CLIMANOSCO

Climate Science for Everyone

The climate change challenge

How to be better prepared

as an engineer

Michel Bourqui, PhD, founder

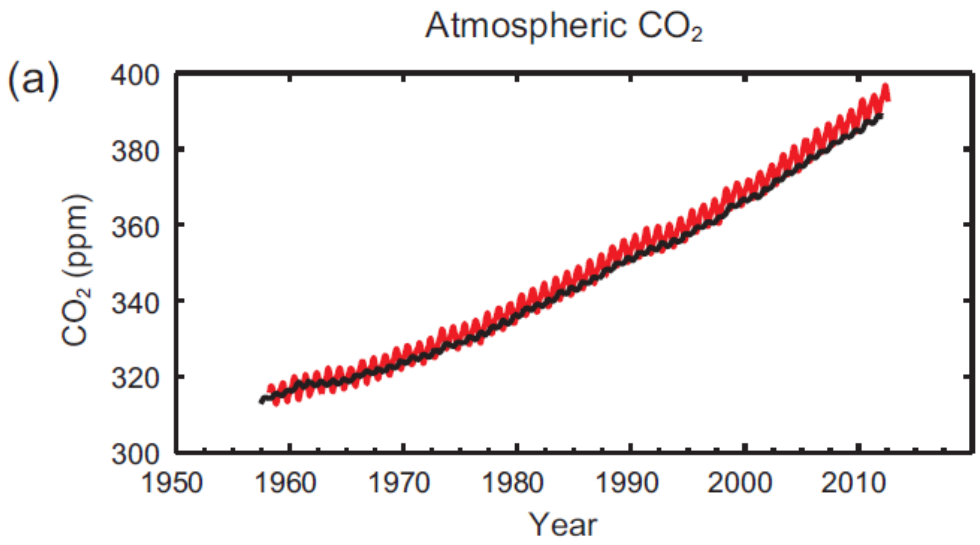
EYE, Sofia, May 19, 2018

Outline

1. How is climate changing?
2. How about engineering?
3. What are engineers' new challenges - discussion
4. How is climate science today?
5. How can scientists support engineers - discussion
6. Wrapping up and next steps

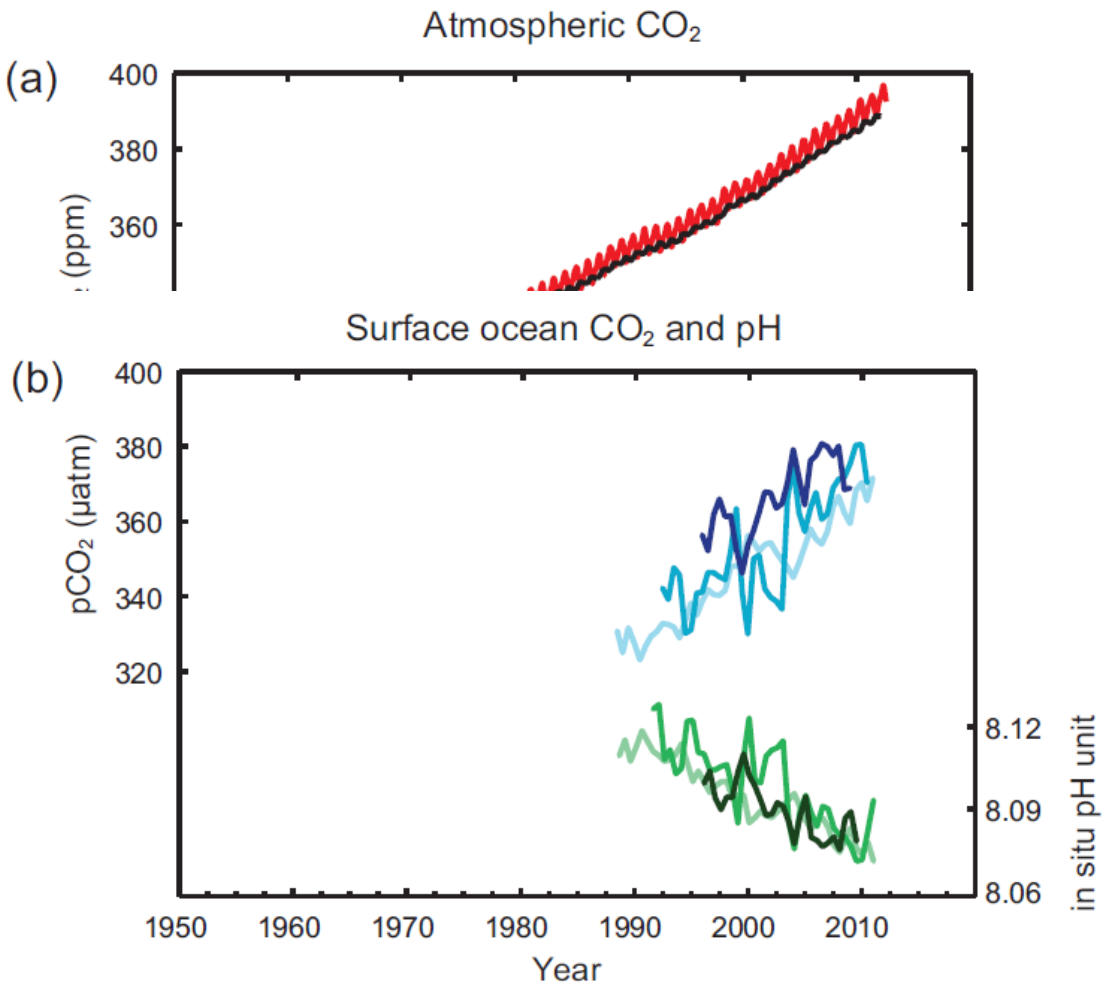
How is climate changing?

