# Hell and High Water & The Low-Carbon Car of the Future

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# Time Is Running Out

- “I think we have a very brief window of opportunity to deal with climate change ... no longer than a decade, at the most.”

  — James Hansen, 9/06

- “The ice sheets seem to be shrinking 100 years ahead of schedule.”

  — Richard Alley, 5/06

# Summary: Ice Sheets (Hansen, 06)

1. Human Forcing Dwarfs Paleo Forcing

2. Sea Level Rise Starts Slowly as Interior Ice Sheet Growth Temporarily Offsets Ice Loss at the Margins

3. Equilibrium Sea Level Response for ~3C Warming (25±10 m = 80 feet) Implies Potential for a System Out of Our Control

# THE CENTURY OF DROUGHT

- "… moderate drought, currently at 25% of the Earth's surface, rising to 50% by 2100 … and *extreme drought, currently 3%, rising to 30 per cent*." — UK's Hadley Centre for Climate Prediction and Research (10/06)
- Suggests that if we delay acting, most available land post-2050 will be **needed for food, not biofuels.**

# Feedbacks Constrain Options

- The tundra has as much carbon locked in it as the atmosphere.
- Much of it is methane (CH4), which traps 20 times the heat of CO2.
- Tundra loss ~60% at 550 ppm (NCAR-05).
- Stabilizing at 550 ppm (a “doubling”) may just be wishful thinking.

