Energy and Environment

Bad Policies and Smart Solutions

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Making a better world

- Rational, not fashionable
  - Doing good vs. feeling good
- Remove our myths
  - Panic is unlikely to be a good guide to making smart choices
- Spend our money best
  - Overworrying about some things mean underworrying about other things

We Care About Global Warming

But scaring people silly doesn't actually help

Higher mortality with heat?

- Absolutely more heat deaths
- Number of deaths
  - Dying from increased heat in the UK by 2050
    - 2,000 more
  - But cold deaths in the UK by 2050
    - 20,000 fewer
  - This also holds true globally
    - Net more than 1.4 million *fewer* deaths by 2050

Bosello, Roson, & Tol, 2006; Keatinge & Donaldson, 2004; Keatinge et al., 2000

Better policies against heat
Policy innovation

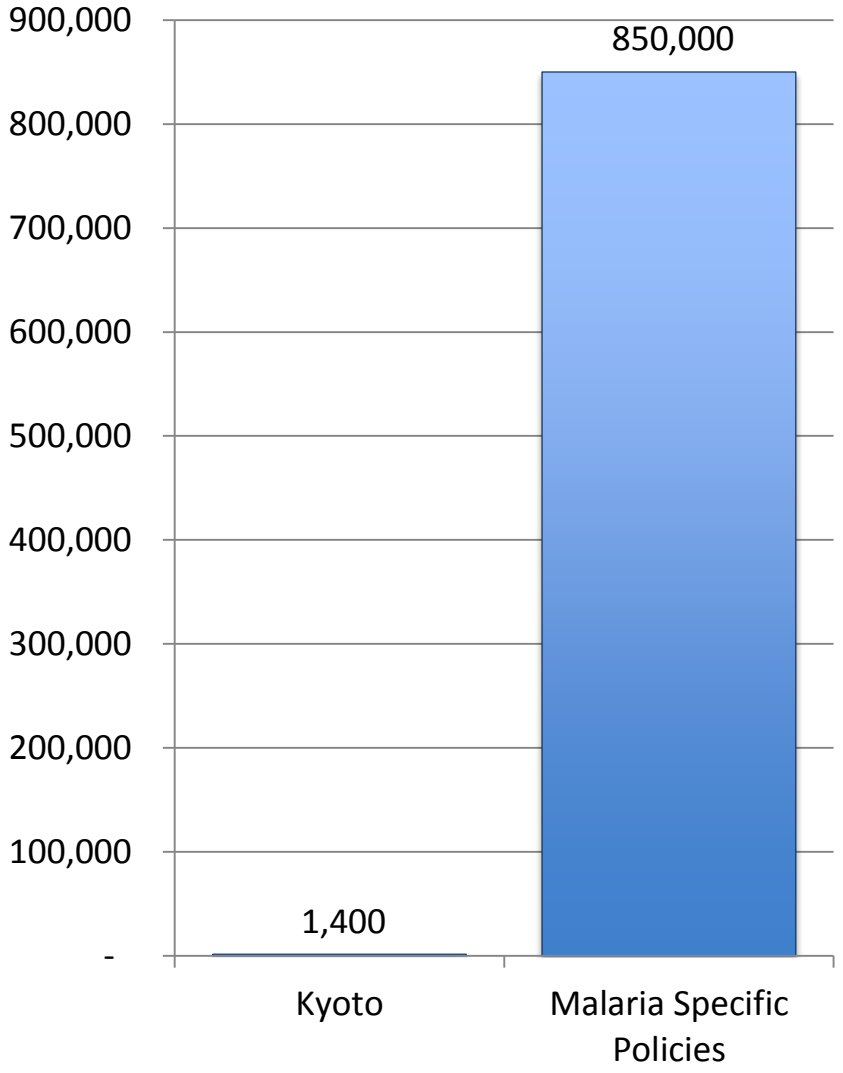
- Almost no heat deaths in the US
  - Because of air conditioning
- Cities much warmer than countryside
  - Lack of water, more black surfaces
  - Take London:
    - Add more water and greenery
      - 8^{o}C reduction in heat waves
    - Make more light surfaces – paint the tarmac
      - 10^{o}C reduction in heat waves

More malaria from heat?

- Malaria is weakly correlated to *heat*
- But strongly correlated to *wealth*
  - So what should we focus on?
    - Temperature?
    - Treatment?

Which knob to tackle malaria?

- Deaths avoided per year
  - Kyoto $180bn
  - Malaria $3bn



Yet, Why Not Just Get Off Fossil Fuels?

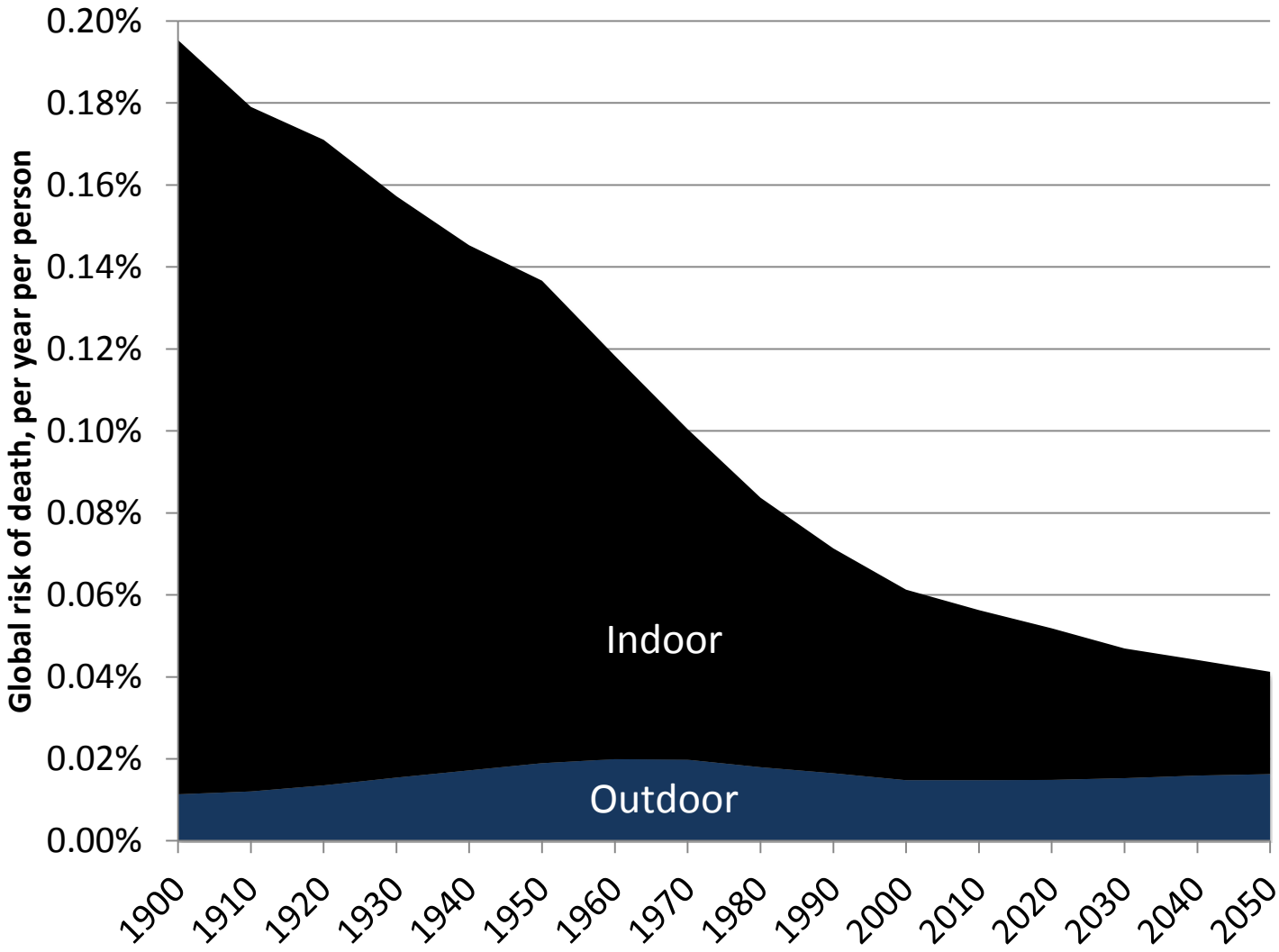
Not so easy

Why Fossil Fuels?

