



**Institute of Actuaries of India**  
Statutory body established under an Act of Parliament



**International Actuarial Association**  
**Association Actuarielle Internationale**



**21<sup>st</sup> Global  
Conference  
of Actuaries**

17<sup>th</sup> - 19<sup>th</sup> February 2020 | Mumbai, India

# Climate Change: Assumption setting and modeling

**Danny Quant, Milliman**

FIA, FSAS

Date: 18<sup>th</sup> February 2020

# • Institute of Actuaries initiatives

“Your assumptions are your windows on the world. Scrub them off every once in a while, or the light won’t come in”, Isaac Asimov



# • Influences of other institutions

“Now is the time to turn it around – lawyers and regulators say actuaries must do their homework on climate risk”, Client Earth

The difference between a politician and a statesman is that the **politician thinks about the next election** while the **statesman thinks about the next generation**. In the Anthropocene, the need for more statesmen is imperative.

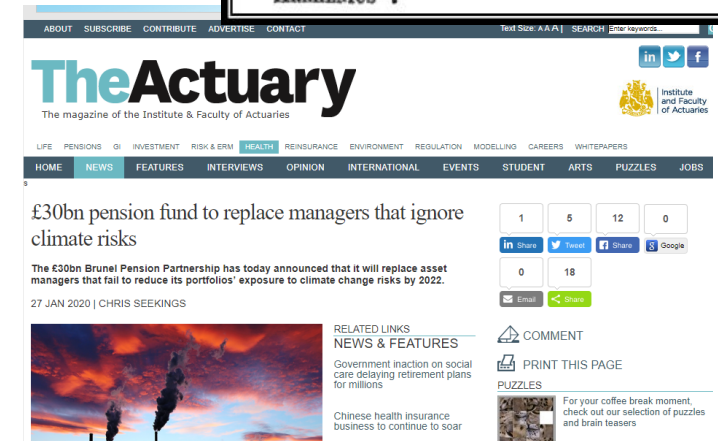
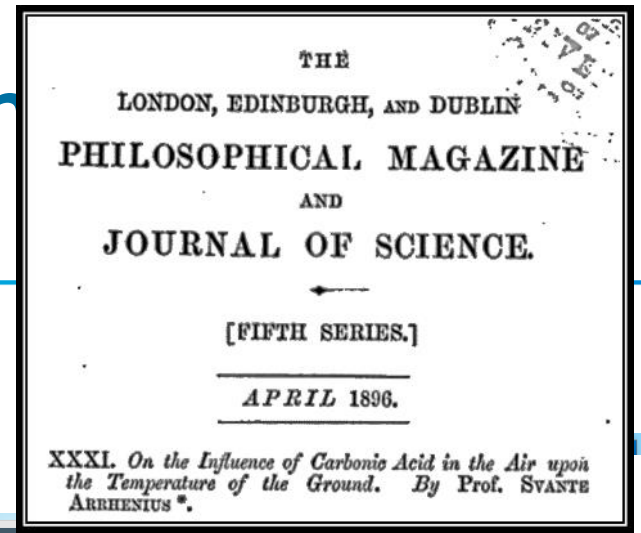
Joerg Tremmel, Editor-in-Chief of the Intergenerational Justice Review

"A classic problem in environmental economics is the tragedy of the commons. The solution to it lies in property rights and supply management. Climate change is the **Tragedy of the Horizon...** the horizon for monetary policy extends out to two to three years. For financial stability it is typically a bit longer, but typically only to the outer boundaries of the credit cycle - about a decade. In other words, **once climate change becomes a defining issue for financial stability, it may already be too late**"

Mark Carney, Governor of the Bank of England and Chair of the Financial Stability Board

Carney, M (2015) “Breaking the tragedy of the horizon – climate change and financial stability”.

