Mitigation in the energy supply sector

Findings from the IPCC Fourth Assessment Report

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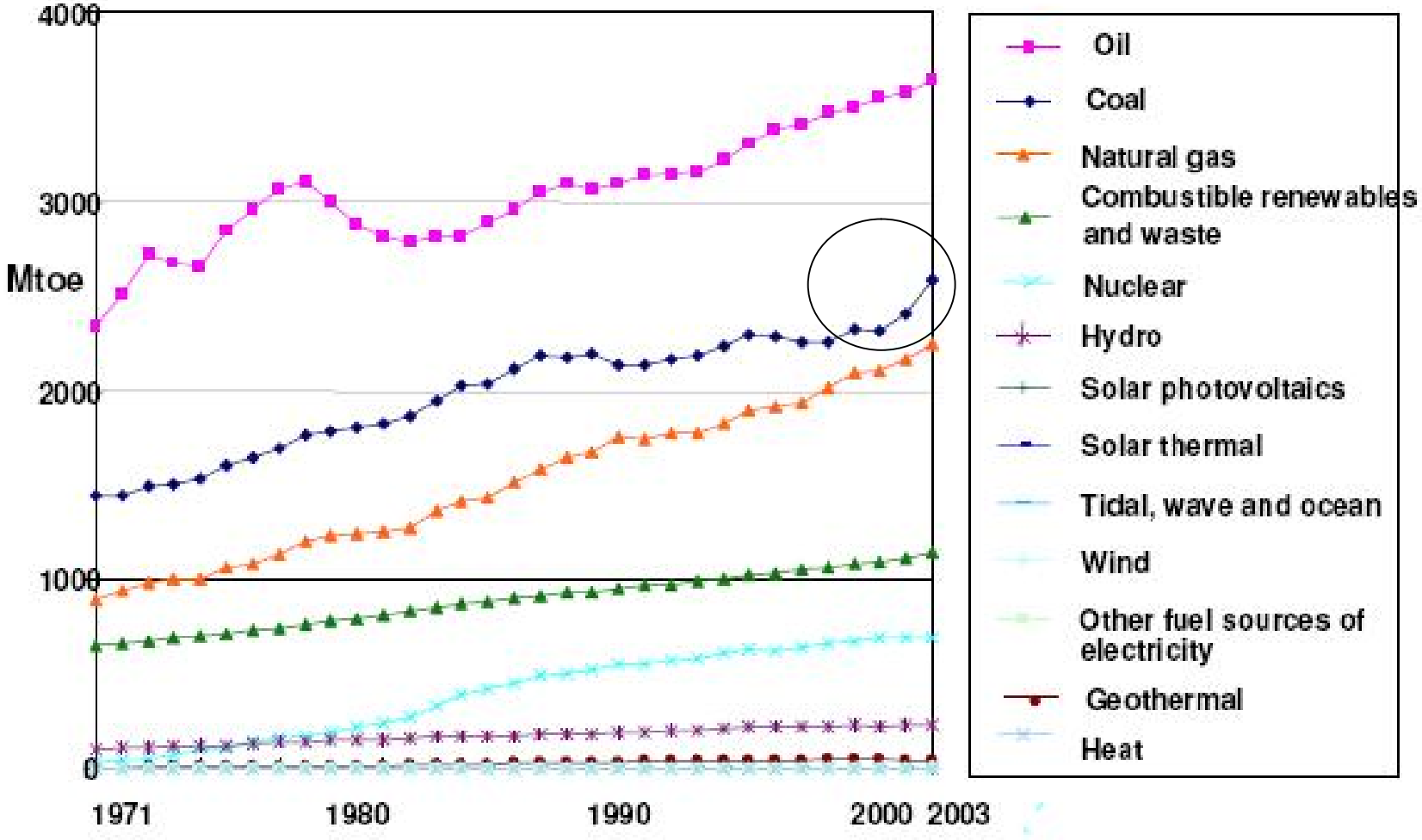
Warning

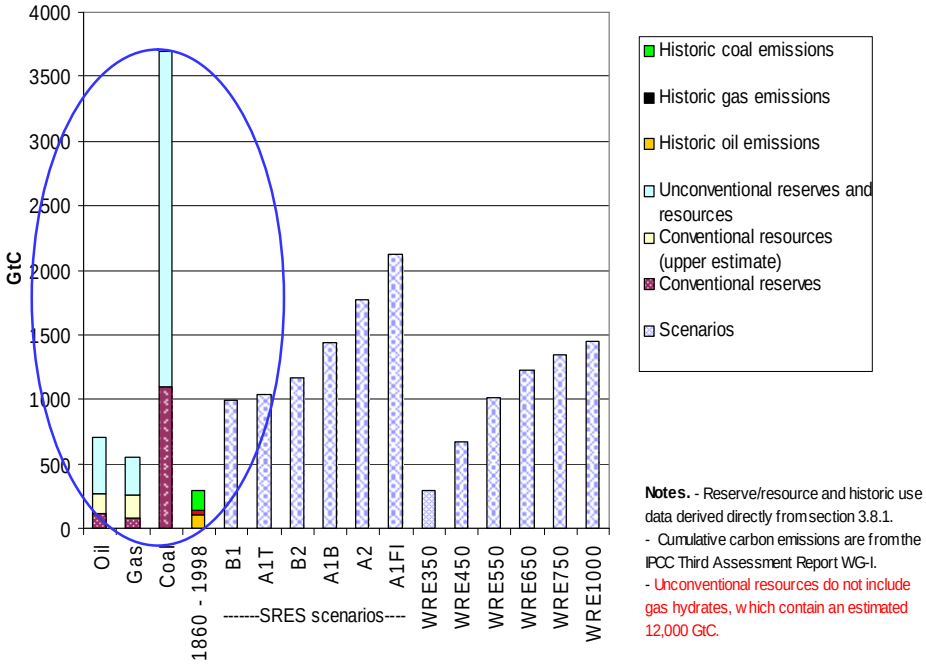
- IPCC does not make any recommendation
- It provides policy relevant information
- It does lay out options

World primary energy consumption by fuel type



Future energy supply

- Strong increase in energy demand projected (upto 100% by 2030)
- Increase in oil/gas price: both low and high carbon alternatives attractive
- Price volatility important barrier against investments
- Shortage of fossil fuel is not going to help to stabilise CO2 concentrations (IPCC TAR)



Notes. - Reserve/resource and historic use data derived directly from section 3.8.1.
- Cumulative carbon emissions are from the IPCC Third Assessment Report WG-I.
- Unconventional resources do not include gas hydrates, which contain an estimated 12,000 GtC.

