



What do the wedges call for? A closer examination of the 15 wedge categories

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May 20, 2006

Efficiency

1. **Improving car fuel efficiency – average 30 miles per gallon to 60 mpg (four times as many cars, fuel type and distance traveled is unchanged)**
2. **Reduced reliance on cars. Miles traveled reduced from 10,000 to 5,000 miles/year.**
3. **More efficient buildings. Pursuing known and established approaches to energy-efficient space heating and cooling, water heating, lighting and refrigeration in residential and commercial buildings.**
4. **Improved power plant efficiency. Doubling the amount of coal-based electricity produced at 60%, not 40% efficiency.**

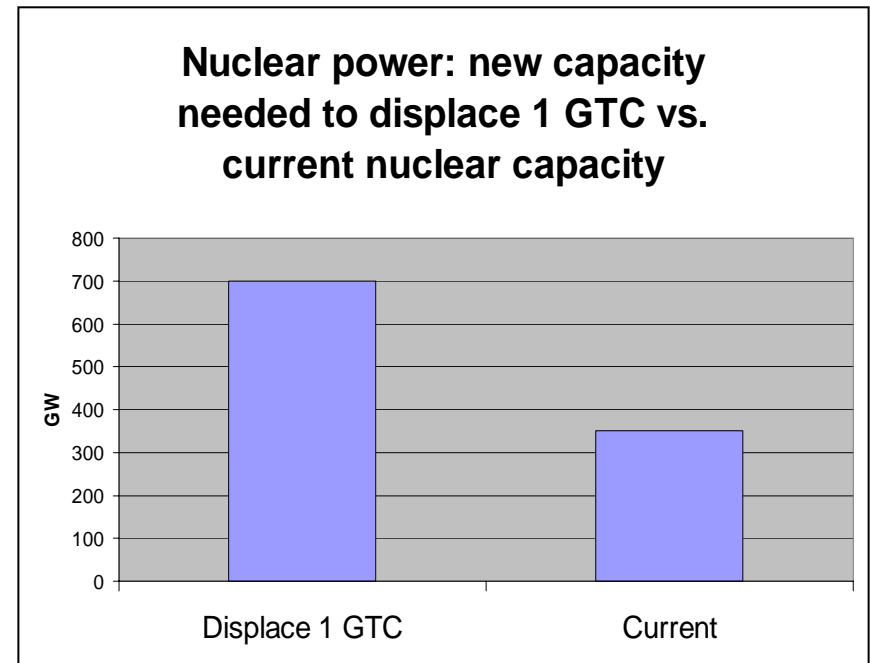
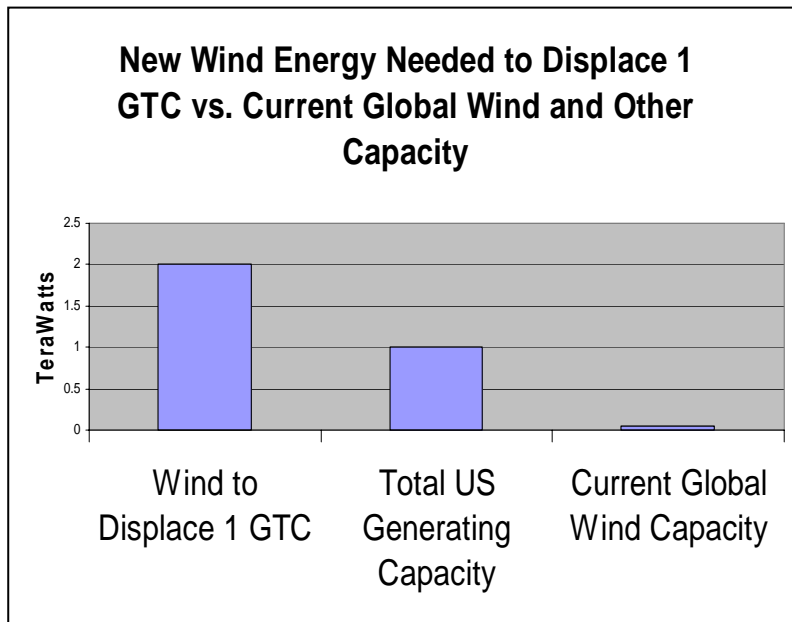
Decarbonization of fuels and electricity

5. Substituting natural gas for coal. Displacing 1400 GW baseload coal with baseload gas (**4 times today's total gas**).
6. Power plant carbon capture and storage (CCS). Install CCS at 800 GW baseload coal plants or 1600 GW baseload natural gas plants. (requires **scaling CO₂ injection up by a factor of 100 over next 50 years.**)
7. Carbon capture for hydrogen production and displace conventional fuels with hydrogen. Produce 250 Mth₂/year at coal plants – **6 times current production.**
8. Synfuels production with CCS. Capture half the carbon entering synfuel plant.
9. Nuclear fission. Nuclear electricity would displace 700 GW efficient baseload coal – **doubling of nuclear capacity.**

Decarbonization of fuels and electricity (cont.)

