Energy, the Environment, and What We Can Do

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

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7 February, 2012

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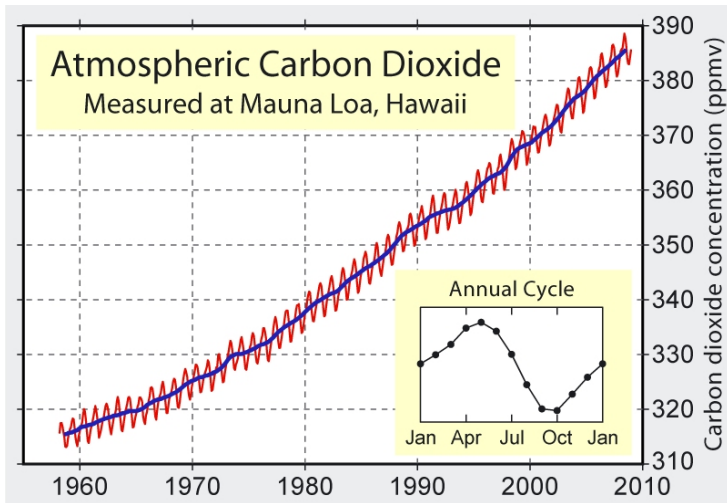
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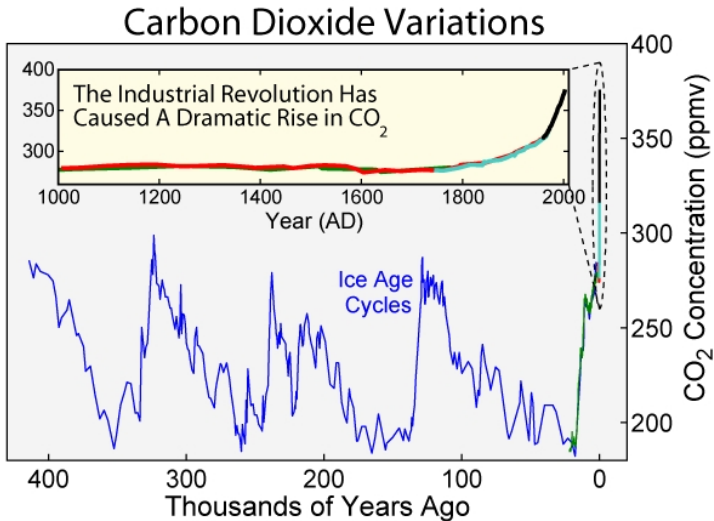
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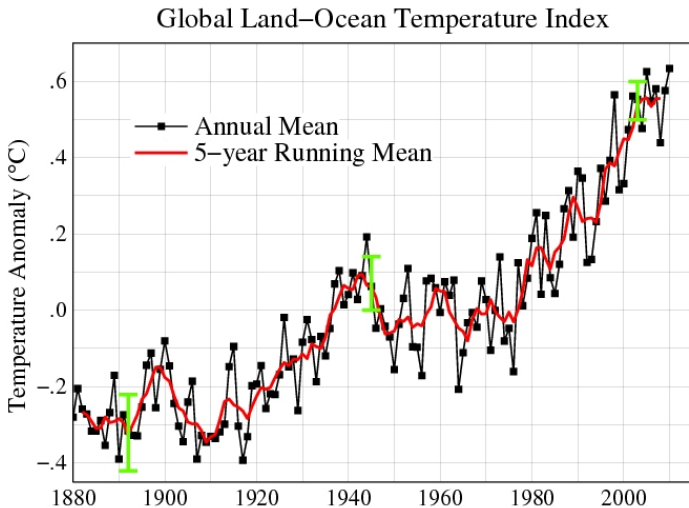Worldwide, we put 9.1 gigatonnes of carbon into the air in 2010.

So, the amount of carbon dioxide in the air is soaring:
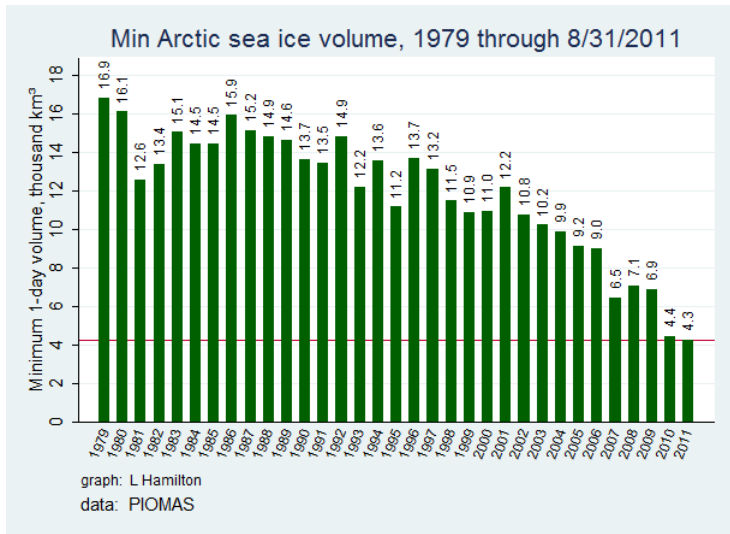
To understand just how much, we need to take the long view:

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

Arctic sea ice is shrinking fast:

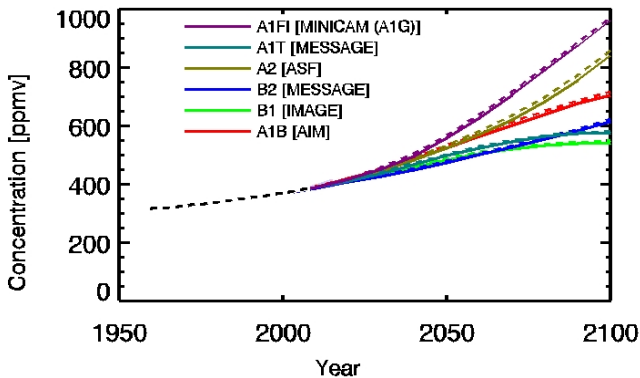So far: *no projections or climate models*. But what do we
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Before the industrial revolution, the CO_2 concentration was 290 parts per million. Now it's 390. What next?

