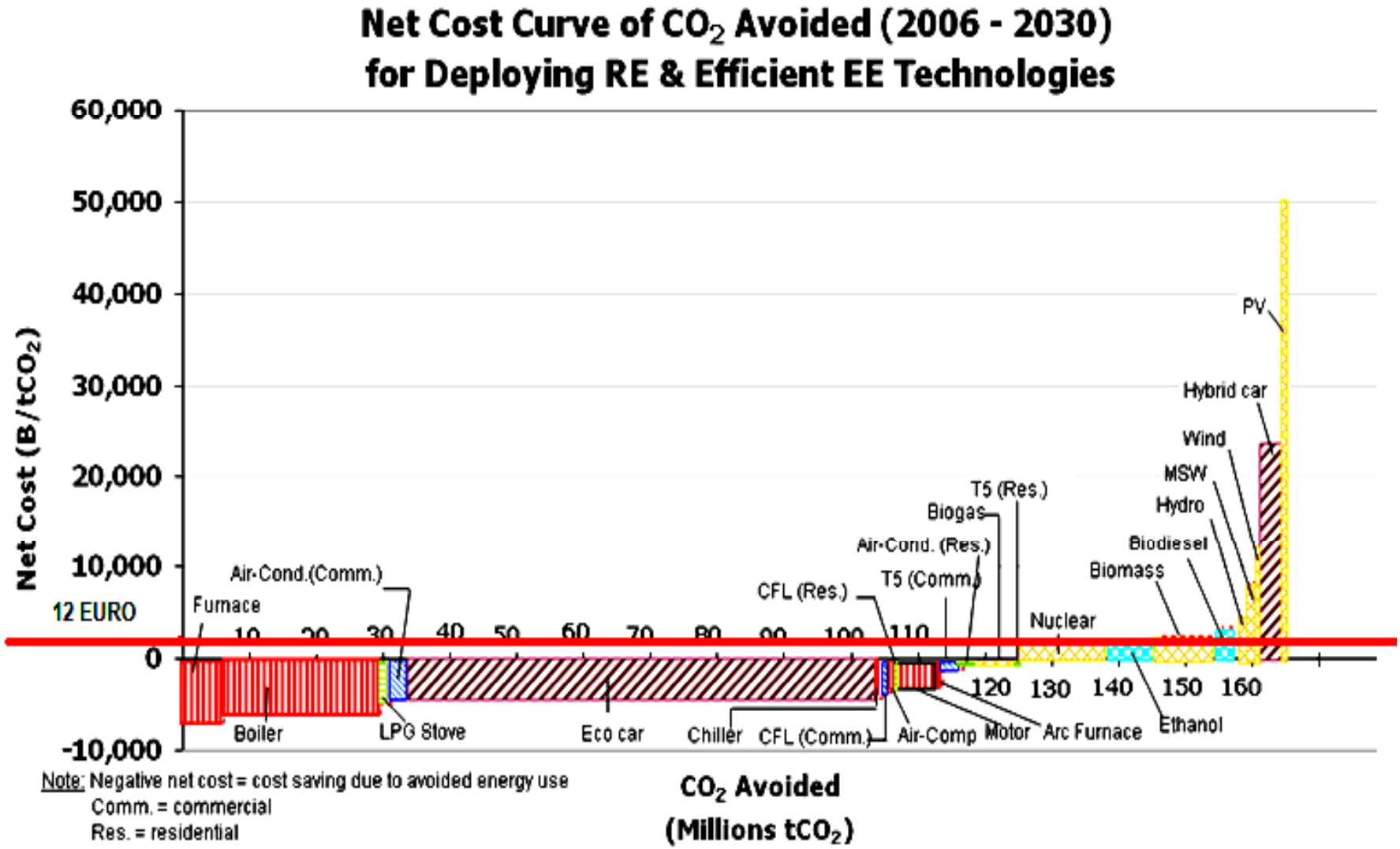


Results: TOE savings per Investment



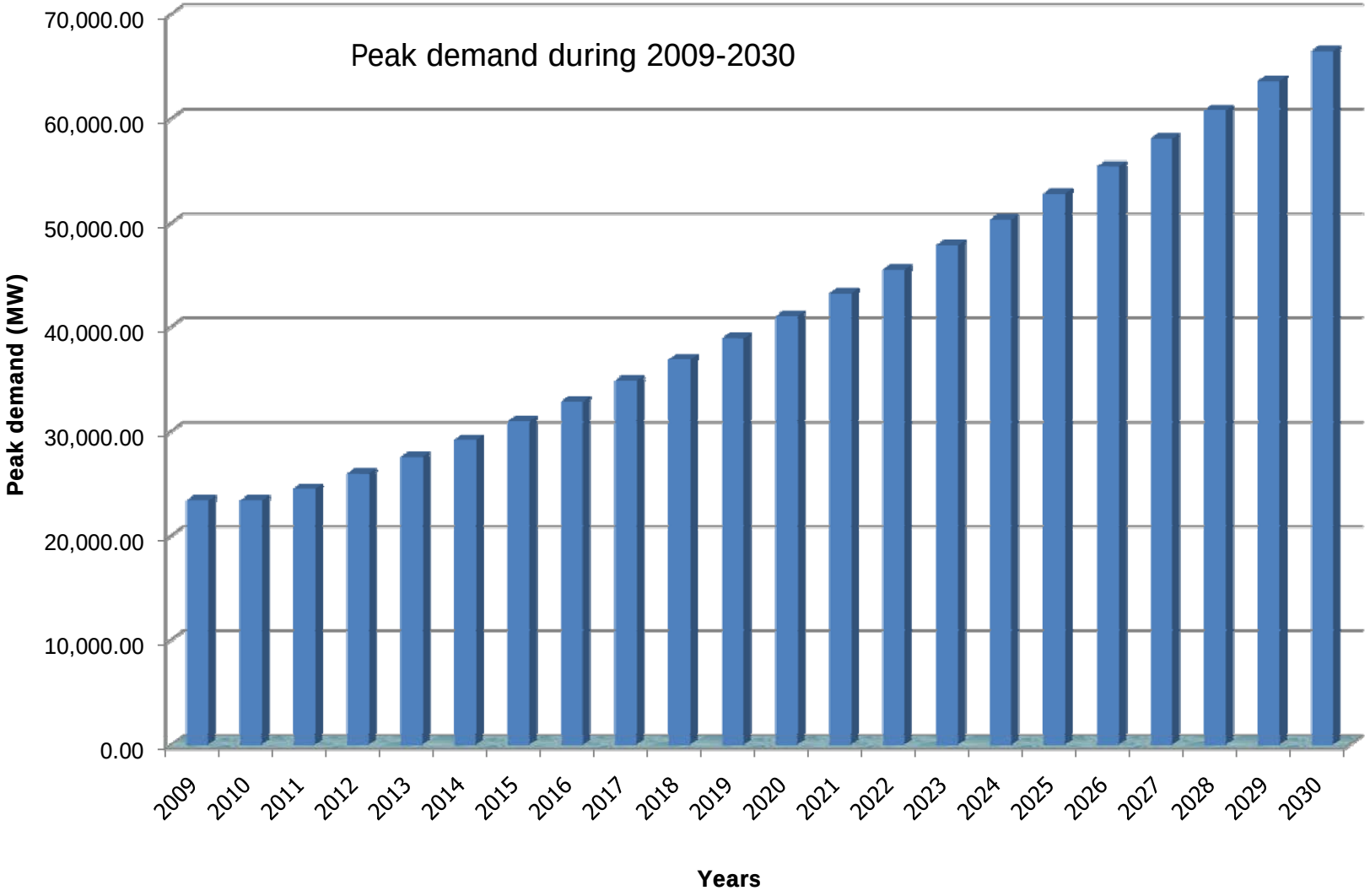
Notes: Exchange rate: 35 Baht = $1 US

Results: NPV per tCO_2 mitigation



Notes: Exchange rate: 35 Baht = $1 US

Forecast of system peak demand in Thailand (MW)