Direct observations of CO2



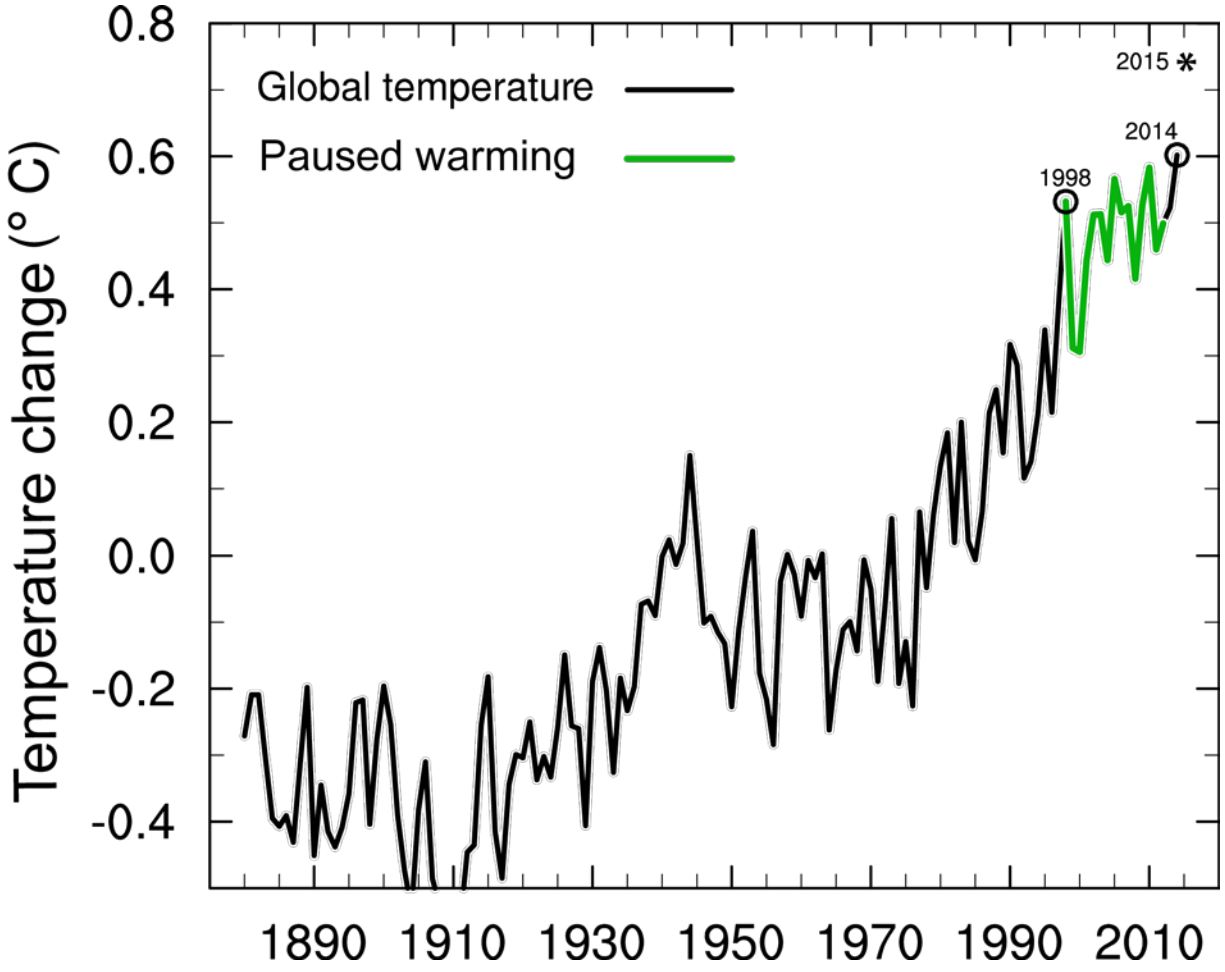
Source: IPCC 2014 WGI SPM

Direct observations of CO2



Source: IPCC 2014 WGI SPM

Direct observations of temperature



Source: Climanosco and Helge Drange, University of Bergen.