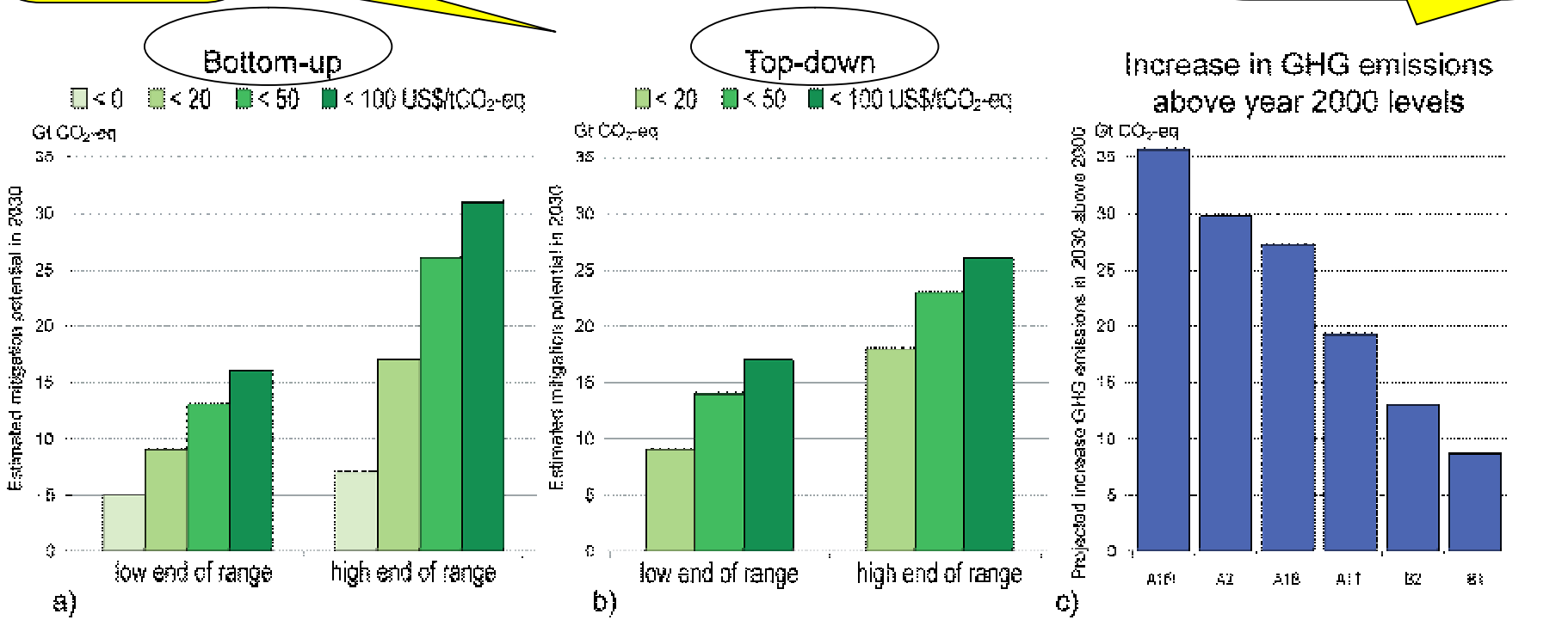
Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels

Stabilization level (ppm CO_2-eq)	Global Mean temperature increase at equilibrium (°C)	Year global CO_2 needs to peak	Year global CO_2 emissions back at 2000 level	Reduction in 2050 global CO_2 emissions compared to 2000
445 – 490	2.0 – 2.4	2000 - 2015	2000- 2030	-85 to -50
490 – 535	2.4 – 2.8	2000 - 2020	2000- 2040	-60 to -30
535 – 590	2.8 – 3.2	2010 - 2030	2020- 2060	-30 to +5
590 – 710	3.2 – 4.0	2020 - 2060	2050- 2100	+10 to +60
710 – 855	4.0 – 4.9	2050 - 2080		+25 to +85
855 – 1130	4.9 – 6.1	2060 - 2090		+90 to +140

