Energy, the Environment, and What We Can Do

John Baez
http://math.ucr.edu/home/baez/what/

Google
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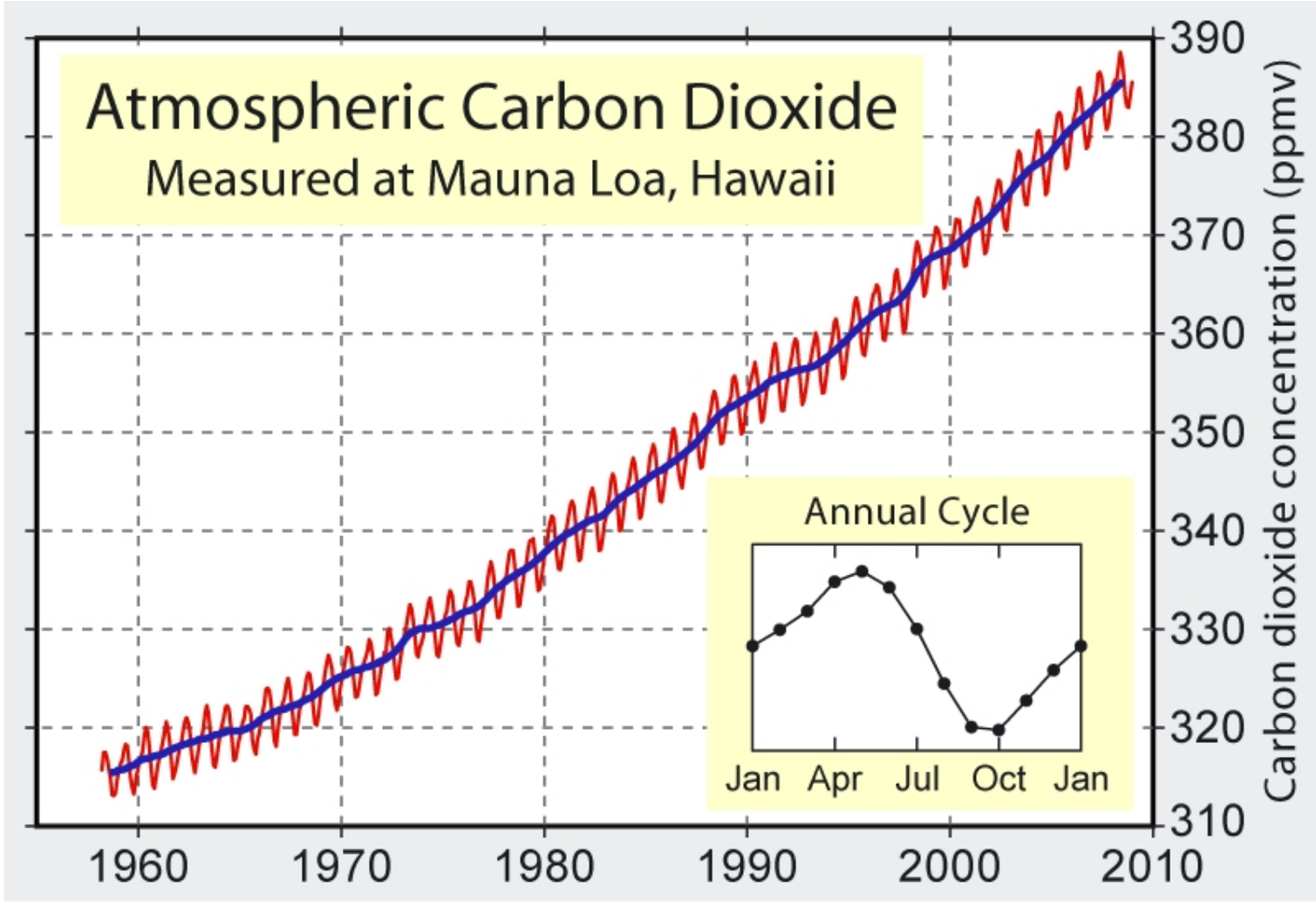
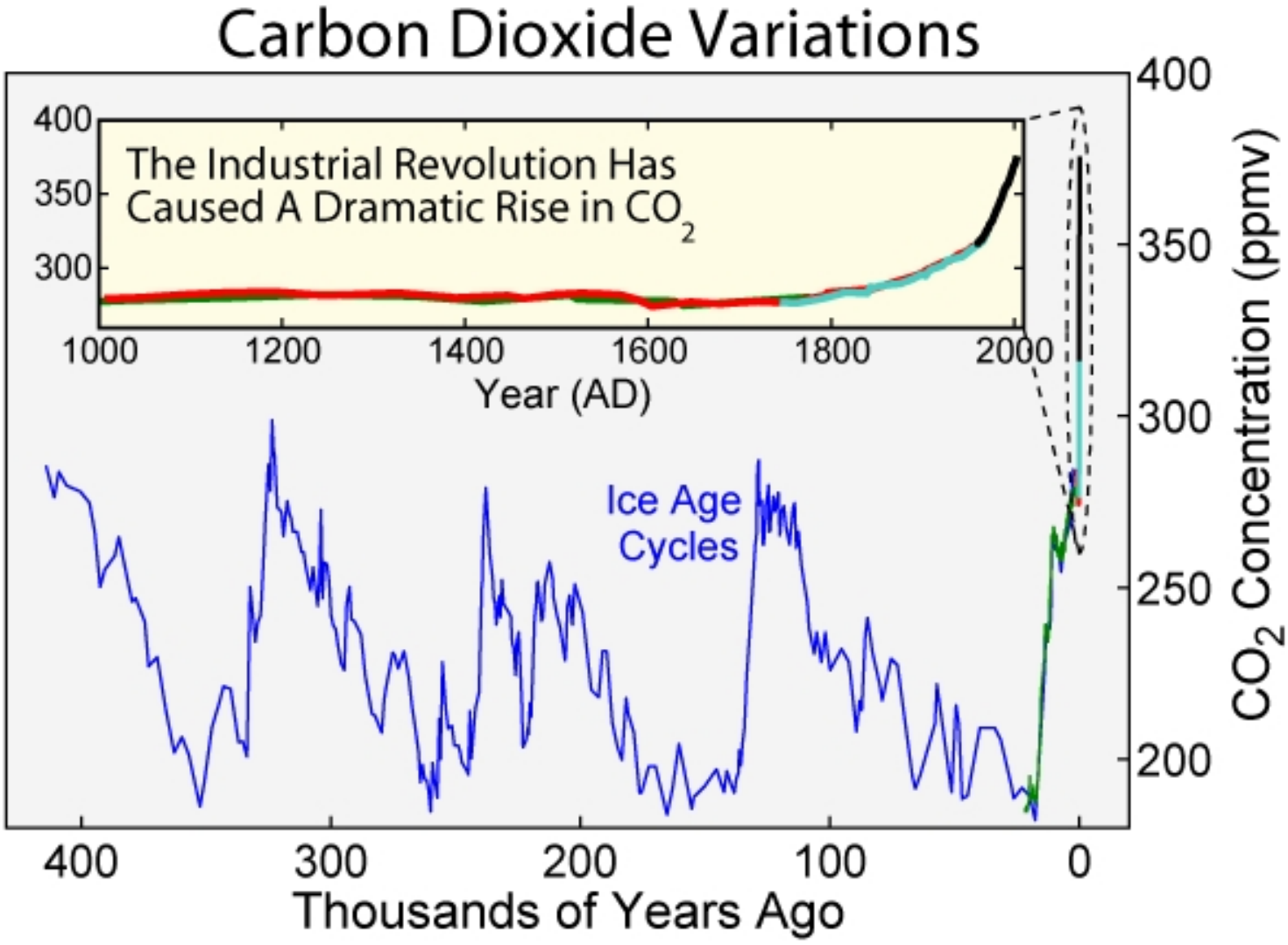
Worldwide, we put 9.1 gigatonnes of carbon into the air in 2010.