Direct observations of glaciers

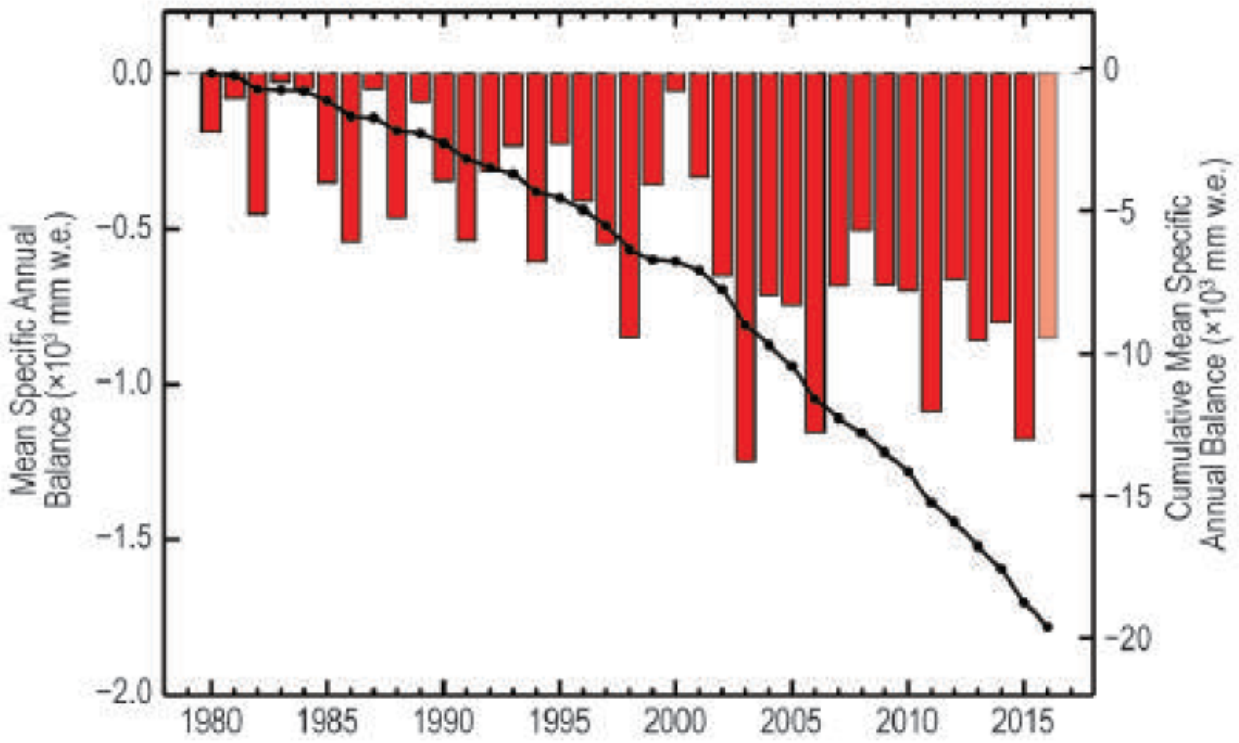