- We don’t burn fossil fuels to annoy Al Gore
  - Fossil fuels provide everything we like about civilization
    - Heat, cold, transport, food, electricity
  - Gives us power that we never had before
    - Why was it fun to be Louis XIV?
      - Average European have the power of 150 people 24x7
      - Americans 300 people, Indians 15

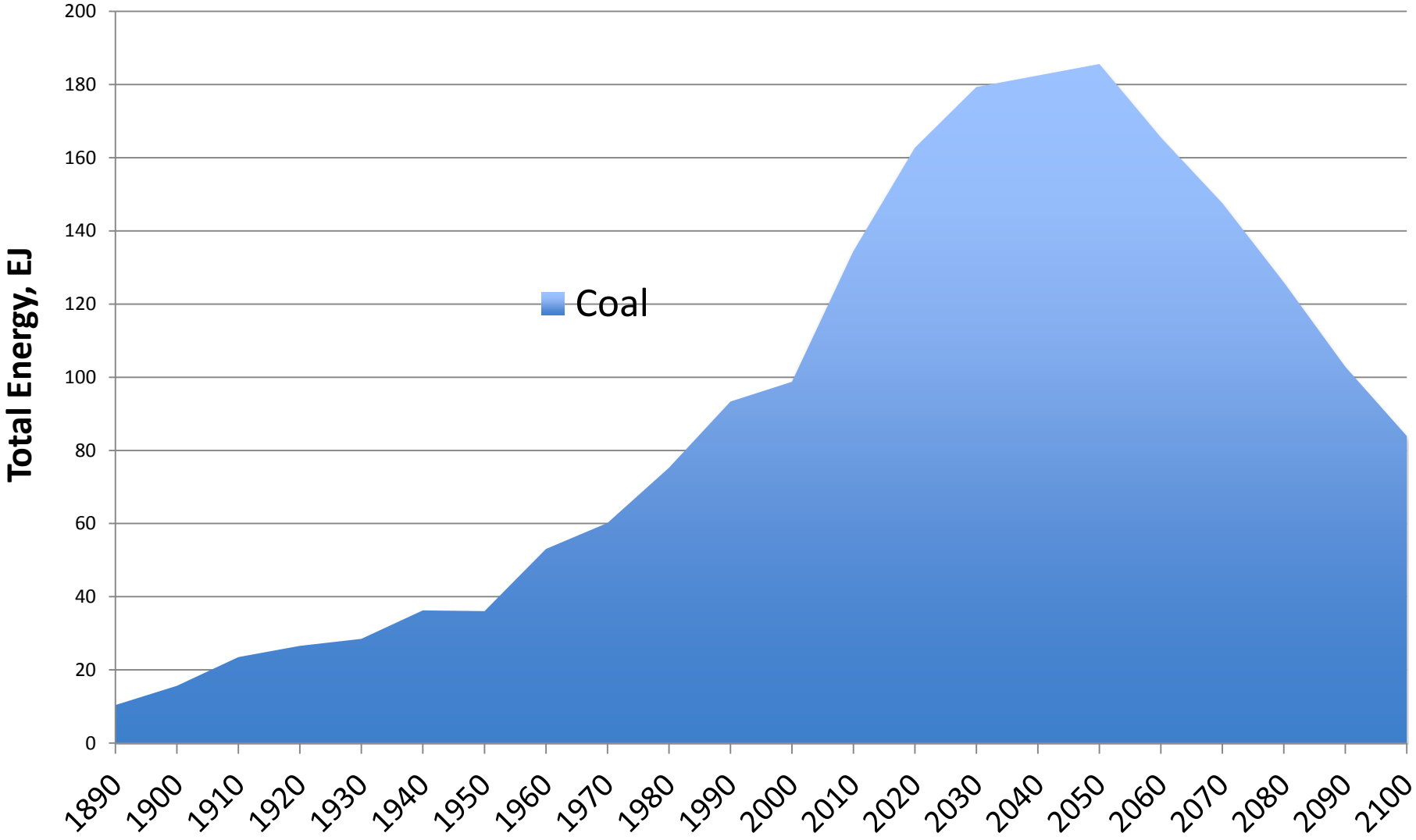
What is the world's biggest environmental problem?

Air pollution, 1900-2050



Hutton 2013

Global Energy, 1890-2100



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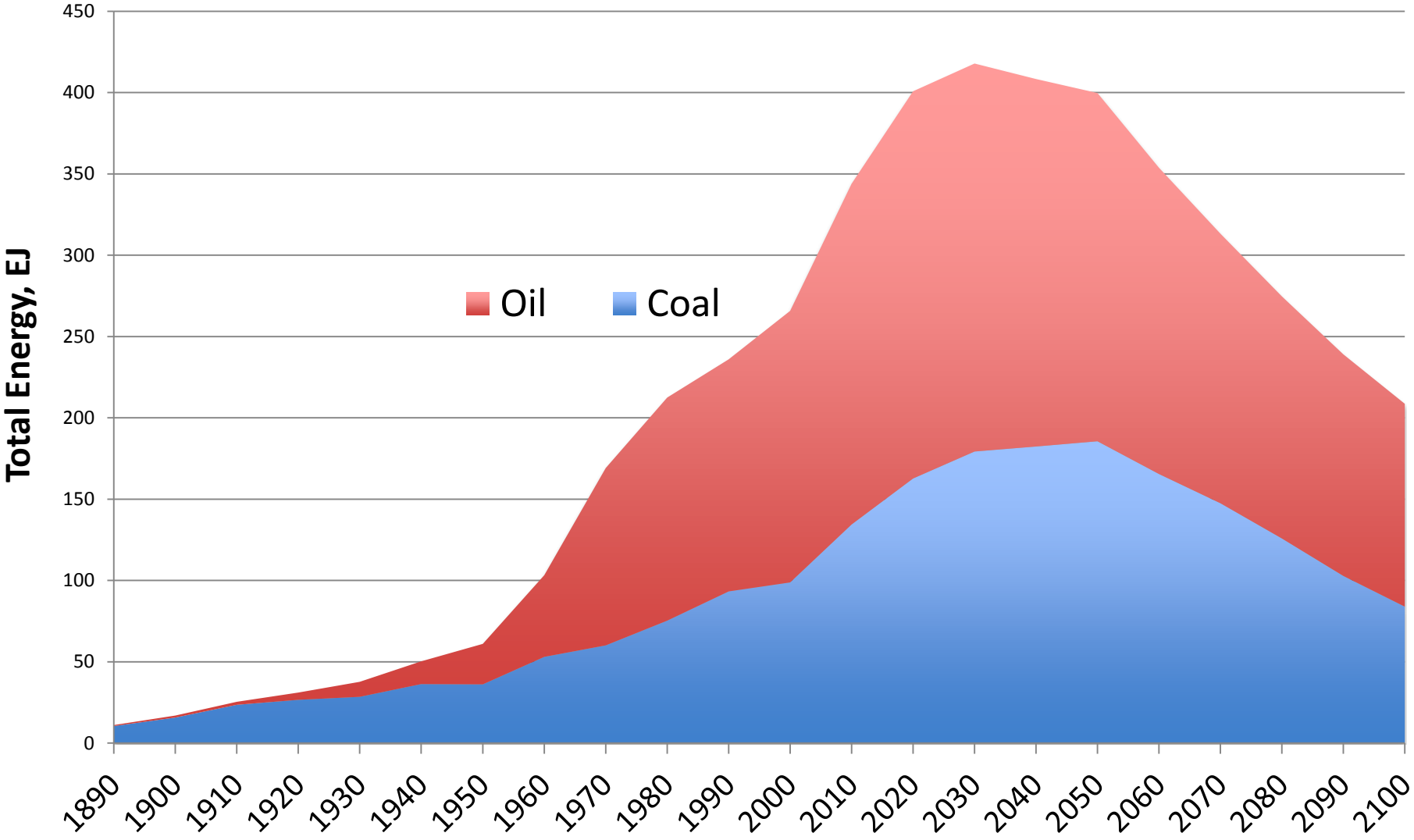

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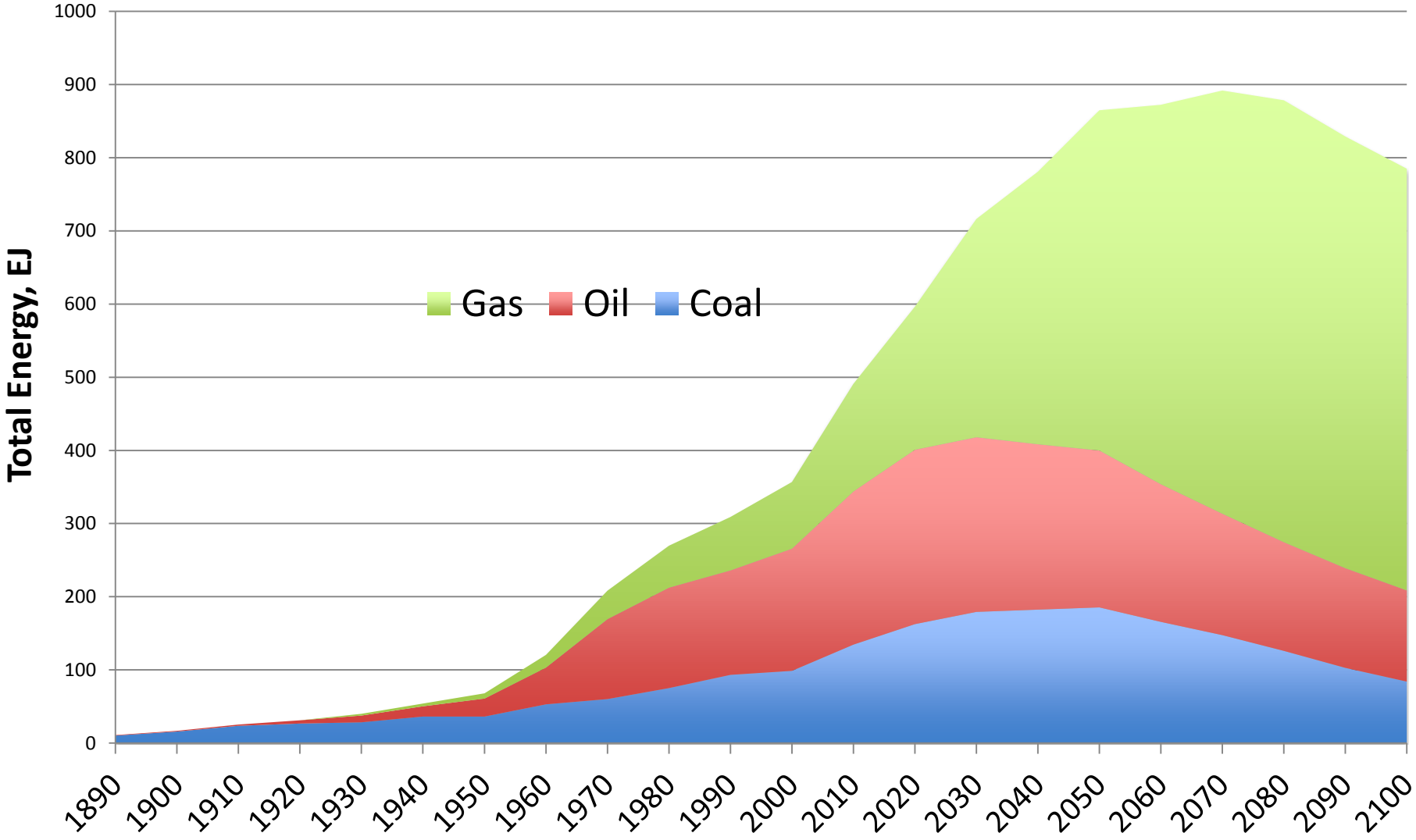