10. **Wind.** Displace coal with 2000 GW wind – 2 million 1 MW wind turbines. (50 times today's deployment occupying 3% US land area – 75 million acres.)
11. **Photovoltaic.** Displace 2000 GW coal, 700 times today's deployment, 5 million acres (2-3 m² per person).
12. **Renewable hydrogen.** Produce H₂ vehicle fuel, 4 million 1 MW windmills.
13. **Biofuels.** Displace gasoline with 34 million barrels/day of ethanol, 50 times larger than today's global production rate. Doesn't consider the full cycle GHG release of ethanol, or land competition.

Existing low-carbon technologies will be hard-pressed to meet targets by mid-century



Note: Mid-century target of 500 PPM requires 7 GTC reduction from “business as usual,” or roughly 22 TW of carbon-free energy.

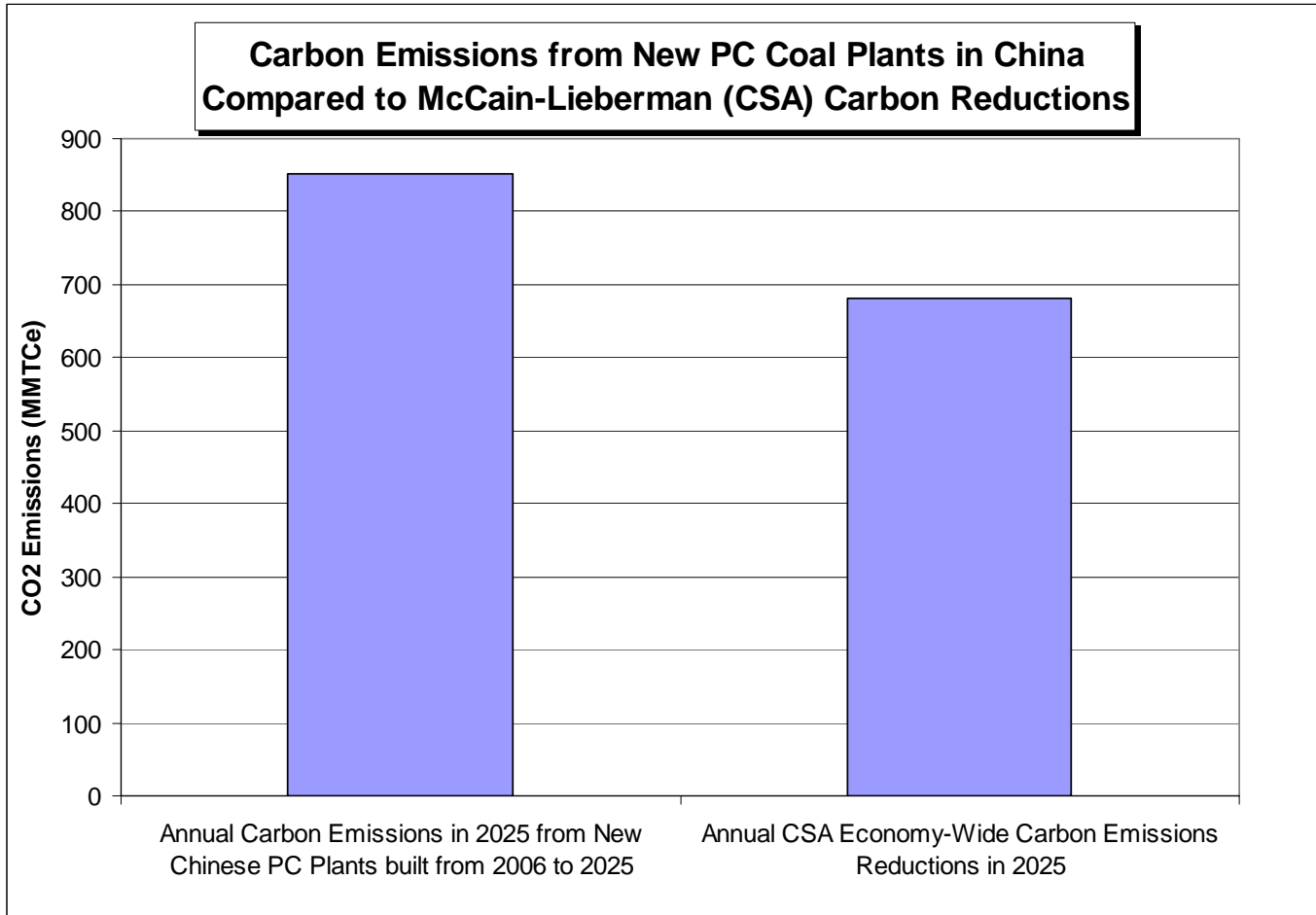
Biological carbon storage, Natural Sinks

