CO_2 emissions, climate change, and human development

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Producing oil is obviously a self-depleting activity . Every year you've got to find and develop reserves equal to your output just to stand still. A company like Exxon-Mobil will have to secure over a billion and a half barrels of new oil equivalent reserves every year. That's like (….) finding two Hibernia fields per year.

….the Middle East with two-thirds of the world's oil and the lowest cost , is still where the prize ultimately lies, even though companies are anxious for greater access there…

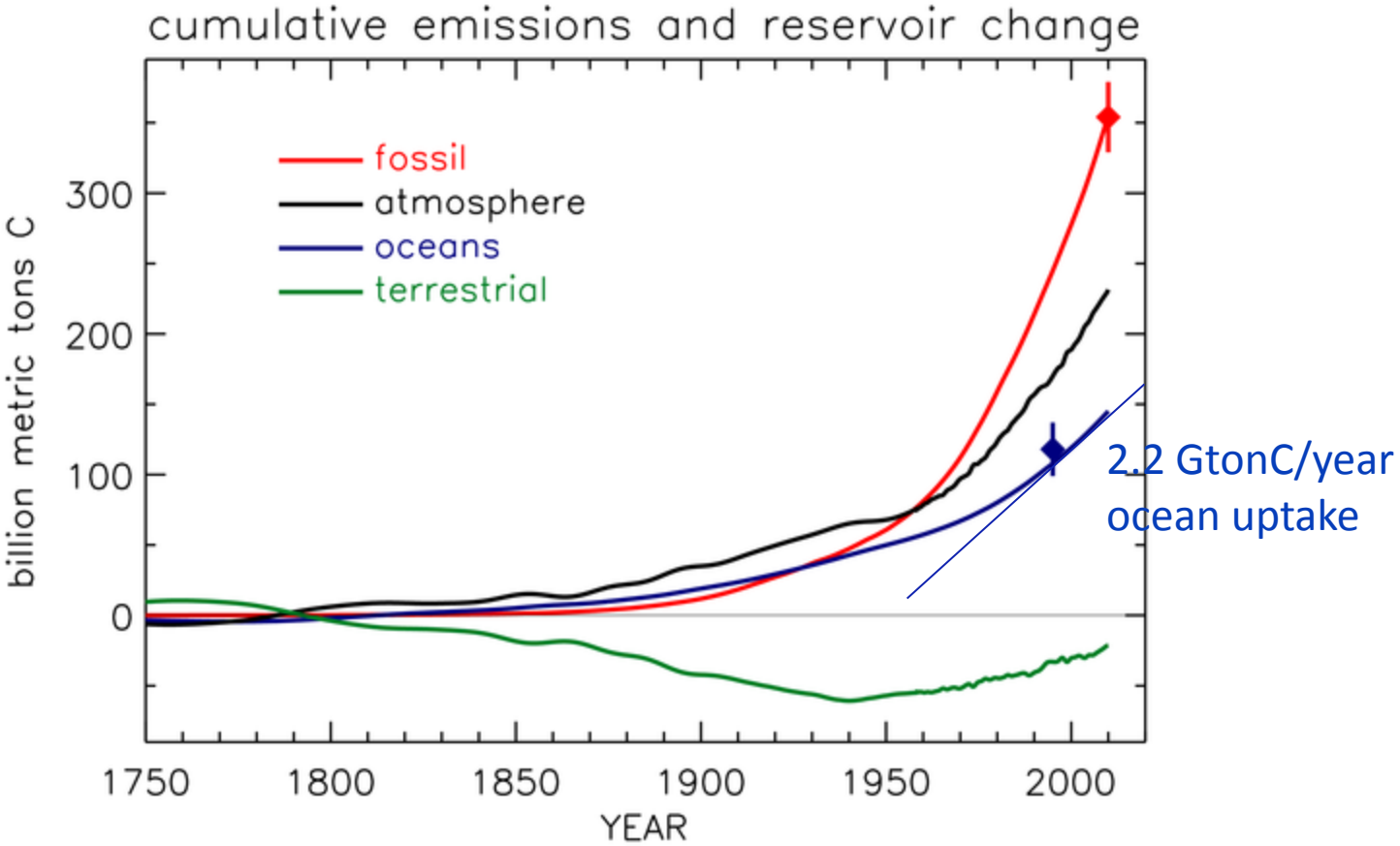
….many of these core areas are now mature and it can be difficult to replace the earnings from the high margin barrels there. Some of the oil being developed in new areas is obviously very high cost and low margin.

