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Macroeconomics II

Lecture 10

The economics of Climate Change and growth

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Theoretical Lecture 10 Climate change and economic effects

- **The Stern Report;**
- **The Paris Agreement on climate change;**
- **Recent discussions.**
- **Portugal: the case of forest fires and systemic impacts.**

Readings:

- ***Stern Report*** (summary available for students in Aquila, report available online)
- NASA site on climate change: https://climate.nasa.gov/
- Stern, N. (2016), **"Economics: Current climate models are grossly misleading",** *Nature*, 24 February 2016, available in:http://www.nature.com/news/economics-current-climate-models-are-grossly-misleading-1.19416
- Core Project, ch 1 (Aquila)

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Long run causes and effects

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difficult systemic solutions

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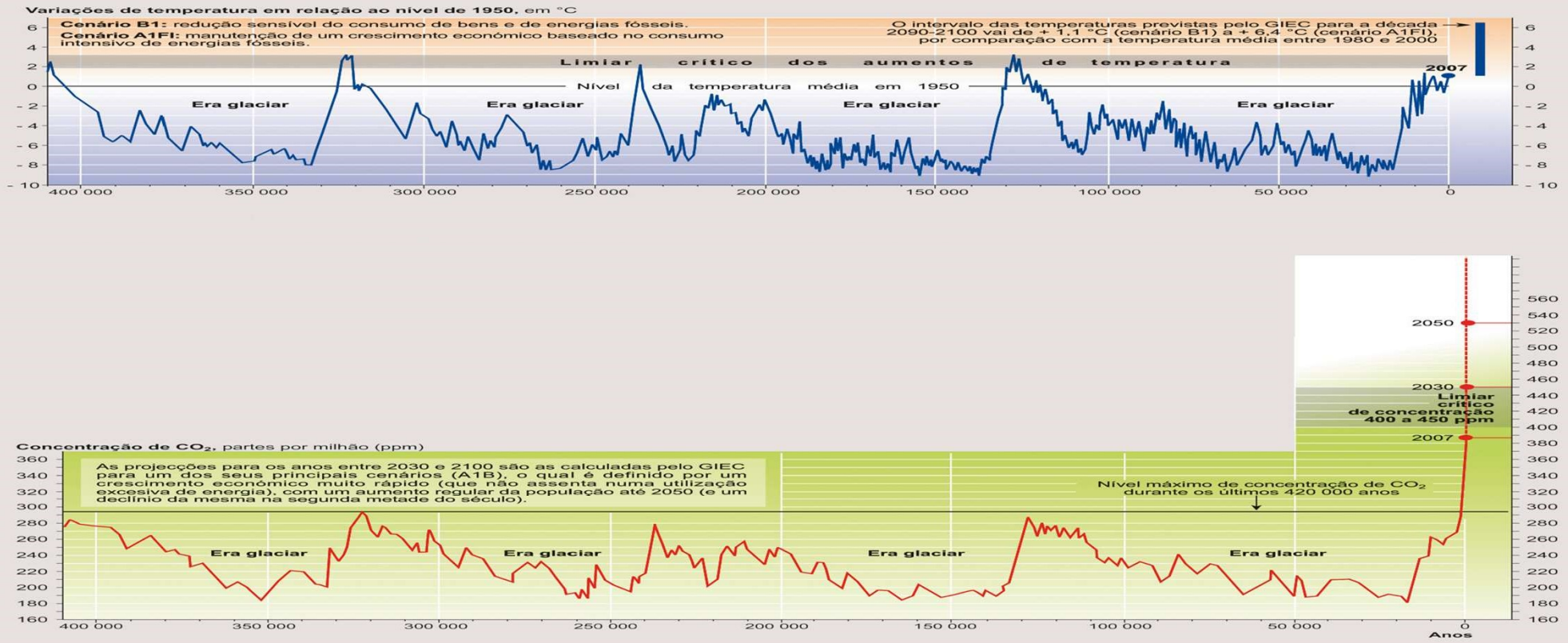
Global warming

GRÁFICO 5.8.
400 000 ANOS DE VARIAÇÕES DE TEMPERATURA



Fonte: Jean-Robert Petit e Jean Jouzel (dir.), "Climate and Atmospheric History of the Past 420 000 Years from the Vostok Ice Core in Antarctica", *Nature*, n.º 399, Maio-Junho de 1999; Grupo Intergovernamental sobre a Evolução do Clima (GIEC), 2001 e 2007; UNEP/GRID-Arendal, 1998. *Monde Diplomatique*, pp. 34, 35.

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A long history and a recent disaster

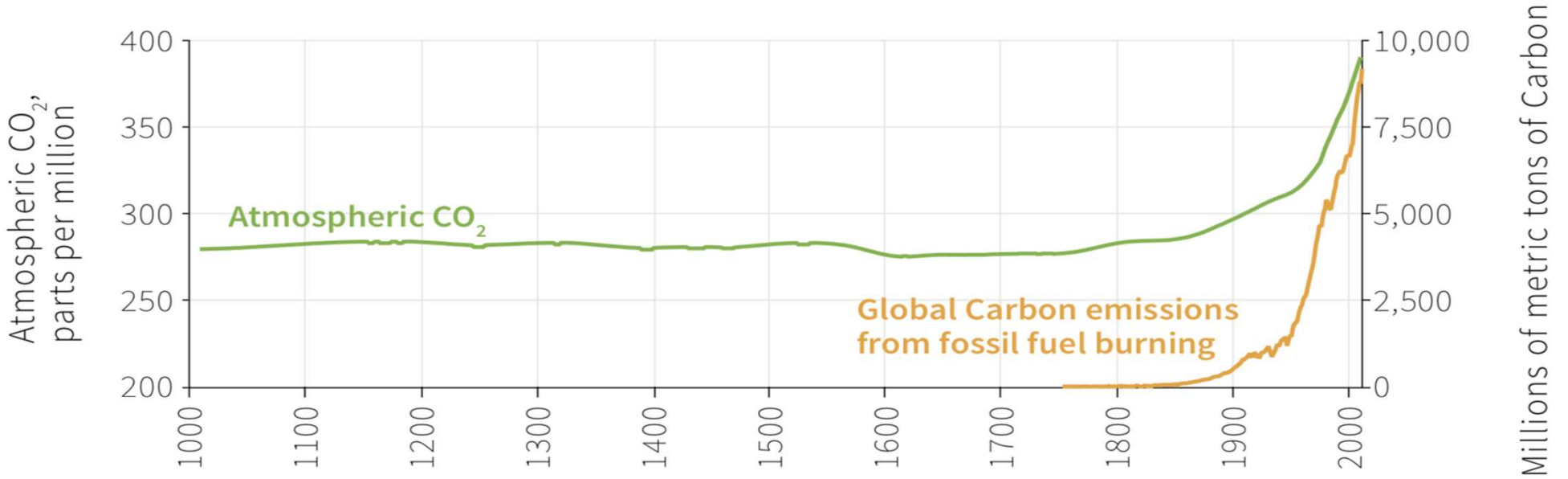

Figure 1.7a *Carbon dioxide in the atmosphere (1010-2010) and global carbon emissions from burning fossil fuel (1750-2010).*