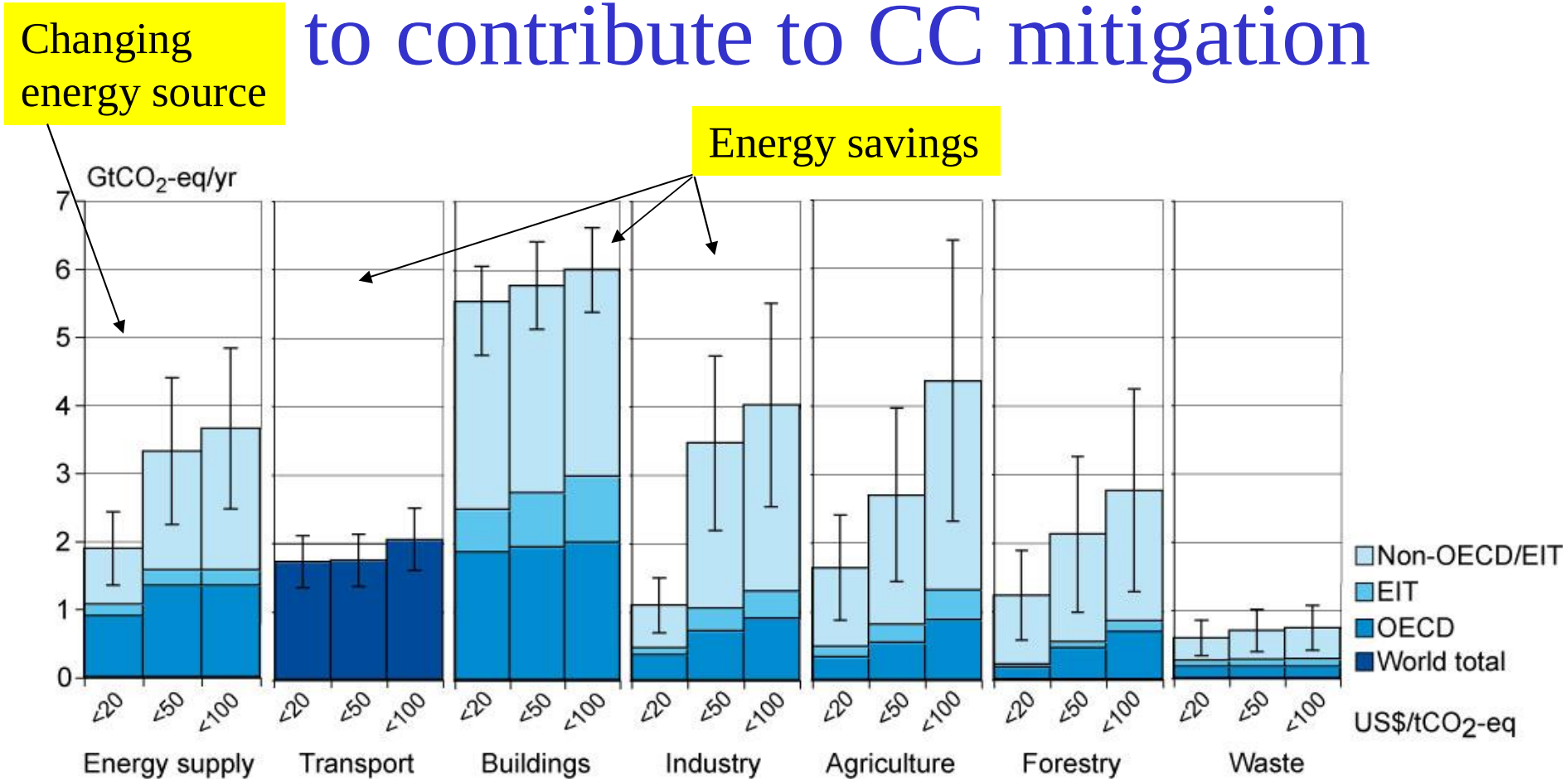
Economic mitigation potential in 2030 could offset the projected growth of global emissions, or reduce emissions below current levels

Potential decrease

Projected increase 25-90% above 2000



All Sectors and Regions have potential to contribute to CC mitigation



Note: estimates are for 2030 and do not include non-technical options, such as lifestyle changes.

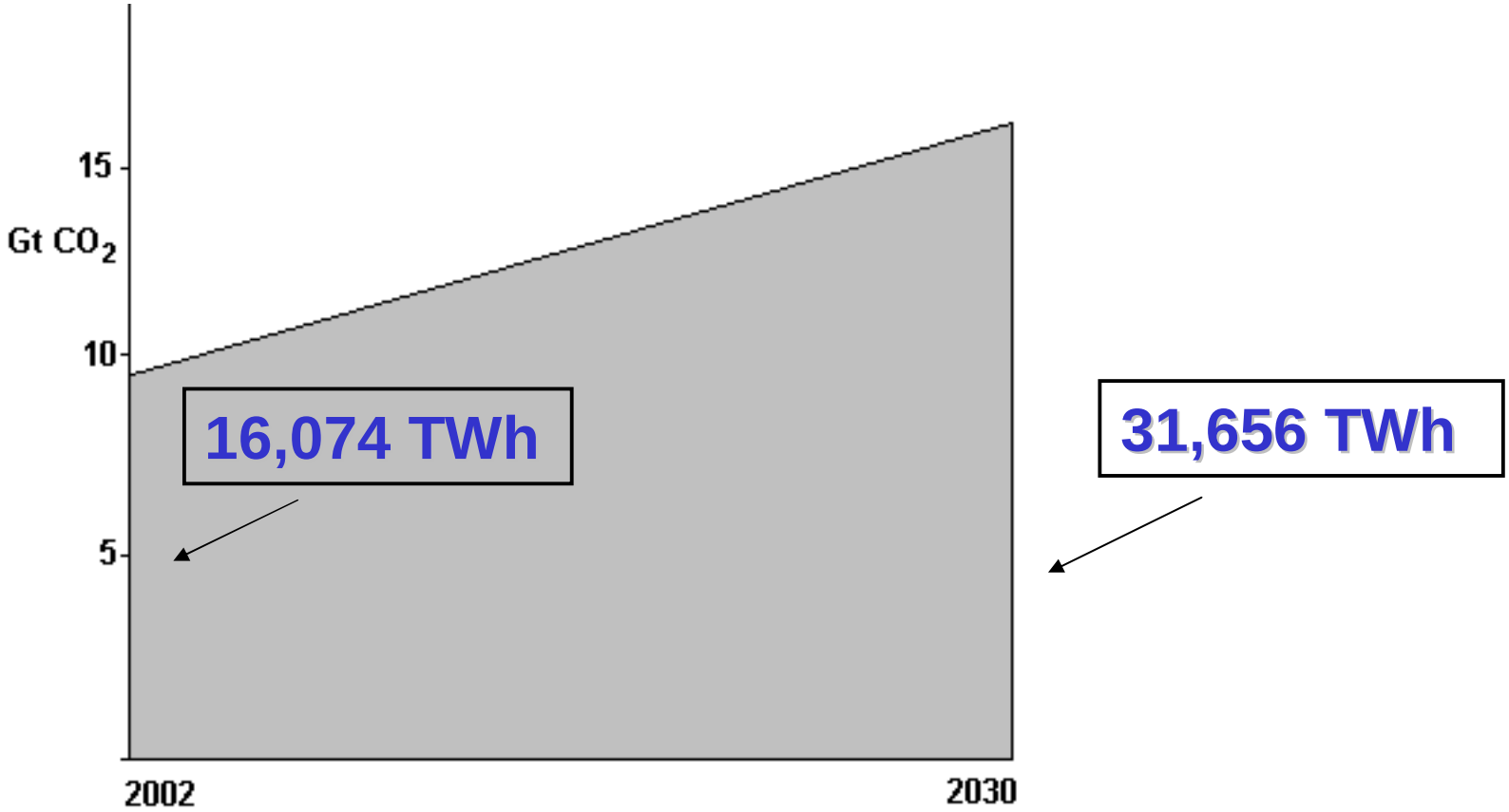
Costs of major electricity supply options