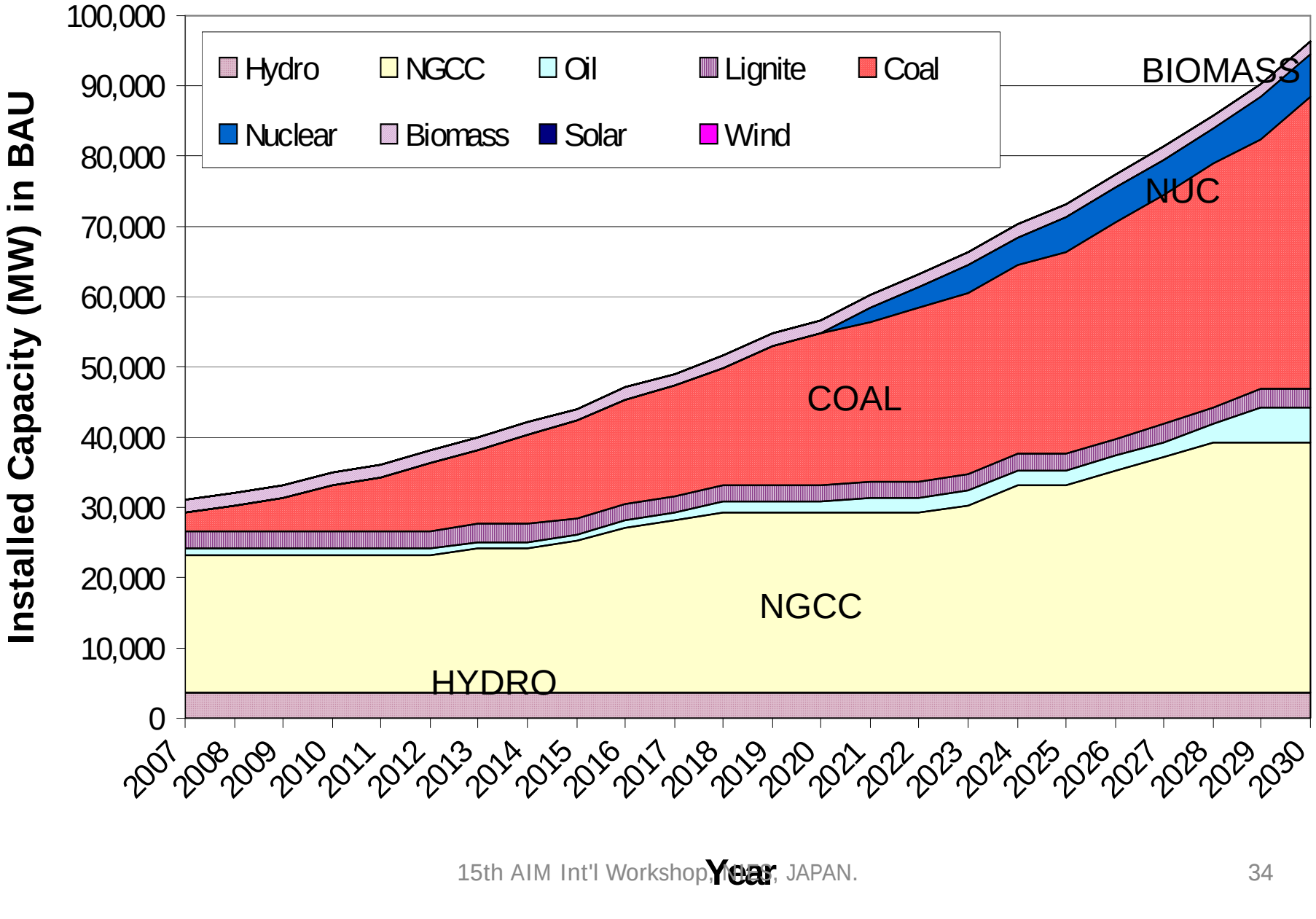


Future power plants in variable system

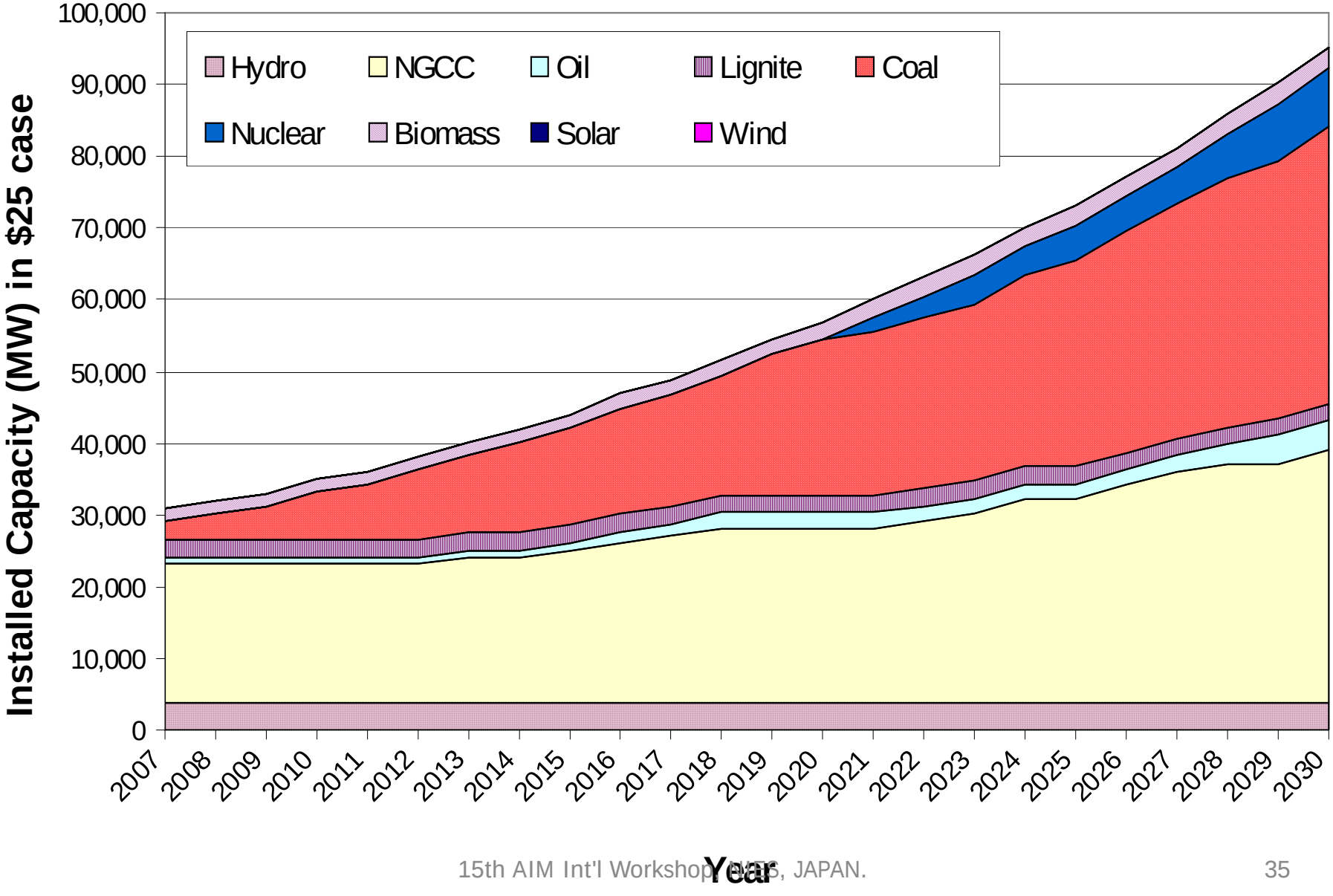
Plant type	Installed capacity (MW)	Investment cost ($/kW)	Life (year)	Fuel cost ($/MMbtu)	Generating cost ($/kWh)
Nuclear	1000	3022	60	0.5	0.0683
Coal-fired with CCS	800	1875	30	4.01	0.0809
Coal-fired (pulverised)	800	1565	30	4.01	0.0737
Combine cycle gas turbine	290	429	20	20.51	0.2894
CHP/Co-generation (SPP)	800	714	25	9.76	0.0974

Source: (EGAT, Thailand, 2010)