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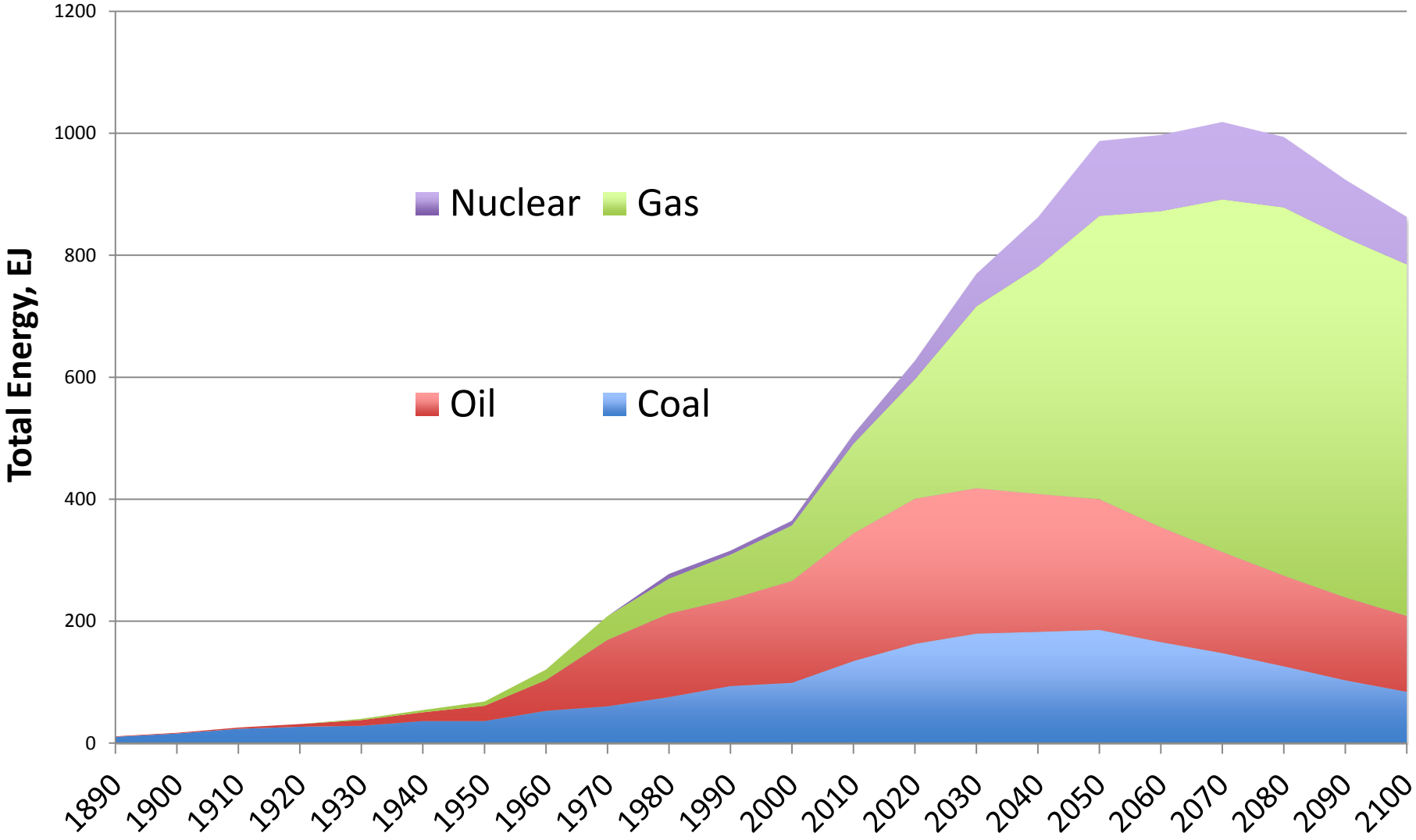

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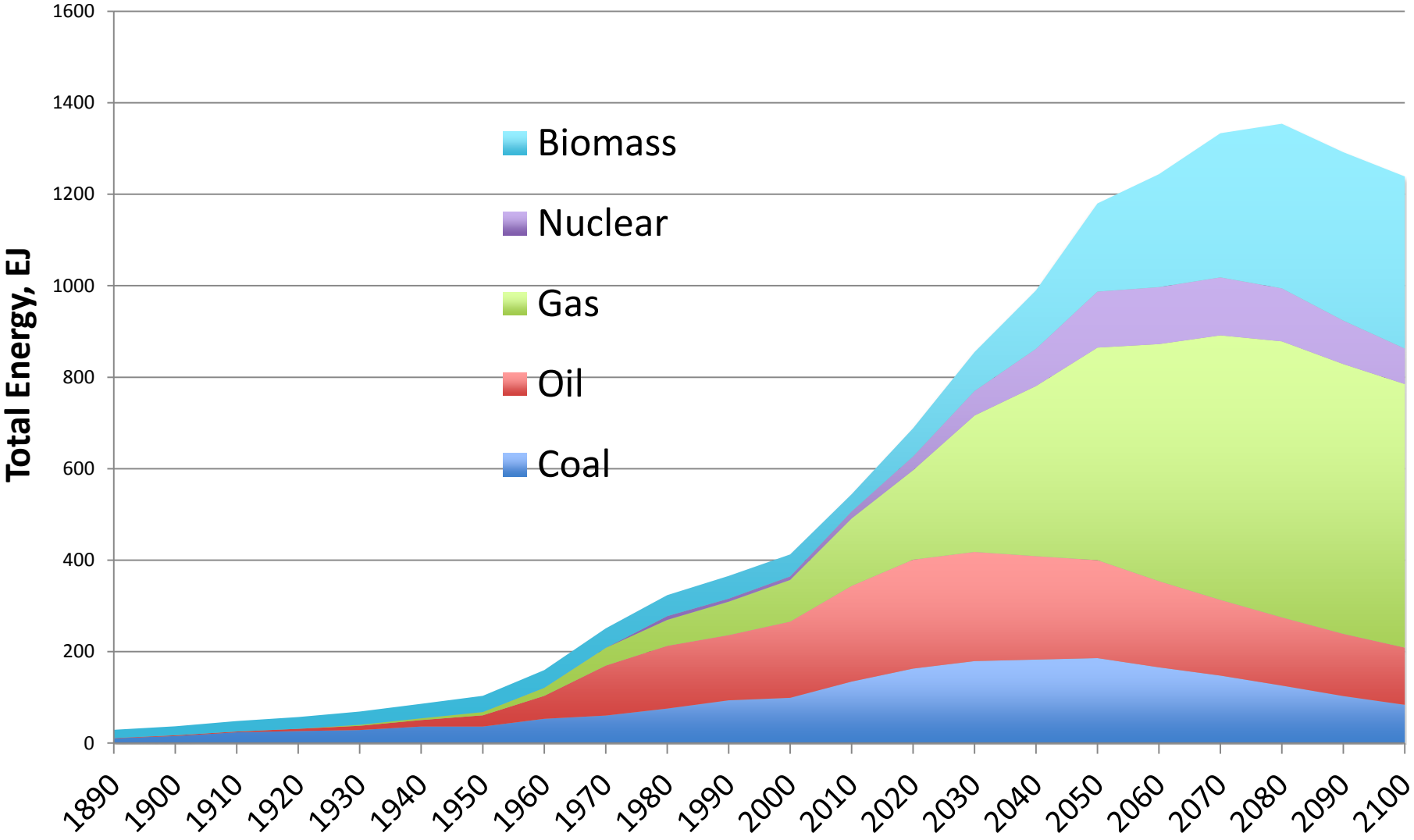