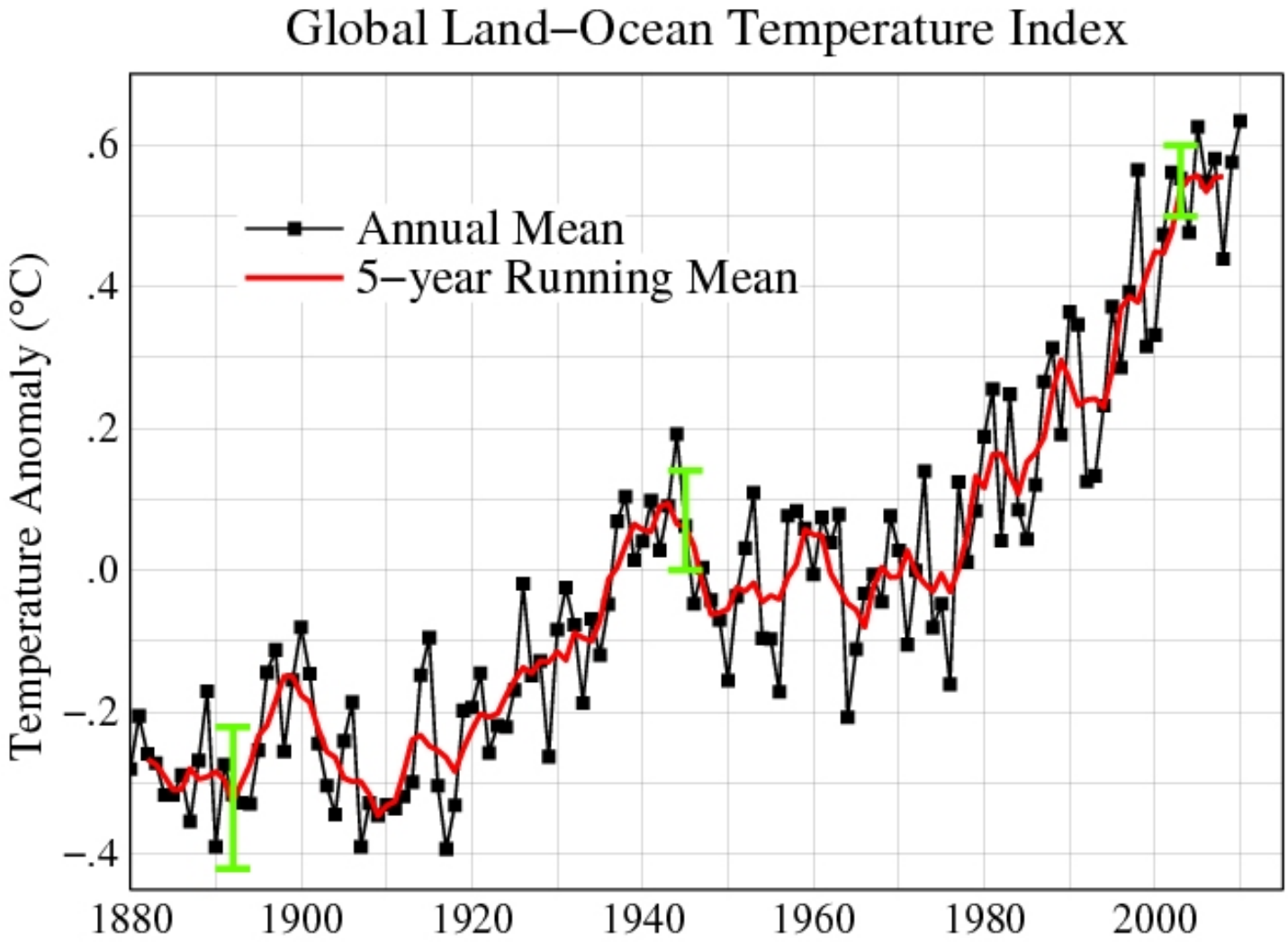
So, the amount of carbon dioxide in the air is soaring:



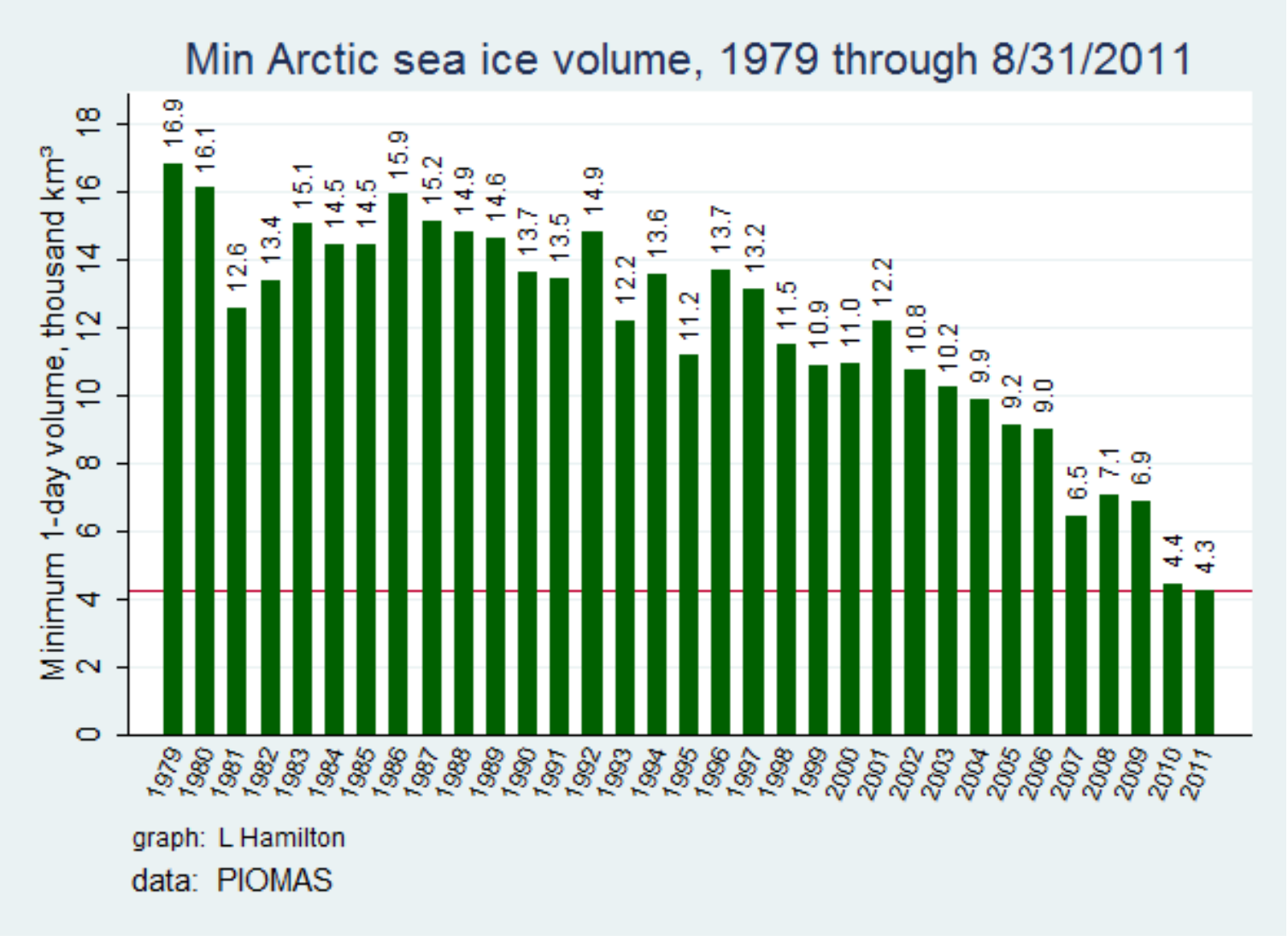
To understand just how much, we need to take the long view:



As you'd expect, the temperature has gone up:



Arctic sea ice is shrinking fast:



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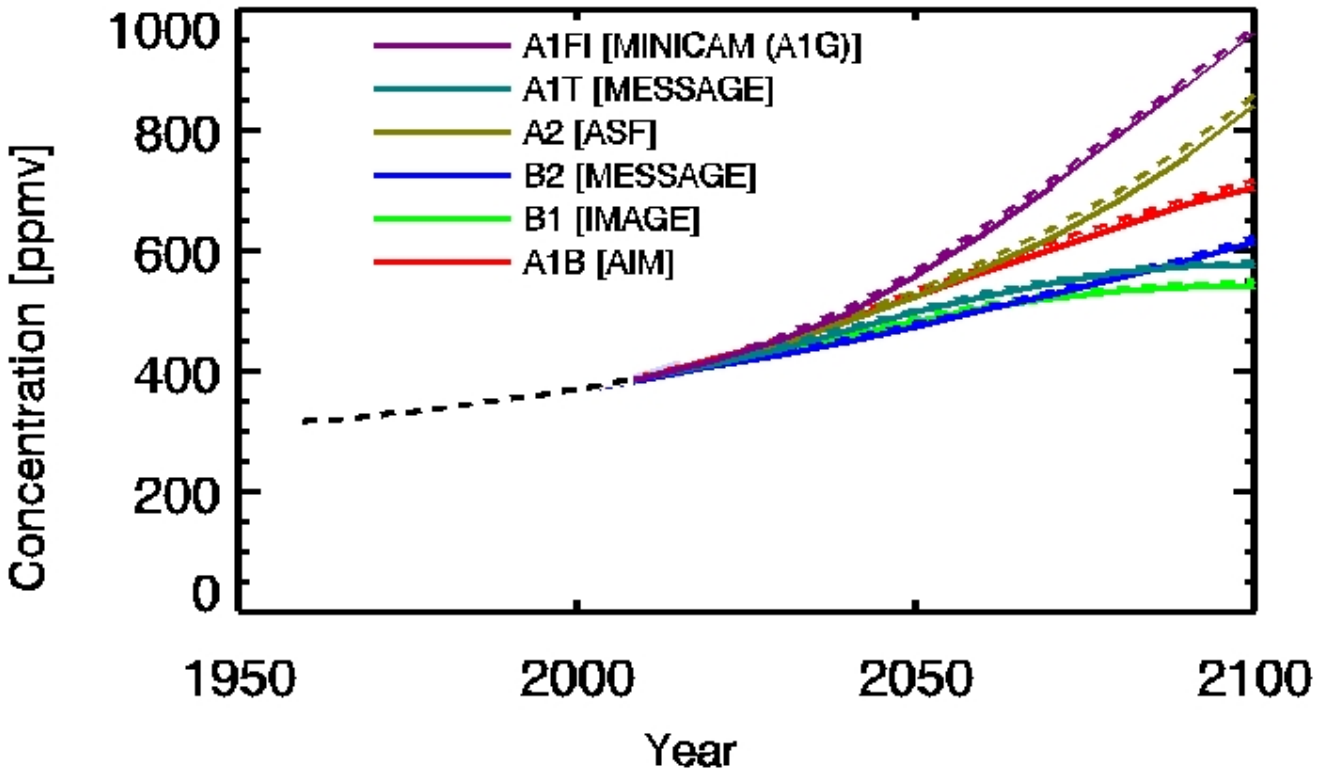
Before the industrial revolution, the CO_2 concentration was 290 parts per million. Now it's 390. What next?