Excerpts from speech by Dick Cheney, CEO of Halliburton,
at the London Institute of Petroleum lunch, Autumn 1999.

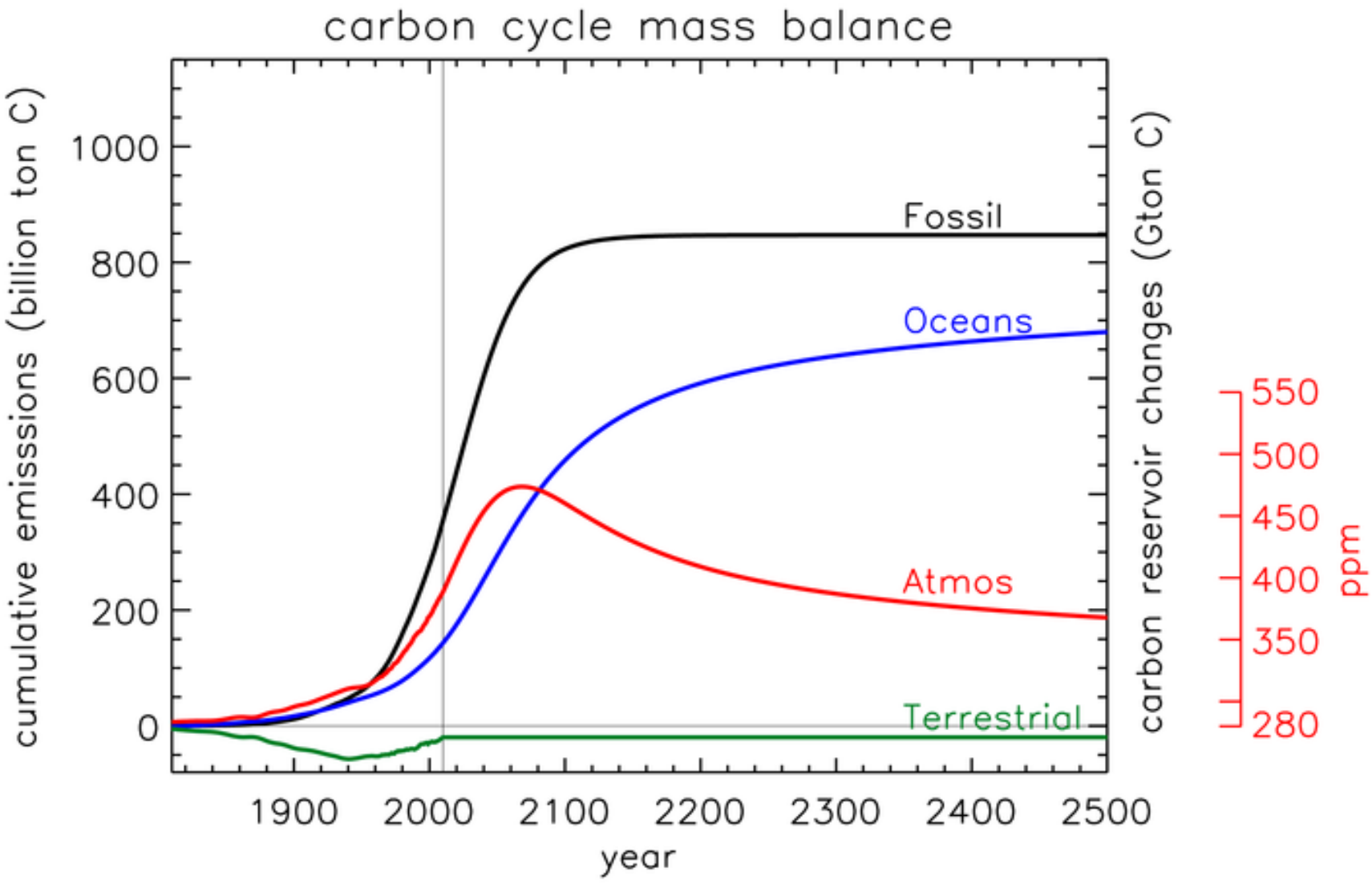
A LIKELY FUTURE CO2 SCENARIO

$$C_{atm}(t) = \int_{-\infty}^{t} dt' E(t') \left[x_0 + \sum_{i=1}^{3} x_i \exp[a_i (t'-t)] \right] \qquad \text{with} \sum_{i=0}^{3} x_i = 1$$

Pulse response function: 0.17 + 0.23exp(t/300) + 0.40exp(t/60) + 0.20exp(t/10)