Table 4.7: *The technical potential energy resource and fluxes available, potential associated carbon and projected costs (US$ 2006) in 2030 for a range of energy resources and carriers.*

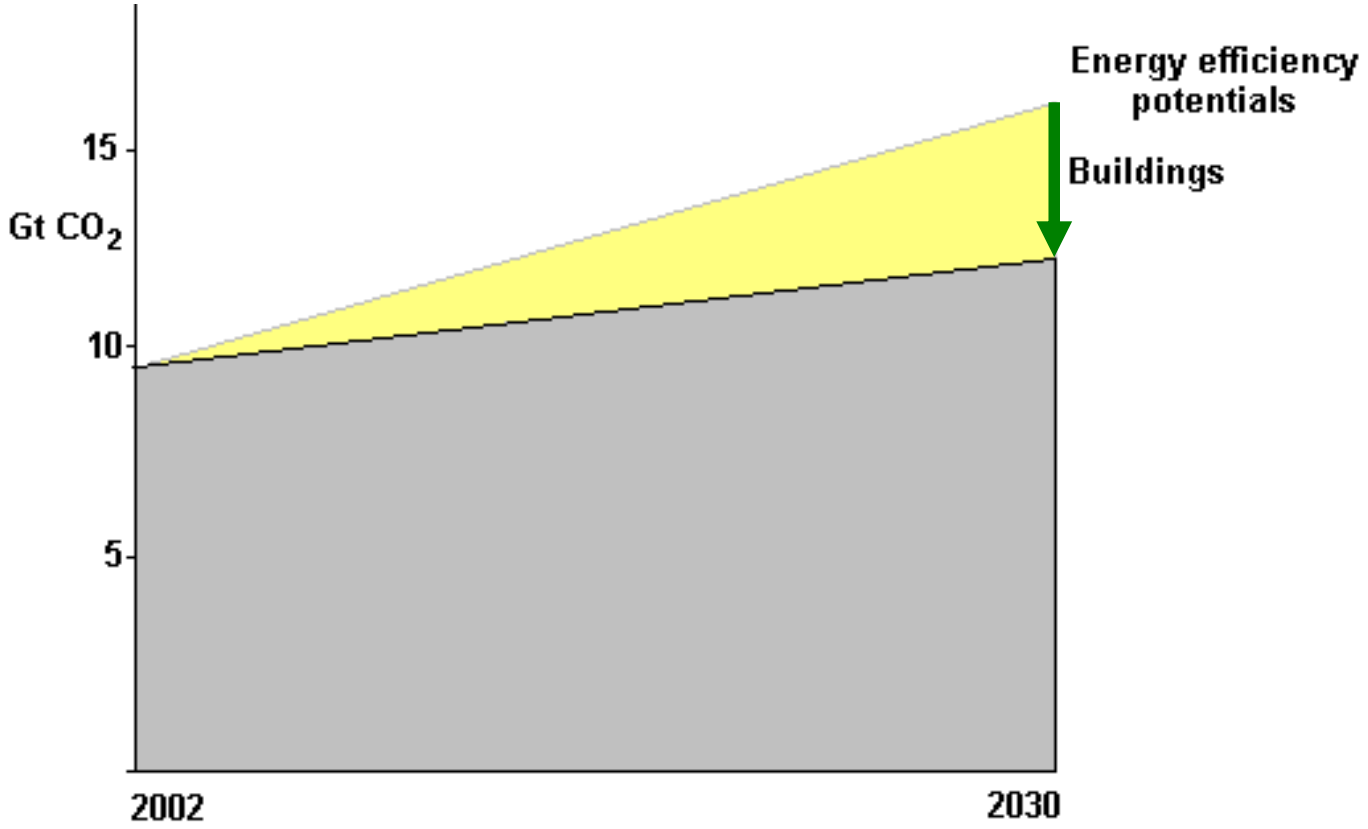
Energy resources and carriers	Technical potential EJ[a]	Approximate inherent carbon (GtC)	Present energy costs[c] US$ (2005)	Projected costs in 2030		Additional references
				Investment US$/$W_e$[d]	Generation US$/MWh	
Oil	10,000-35,000[e]	200-1300	~9/GJ ~50/bbl ~48/MWh	n/a	50-100	Wall Street Journal, daily commodity prices
Natural gas	18,000-60,000	170-860	~5-7/GJ ~37/MWh	0.2-0.8	40-60 +CCS 60-90	EIA/DOE, 2006 IPCC, 2005
Coal	130,000	3500	~3-4.5/GJ ~20/MWh	0.4-1.4	40-55 +CCS 60-85	EIA/DOE, 2006 IPCC, 2005
Nuclear power	7400 (220,000)[f]	*[b]	10-120	1.5-3.0	25-75	IAEA, 2006 Figures 4.27, 4.28
Hydro > 10MW	1250	*	20-100/MWh	1.0-3.0	30-70	
Solar PV	40,000	*	250-1600/MWh	0.6-1.2	60-250	
Solar CSP	50	*	120-450/MWh	2.0-4.0	50-180	
Wind	15,000	*	40-90 MWh	0.4-1.2	30-80	
Geothermal	50	*	40-100/MWh	1.0-2.0	30-80	
Ocean	large	*	80-400/MWh	?	70-200	
Biomass - heat and power	Modern 9	6000	30-120/MWh 8-12/GJ	0.4-1.2	30-100	
Biofuels	1.2	*	8-30/GJ	?	23-75 c/l	Chapter 5, Figure 5.9
Hydrogen carrier	0.1	?	50/GJ	?	?	US NAE, 2004