14. **Forest management. Reduce clearcutting of primary tropical forests to zero and reforest 620 million acres in the tropics or 990 million acres in the temperate forests.**
15. **Agricultural soils management. Extend conservation tillage to all cropland, along with a verification program.**

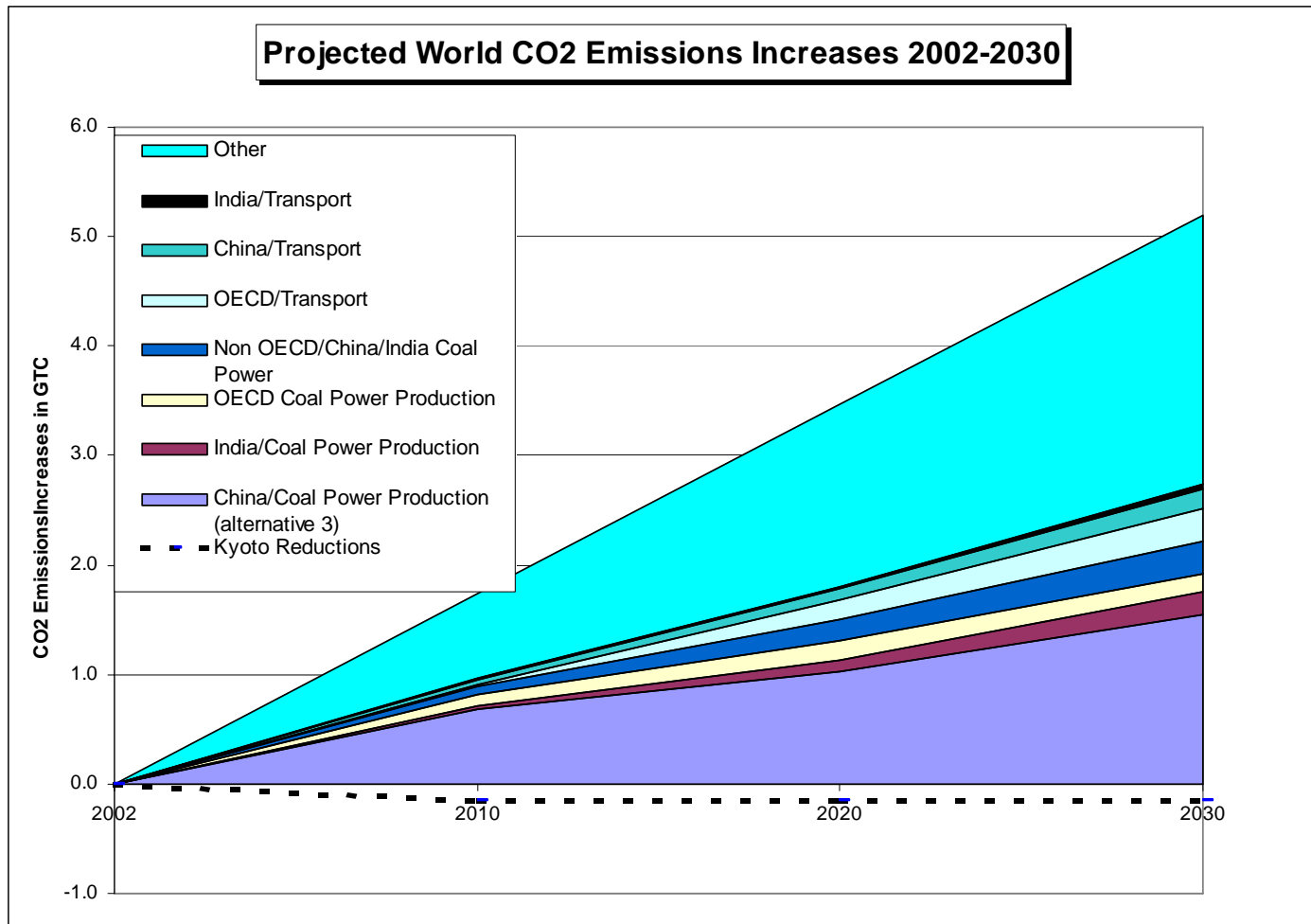
Another wrinkle: New pulverized coal plants are “locking in” huge future carbon emissions