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This could cause temperatures roughly $2.4 - 6.4°C$ higher than today.

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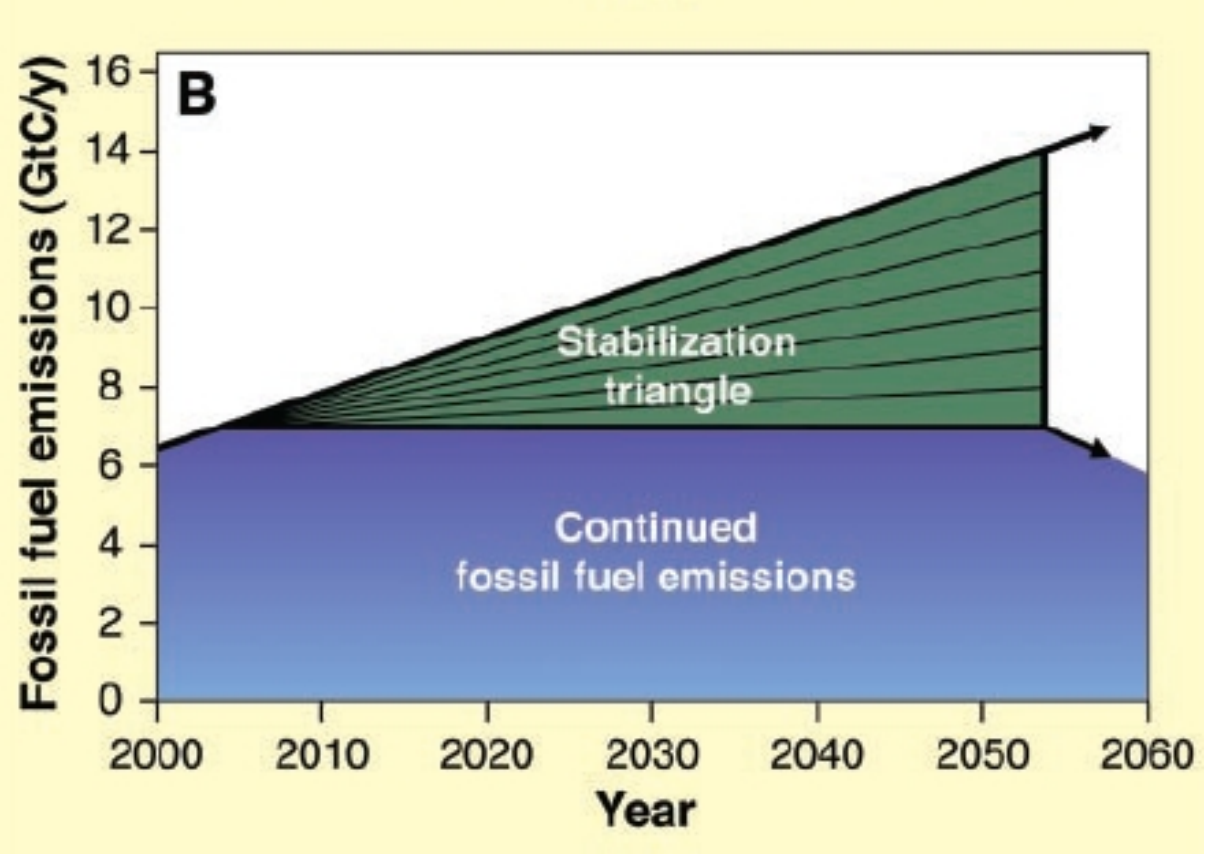
I could spend the rest of my time arguing that these are serious problems. But instead, let me talk about *solutions.*