<https://www.bankofengland.co.uk/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability>



# • Other reference points (not exhaustive!)

IFoA Resource and Environment Board:

<https://www.actuaries.org.uk/practice-areas/resource-and-environment>

International Panel on Climate Change:

<https://www.ipcc.ch/>

Task Force on Climate Change (Financial Stability Board):

<https://www.fsb-tcfd.org/publications/>

Institutional Investors Group on Climate Change:

<https://www.iigcc.org/>

Conference(s) of the Parties (COPxx) ... COP26 in Glasgow November 2020

World Bank:

<https://data.worldbank.org/topic/climate-change>

Client Earth:

<https://www.clientearth.org/>

Centres for disease control and prevention:

<https://www.cdc.gov/climateandhealth/effects/default.htm>

# • Stress testing

## European Insurance and Occupational Pensions Authority (EIOPA) (Dec 2019)

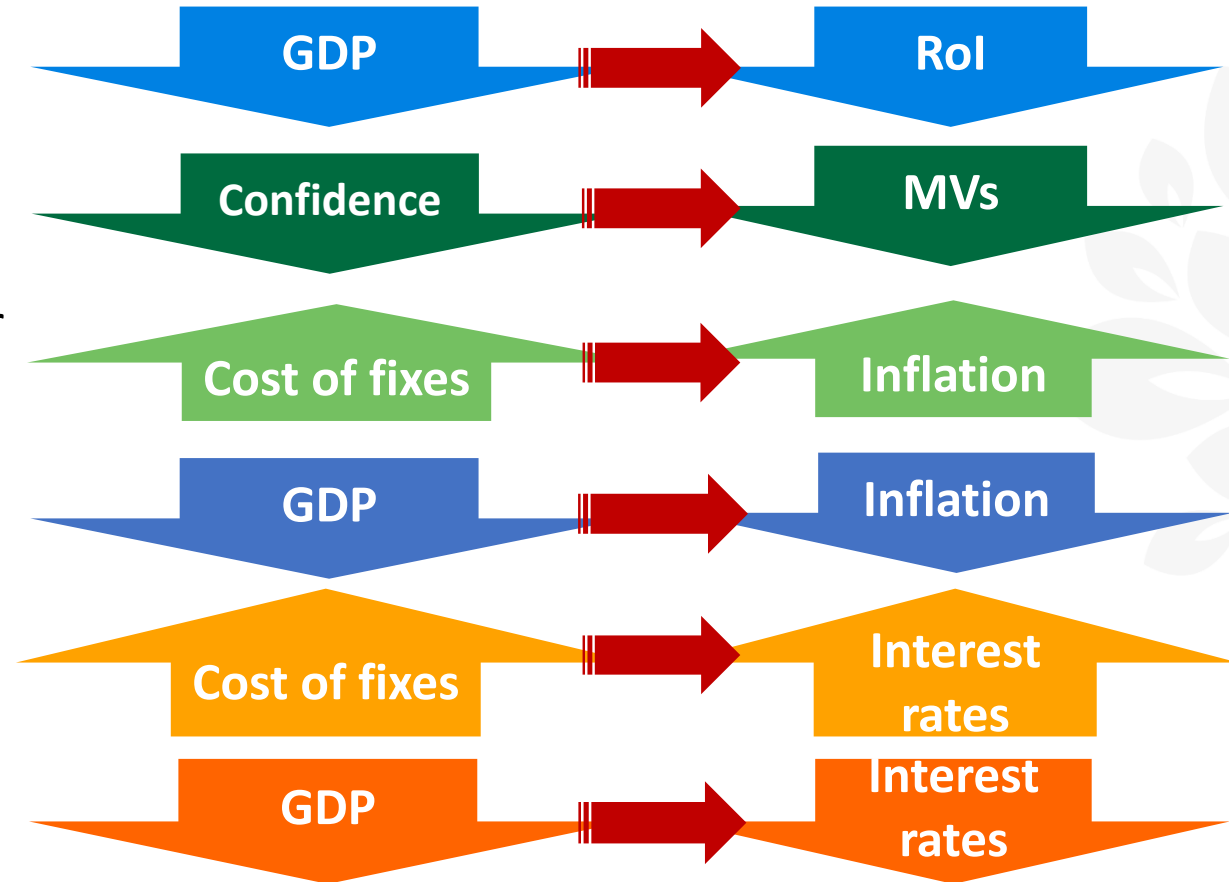
- Abrupt reversal in global risk premia
- Shocks to interest rates: higher on short end lower for long-term maturities
- Increased yields and widening of credit spreads
- Concerns about debt sustainability
- Government bond yields rise due to the increase in risk-free rates and widening of the spreads
- Equity prices would also fall substantially
- Residential and commercial real estate prices decline significantly