Source: *Years 1010-1975: Etheridge, D. E., L. P. Steele, R. J. Francey, and R. L. Langenfelds. 2012. 'Historical Record from the Law Dome DE08, DE08-2, and DSS Ice Cores.' Division of Atmospheric Research, CSIRO, Aspendale, Victoria, Australia. Years 1976-2010: Data from Mauna Loa observatory. Boden, T. A., G. Marland, and R. J. Andres. 2010. 'Global, Regional and National Fossil-Fuel CO2 Emissions.' Carbon Dioxide Information Analysis Center (CDIAC) Datasets.*

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Just the North for a thousand years

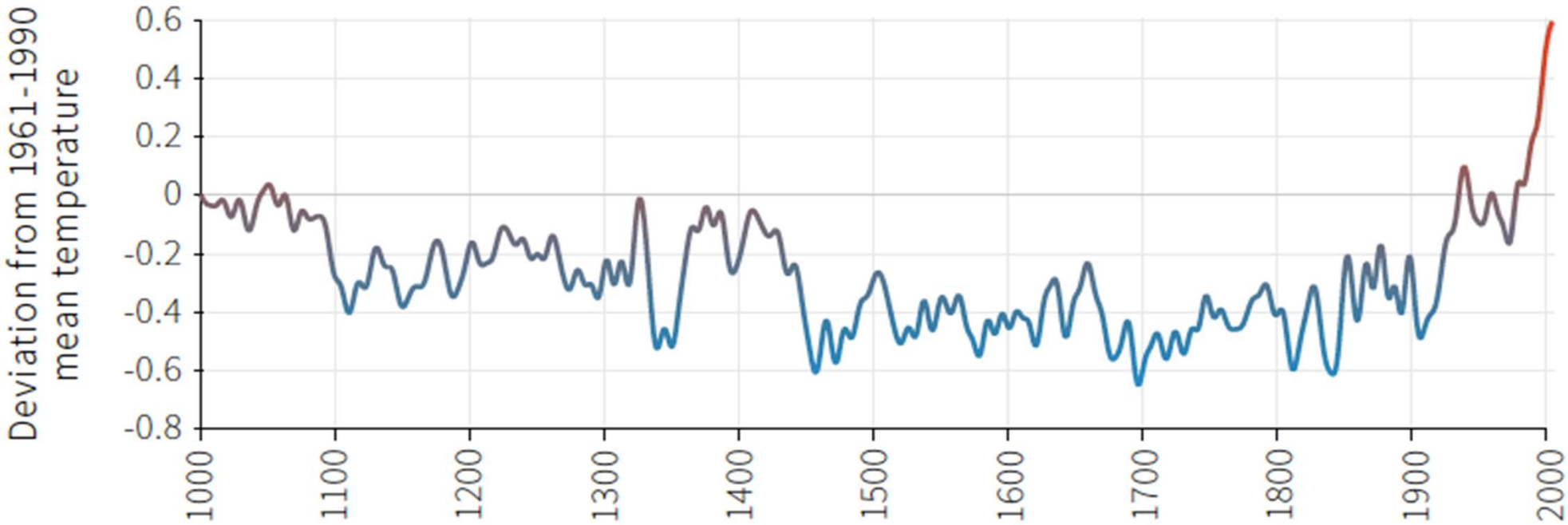

Figure 1.7b *Northern hemisphere temperature over the long run (1000-2006).*

Source: *Mann, M. E., Z. Zhang, M. K. Hughes, R. S. Bradley, S. K. Miller, S. Rutherford, and F. Ni. 2008. 'Proxy-Based Reconstructions of Hemispheric and Global Surface Temperature Variations over the Past Two Millennia.' Proceedings of the National Academy of Sciences 105 (36): 13252–57.*

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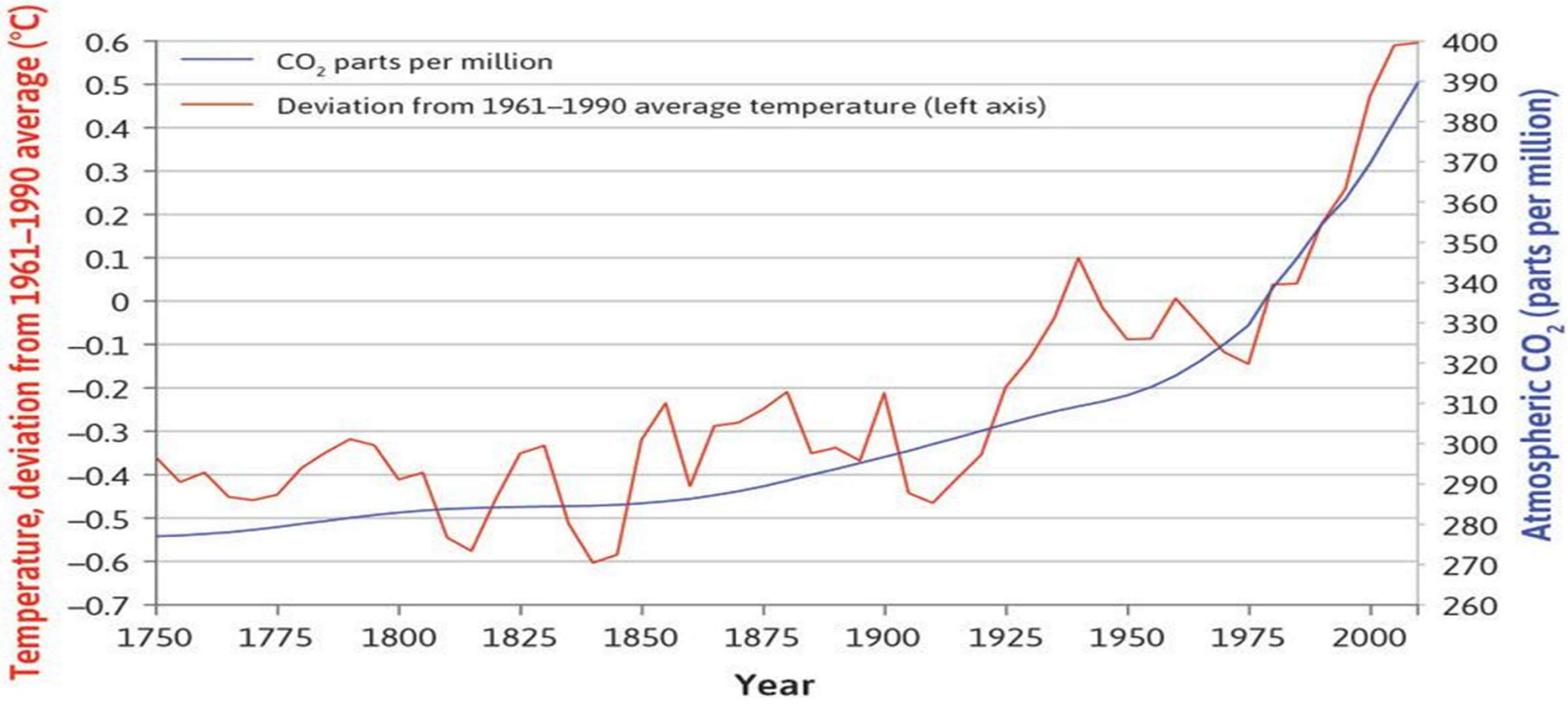
After the industrial revolution:

Concentration of CO2 in the atmosphere



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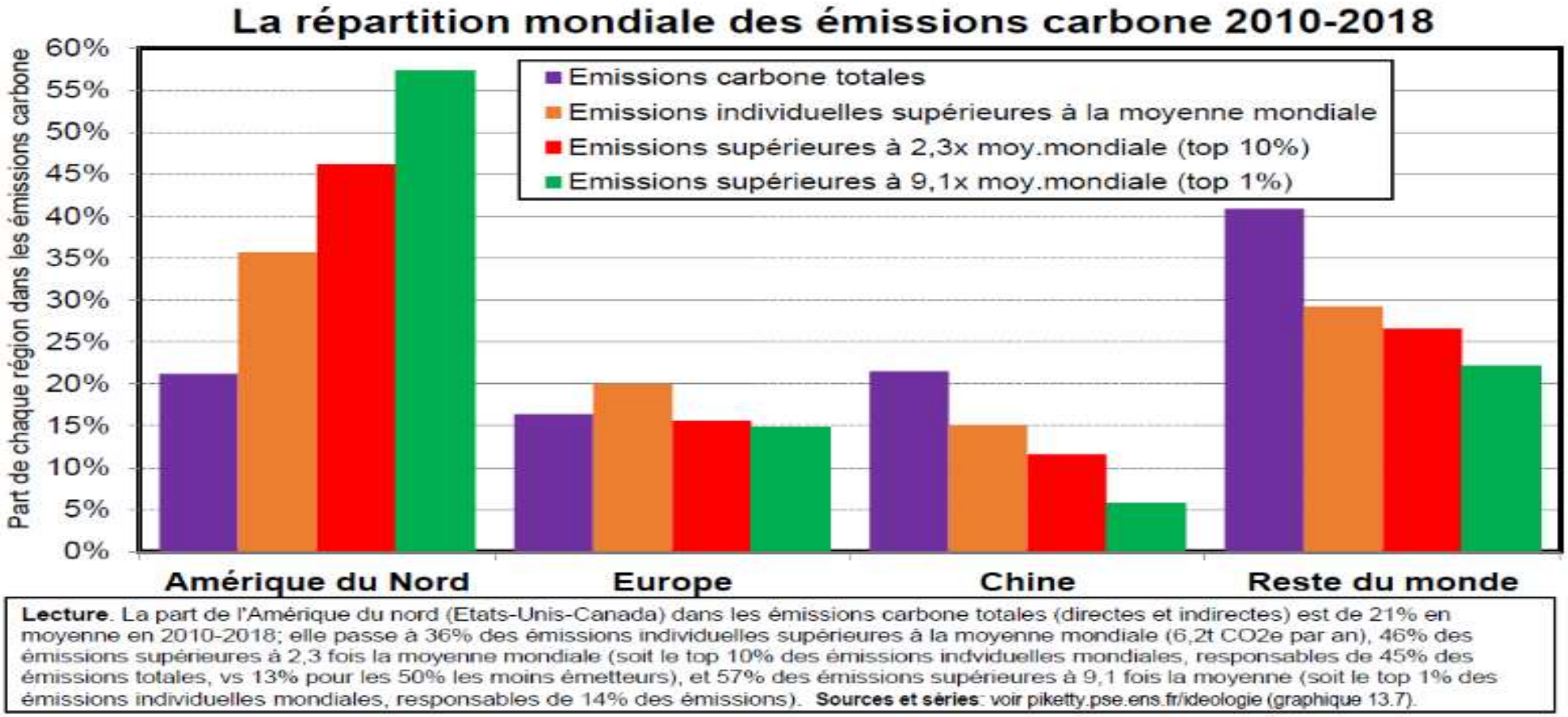
Is there and excess production of CO2? Who is endangering the planet?



Lecture. La part de l'Amérique du nord (Etats-Unis-Canada) dans les émissions carbone totales (directes et indirectes) est de 21% en moyenne en 2010-2018; elle passe à 36% des émissions individuelles supérieures à la moyenne mondiale (6,2t CO2e par an), 46% des émissions supérieures à 2,3 fois la moyenne mondiale (soit le top 10% des émissions indviduelles mondiales, responsables de 45% des émissions totales, vs 13% pour les 50% les moins émetteurs), et 57% des émissions supérieures à 9,1 fois la moyenne (soit le top 1% des émissions individuelles mondiales, responsables de 14% des émissions). **Sources et séries**: voir piketty.pse.ens.fr/ideologie (graphique 13.7).

Not enough

Check this tweet (UN data, december 2019, on the adaptation required to match the limits to emissions as declared by the Paris Agreement):

https://twitter.com/GretaThunberg/status/1220355420600008704

And does this matter

to economists?