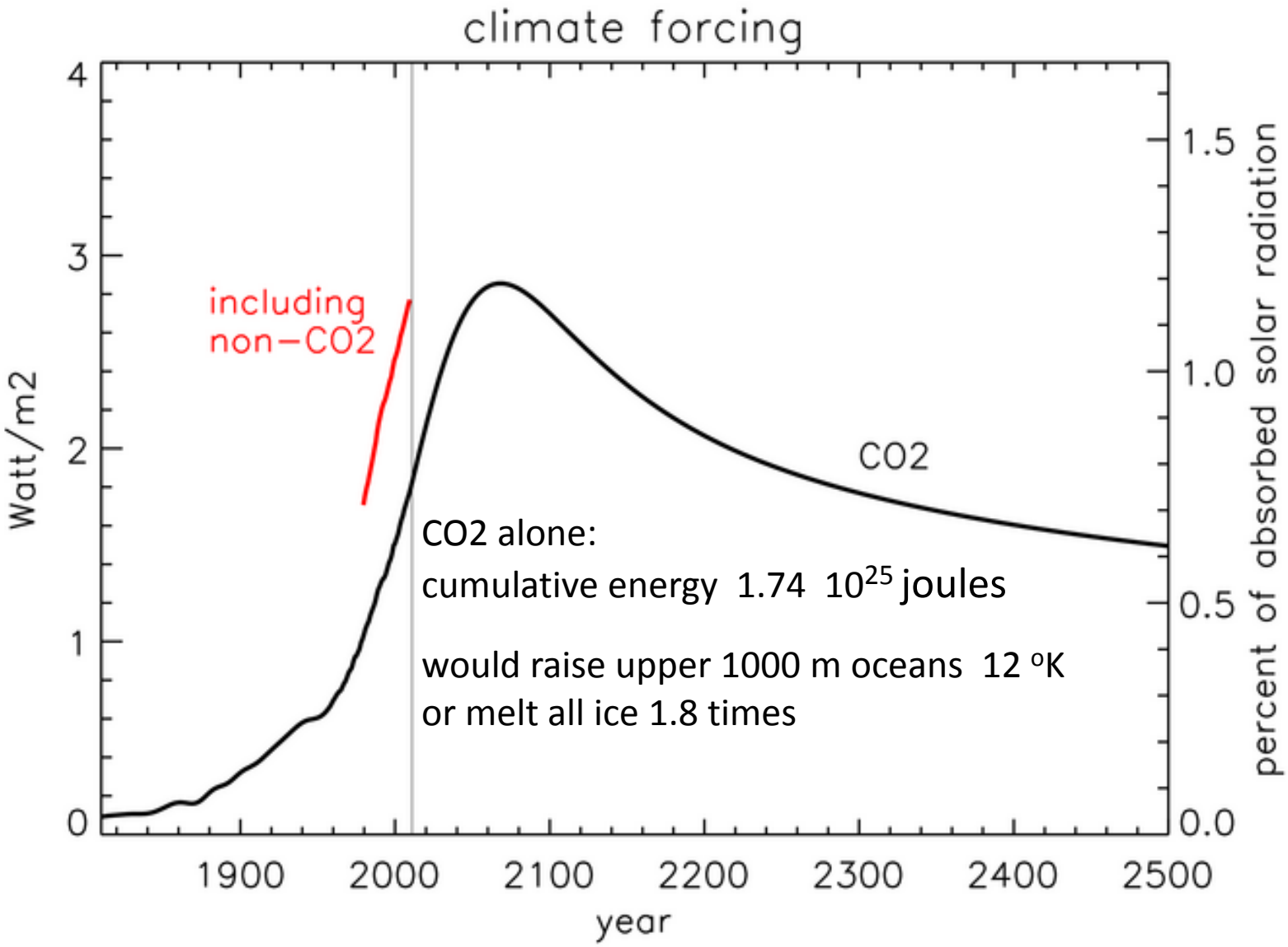


A LIKELY FUTURE CO2 SCENARIO



Fossil = Atmos + Oceans + Terrestrial

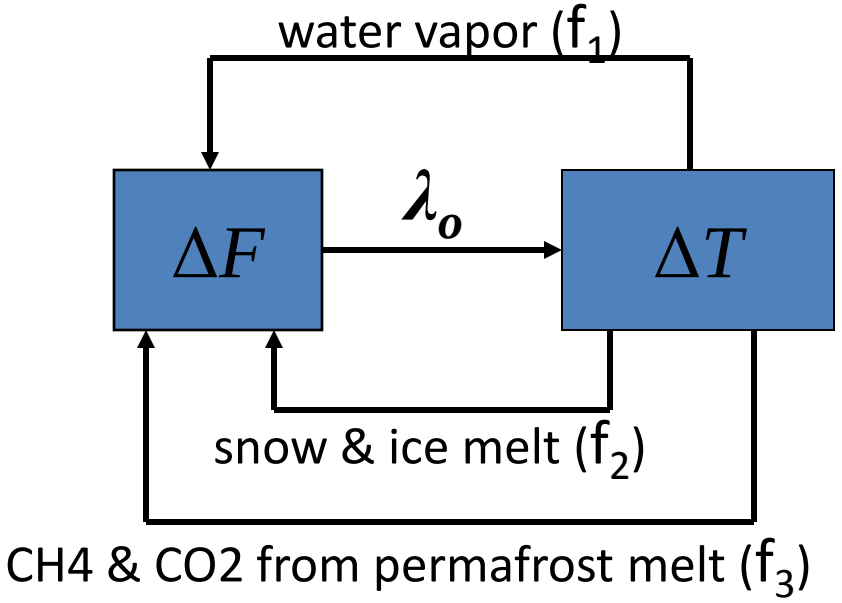
WILL LOWER CO2 EMISSIONS SAVE US FROM CLIMATE CHANGE?



Feedbacks make it difficult to predict climate,
but could also make it catastrophic.