## Bank of England

- 2021 Biennial Exploratory Scenario (BES) exercise
  - Early/late/no additional policy action
  - Interaction between banks and insurers
  - Model over 30 years
  - Bottom-up counterparty risks
  - Publication of aggregate results
- 1Q 2020 feedback on BofE proposals
- 2H 2020 publication of final framework
- 2021 publication of results

# • Investment issues

- Lower economic growth leads to lower returns on equities, property and other assets
- Greater uncertainty in the economic outlook leads to lower asset values
- Costs of dealing with climate change lead to higher price inflation
- Lower economic growth leads to lower price inflation
- Greater investment in climate adaptation and mitigation leads to higher interest rates
- Monetary policy measures to address lower economic growth lead to lower interest rates.



- Demographic issues

Direction depends on whose perspective

Fewer suffer from the effects of cold weather

Lower demands on sick care

Good news for healthcare costs

Pensions & Annuities?

Longevity improves

Life assurance claims lower

Good news for life companies

Annuities!

Longevity weakens

Higher demands on health care

High care costs & life claims

Historic data less reliable

Doubts lead to more capital

More suffer from extreme heat



# • Research necessary

## • Portfolio make up:

- Sustainability content
- Stranded assets
- Assets that may benefit

## • Mortality

- Implications for longevity
- Current models for expected life times and mortality improvement
- Shape of mortality curves

## • Morbidity

- Sickness drivers
- Durations of sickness
- Costs of care

## • Shape of costs

- Costs for young, in-work, retirees
- Shift in healthcare demands
- Implications for retirement spending
- Long term care