What can we do? Slowing the rate of carbon burning is not enough: most CO_2 stays in the air *over a century*, though individual molecules come and go. We need to:

- leave fossil fuels unburnt,
- live with a hotter climate,
- sequester carbon, and/or
- actively cool the Earth.

In 2004, Pacala and Socolow looked for ways to hold carbon emissions constant until 2054 — *not a solution, just a start!*



They said it would require 7 ‘wedges’. Each wedge is a way to reduce carbon emissions by 1 gigatonne/year by 2054.

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Nuclear: Replace 700 gigawatts of coal power by nuclear power. This requires *doubling existing nuclear power*.

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Conservation/efficiency: Cut carbon emissions by 25% in buildings and appliances.

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In short: we need an intelligent economic system.

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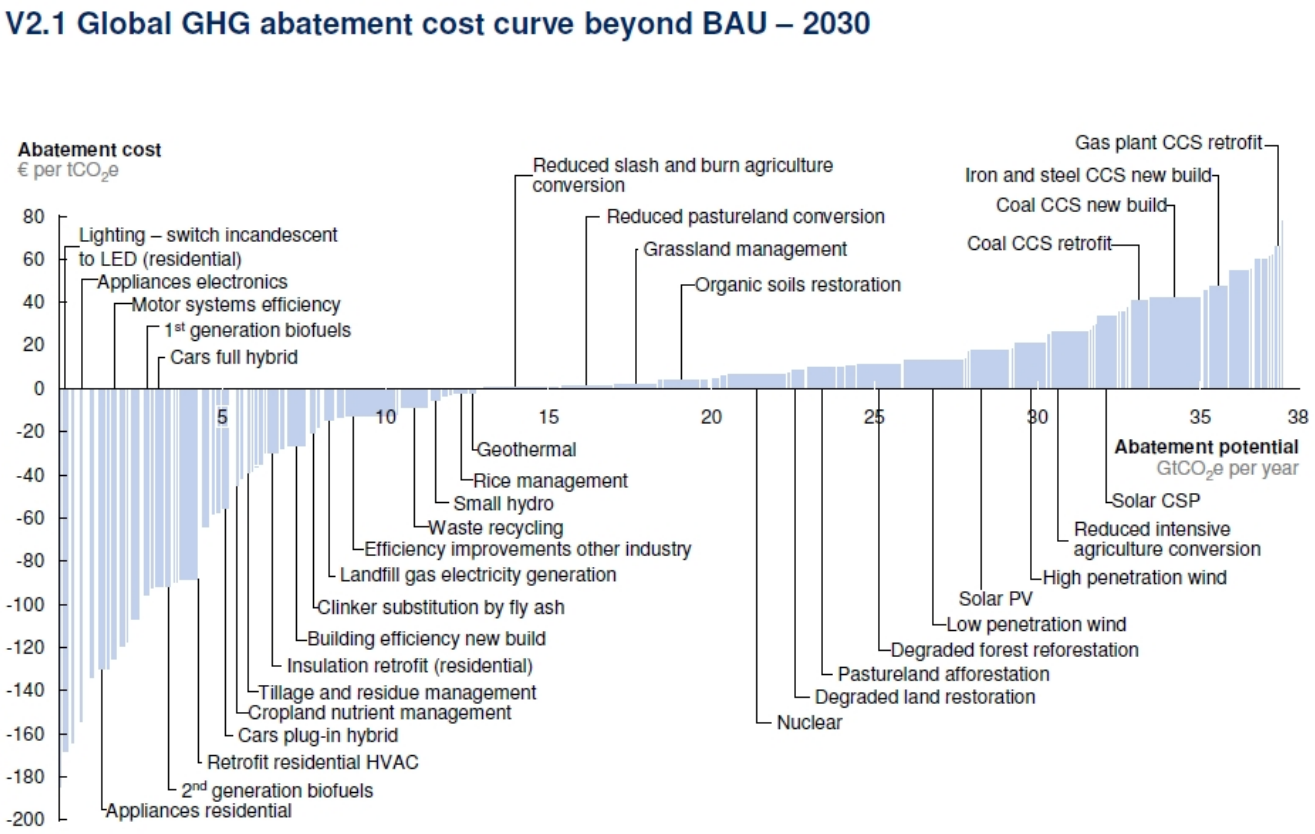