Electricity sector emissions, 2002 to 2030

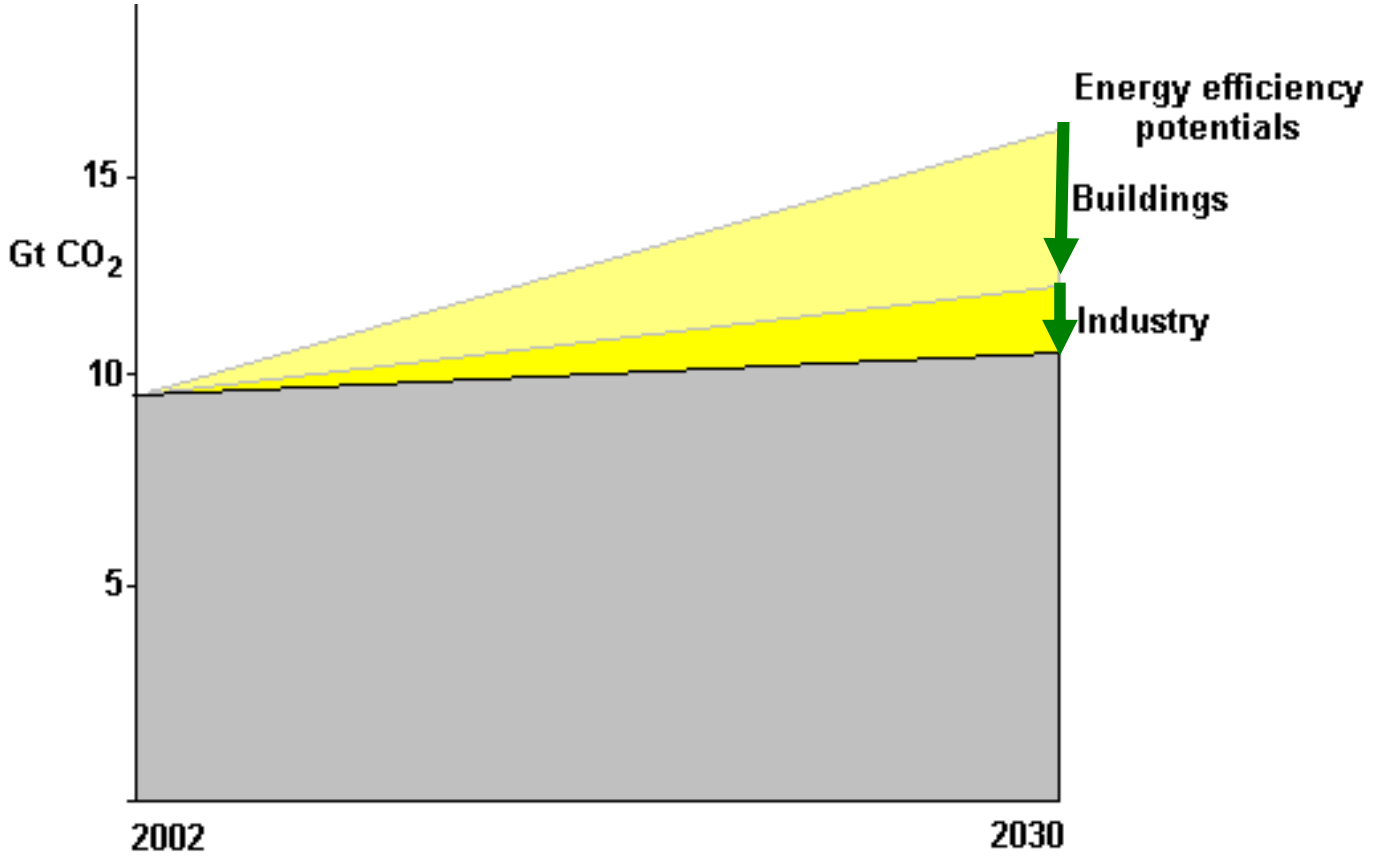
(IEA/WEO 2004 baseline)



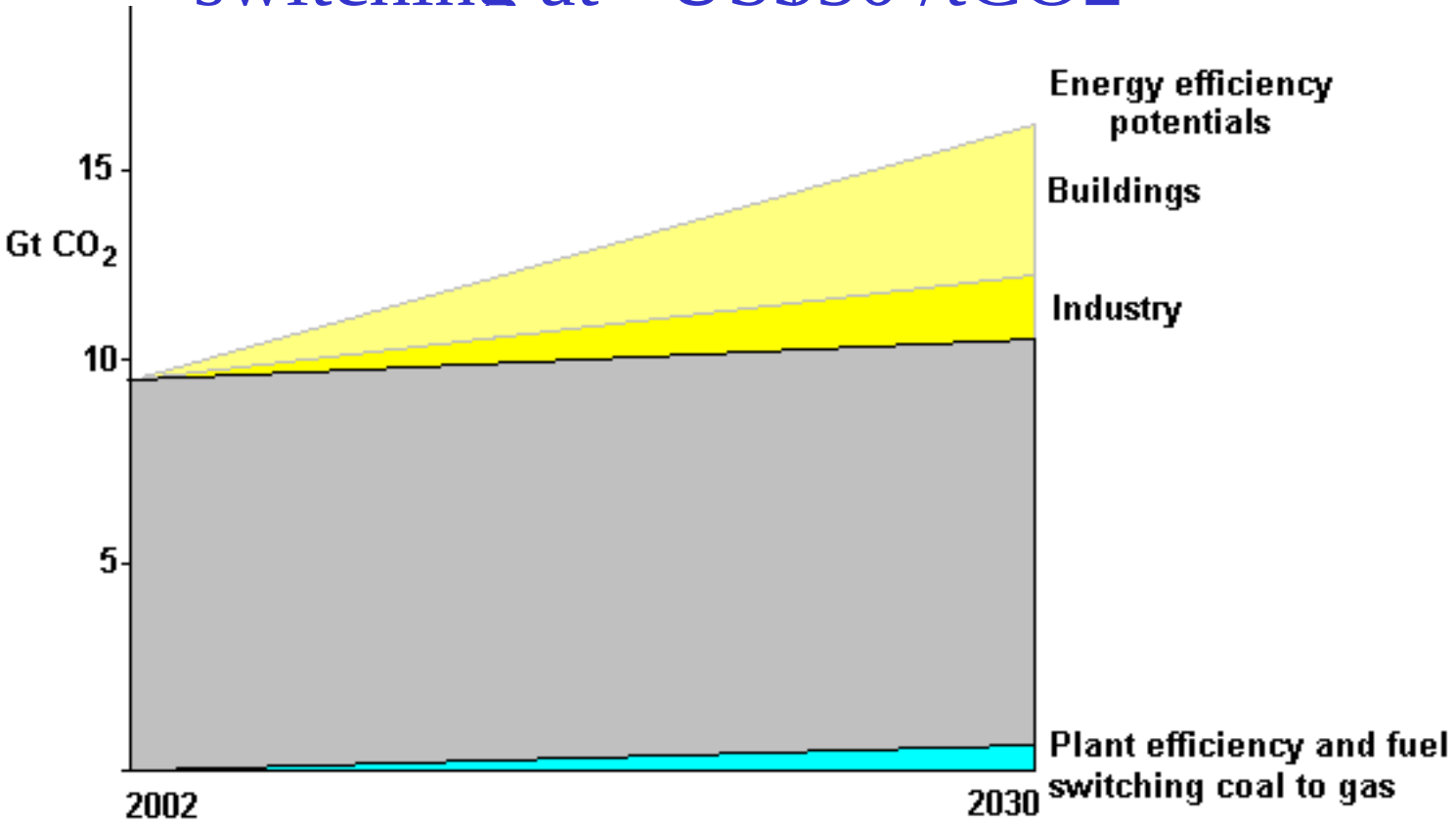
Potential emission reductions from additional electricity saving in Building sector at <US$ 50 /t CO_2