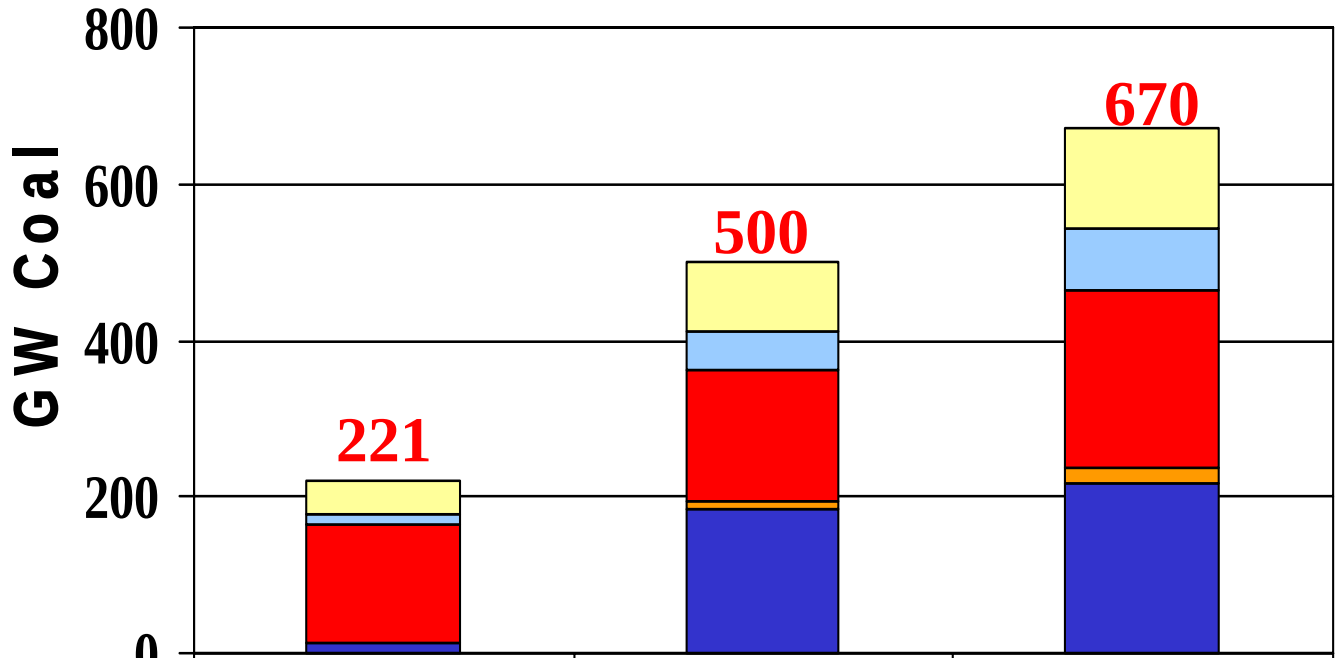
# Time is Running Out

- We're at 380 ppm CO2, rising 2+ ppm/yr
- If 500 & rising 3 ppm/yr in 2050, 700+ in 2100 may be unstoppable
- AR4:  For 450 ppm stabilization, + feedbacks could reduce cumulative emissions allowable this century to 490 GtC, down from 670 GtC
- We are at 8 GtC/yr already

# Dealing with Coal *and* Cars

- Coal strategy
  - Stop new coal builds with efficiency, renewables
  - Aggressively pursue CO2 capture
  - Coal-biomass blending for gasification
- Car strategy
  - Fuel efficiency for 20+ years
  - Then need low-CO2 fuel
  - Best alt fuels minimize new infrastructure

# New Coal Build by Decade




| | 2003-2010 | 2011-2020 | 2021-2030 |
|---|---|---|---|
| Other Developing | 43 | 90 | 128 |
| India | 16 | 48 | 79 |
| China | 150 | 168 | 226 |
| Transition | 1 | 11 | 19 |
| OECD | 12 | 184 | 218 |