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Just facts

It took 99.9% of modern humans' 200,000 year history for a population of one billion in the early 19th century. In just the **following 200 years** (1/1000th as much time) **it ballooned to 7.7 billion** by 2018.

This was an energy revolution. **From 1800 to 2016**, globally fossil energy use increased over **1300 fold**. By 1997 (when annual consumption was 40% less than in 2018) humanity was already burning fossil fuel containing about **422 times the net amount of carbon fixed by photosynthesis** globally each year.

Meanwhile, between 1800 and the present, **real average per capita GDP and incomes** rose by a factor of **13** (rising to 25-fold in the richest countries). Inevitably, material consumption and pollution rose, driving a degradation of air, land and water. With exponential growth, **half the fossil energy ever used** (and half of the fossil CO2 ever produced), **has been burned or emitted in just the past 25-30 years**.

During the 20th Century our species became the major geological force changing the earth.

Two major impacts:

scarcity of water
and plenty of fires

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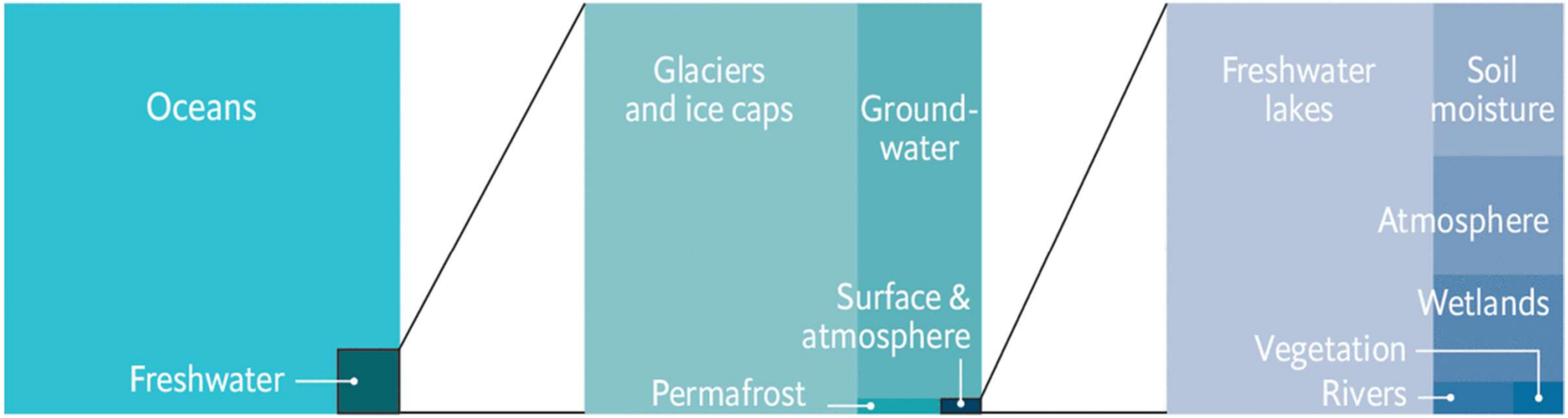
Water: the strategic resource of the 21st century

Mostly salt

Global water resources, %



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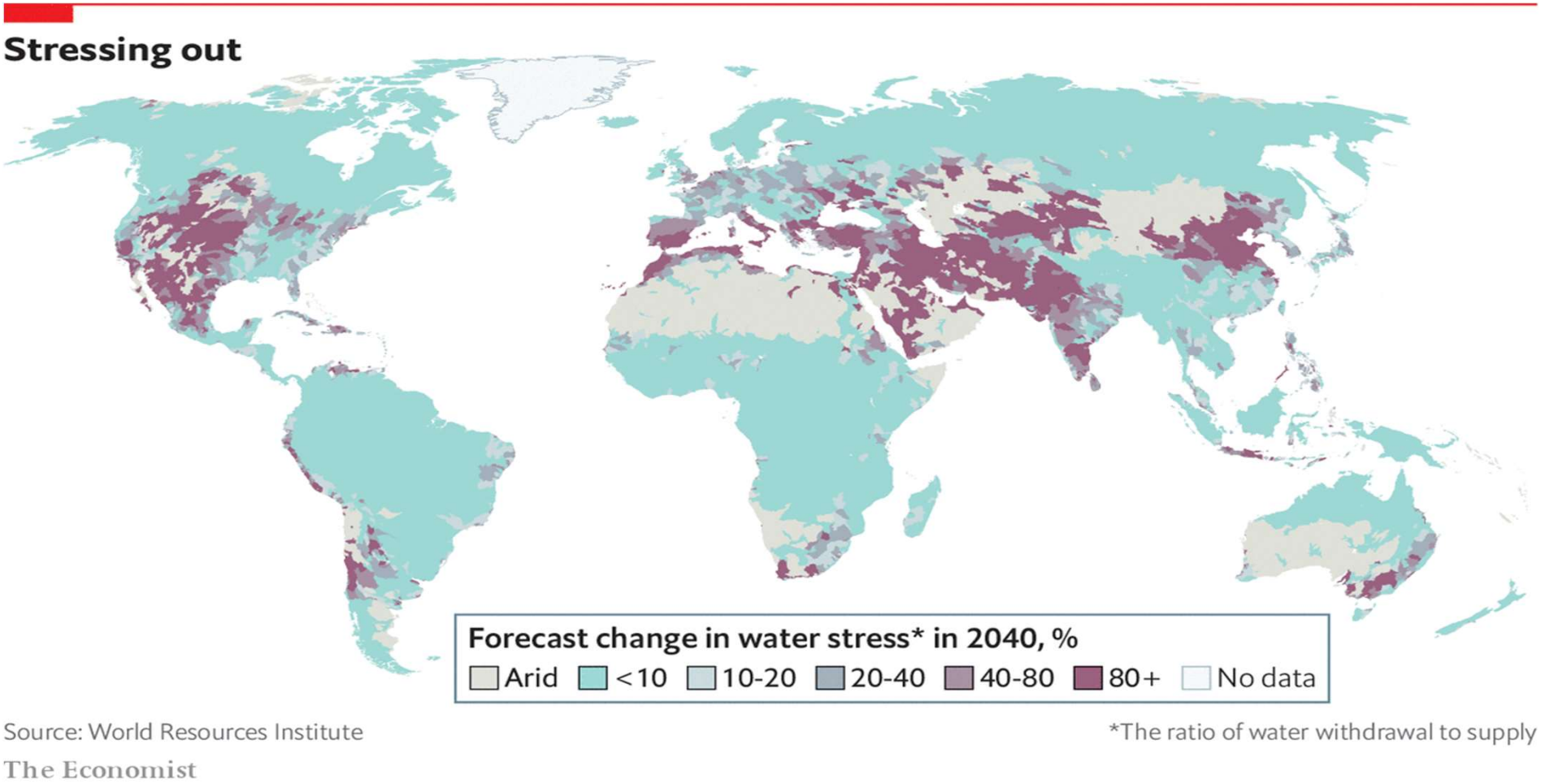
Water stress in 2040