## • Background dynamics

- Broader exposure of financial services
- Expansion of micro-cover

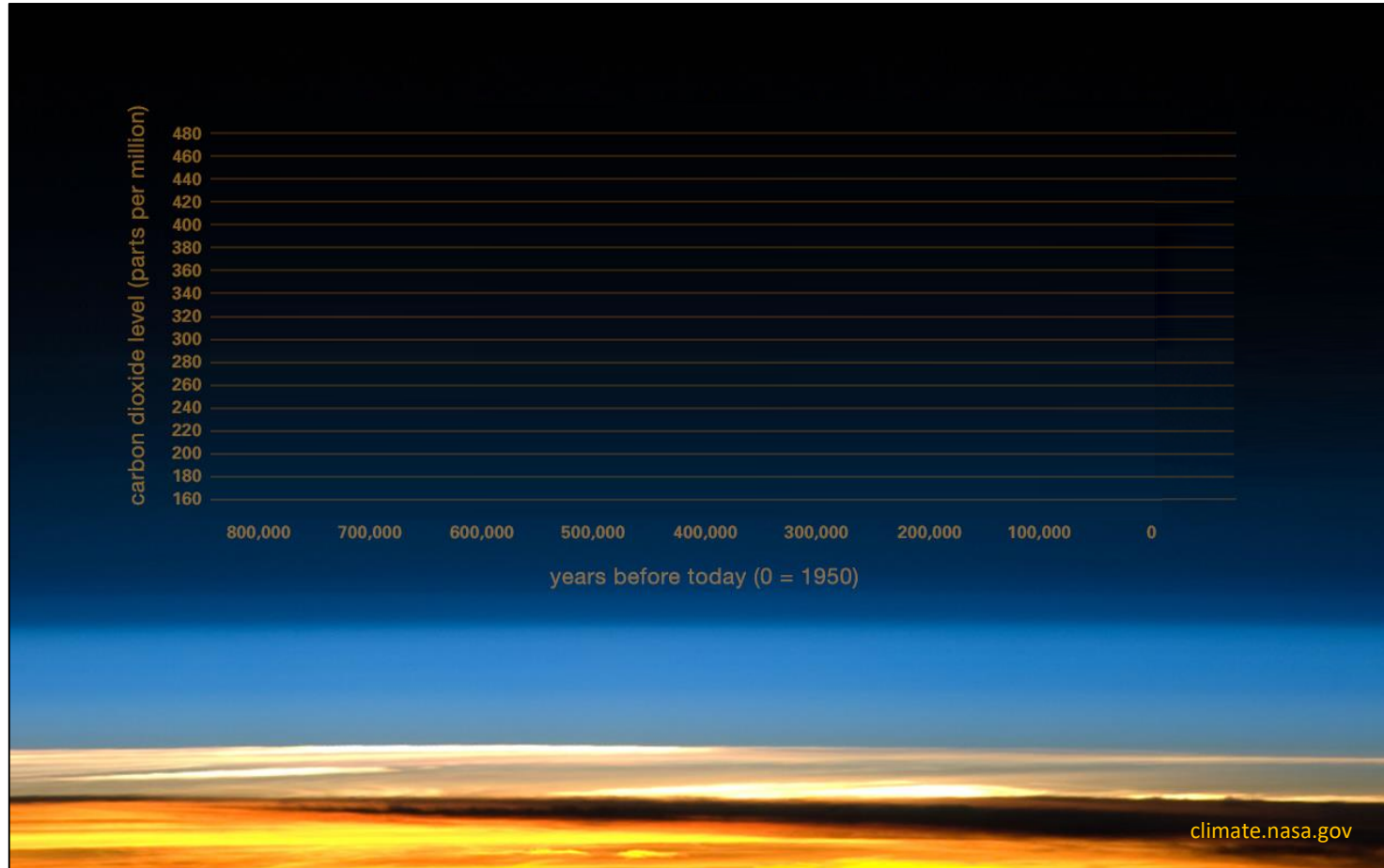


# • Implications for actuaries: heed the data

Illustration of the issues humanity faces and difficulty for actuaries:

The atmospheric concentration of CO<sub>2</sub> has been on the rise since the 1950s.

The data suggests there is trouble ahead based on the amount of CO<sub>2</sub>



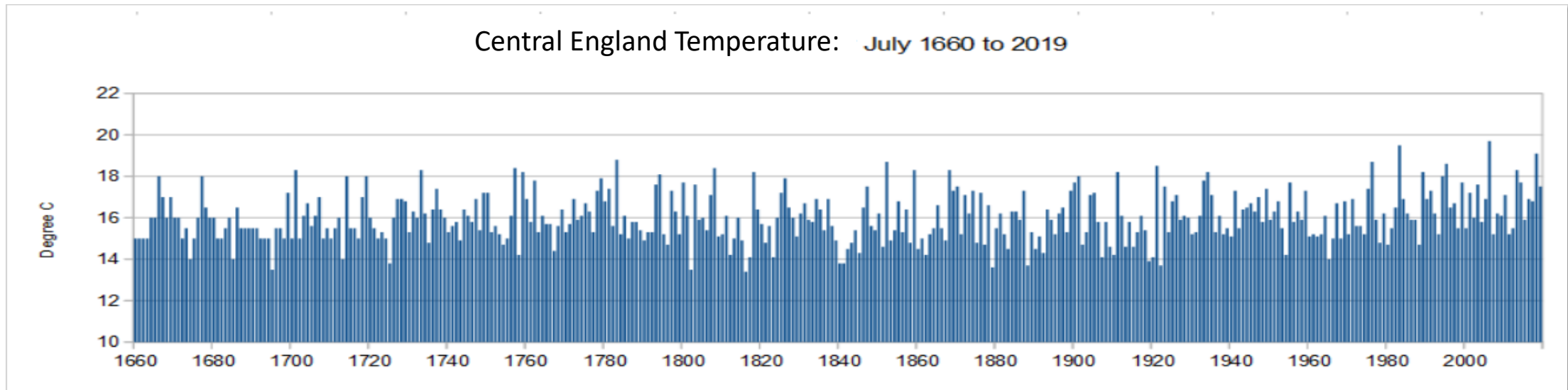
I rarely talk about **expected outcomes** to my clients – I try talk about **possible outcomes**, and give some idea of how possible they are.