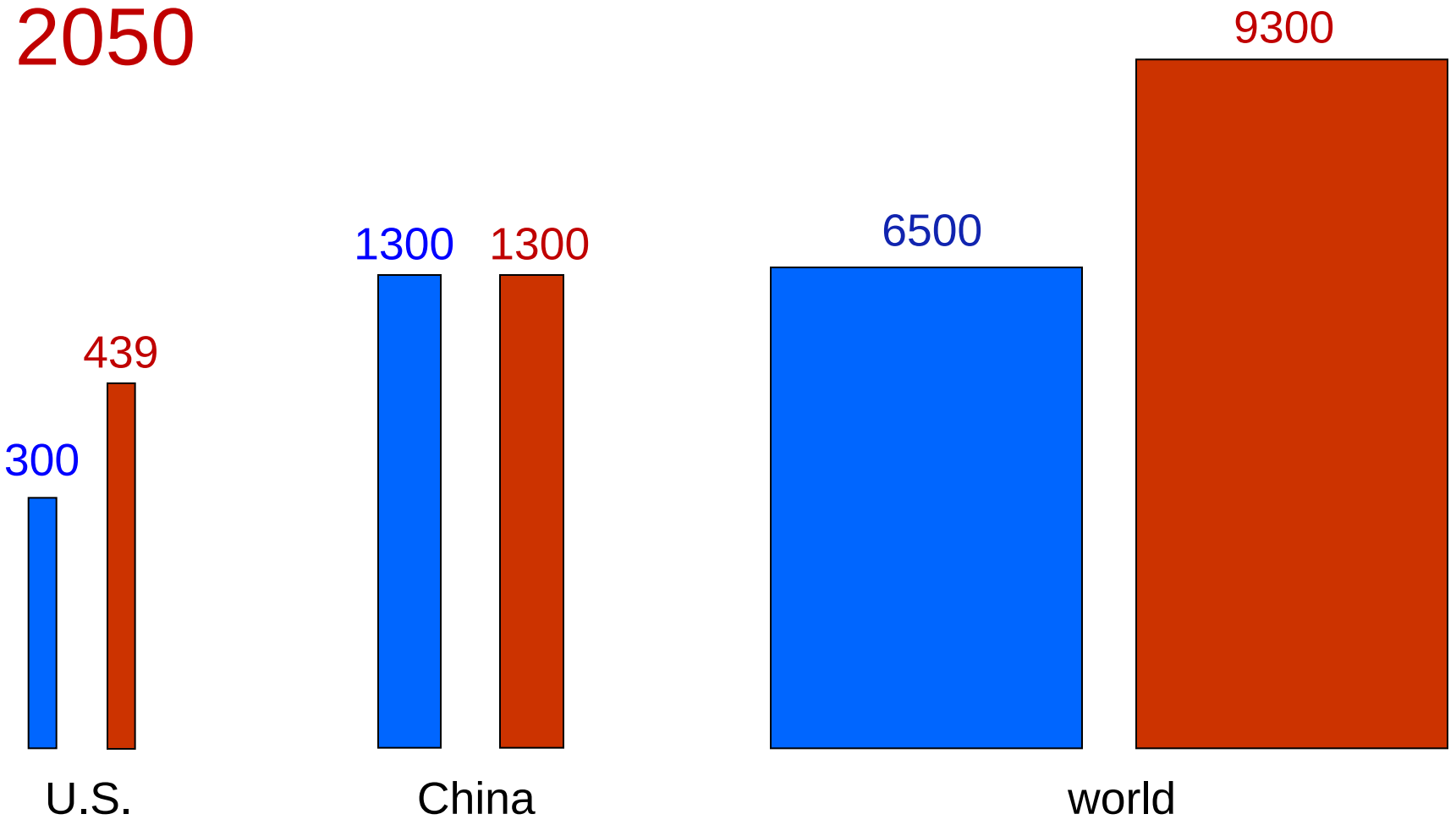
$$\Delta T = \lambda_o \Delta F$$

$$\Delta T = \frac{\lambda_o}{1 - f} \Delta F$$

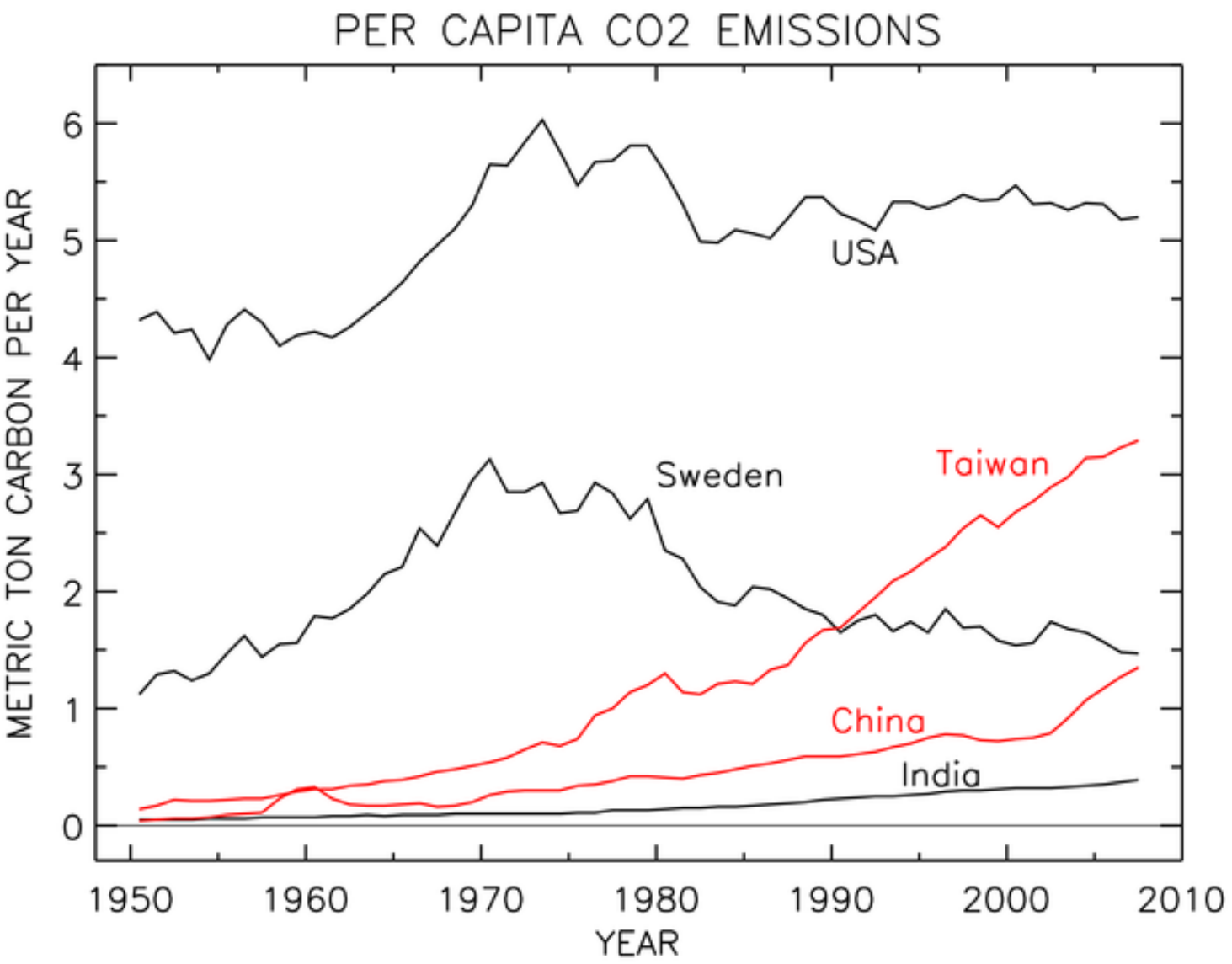


Fast feedbacks : 3.0-3.3 times (A. Lacis, Science, 2010) f ~ 0.7
Slow feedbacks: another factor of ~2 (J. Kiehl, Science, 2011) f ~ 0.85

human population
(millions)