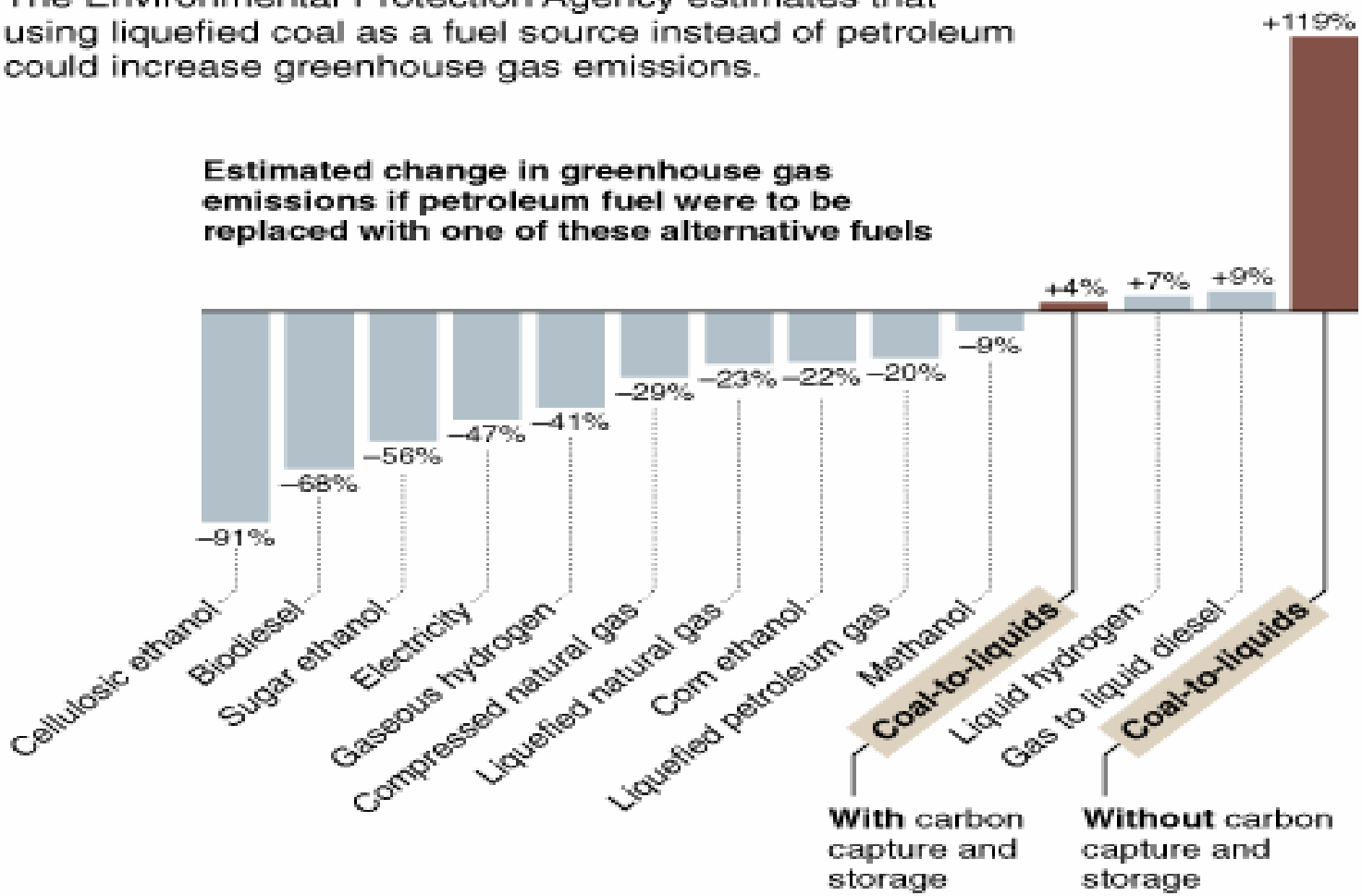
>$1 *trillion* in misallocated capital

**Source: IEA, WEO 2004**

NRDC

# Comparing Fuels

The Environmental Protection Agency estimates that using liquefied coal as a fuel source instead of petroleum could increase greenhouse gas emissions.




Note: The estimates include emissions from all parts of the process of making the fuels including fossil extraction, feedstock growth and distribution as well as averaging for the different methods of producing the fuels.

*Source: Environmental Protection Agency*

The New York Times

# Vehicle Strategies to Reduce Pollution and Oil Use

- Efficiency:  Least Expensive Option
  - Hybrids and Diesels
- Hydrogen:  Most Expensive Option
- Electricity
- Biofuels