And it's possible outcomes that policymakers should be thinking about in the context of the long term.

*Louise Pryor, Chair of the Resource and Environment Board, IFOA*

- Implications for actuaries: beware!

Some data contradicts the perceived wisdom: “summers are getting hotter”

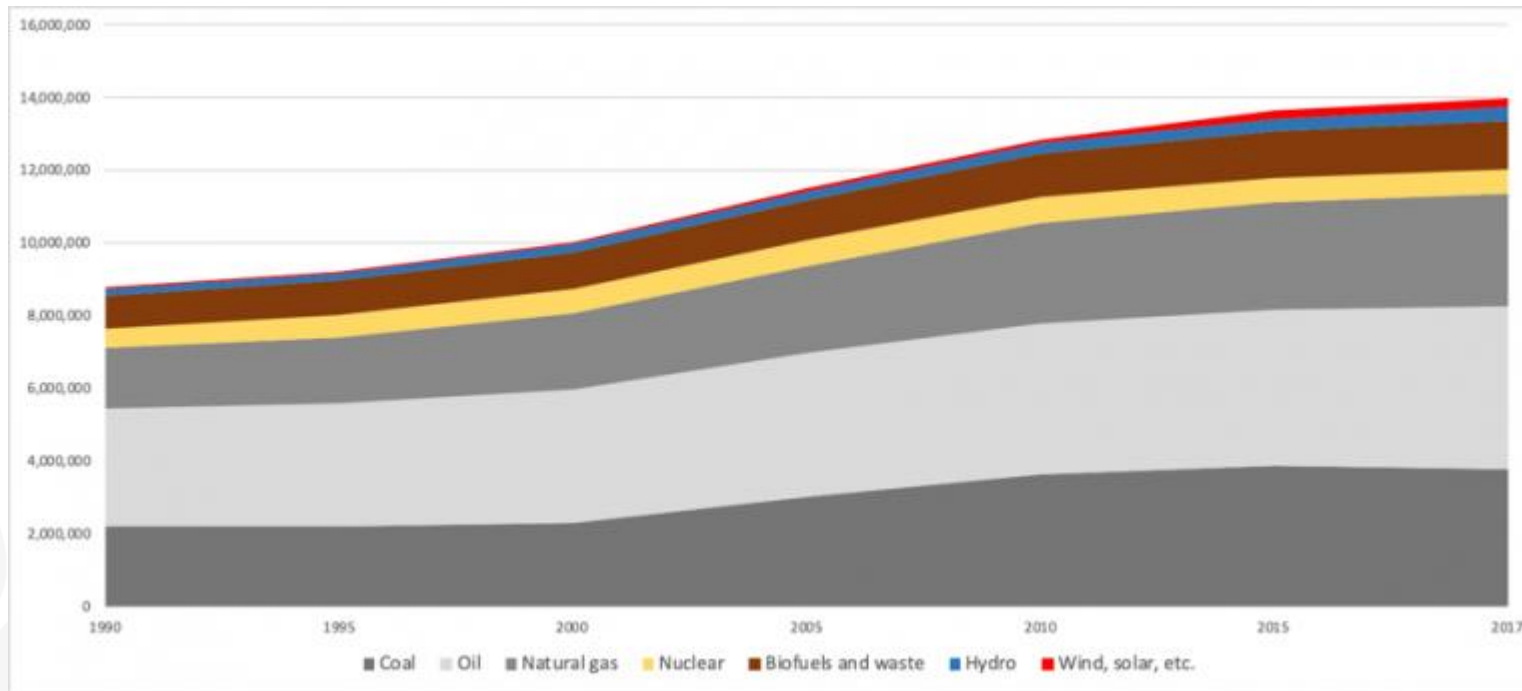


The data doesn't appear to tell us that with conviction.

# • Implications for actuaries: beware!

Some data contradicts the perceived wisdom: “stranded assets”

Global Total Primary Energy (TPE) supply 1990 to 2017



Stranded assets: Fossil fuels will be in such low demand that they will become worthless assets.