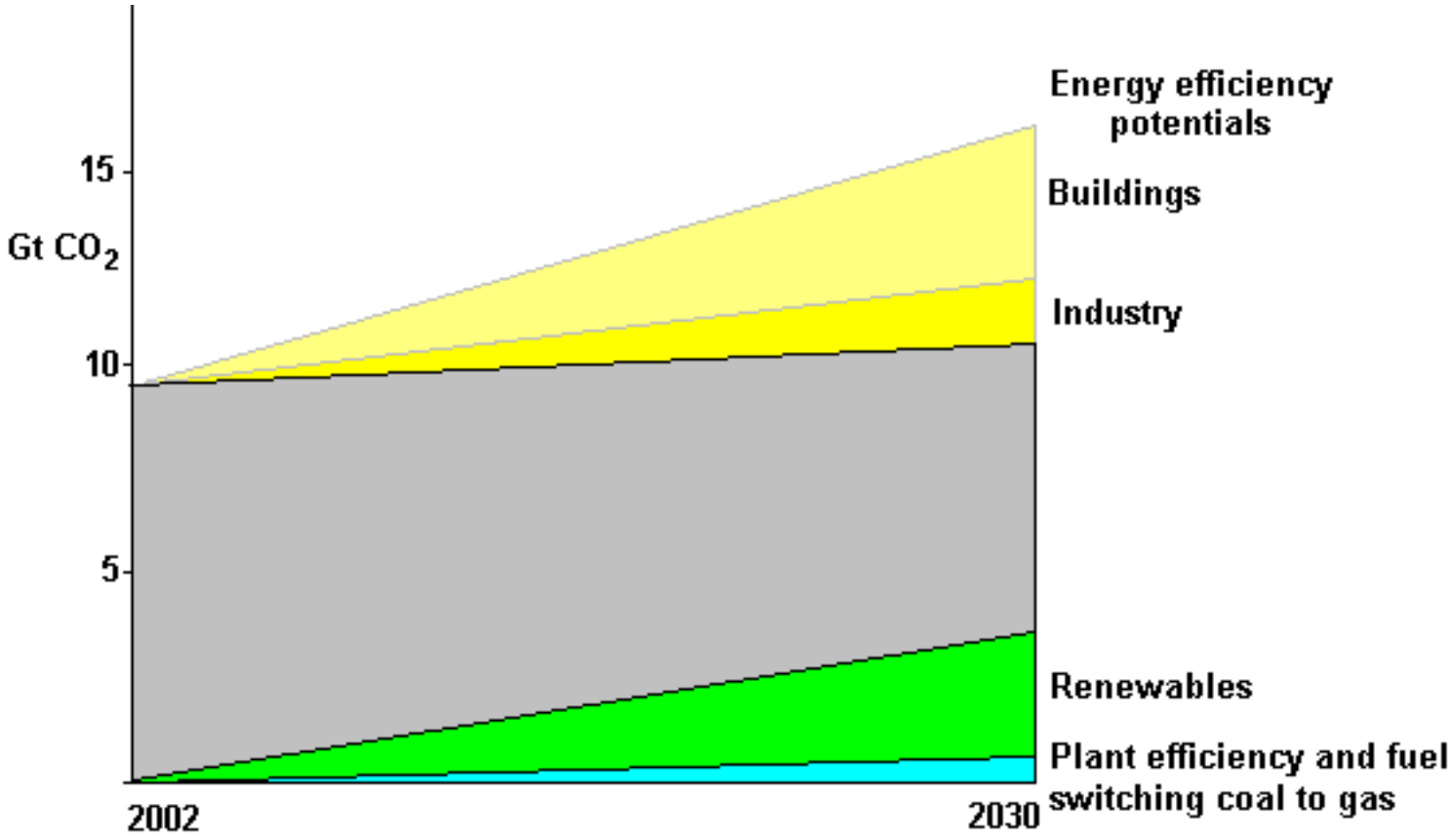
Potential emission reductions from additional electricity saving in the industrial sector at <US$ 50 /t CO2



Potential emission reductions from additional improved generation plant efficiency and fuel switching at <US$50 /tCO2