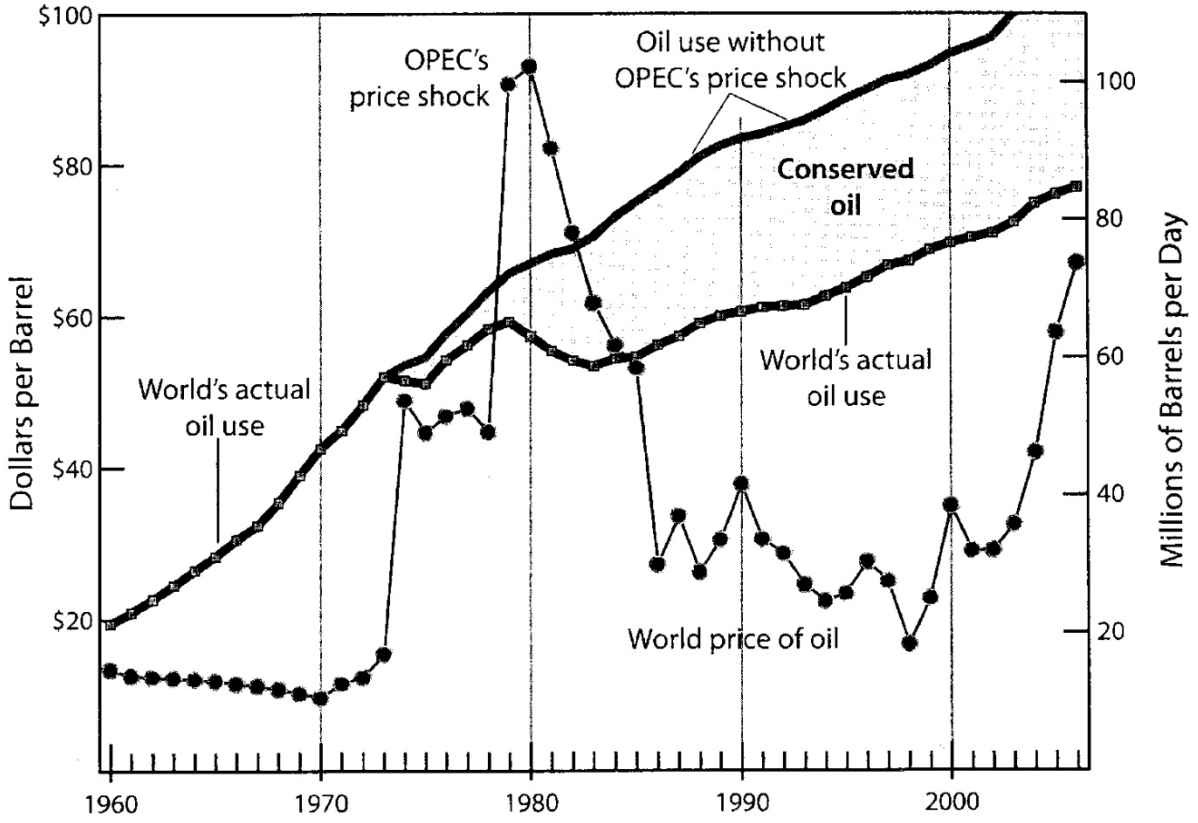


U.N. projections 2010



Source: CDIAC

Figure 1. OPEC Raised the Price, and the World Conserved Oil



The top line is estimated world oil use without the two OPEC crises. The line that branches off below it in 1974 is actual world oil use. The difference is the amount of oil conserved because of OPEC's high prices. Notice that changes made because of OPEC—things like fuel-economy standards and better insulation—are still saving an enormous amount of oil worldwide. Oil prices are in 2007 dollars.*

Steven Stoft, Carbonomics, Diamond Press, 2008

Can OPEC keep up with increasing world demand for oil?

A development path of increasing world consumption to U.S. levels is impossible.

Supply and demand for oil and other fossil resources will have to be matched to each other by price. This can be both expensive and unstable.

In the traditional economic framework Steven Stoft proposes the “untax” for decreasing emissions and promoting renewable energy.

The world will be forced to transition to an economic system that minimizes consumption of natural resources. We can either do that by deliberate policy choices and re-definition of economic measures of success like wealth and GDP, or we can choose conflict and war.