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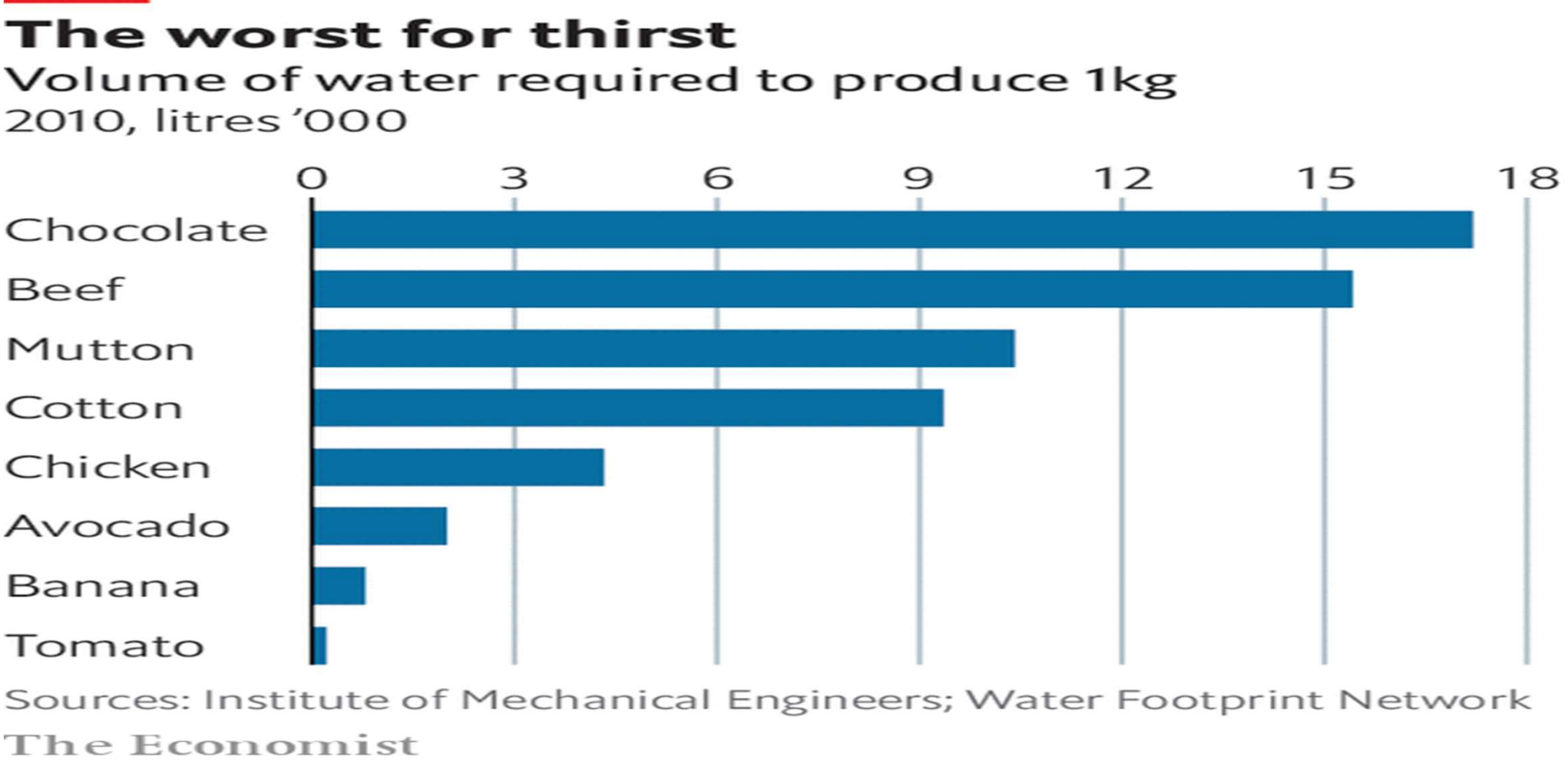
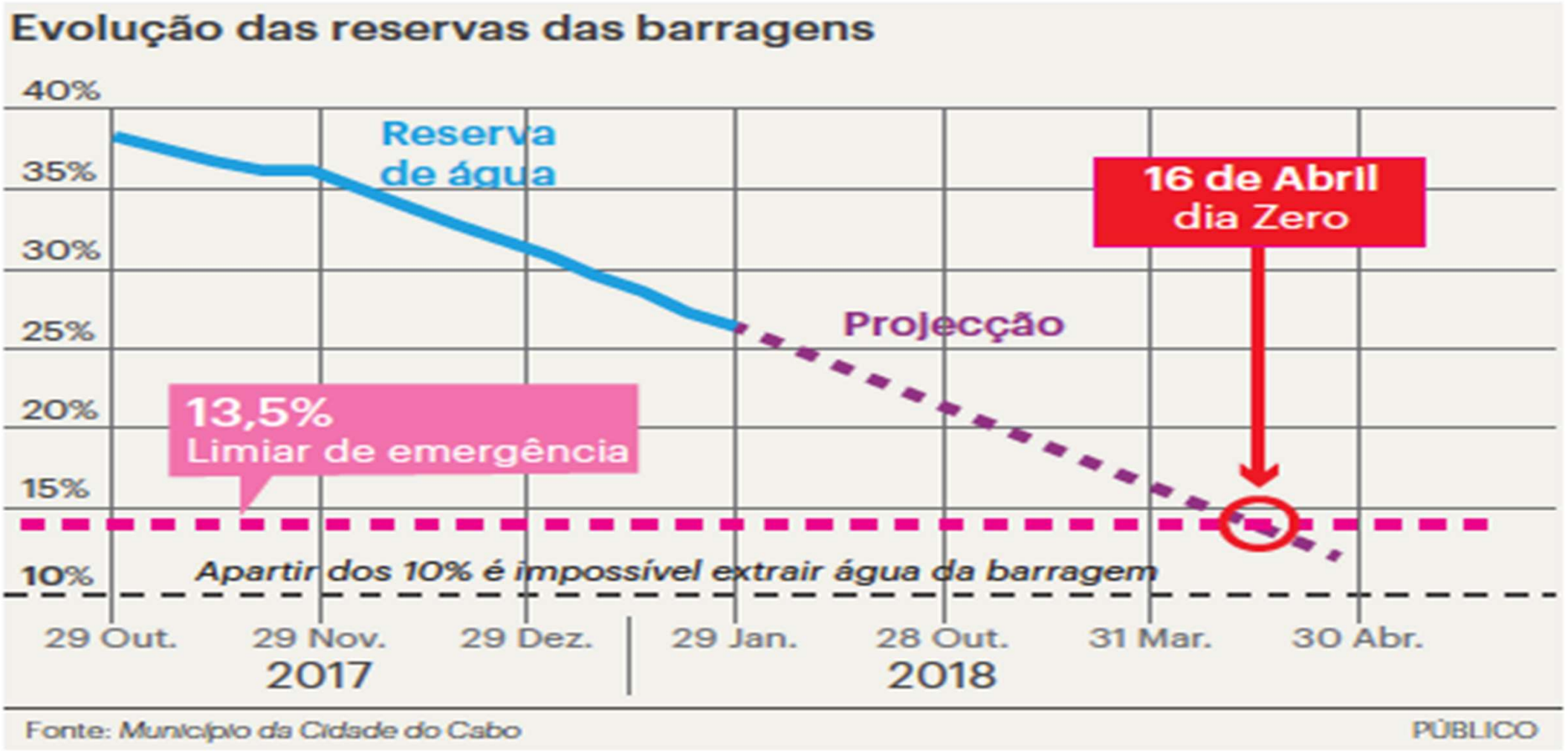
Thirst for water, today