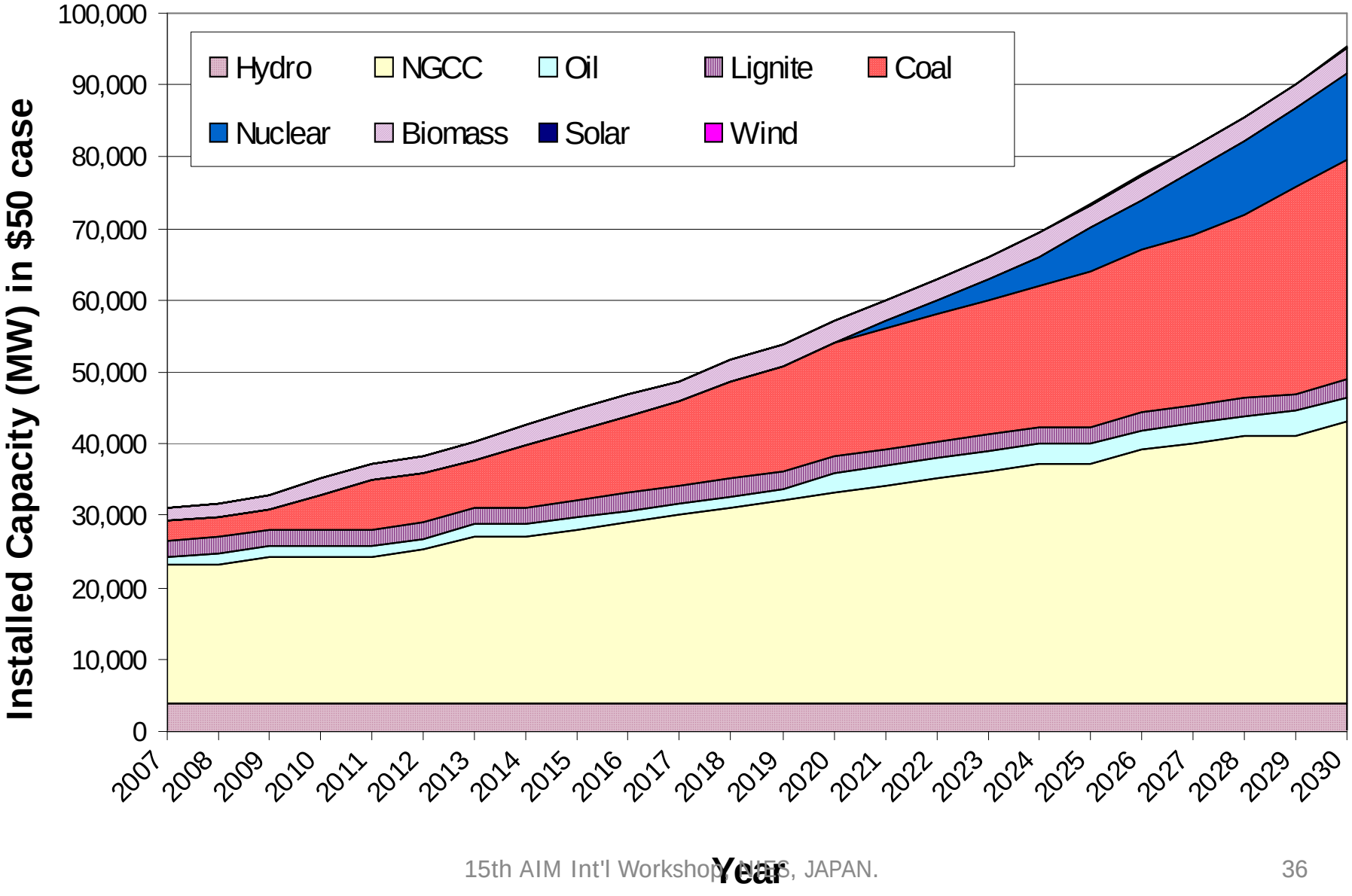
Installed capacity (MW) in BAU



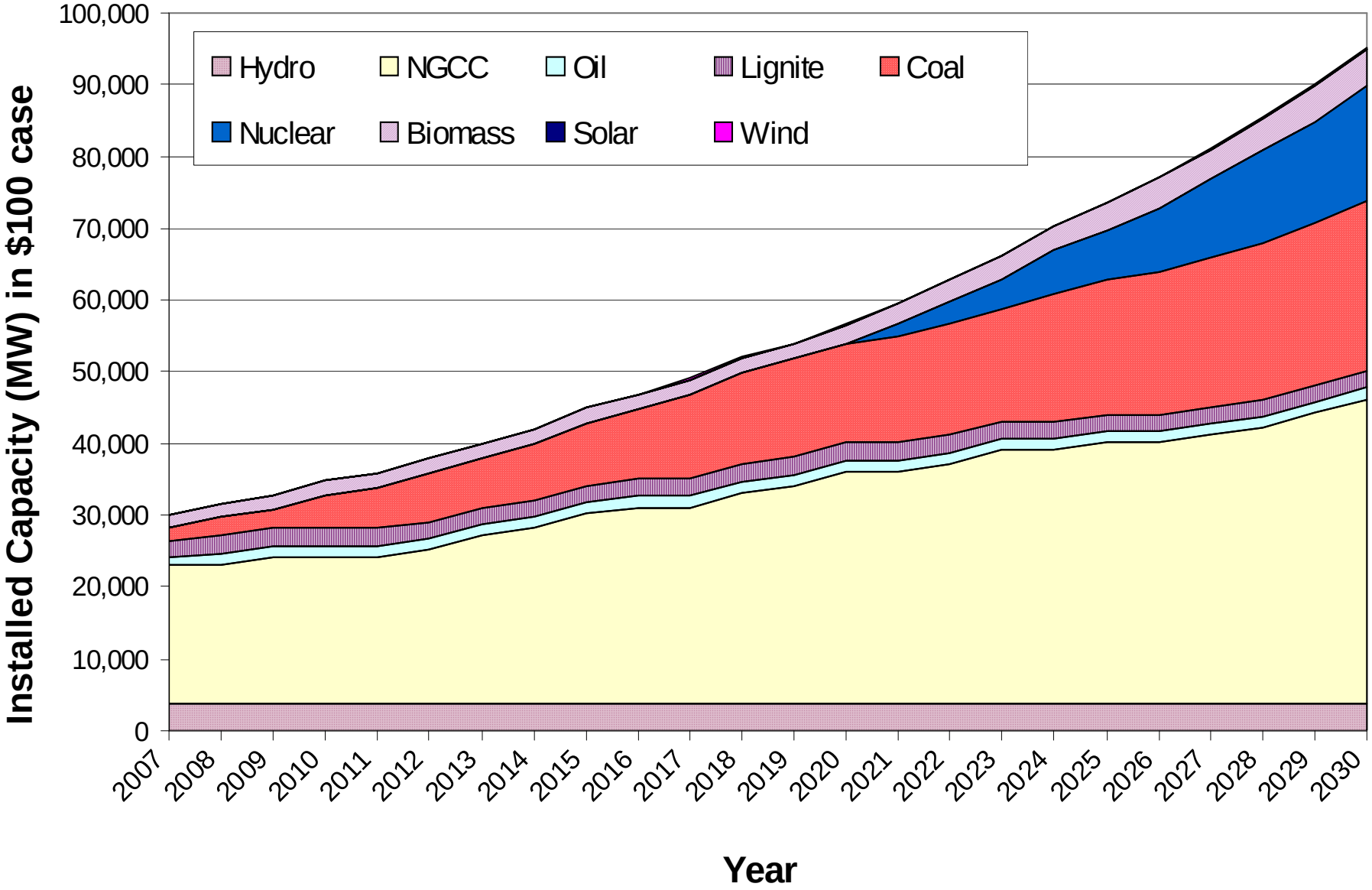