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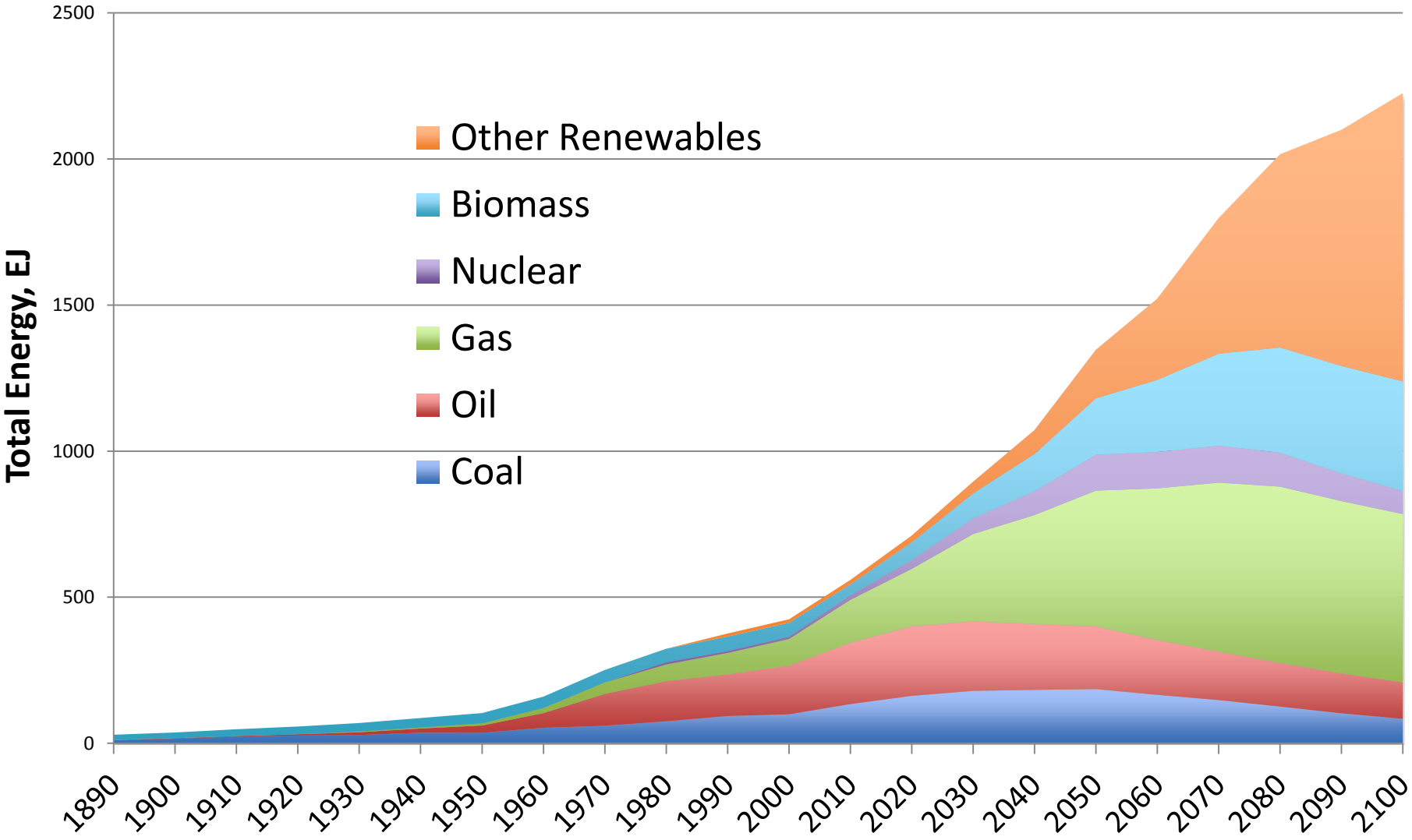
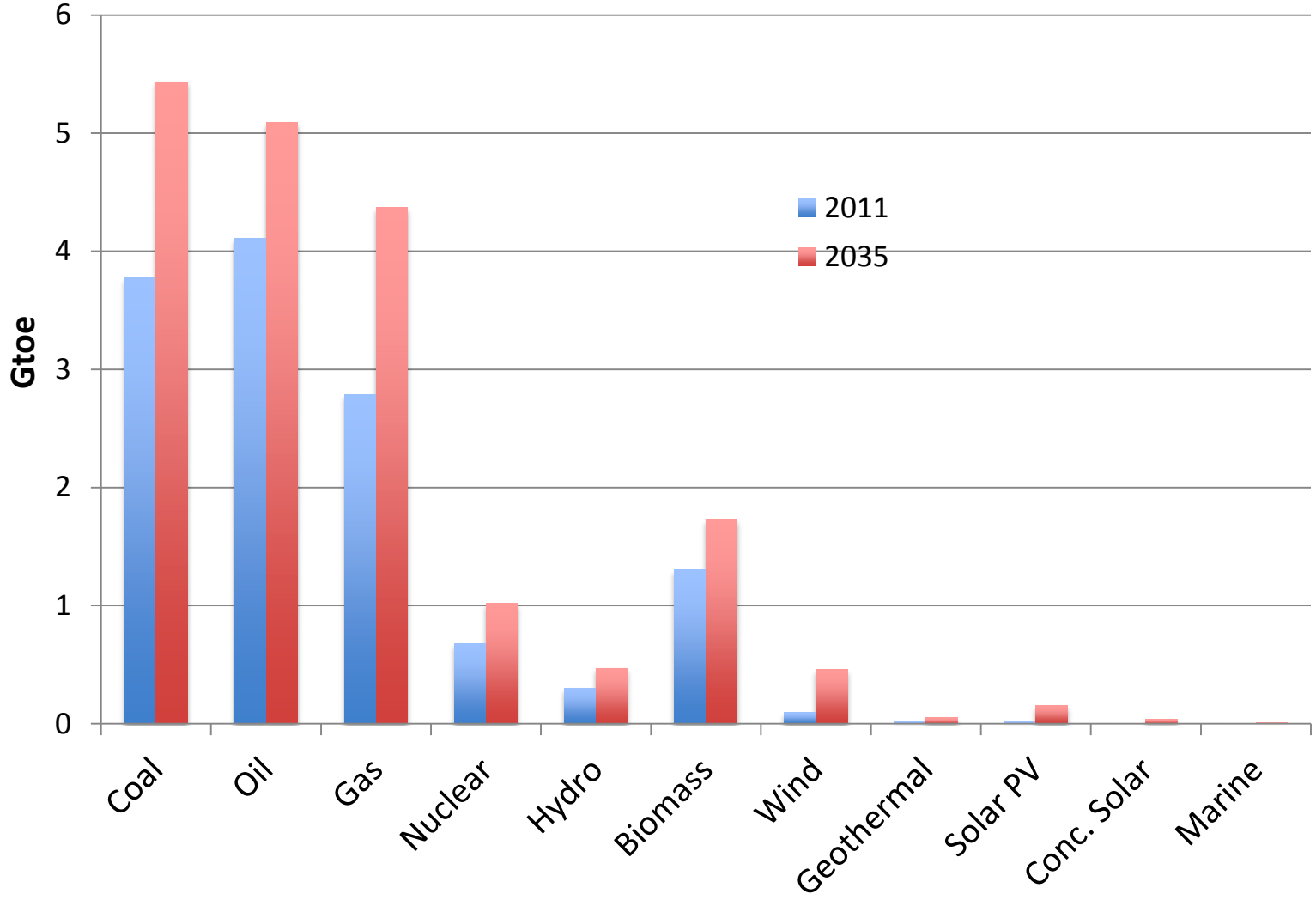
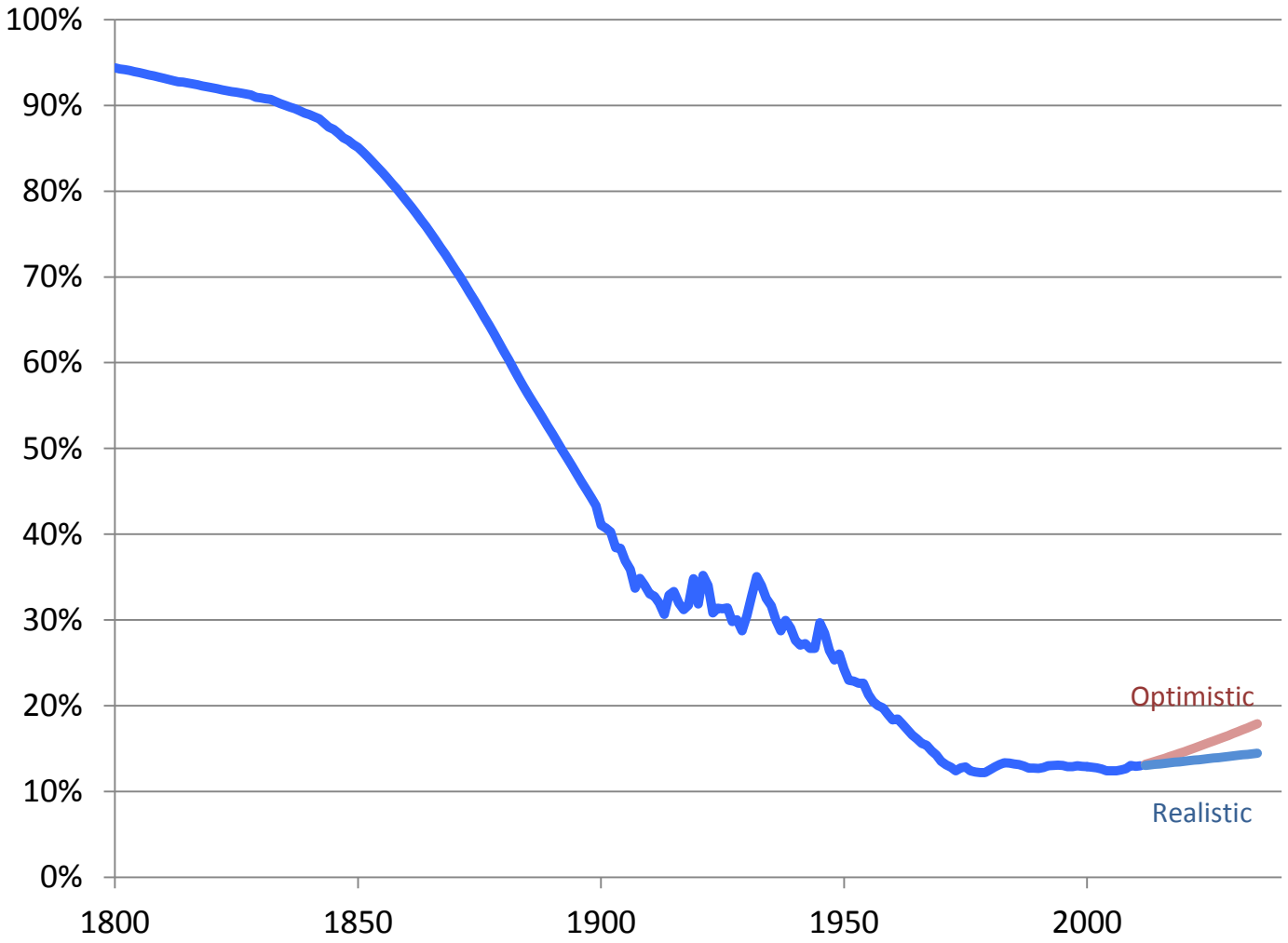