Cape Town: no more water by April 2018?

But this catastrophe was delayed, given emergency measures



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Fires in Portugal

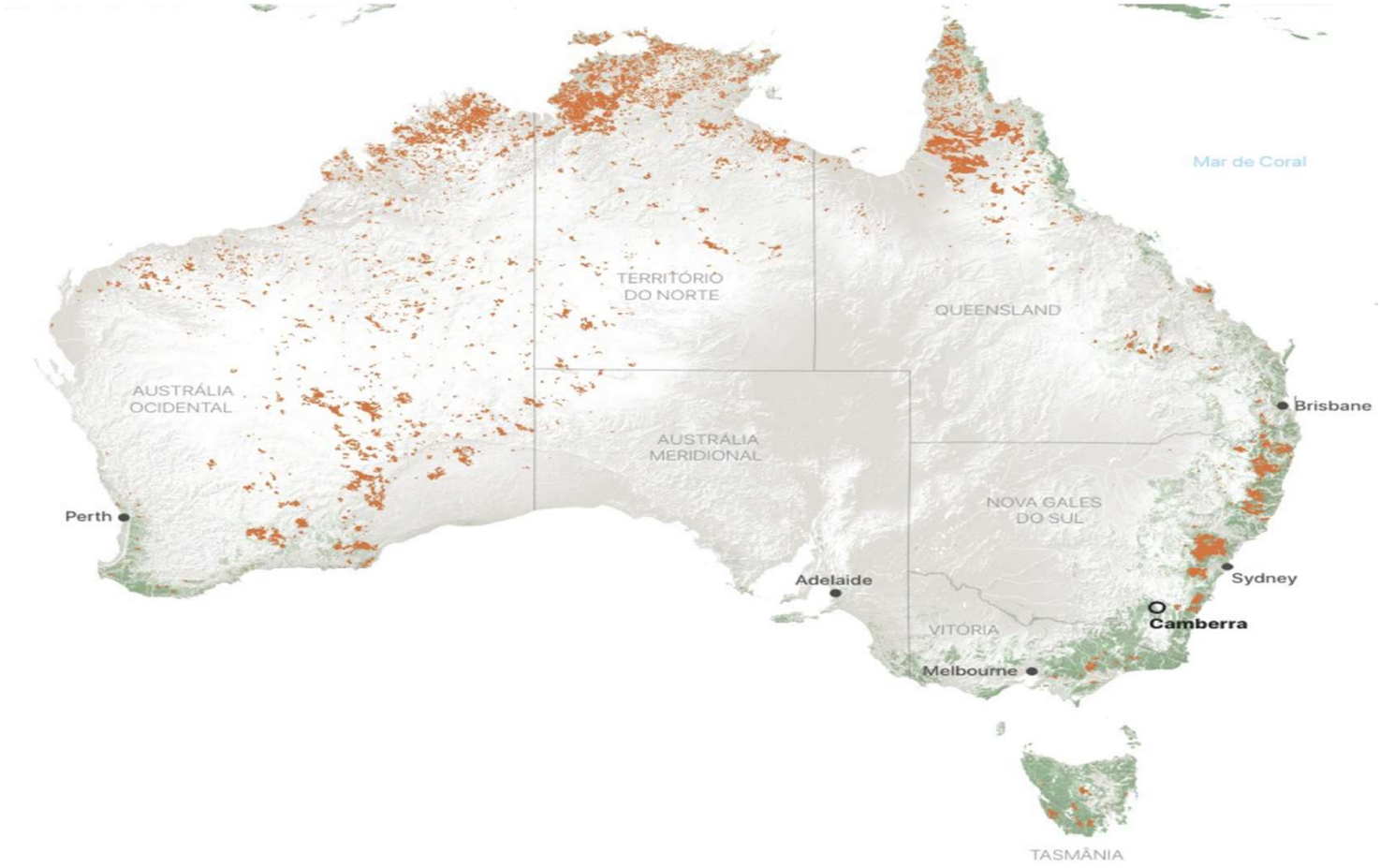
2016

2017

2018

There is a problem:

Australian fires, September 2019-February 2020



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Some questions for the discussion on climate change

1. Availability of energy (price of fossil combustibles)
2. Place for urban communities (given the level of the seas)
3. New and old health risks from warming
4. Access to water and other essential resources
5. More inequality

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The Stern Report (2006)

Nicholas Stern: climate economics must "**be global, deal with long time horizons, have the economics of risk and uncertainty at center stage, and examine the possibility of major, non-marginal change**"