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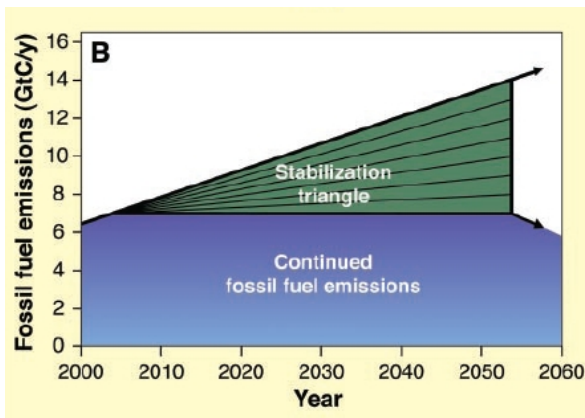
They said it would require 7 'wedges'. Each wedge is a way to reduce carbon emissions by 1 gigatonne/year by 2054.

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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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So: we need to take dramatic action on many fronts, but focused on what really matters.

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So, we need a more intelligent version of economics.

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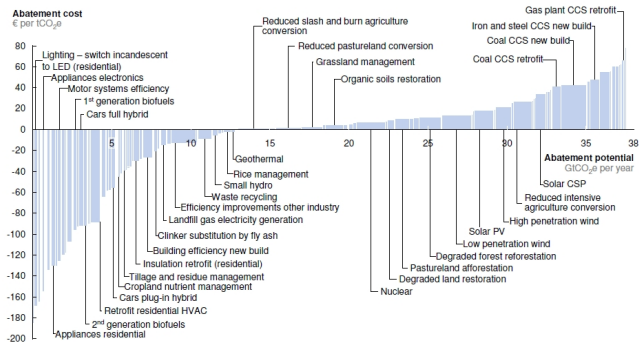V2.1 Global GHG abatement cost curve beyond BAU – 2030
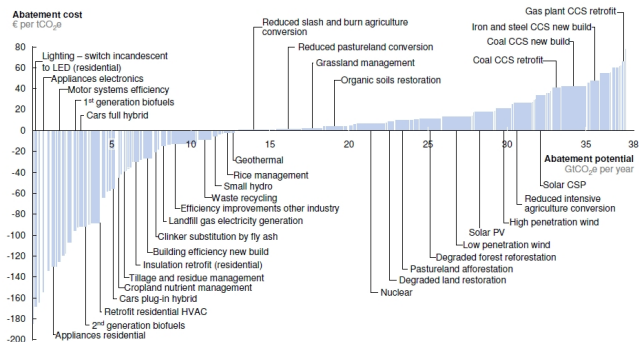
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In 2010, we spent $409 billion subsidizing fossil fuels!

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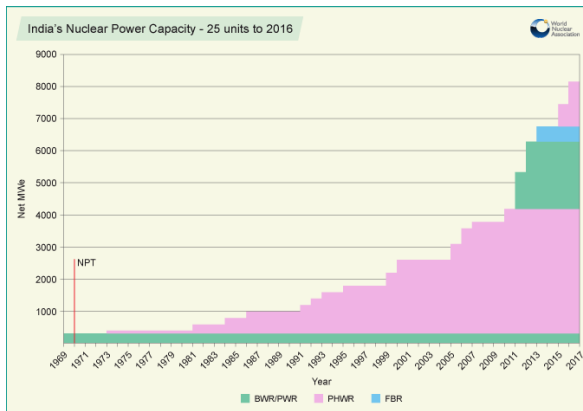
Of course safety is an issue: we need to build reactors that turn off, not heat up, when something breaks. This is called 'passive nuclear safety'.

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:

India's Nuclear Power Capacity - 25 units to 2016

China is building reactors too.

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And what can high-tech dreamers do?

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.

We can start doing these things *now*, or wait until weather disasters and crop failures will combine with *declining oil supplies* to force us into action:

World liquids production: ultimate 2000 Gb conventional + 750 Gb non-conventional
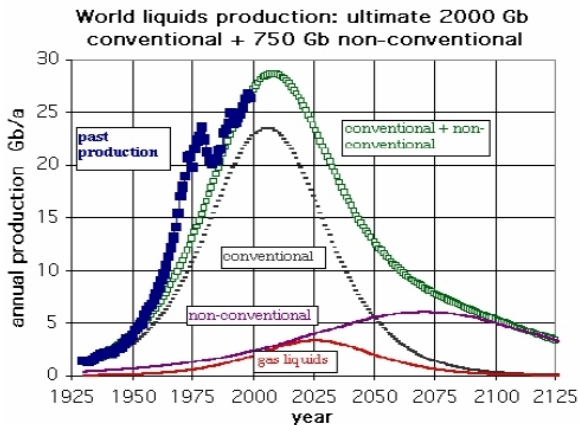
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But I've cut back immensely... and I'm happier.

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We need clear thinking and a good understanding of the facts now more than ever. If you teach for a living, *that's your big chance to do something to save the planet*.

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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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