Fuels in 2011 and 2035

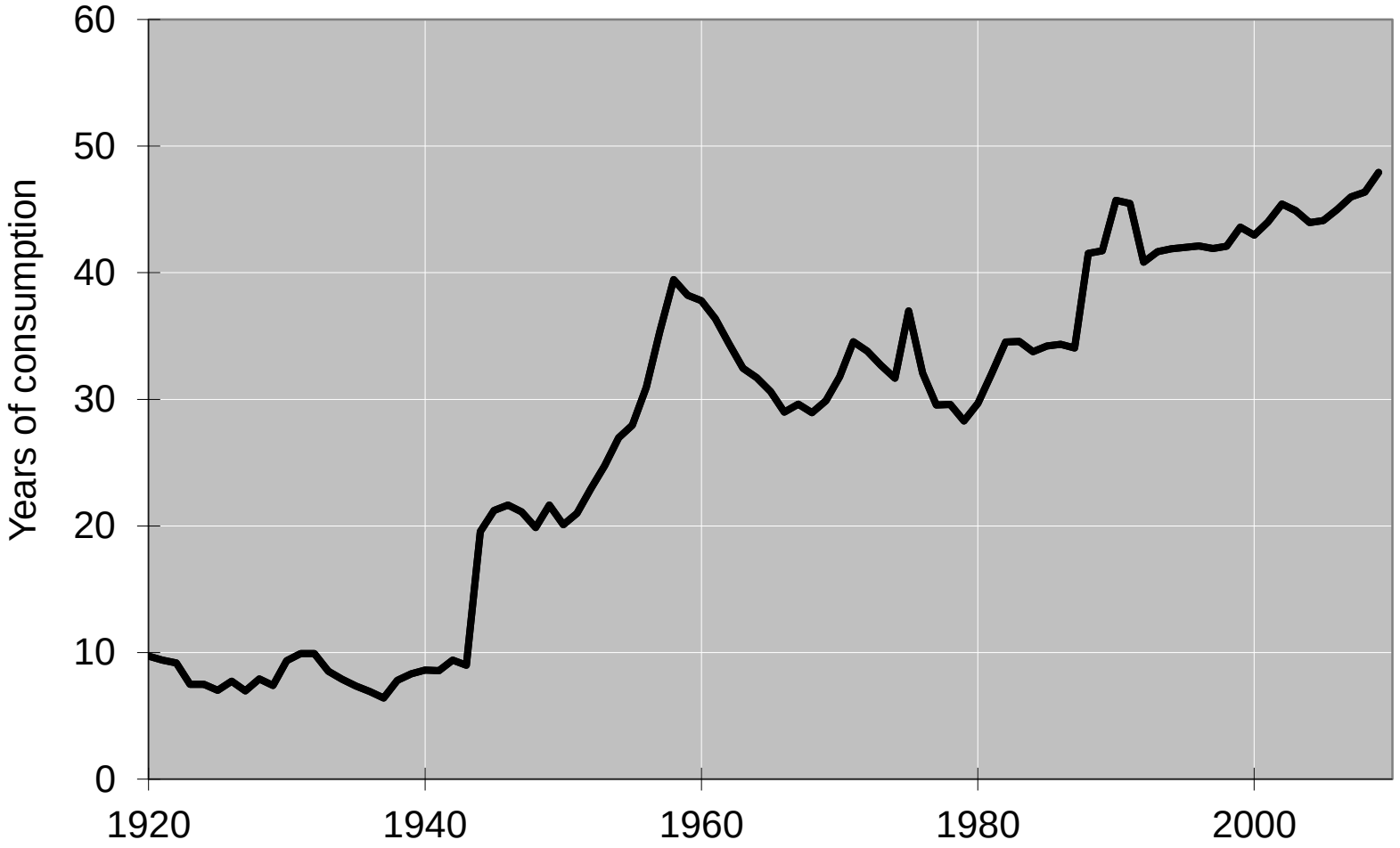


IEA 2013

Global Share of Renewables 1800-2035



But, Aren't We Running Out of Oil?

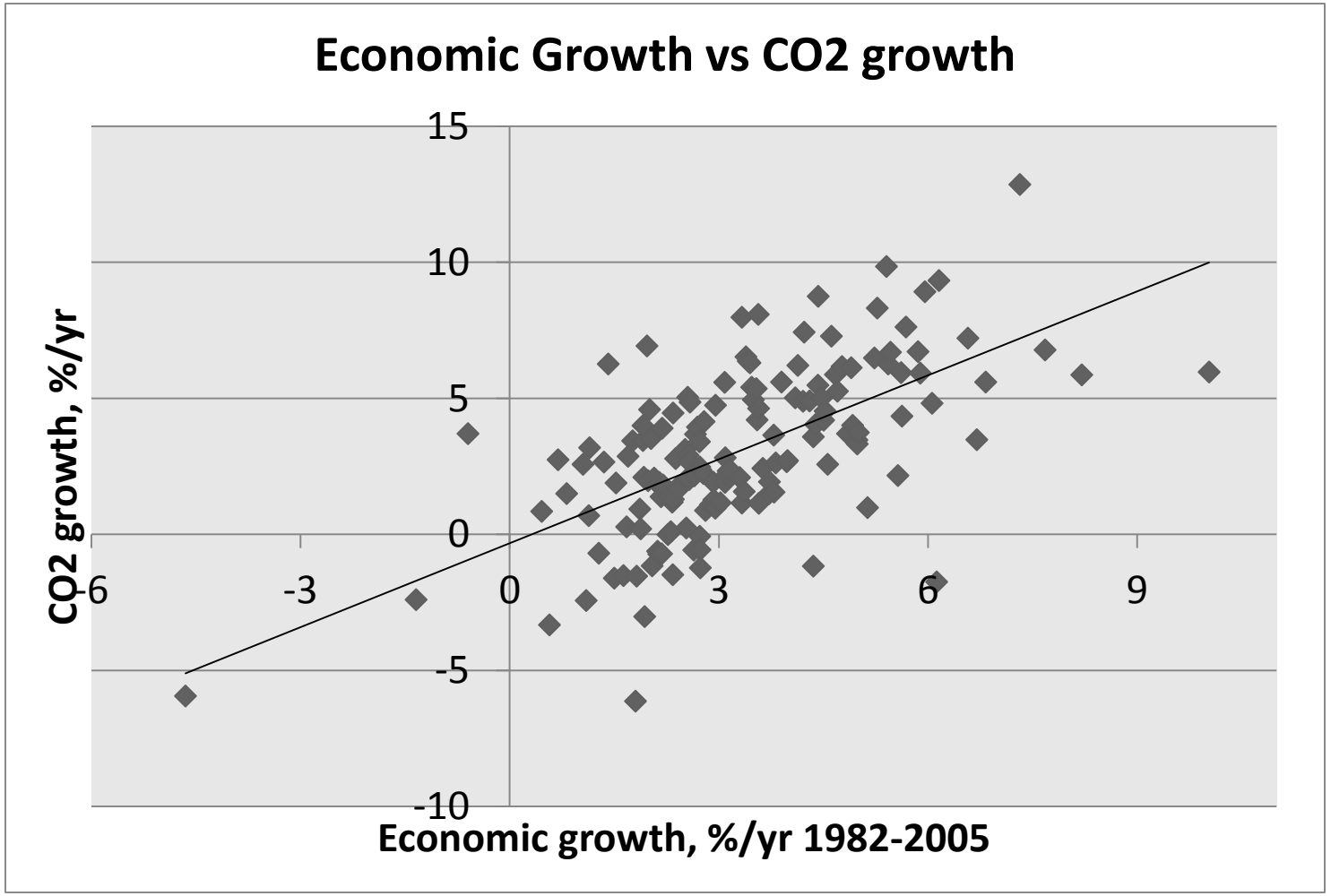


Simon et al. 1994 & EIA 1997, 1999, 2000, 2012

Cutting CO_2 Hasn't Worked So Far

Rio, Kyoto, EU 20-20 etc.