Installed capacity (MW) in CTX $25



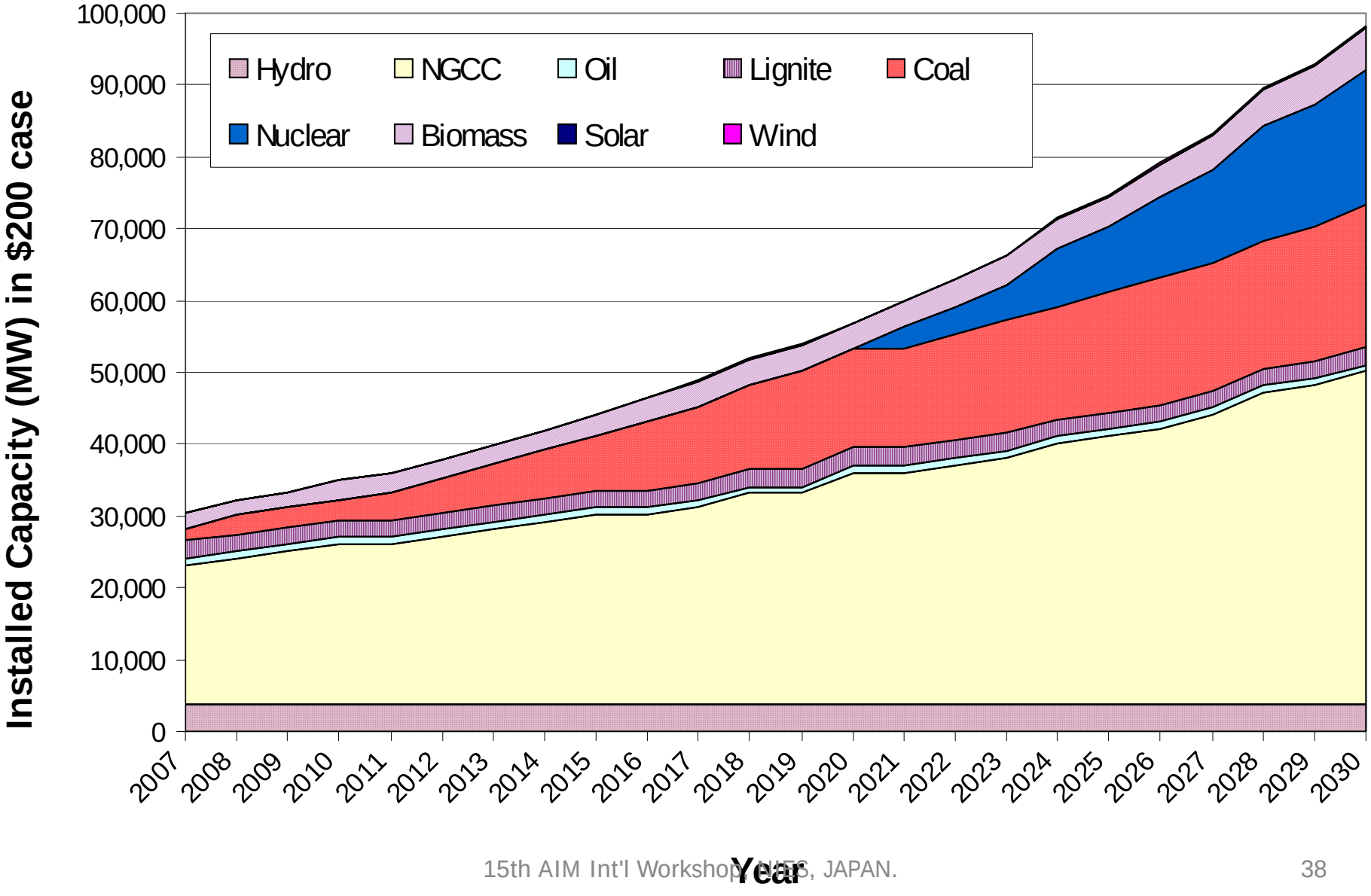
Installed capacity (MW) in CTX $50