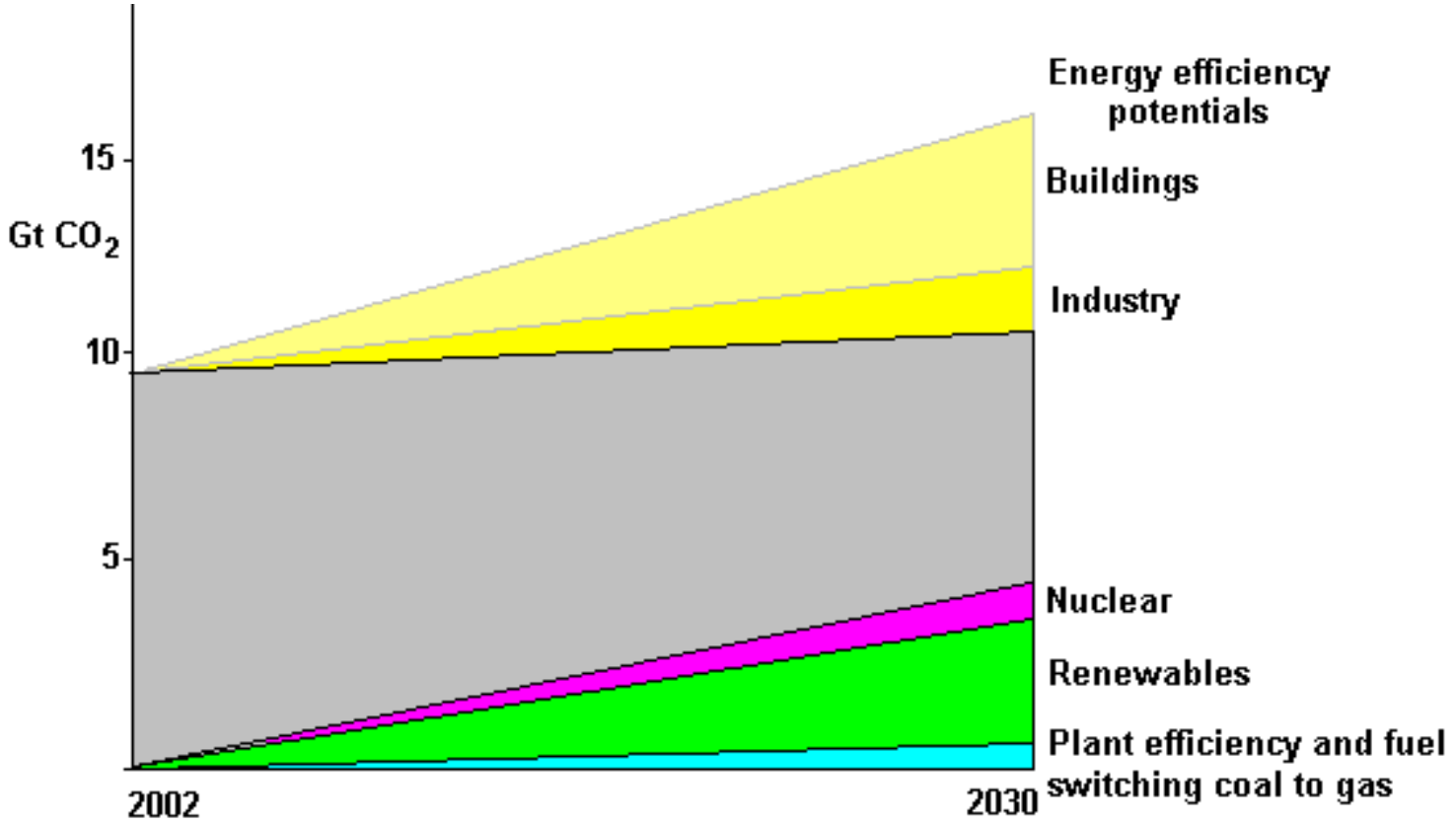


Potential emission reductions from additional hydro, wind, geothermal, bioenergy, solar at <US$ 50 /tCO2



The share of renewables in the total electricity supply can rise from 18% in 2005 to 30 – 35% by 2030 (at carbon price < US$50/tCO2eq).