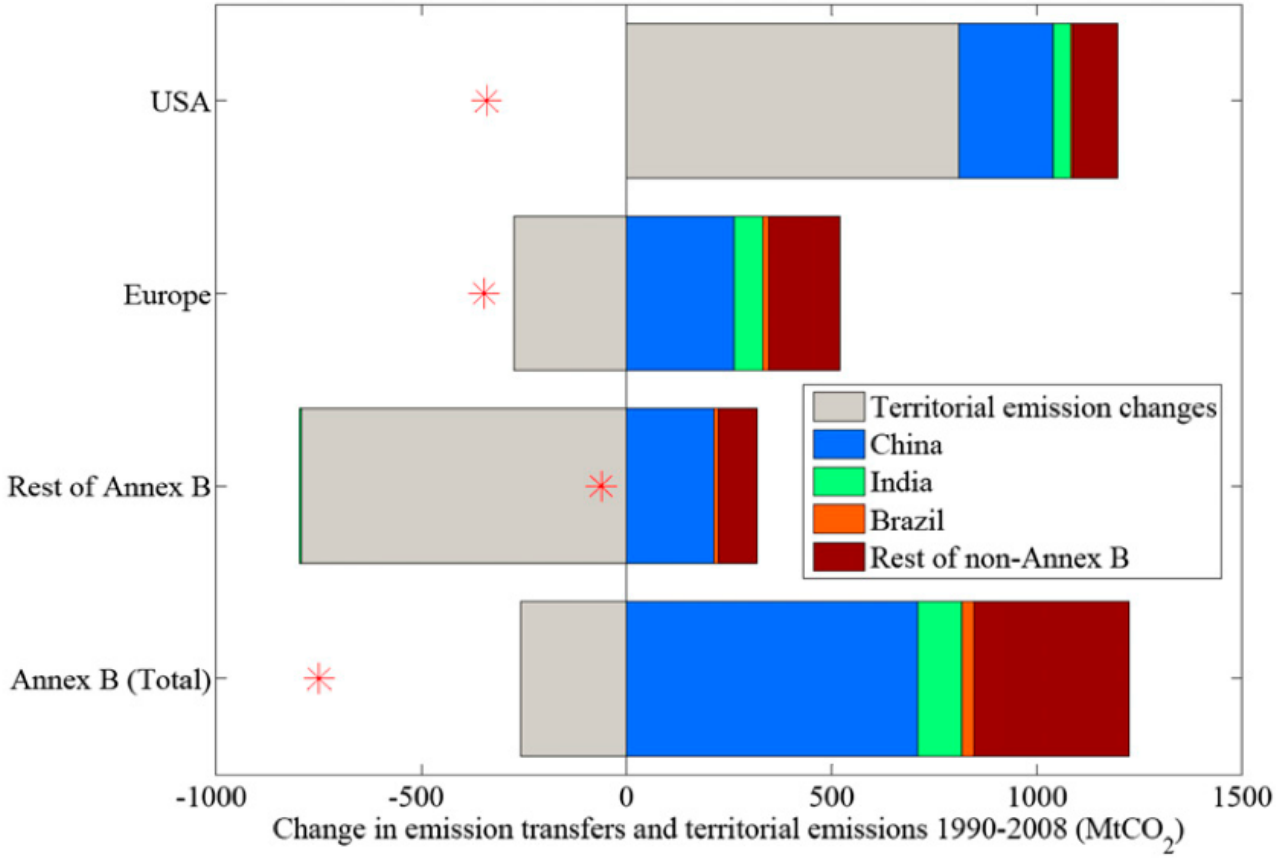
For a very simple reason: Cutting CO_2 is expensive



OECD 2009

But EU lived up to Kyoto?

- Yes
  - But mostly by 'cheating'
  - Outsourcing to China



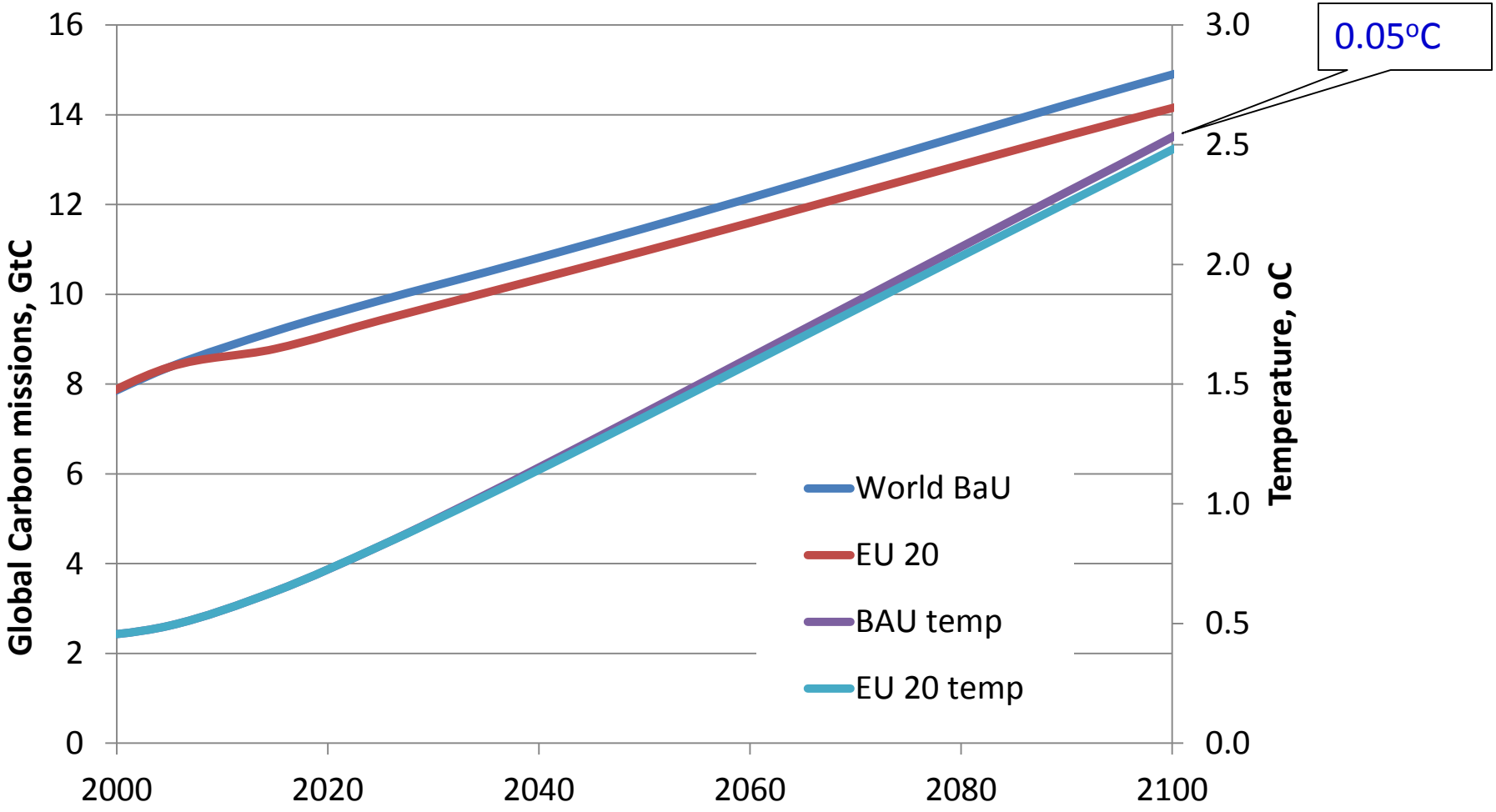
Peters et al. 2011

EU 20-20 policy

- Reduce emissions 20% by 2020
- Renewables to 20% share
- Cost estimates from 5 models
  - $250 billion annually 2020-2100
  - Cost across the century is $20-30 trillion
- For every $1 spent, the EU will avoid ¢3 of global climate damage