If there is **no action**, the greenhouse gases emissions imply a global temperature rise to the forbidden levels **as early as 2050 (or 2030?)**, the equivalent of the change in temperature since the last Ice Age, and a reduction of the world GDP of 5% to 20% year

A **preventive action** costs 1% cost for 10-20 years
with the aim to **reduce 25% of emissions until 2050** and keep the rise of temperature under control

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Possible alternative courses of action (as suggested by the Stern Report, 2006)

A very limited scope of choices: even with strong growth of renewable energy, fossil fuel will still be more than half of the global energy supply by 2050

Alternatives (according to the Stern Report):

- Emission trading
- Technological cooperation
- Reduce deforestation
- Adaptation to damages

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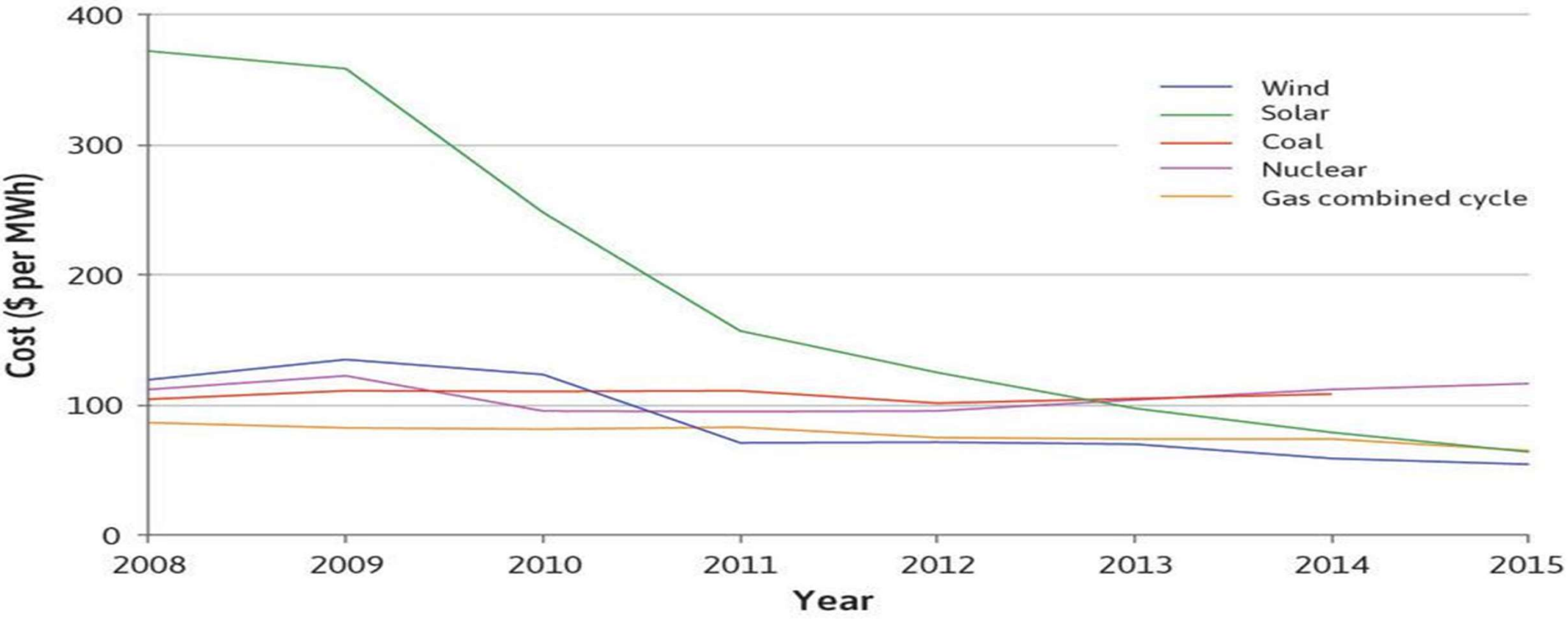
It is possible:

the cost of production of solar energy



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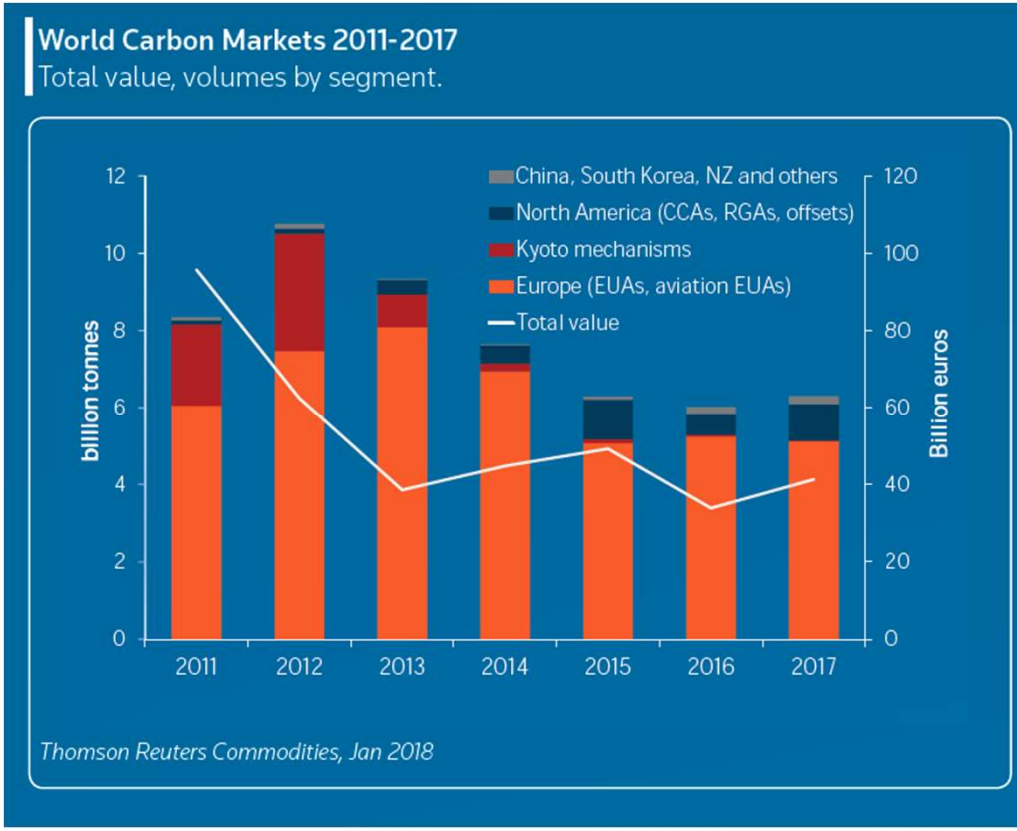
Is the price mechanism a way of containing or expandir emissions?