But:

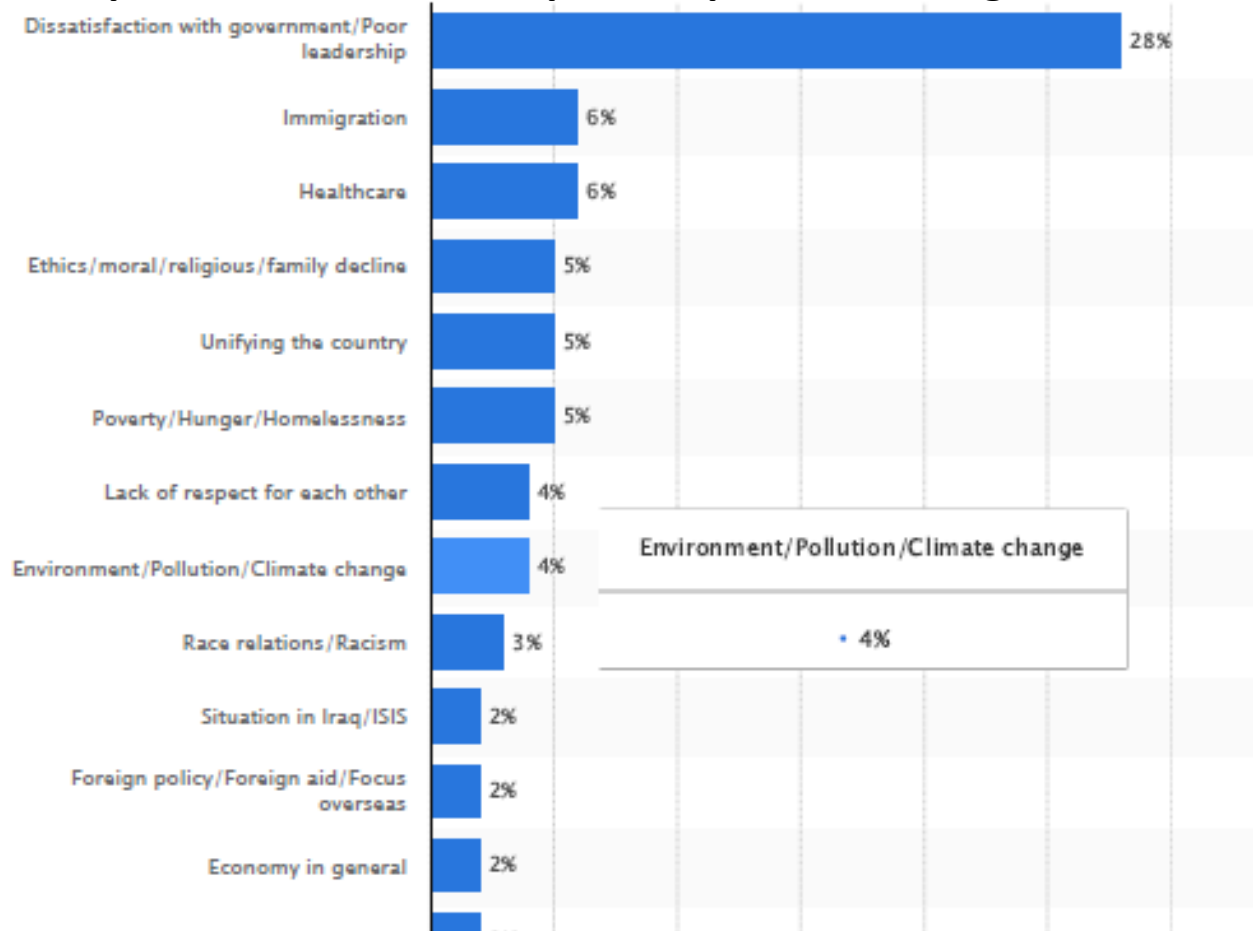
Renewables grown by 72%.

Growth of carbon based fuels in the last 30 years at 59% from a large base.