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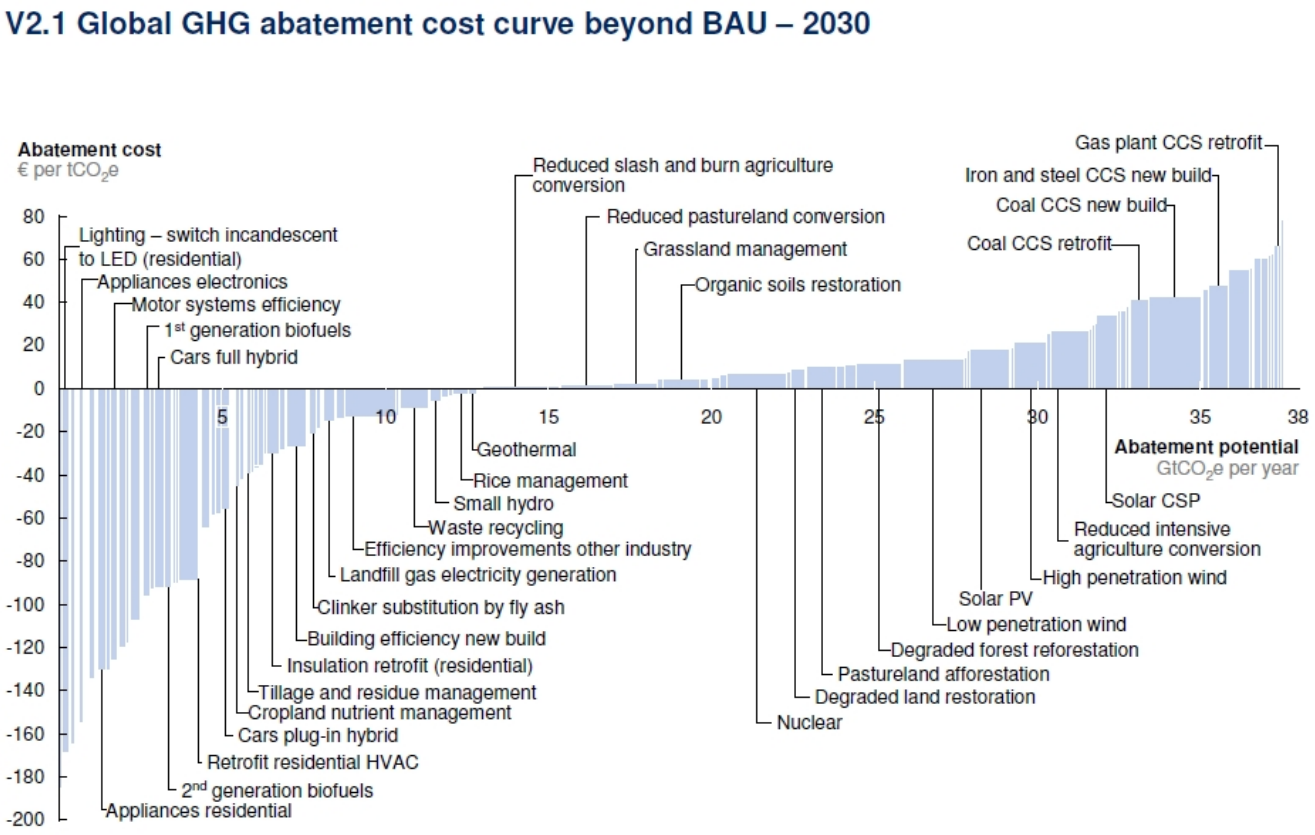

In 2010, we spent $409 billion subsidizing fossil fuels!