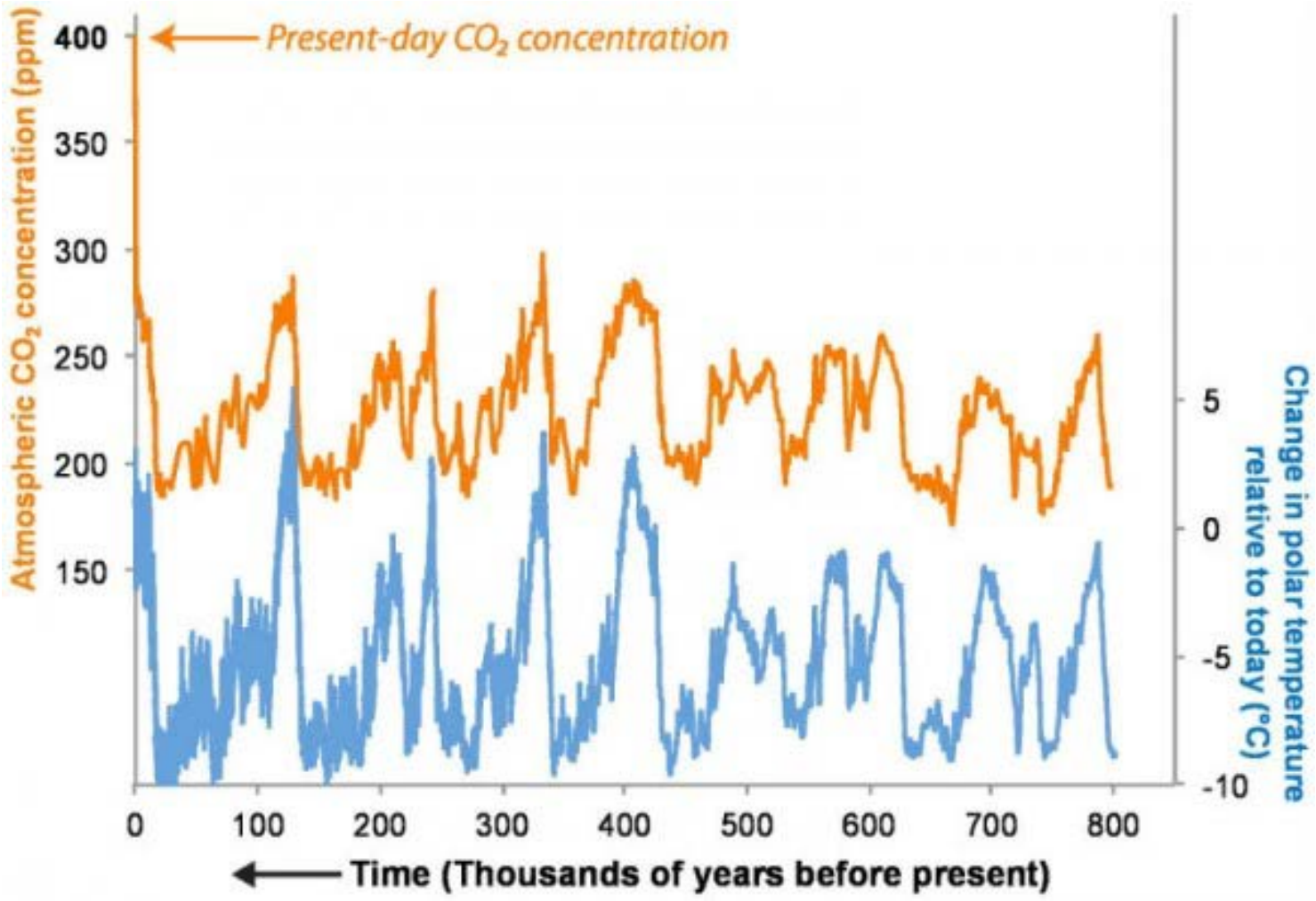


