LEARNING TO LIVE
ON A FINITE PLANET
Robert Fogel - *The Escape from Hunger and Premature Death, 1700-2100*
Carbon Dioxide Variations

The Industrial Revolution Has Caused A Dramatic Rise in CO$_2$

Antarctic ice cores and other data — Global Warming Art
Reconstruction of temperature from 73 different records — Marcott et al.
With just 3°C of warming, the US National Academy of Sciences expects that:

▶ 9 out of 10 northern hemisphere summers will be warmer than 1 out of 10 in 1980-2000.
▶ Much more land will be burned by wildfires in parts of Australia, Eurasia and North America.
▶ Extreme precipitation events will increase by 9-30%.
▶ Rainfall in some dry regions will drop by 15-30%.

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Acting as if these are true inevitably brings us to a point where they *stop* being true.
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For better or worse, we *will* adapt to life on a finite-sized planet.

It’s just a question of how.
What can we do? Slowing the rate of carbon burning is not enough: most CO₂ 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.
Some examples of wedges:

- Wind: Replace 700 gigawatts of coal-fired power plants by wind power. Starting in 2012, this requires multiplying existing wind power by 7 by 2054. This is a 5% average annual growth rate. But the growth rate is now 20%.

- Solar: Replace 700 gigawatts of coal power by solar power. This requires multiplying solar power by 20. This is a 7% average annual growth rate. But the growth rate is now 40%.

- 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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**Meinshausen** estimates cutting current emissions in half by 2050 leaves a 12%–25% chance of a rise of 2°C or more.
Some good news: McKinsey & Co. has argued that the world could cut carbon emissions by **10 gigatonnes per year** at roughly no net cost — all of Pacala and Socolow’s wedges!

![V2.1 Global GHG abatement cost curve beyond BAU – 2030](chart-url)
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But, this requires doing *many things, half of which cost money.*
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*_No physical quantity can grow exponentially forever in a finite system._ We are living on a finite planet.

We need to create an intelligent economic system, which recognizes this fact.
To lighten our impact on the Earth, we should move from:

- a matter economy to
- an energy economy to
- an information economy to
- a knowledge economy to
- a wisdom economy.
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LET’S GET STARTED!

Look up Azimuth Project for more.