Potential emission reductions from additional nuclear power at <US$ 50 /tCO2

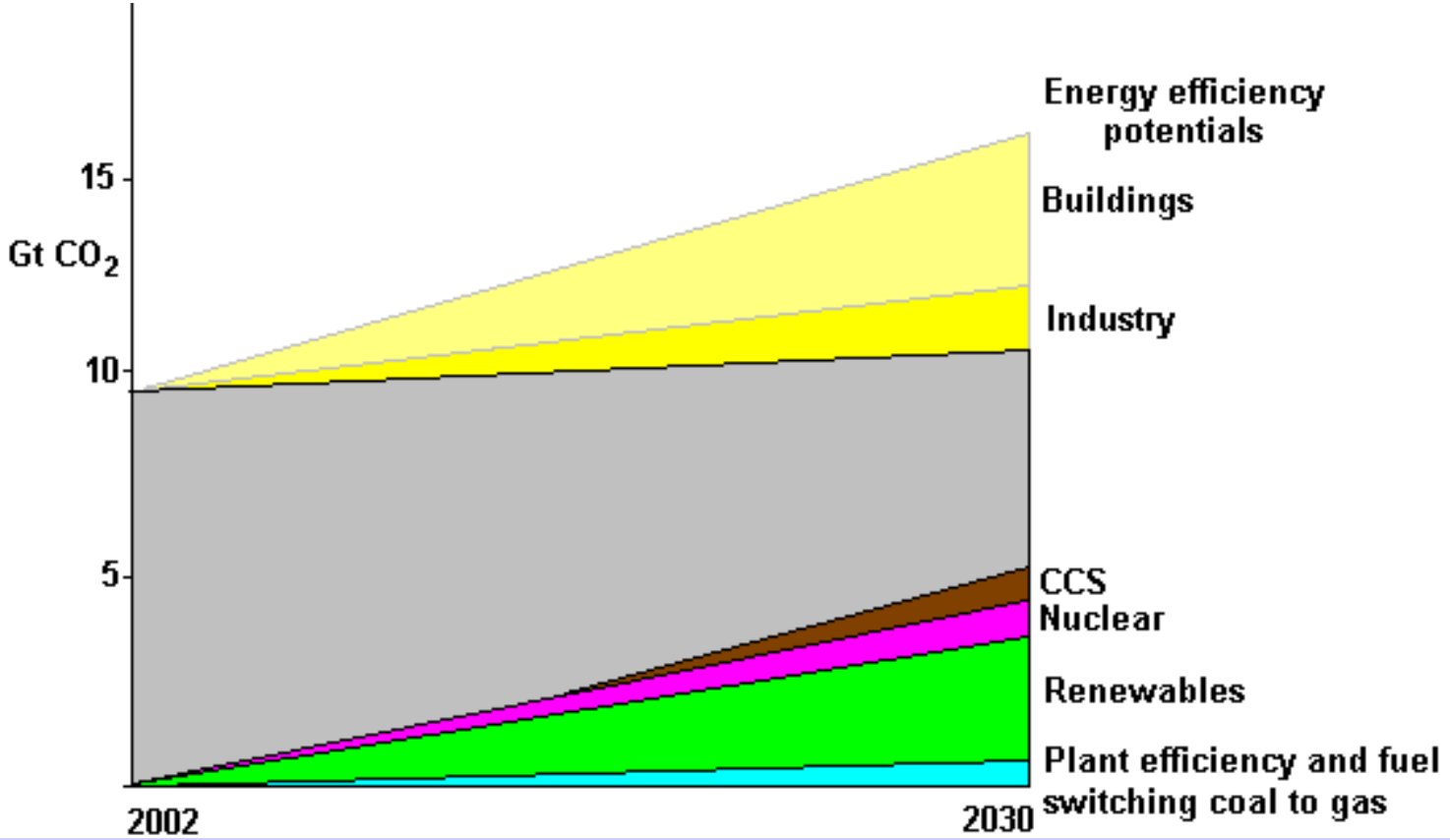


Economic mitigation potential of nuclear power

- Given costs relative to other supply options,

  nuclear power, which accounted for 16% of the electricity supply in 2005, can have an 18% share of the total electricity supply in 2030 at carbon prices up to 50 US$/tCO2-eq,
- but safety, weapons proliferation and waste remain as constraints

Potential emission reductions from additional CCS in new coal and gas plants at <US$ 50 /tCO2



Fossil fuel share of electricity generation without CCS drops to < 50% of total supply by 2030 (at carbon price < US$50/tCO2eq).

Top-down models: changes in primary energy mix in 2030 and beyond

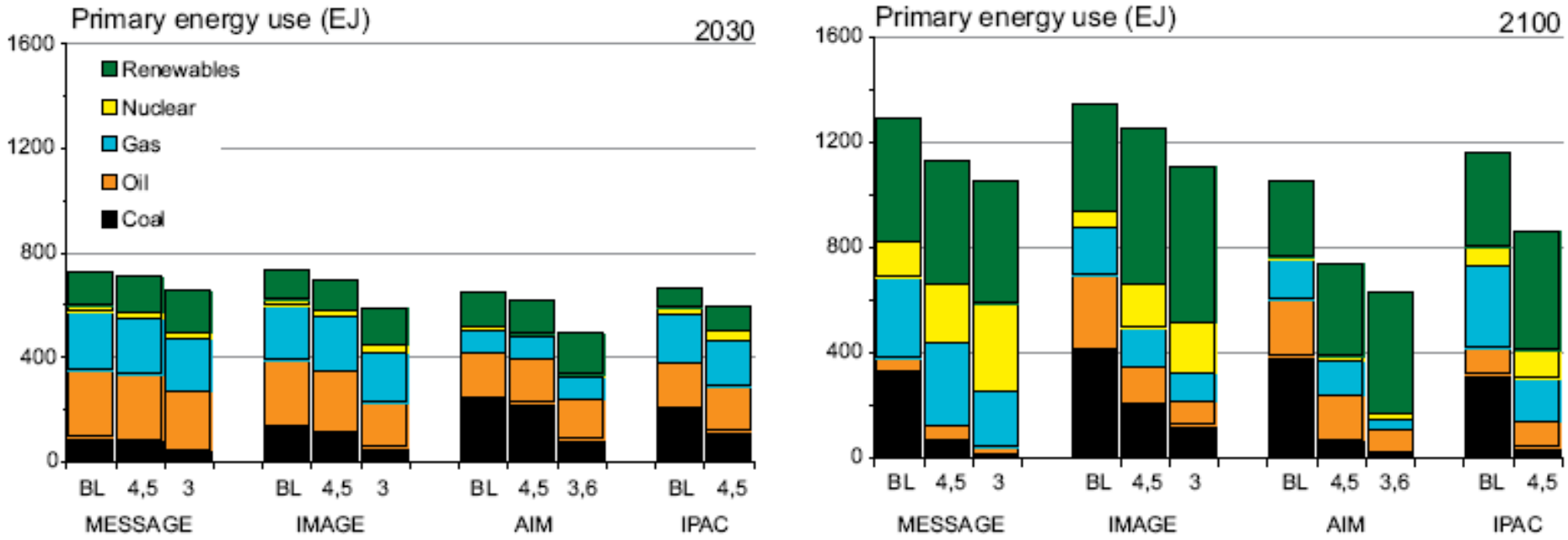


Figure 3.24: *Primary energy mix for the years 2030 and 2100. Illustrative scenarios aim at stabilizing radiative forcing at low (3–3.6 W/m²) and intermediate levels (4.5 W/m2) respectively.*

Note: BL= Baseline. For the corresponding contribution of individual mitigation measures in (in $GtCO_2$) see also Figure 3.23.

An effective carbon-price signal could realise significant mitigation potential in all sectors

- Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low-GHG products, technologies and processes.

- Such policies could include economic instruments, government funding and regulation

- For stabilisation at around 550 ppm CO2eq carbon prices should reach 20-80 US$/tCO2eq by 2030 (5-65 if “induced technological change” happens) <> current EU-ETS price:~ $25/t; CDM price $ 5-15/t

Investments

- Energy infrastructure investment decisions, (20 trillion US$ till 2030) will have long term impacts on GHG emissions.
- The widespread diffusion of low-carbon technologies may take many decades, even if early investments in these technologies are made attractive.
- Returning global energy-related CO2 emissions to 2005 levels by 2030 would require a large shift in the pattern of investment, although the net additional investment required ranges from negligible to 5-10%
- It is often more cost-effective to invest in end-use energy efficiency improvement than in increasing energy supply

The full WG III Report and the Synthesis Report can be downloaded from

www.mnp.nl/ipcc

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