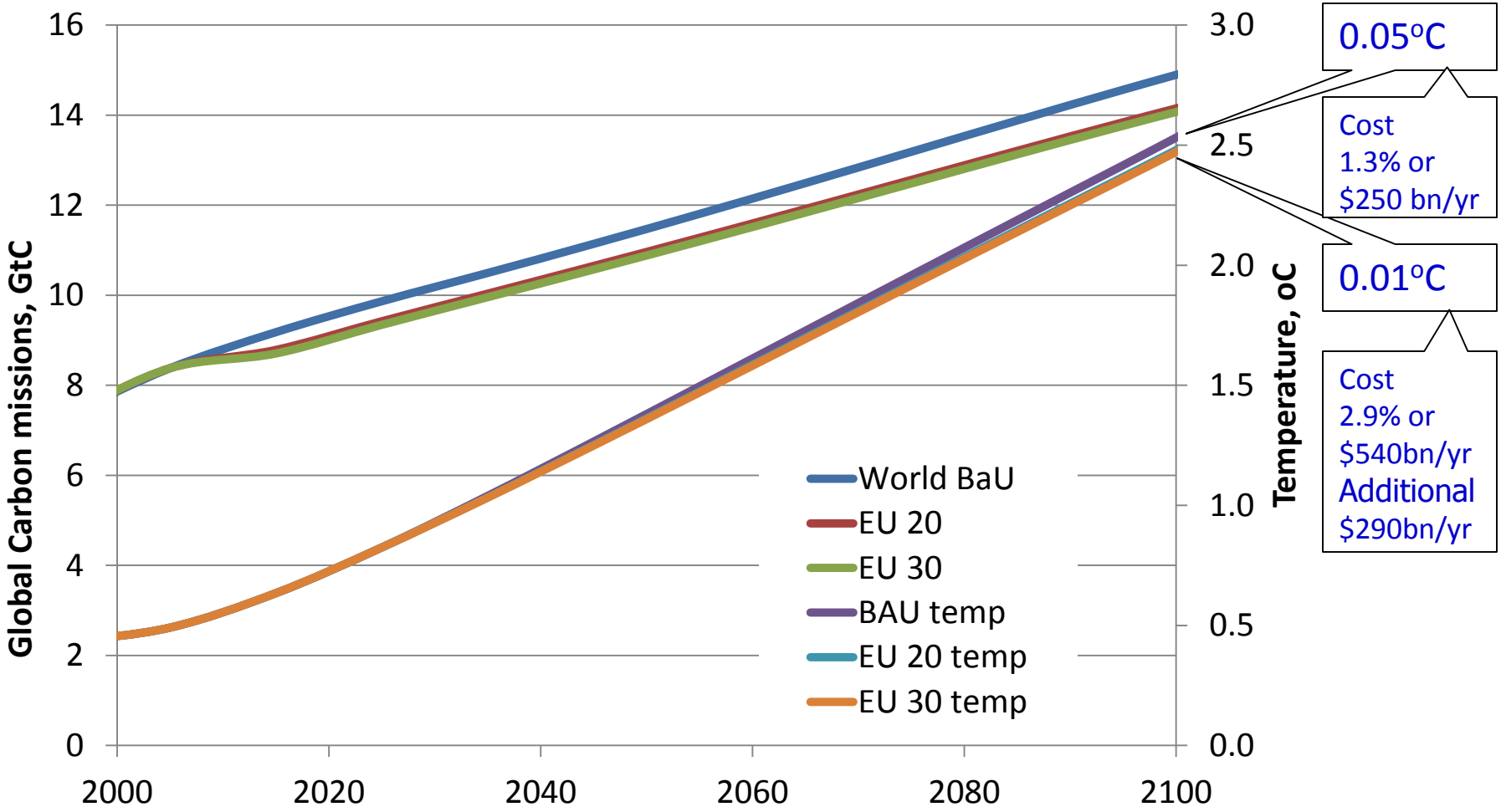
Böhringer et al 2009, Tol 2012

Climate effect of EU 2020



Nordhaus 2006

Climate effect of EU 2020, 30%



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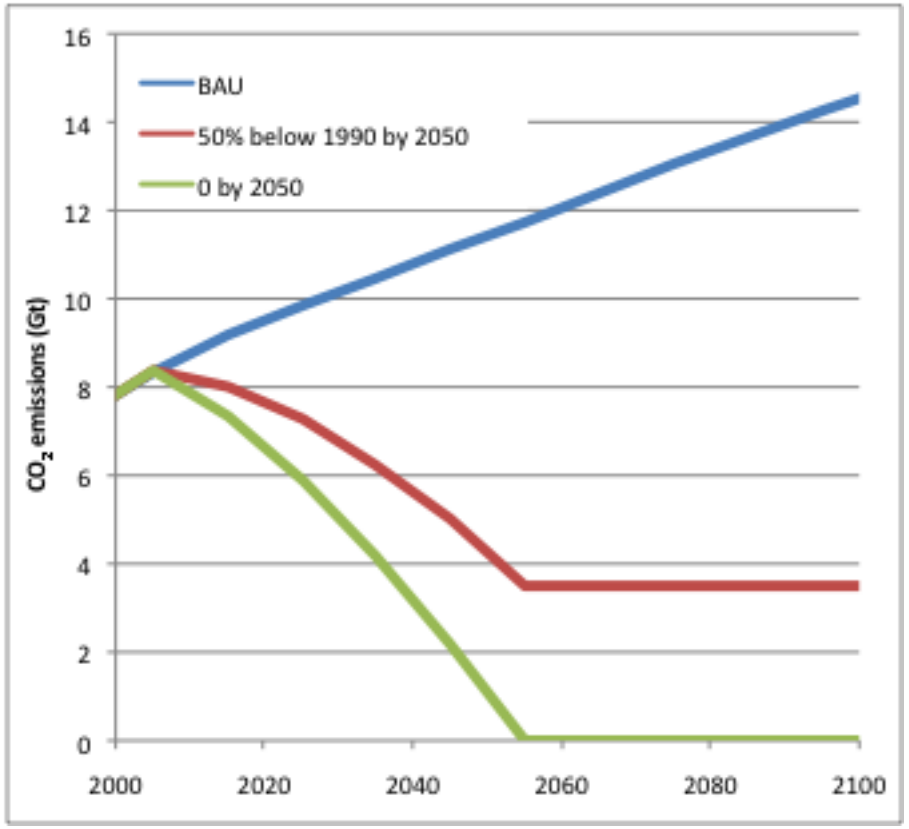
CO2-reductions: Unrealistic and inefficient



- BAU
  - Continues up like past 50 years
- 50% below 1990
  - Best conceivable outcome
  - A bit like Somalia
  - Expensive (12.9% GDP, $40 trillion/yr)

Nordhaus 2006

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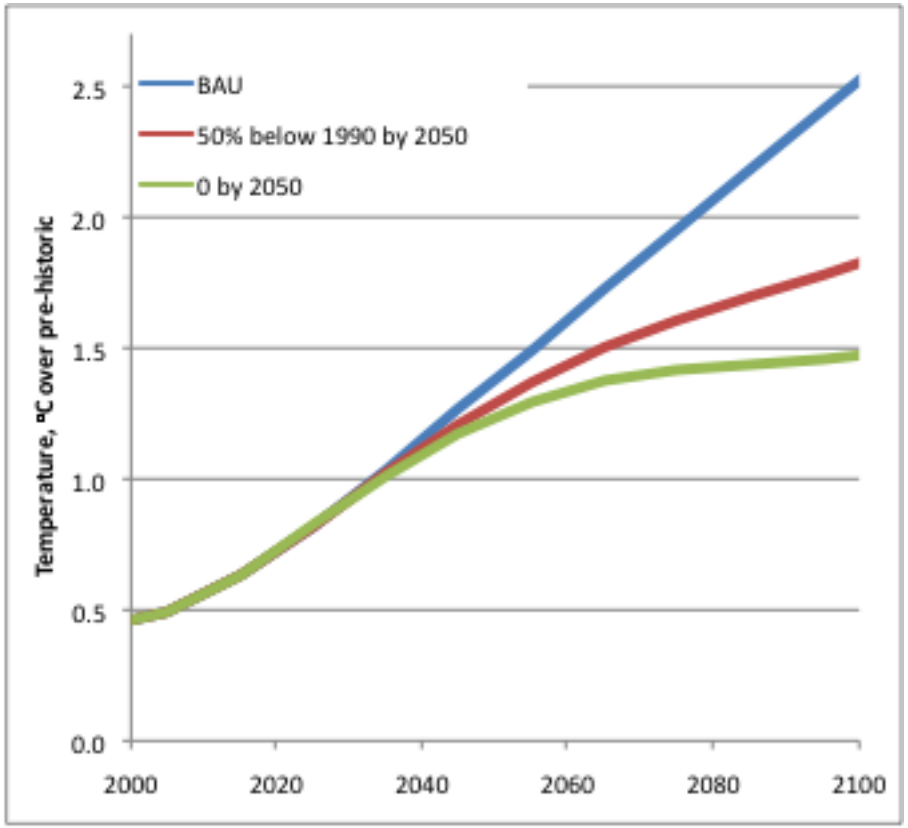

- Even very large cut
  - No effect by mid-century

Nordhaus 2006

How do we reduce emissions 50% below 1990 in 2050?