FIG. 2.13. Mean annual (red bars) and cumulative (black line) annual balance reported for the 41 reference glaciers to the WGMS (1980–2016). The data for 2016 are prelimimary only including 27 reference glaciers at the time of publication.

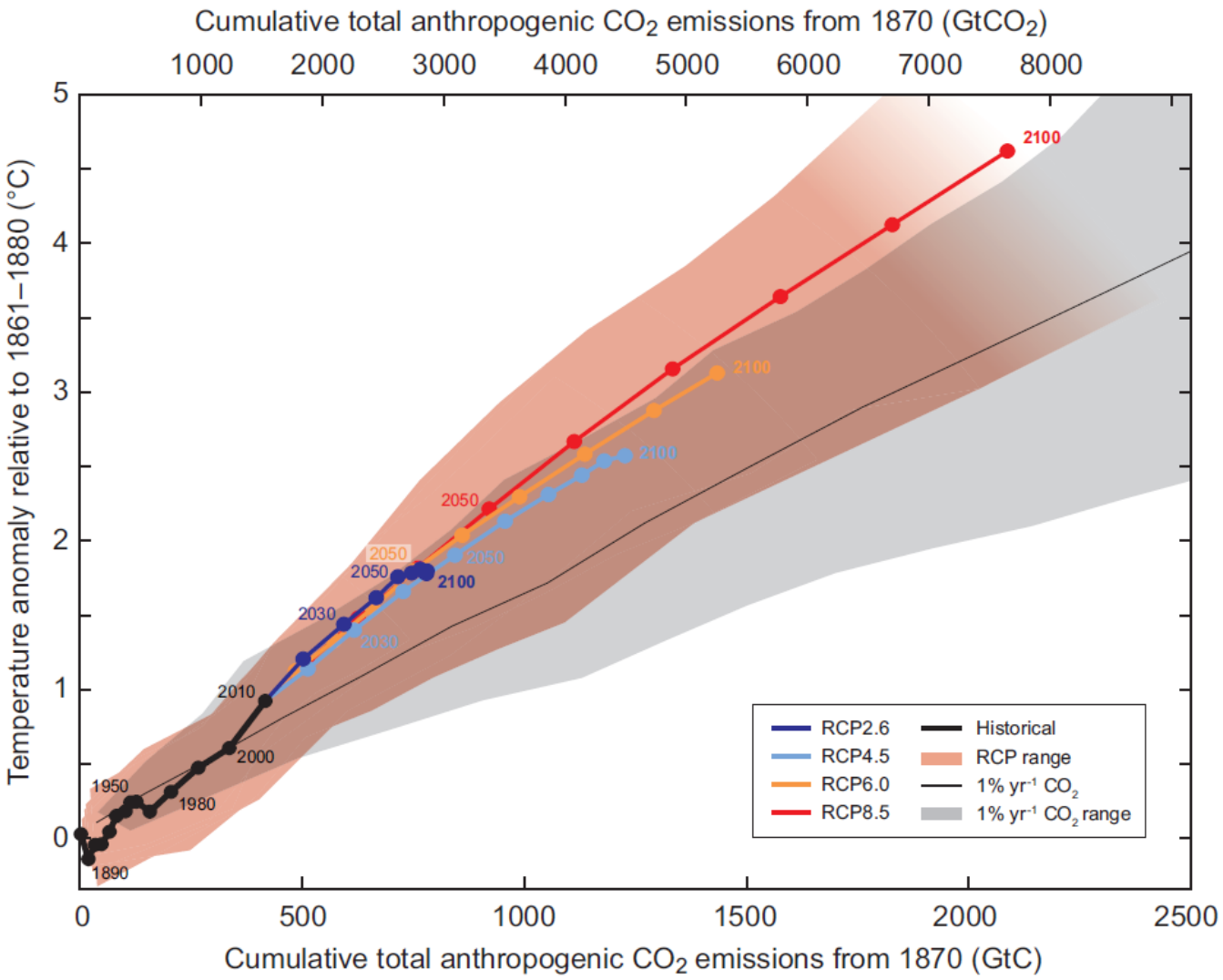
Source: State of climate 2016 BAMS

Proxy observations of remote past



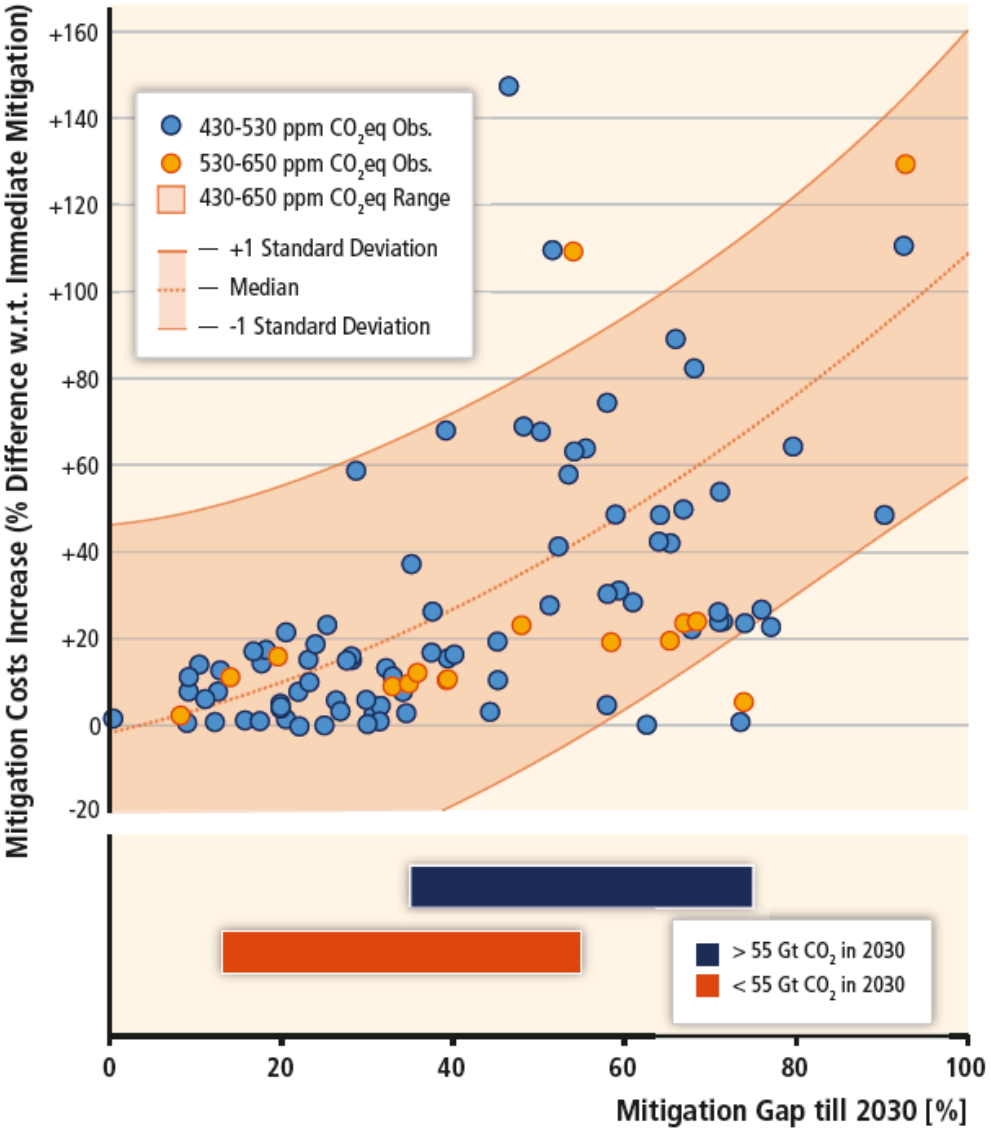
Source: NOAA Paleoclimatology Program. Courtesy Prof. A. Patt, ETHZ