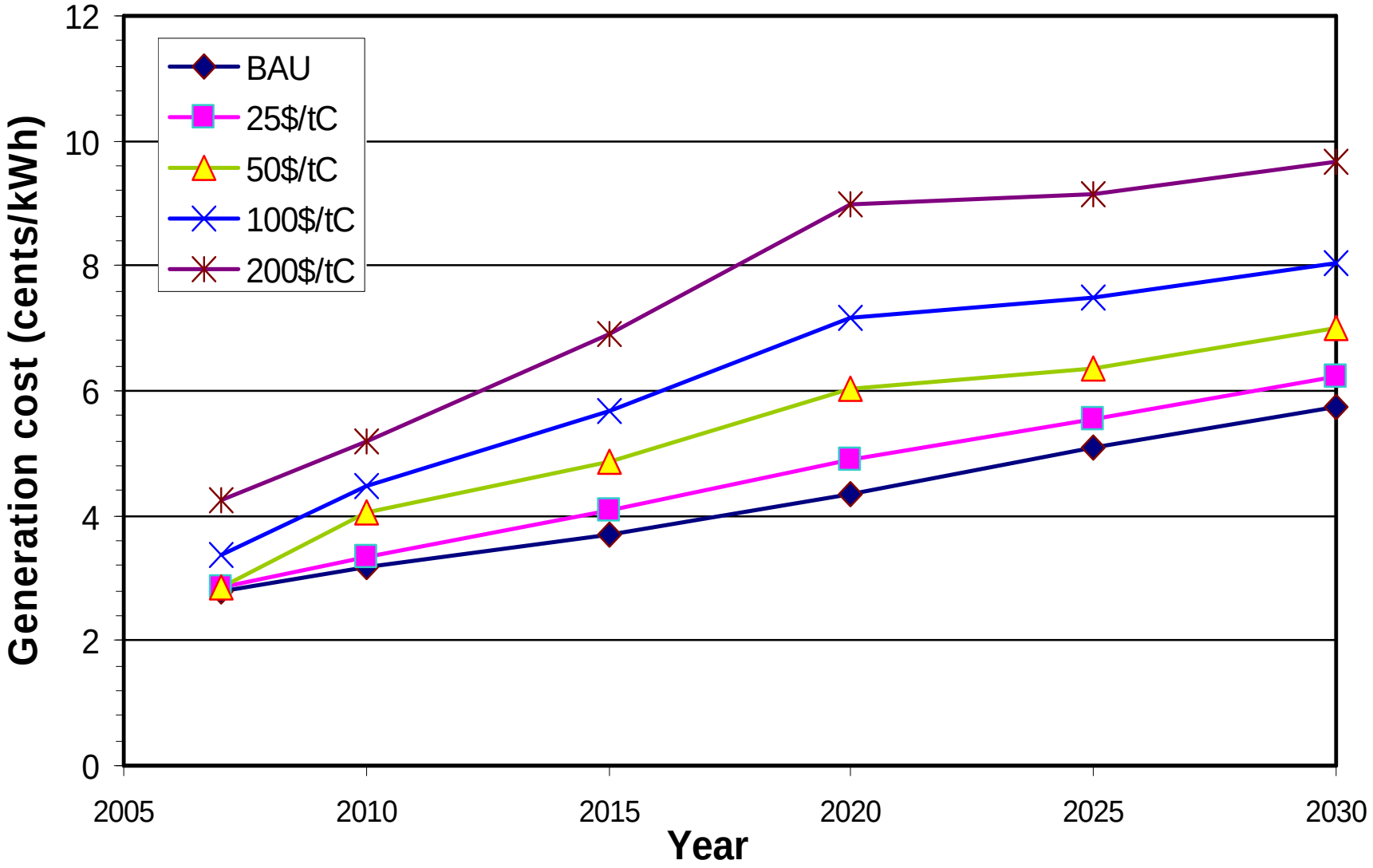
Installed capacity (MW) in CTX $100



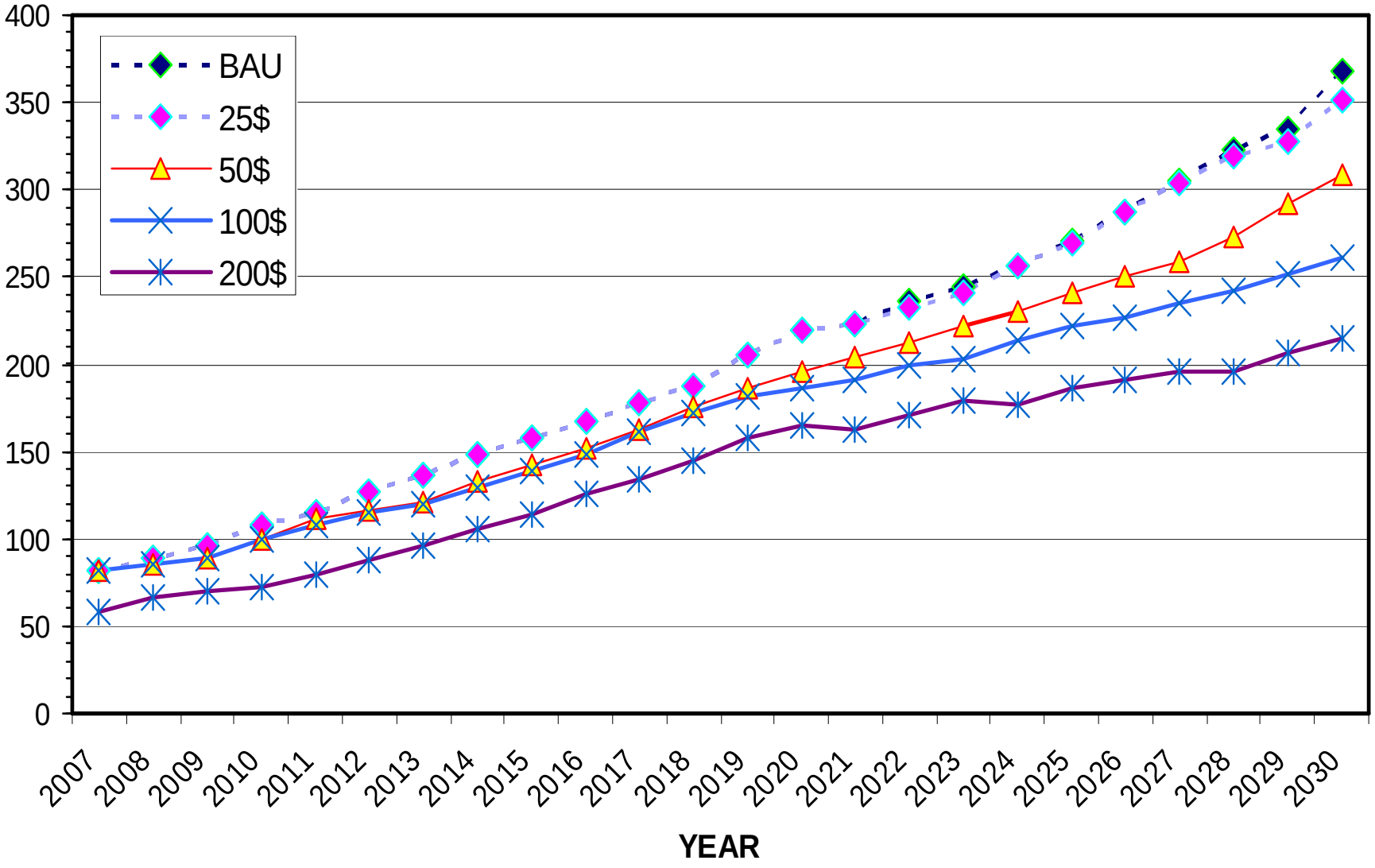
Installed capacity (MW) in CTX $200



Generation cost (cents/kWh)



Total CO_2 emission (million tons CO_2)