1. **30 new nuclear plants (30GW)**

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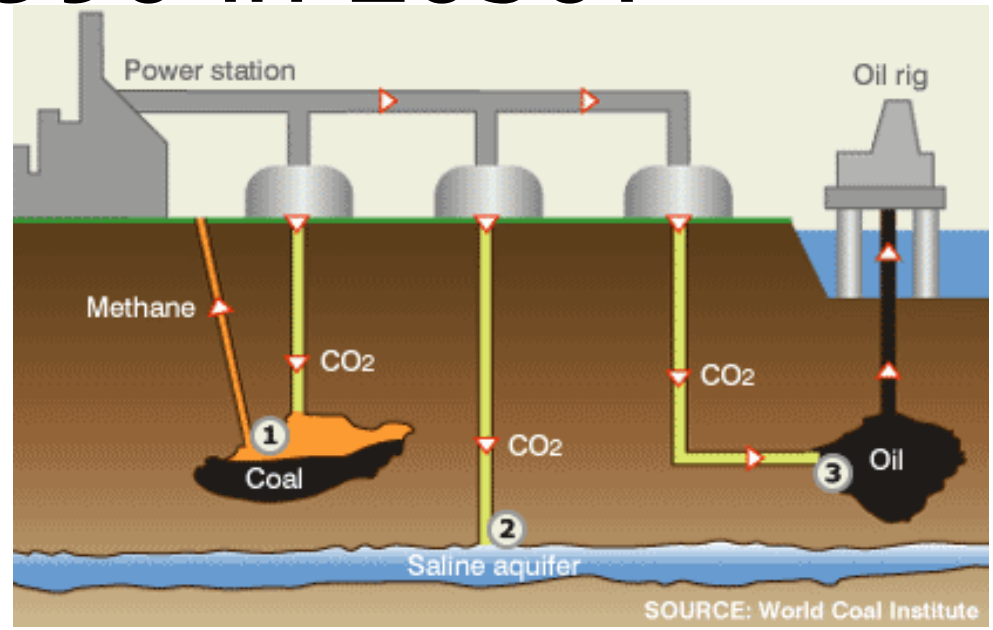
1. 30 new nuclear plants
2. 17,000 wind mills
3. 400 biomass power plants
4. **Two Three Gorges dams (50GW)**

How do we reduce emissions 50% below 1990 in 2050?

1. 30 new nuclear plants
2. 17,000 wind mills
3. 400 biomass power plants
4. Two Three Gorges dams
5. **42 coal and gas with CC (28GW)**



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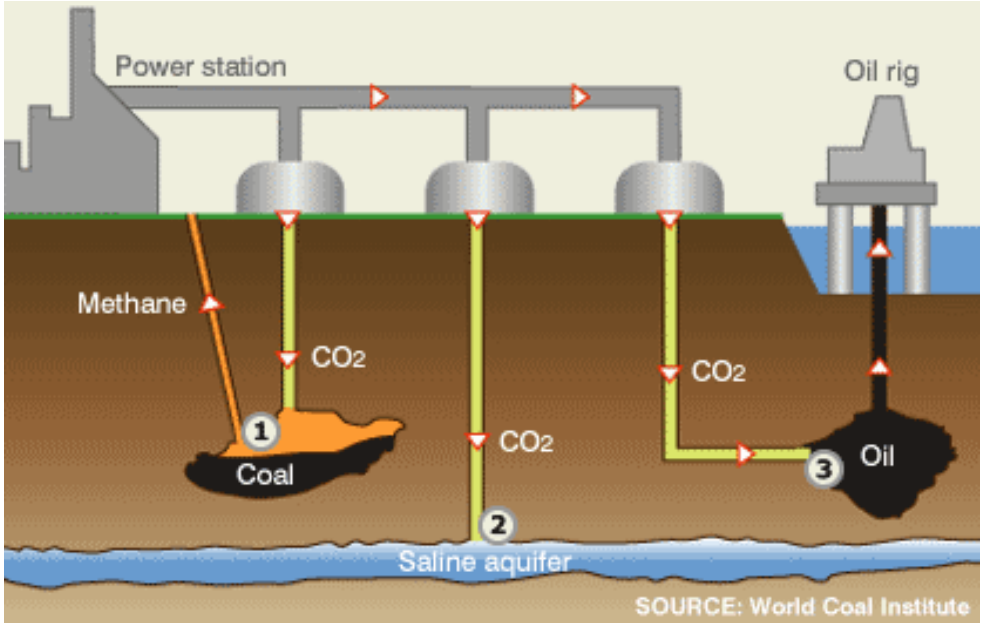

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- **REPEAT *EACH AND EVERY YEAR* TIL 2050**

We Need Smarter Ways Forward

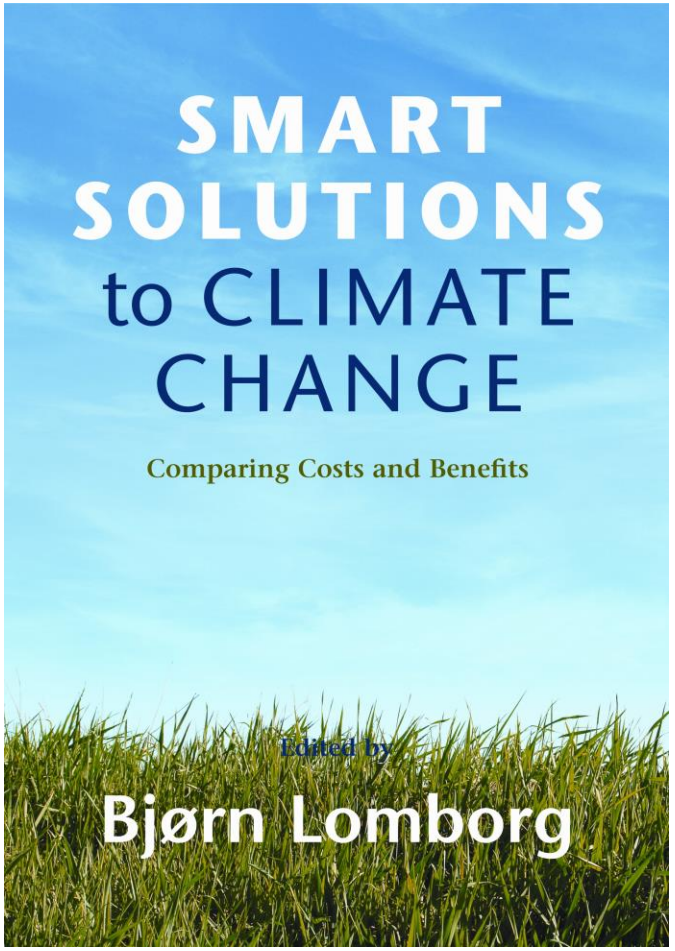
Environment meets economics

Polar Bears

- Are the polar bears in trouble?
  - Yes, less ice means fewer polar bears, *but*
    - Global population *increasing*
    - 1960: about 5,000
    - Now: about 22,000
- But what can we do?
  - If we implement the Kyoto Protocol
    - Save 1 polar bear each year
  - But each year we shoot polar bears
    - 300-500 each year

Tackling climate

- Four ways
  - Cut emissions
  - Green R&D
  - Geo-engineering
  - Adaptation



Cut emissions

- Fundamental facts
  - Not going to happen in any major way anytime soon
  - As long as green energy is more expensive than fossil fuels it won't be used
    - If it was cheaper, everyone would use it

Thanks to Germany: How not-to

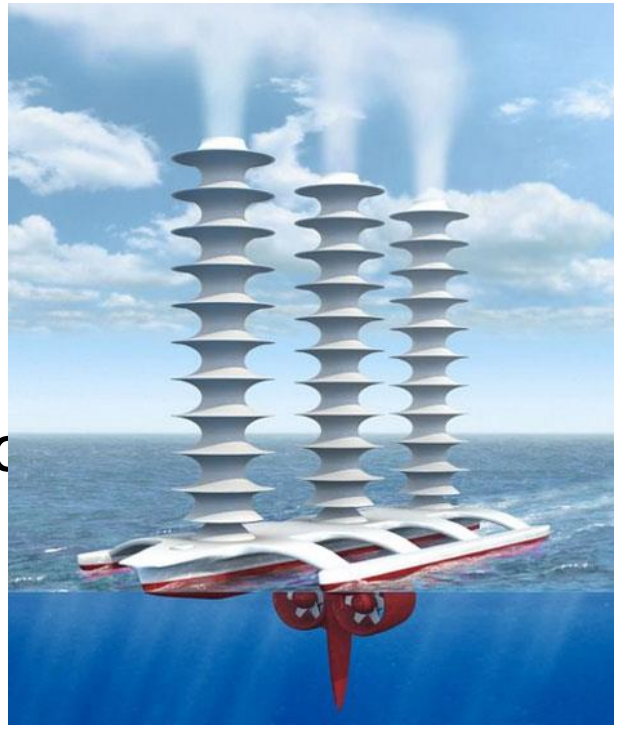
- German solar policies
  - The largest per cap PV capacity in the world
  - Fulfills 0.7% of total primary energy
  - Cost is about $130bn so far
    - Effect is to postpone global warming 37 hrs

Adaptation

- Not as sexy, but much cheaper and quicker to tackle impacts
  - Flooding
  - Heat waves
  - Etc.
- Benefits about $2-3 back on the dollar

Geo-engineering

- Only way to buy insurance
- Shouldn't do now, but we should investigate
- Benefits to research about $1000 back on the dollar
  - If it works, we could potentially all of climate change for $6 billio



Green R&D

- Unless we make green energy cheaper we will never cut back on fossil fuels
  - World spends about $10bn/yr on R&D now
  - Nobels suggest spending $100bn/yr (0.2% of GDP – $14bn from China)
    - This would likely make green energy dramatically cheaper than fossil fuels over the next 2-4 decades
- Fix global warming in medium term
- Benefits about $11 back on the dollar