Modelling the climate physics



Source: IPCC 2014 WGI SPM

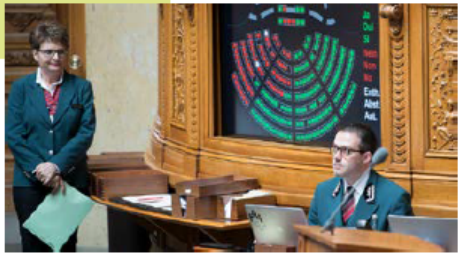
Modelling the climate economy



Source: IPCC 2014 WGIII SPM

Brief history of climate policy

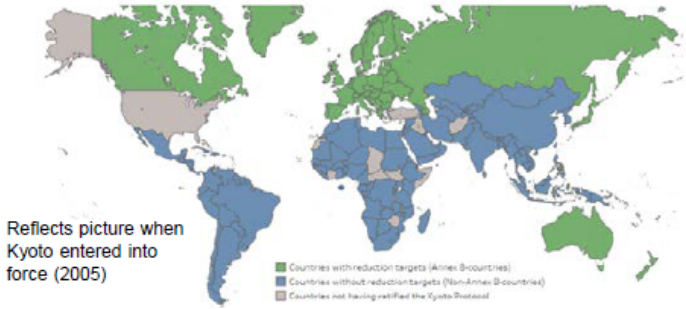
1988	IPCC established
1992	Rio Earth Summit – UN Framework Convention on Climate Change (FCCC) open for signature
1995	First COP in Berlin (presided by A. Merkel as German Env. Minister)
1997	Kyoto Protocol adopted at COP3 in Kyoto
2004	Ratification of Kyoto Protocol (55 countries causing >55% of emissions)
2005	Kyoto Protocol enters into force
2008	First commitment period starts (5 years)
2009	COP15 Copenhagen failure to agree on post-Kyoto agreement
2015	COP21 Paris delivers Paris Agreement
2016	Ratification of Paris Agreement (same rule as for Kyoto)



Courtesy Prof. T. Schmidt, ETHZ

Kyoto Protocol

- Objective: overall reduction of **4.2%** of Greenhouse Gas (GHG) emissions in Annex I countries compared to 1990
- Fair distribution of **economic burden** of climate change mitigation (and adaptation)

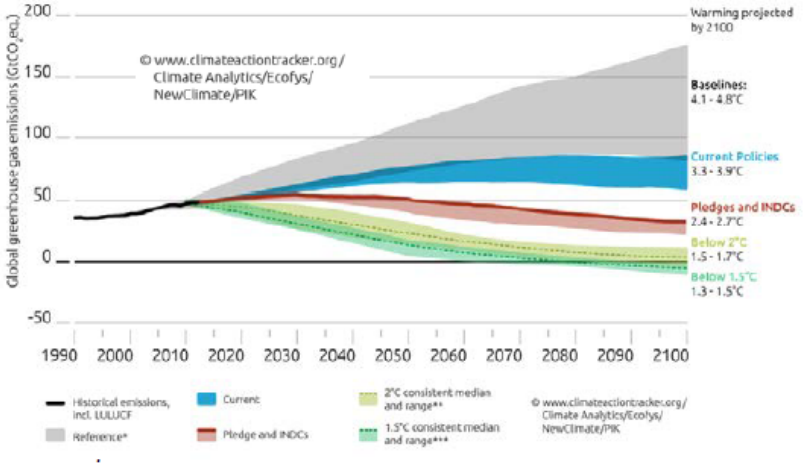


Reflects picture when Kyoto entered into force (2005)