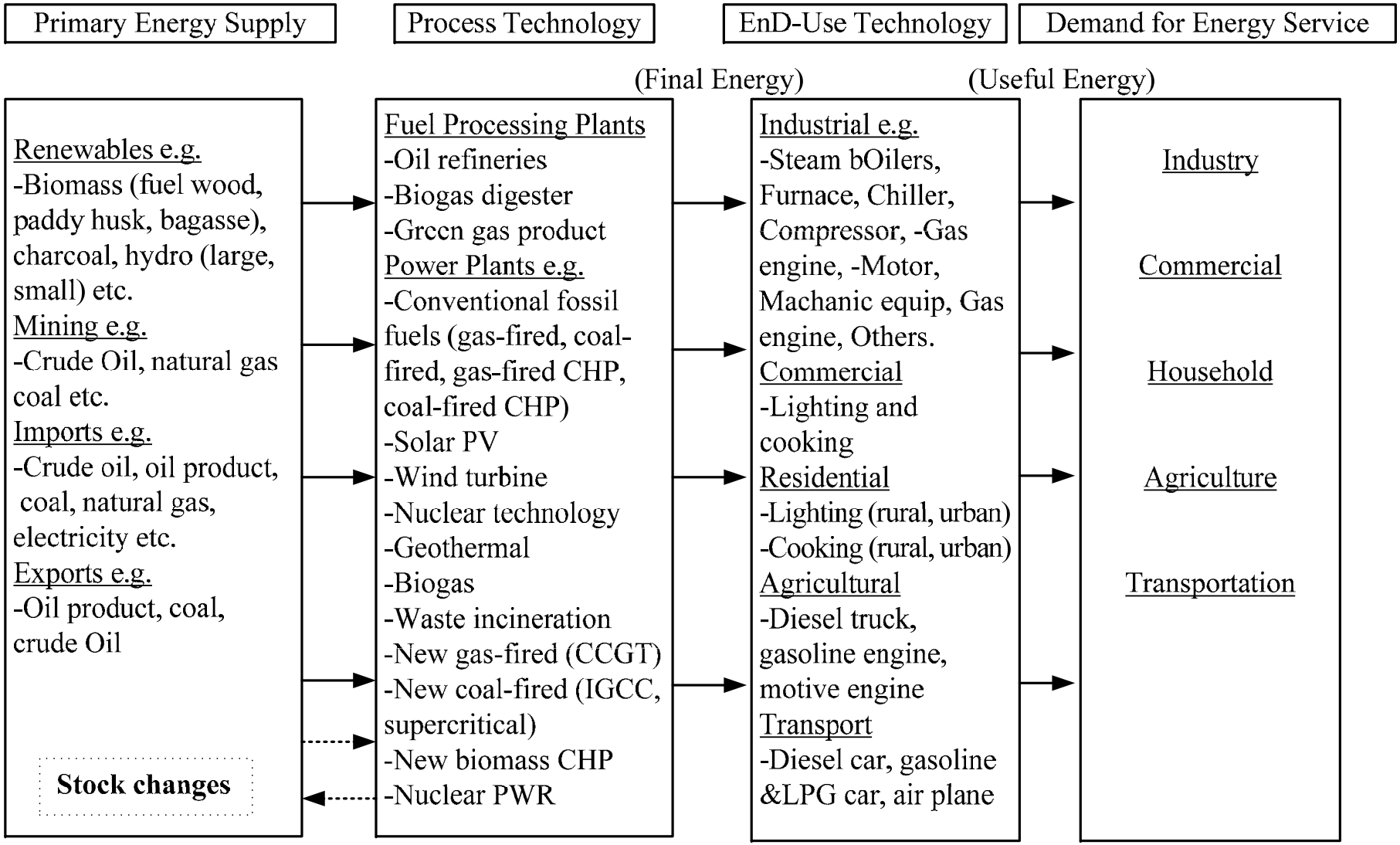


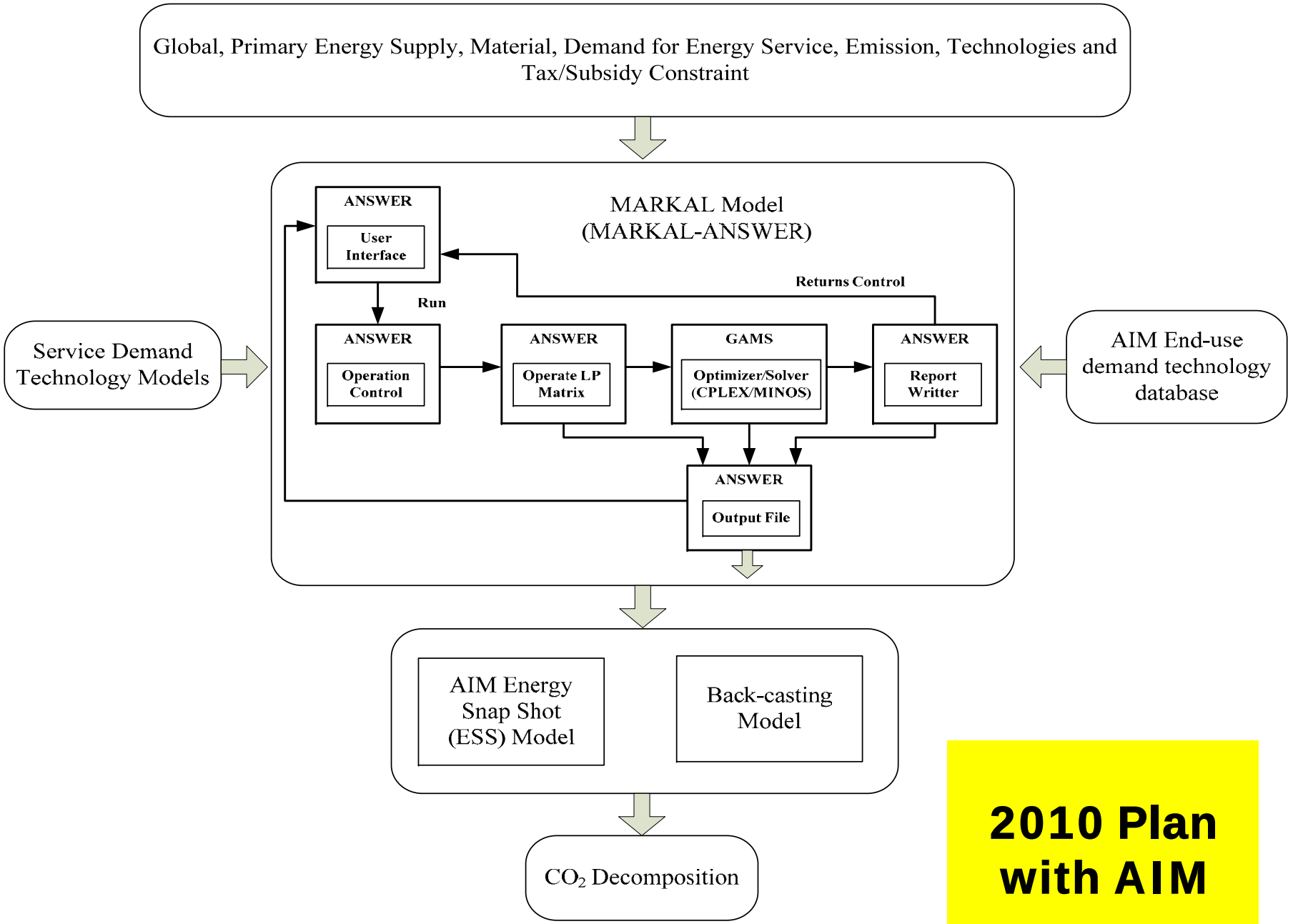
Cumulative CO2 reduction from power generation

Carbon tax rate	CO_2 reduction 2007-2020 Million tons	CO_2 reduction 2021-2030 Million tons	Total CO_2 reduction Million tons
25$/tC	0.136	34.83	34.97 (0.7%)
50$/tC	163.22	353.19	516.41 (10.6%)
100$/tC	200.35	601.23	801.57 (16.5%)
200$/tC	538.97	967.23	1,506.20 (31.0%)

Reference Energy System (RES), Thailand-MARKAL Model

MARKAL-ANSWER and MARKAL-MACRO





2010 Plan with AIM

Thailand's Future Plan

- Low carbon society (within April 2010)

- AIM End-Use Model
- AIM-MARKAL Integrated Analysis
- Integrated analysis of RE & EE
- Evaluation of low carbon scenarios

- AIM/CGE for Policy Assessment

THANK YOU