Source: Data from the International Energy Agency (IEA) [tiny.cc/4eo8hz](http://tiny.cc/4eo8hz) :  
Chart by Dr John Constable: GWPF Energy Editor, [thegwpf.com](http://thegwpf.com)

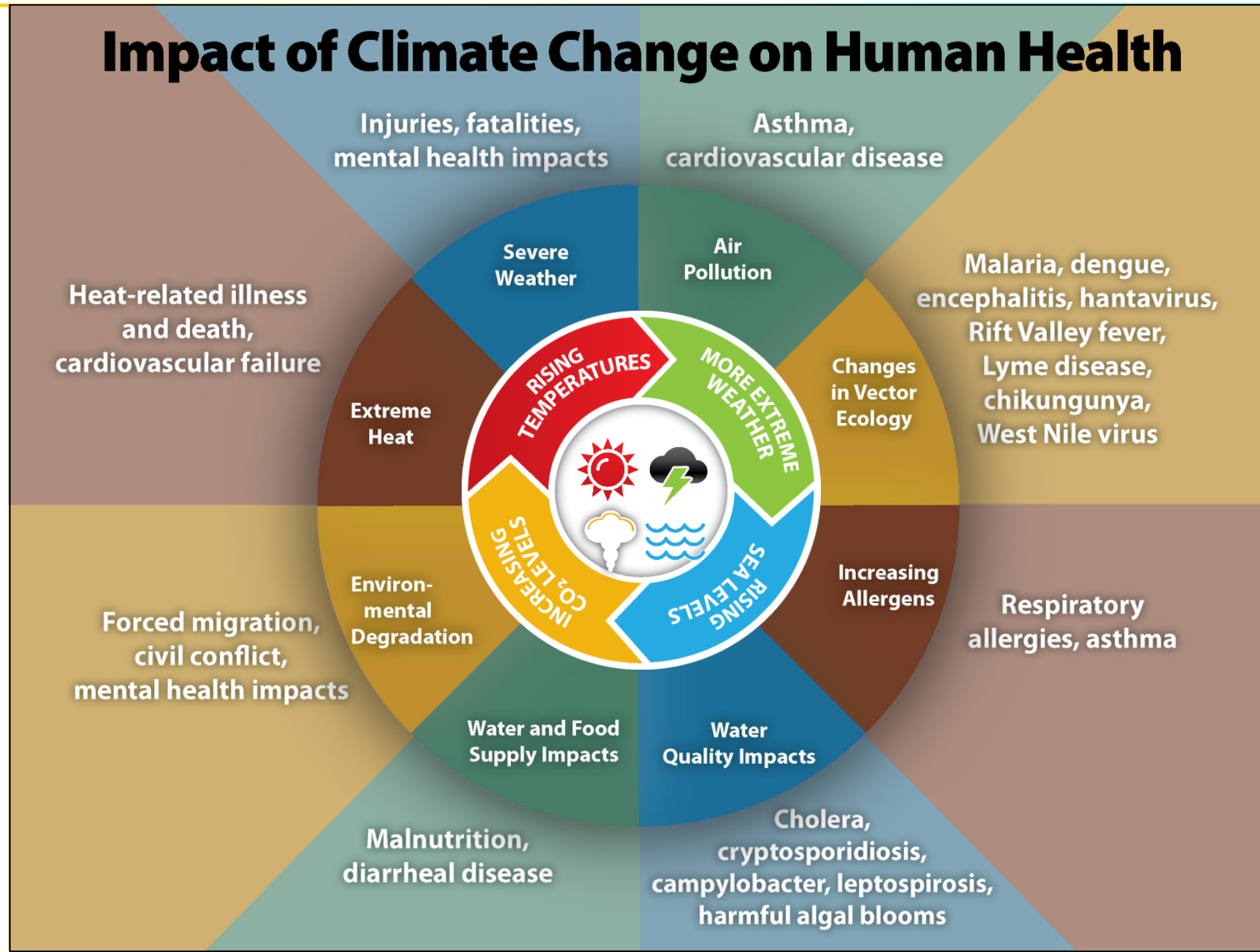
- If you think CC is an important issue, not everyone else does .....

Public opinion on the most important problem facing the U.S. 2020



Source: <https://www.statista.com/statistics/323380/public-opinion-on-the-most-important-problem-facing-the-us>

Actualities need to equip themselves to communicate the possibilities ..... like the CDC:





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## Thank You

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