# The Hype About Hydrogen

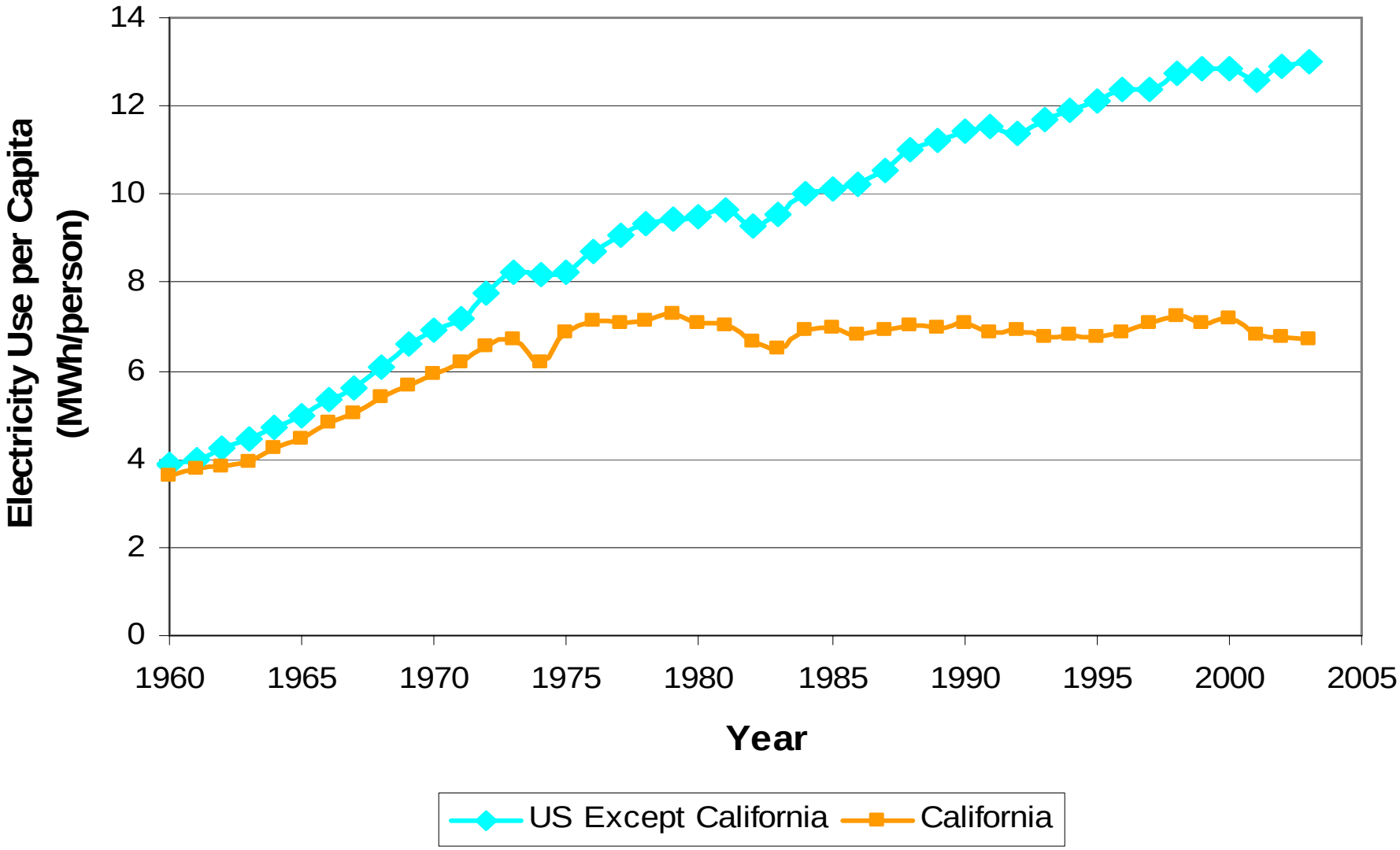
- "Total time to noticeable impact … is likely to be more than 50 years." —Heywood, MIT, 7/05
- "If I told you '**never**,' would you be upset?"

  Toyota's Bill Reinert on when H2 replaces gas, 1/05
- "Forget hydrogen, forget hydrogen, forget hydrogen." — James Woolsey, 1/06
- After "CO2 emissions from electricity generation are virtually eliminated…." — *Science*, 7/03