- **New PC power plants:**
 - **Are the longest-lived energy system investments being made as they will operate for 50 – 60 years (vs. media 12 year age of a US car);**
 - **Are the most carbon-intensive energy system investments being made; and**
 - **Have little or no practical potential for adding equipment that could capture carbon before it is emitted and then injecting the captured carbon into geologic formations for permanent sequestration**
- **Large numbers of new PC power plants are being built today and are projected to be built over the next twenty five years – *primarily (56%) in China and India.***
- **If these projected PC plants are built, they will clearly “*bust the global carbon budget*” for achieving the EU temperature targets.**
- **This “batch” of new coal plants will burn more coal in their lifetime than has been burned by industrial society to date**

China new PC power plant carbon emissions in context



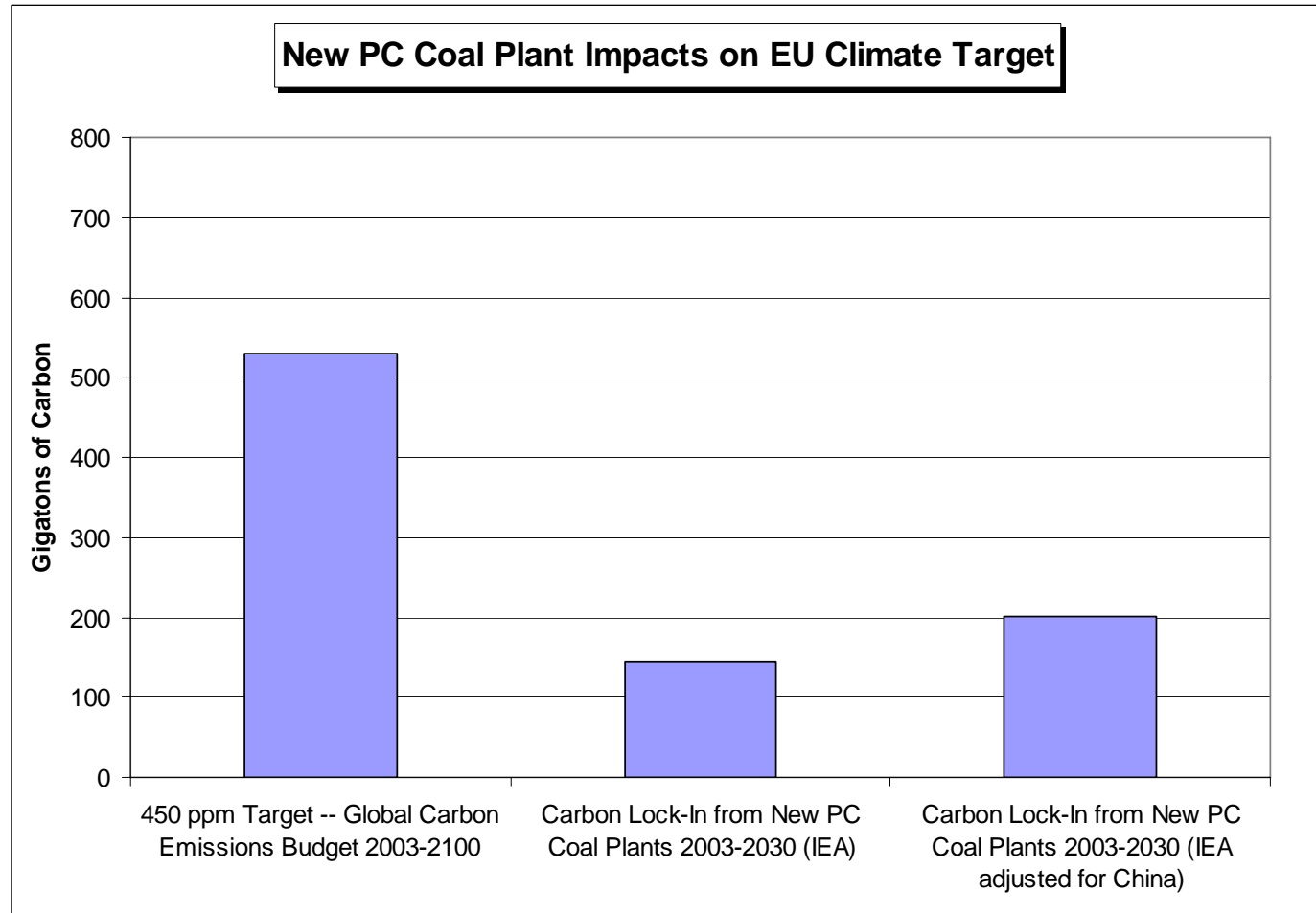
The dominance of coal in climate



CLEAN AIR TASK FORCE

Source: International Energy Agency 2004 as modified by recent CATF China projections.

Projected carbon “lock-in” from new PC plants through 2030



China new PC power plant carbon emissions in context