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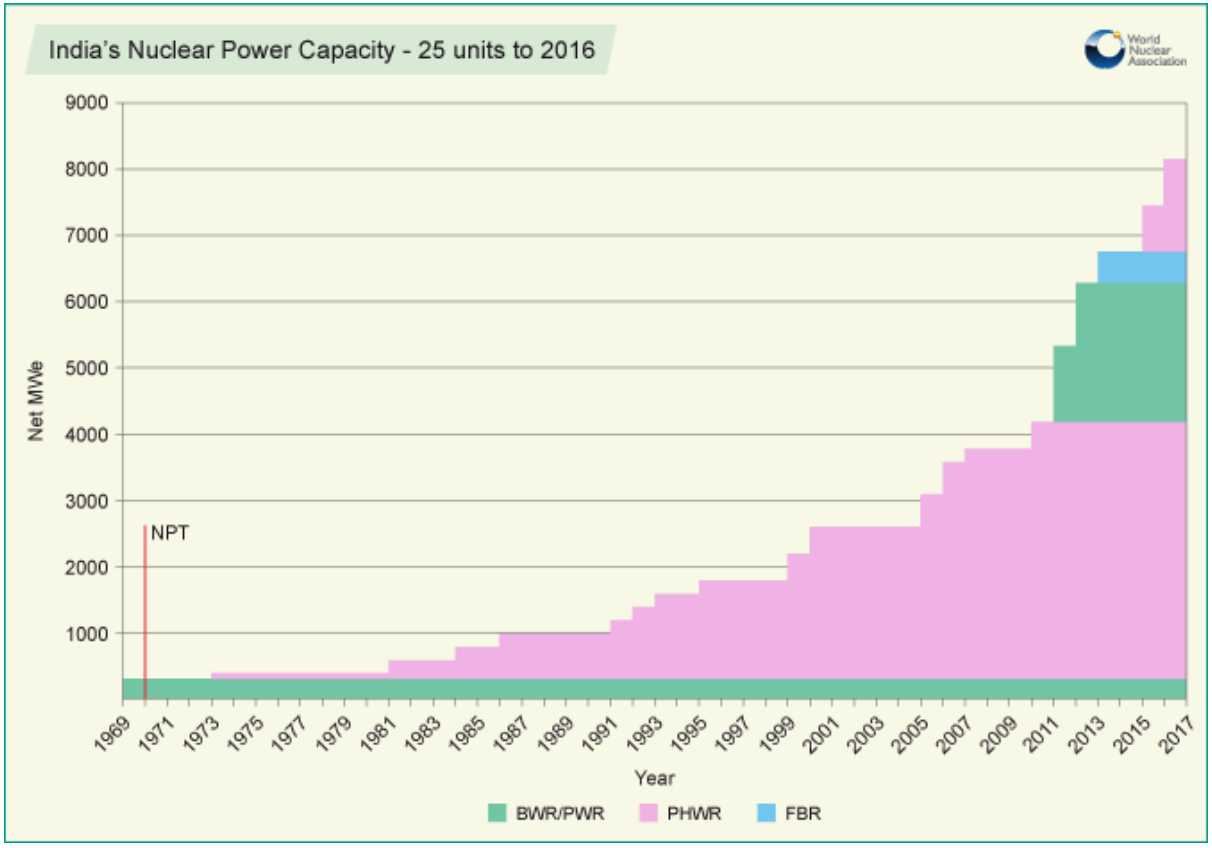
But calculations show coal causes at least 1000 times as many deaths per kilowatt-hour as nuclear! If you disagree, find and fix the mistakes.

India is rapidly building reactors:



China is building reactors too.

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Biochar: they can burn agricultural waste in low-oxygen conditions to make charcoal, then bury it. This harnesses the power of plants to remove CO_2 from the air! The Amazon jungle is full of soil enriched by biochar.

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Study geoengineering: for example, Gregory Benford estimates that cooling the Arctic to its earlier state would cost maybe $300 million/year if we use big refueling aircraft to put sulfur dioxide in the Arctic stratosphere. We need to study options like these *now*, using actual experiments, to make informed decisions.

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By manifesting myself in robot form, that's how much I've saved! I've been cutting back on flights a lot these days, and I'm happier.

2. Educate.

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We need clear thinking and a good understanding of the facts now more than ever. Educate yourself and your friends. Always keep in mind: you could be wrong. Seek data that could change your mind. Weigh the evidence wisely.

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Climate cycles: what causes the ice ages? How important are changes in the Earth's' orbit, perhaps made stronger by stochastic resonance?

On the **Azimuth Wiki**, we are explaining the main environmental and energy problems the world faces today:

- Global warming - human caused climate change.
- Extinction - mass die-offs caused by global warming and habitat changes.
- Deforestation - loss of primary and secondary forests.
- Ocean acidification - rise in ocean acidity due to rising CO_2.
- Dead zones - large areas of the ocean that can't support life.
- Water crisis - the decline of aquifers and freshwater supplies.
- Peak oil - the decline in the availability of oil as an energy source.

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