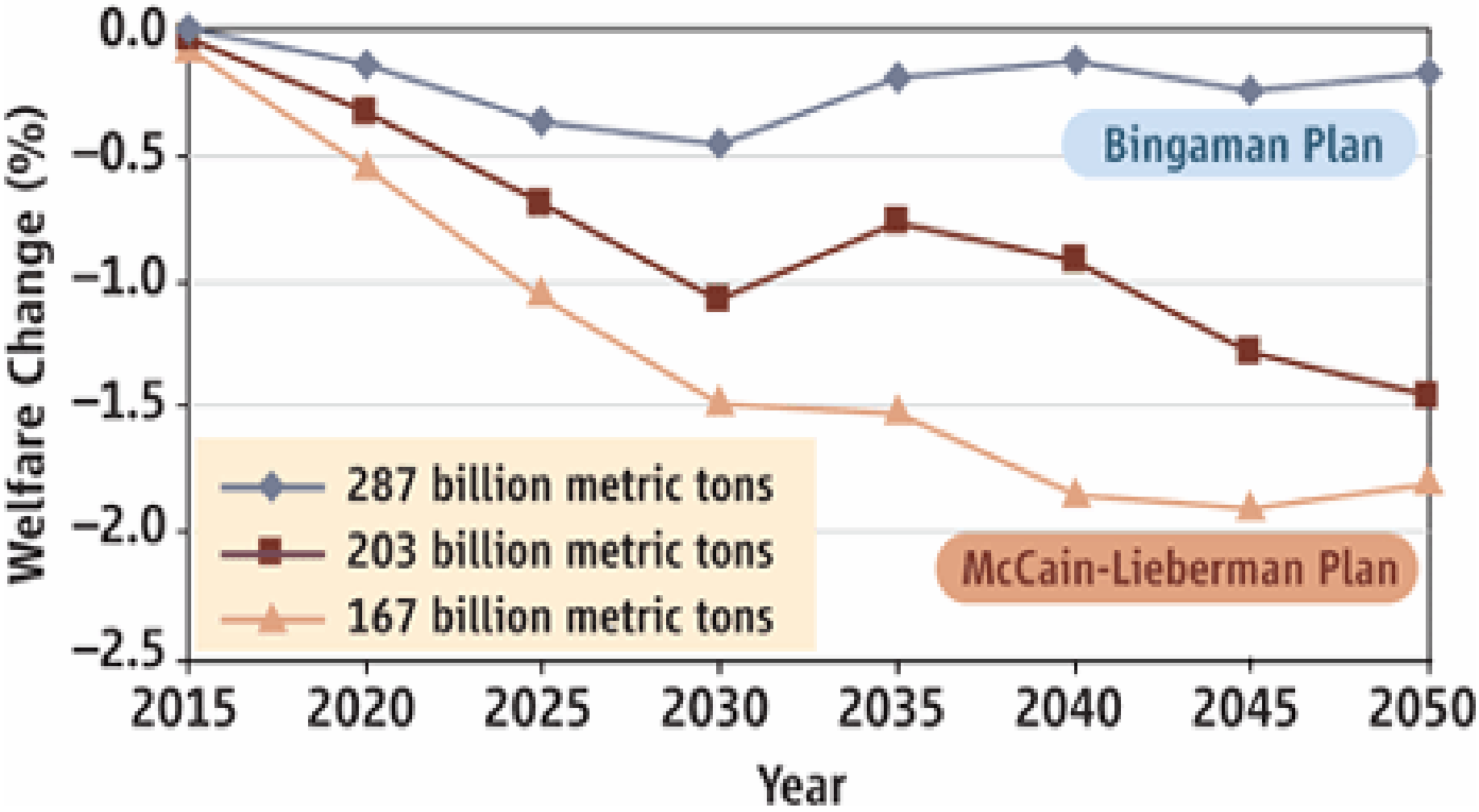
# Car of the Future: Plug in Hybrids

- 20-mile electric range, then reverts to hybrid
- Could displace half of gasoline
- Works best with carbon cap
- Blend in cellulosic ethanol
- Why use future clean electricity for H2?
  - Plug in uses electricity *3 to 4 times more efficiently*
  - Make use of existing infrastructure/vehicles
  - A Boon for Utilities:  Load balancing, etc.