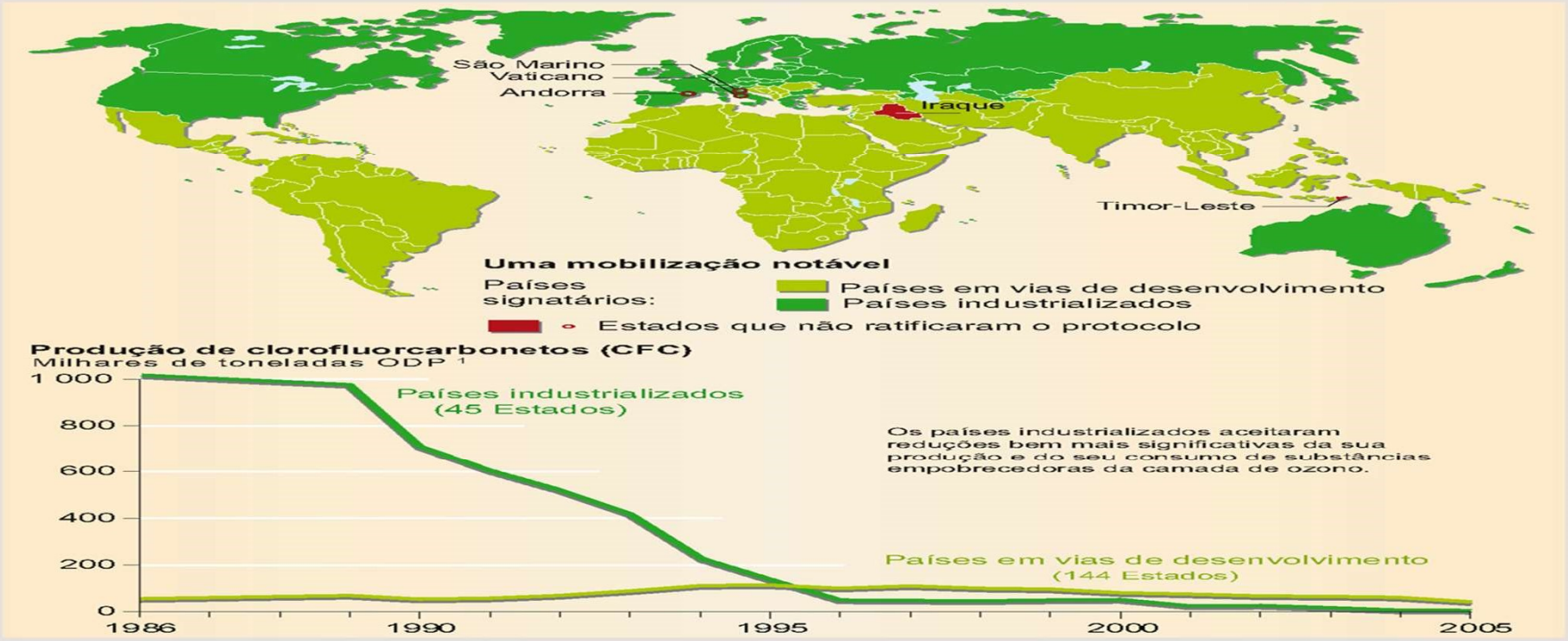
The argument against the market of emissions

- It increases the emissions: the rich economies and larger firms buy rights of emission from the poor economies, and the global result is an increase and not a reduction
- It enlarges the inequality of development, making more difficult for the poor economies to access the benefits of new technologies, since they don't have the scale, capital and knowledge and are paid to give up their right to produce, and are forced to concentrate on low value added activities

Check the alternatives:

there is a case of success, the reduction of CFC

GRÁFICO 5.9.
OS EFEITOS DO PROTOCOLO DE MONTREAL



1. Ozone Depleting potential Tonnes: toneladas multiplicadas pelo potencial de destruição do ozono do gás em causa.

Há poucos exemplos virtuosos na redução de danos ambientais. O resultado do Protocolo de Montreal é um deles, tendo-se obtido uma importante redução da emissão de clorofluorcarbonetos, responsáveis pelo buraco na camada de ozono.

Fonte: Secretariado do Ozono do Programa das Nações Unidas para o Ambiente (PNUA); Divisão Tecnologia, Indústria e Economia (DTIE) do PNUA, Secção Acção Ozono, 2007. *Monde Diplomatique*, p. 50.

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Price of oil, a political variable

The debate Nordhaus-Weitzman

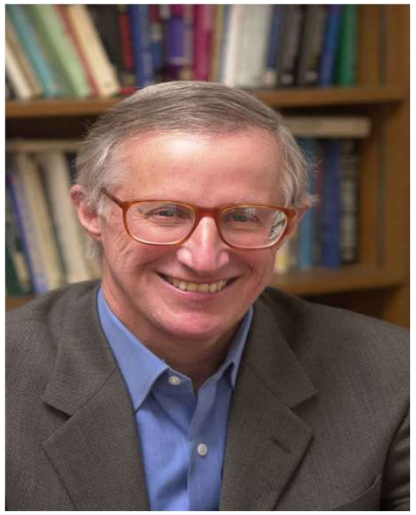
- Discussion on the “calamity theorem”, by Weitzman, on the catastrophic effects of global emissions

- *But how do you compute the future?*

- If a trillion dollars damage is anticipated for 2100, at a discount rate of 4% you need 86 billion of investment today; if you consider 7%, only 4 billion are required (Weitzman argues for the first alternative, Nordhaus for the second)

- **Nordhaus**: with a moderate carbon tax, only more 3ºC of global warming with loss of 2% of welfare (or consumption)

- In what way does this help to think about, let alone address in any meaningful manner, the climate challenges of our, and foreseeable future, days?



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An agenda for climate change politics:

- Change of transport systems, namely urban transportation and long distance (railroads)
- Transformation of industrial production, with low emissions
- Creation of new activities (recycling)
- Transformation of agriculture, reduction of cattle and growth of forests
- Changes in food habits
- Changes in international trade, protection of local production
- New professions, new training and education
- Incentives to innovate
- Change in patterns of consumption/living – are there lessons we can learn from the SARS-CoV-2 (the virus that creates covid-19) pandemic?