## Figure 4: What Energy Efficiency Can Really Do

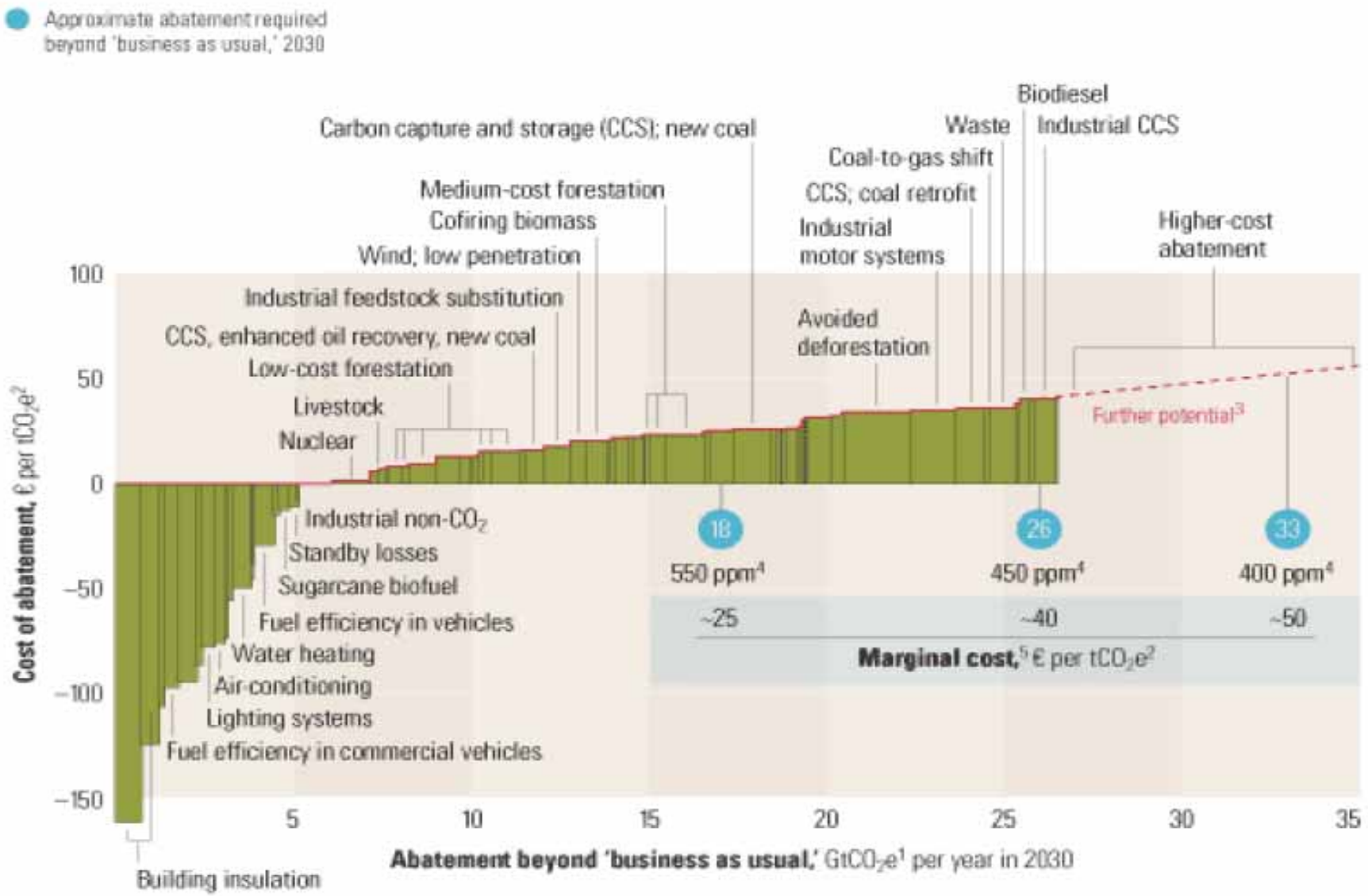


# What will it cost us?




Source: MIT & *Science*

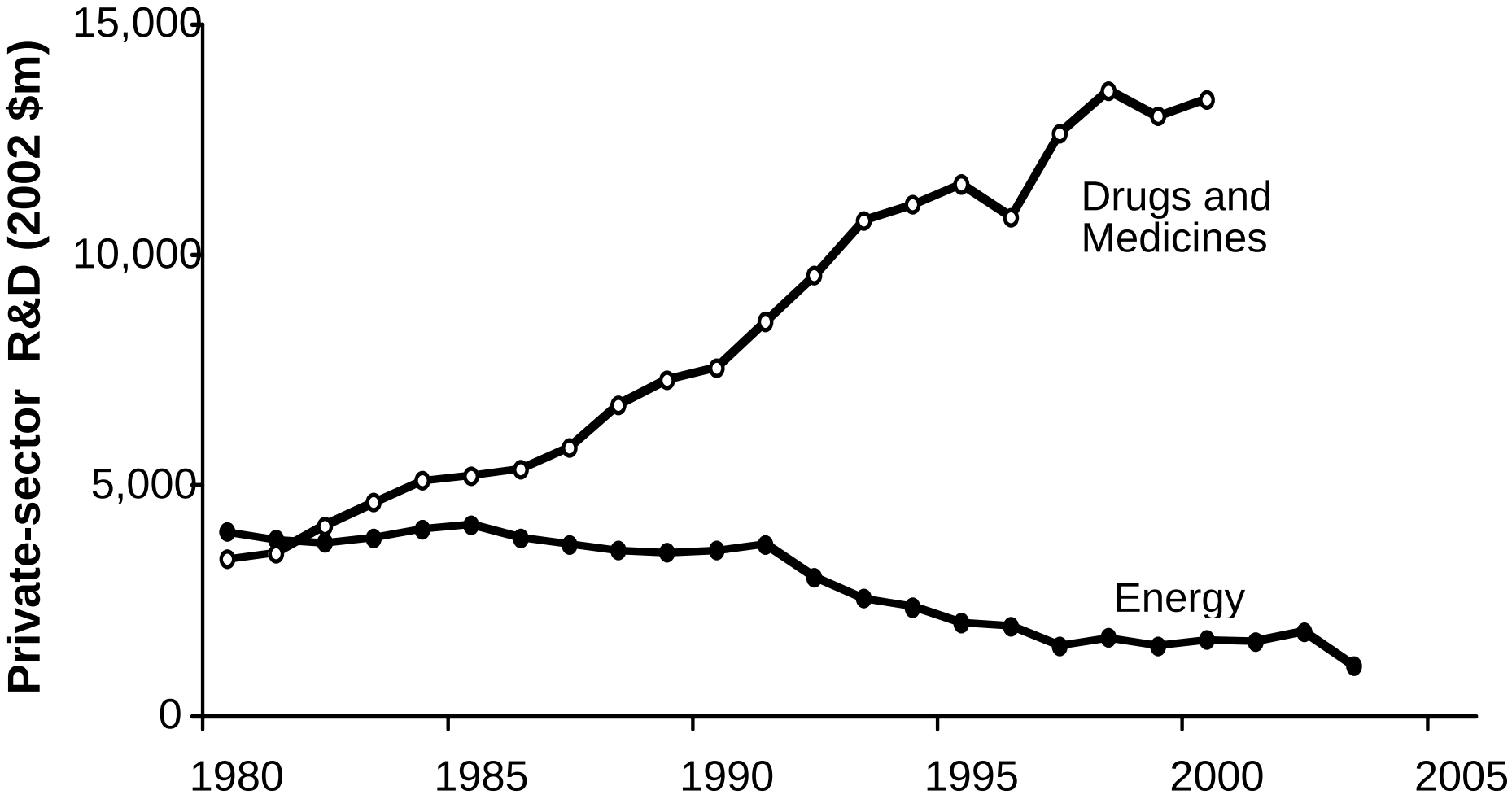
Global cost curve for greenhouse gas abatement measures beyond 'business as usual'; greenhouse gases measured in $GtCO_2e$[1]




[1] $GtCO_2e$ = gigaton of carbon dioxide equivalent; "business as usual" based on emissions growth driven mainly by increasing demand for energy and transport around the world and by tropical deforestation.
[2] $tCO_2e$ = ton of carbon dioxide equivalent.
[3] Measures costing more than €40 a ton were not the focus of this study.
[4] Atmospheric concentration of all greenhouse gases recalculated into $CO_2$ equivalents; ppm = parts per million.
[5] Marginal cost of avoiding emissions of 1 ton of $CO_2$ equivalents in each abatement demand scenario.

Source: McKinsey

# Private Sector R&D Investment in Health and Energy




Kammen and Nemet, 2005

# The Gravest Security Threat to our Way of Life for **50 Generations**

- We need a World War II-scale effort ***now***
  - Efficiency, Efficiency, Efficiency
- It is only money!
- *Homo sapiens sapiens?*
- Climateprogress.org
- *Hell and High Water*