- Instrument: **emissions trading**, i.e. negotiated caps (reduction targets) and trading of emission rights between parties (countries) => reduce emissions where it is cheapest
- "legally binding"

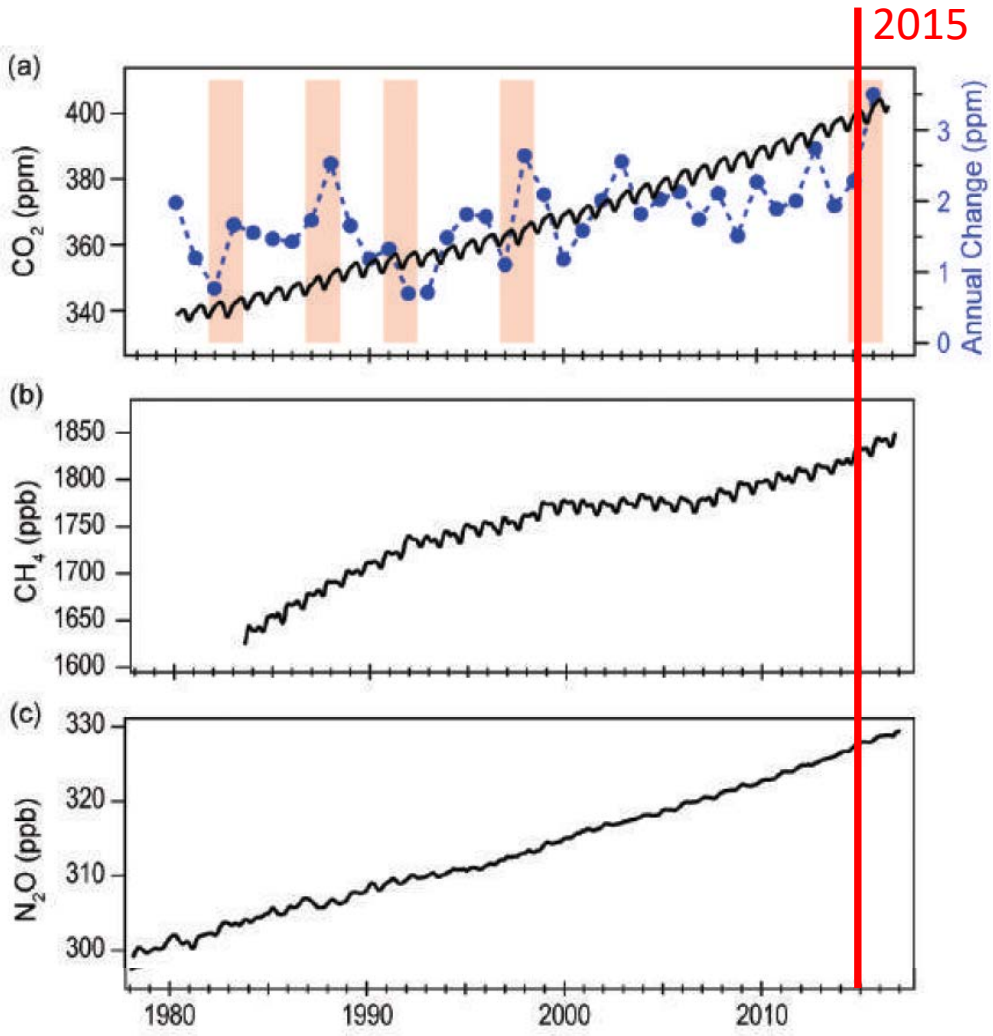
Paris Agreement

- Objective: "limit the increase in the global average temperature to well **below 2°C** above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C…"
- Nationally determined contributions (NDCs): reduction targets put forward by each country
- National/regional policies to achieve targets: emissions trading, carbon tax, but **many more**
- Article 6: similar to Emissions Trading/Kyoto mechanisms (tbd)
- **Ratcheting up**: countries to increase (but not lower) their ambitions over time



Courtesy Prof. T. Schmidt, ETHZ

Any changes since COP21?



Source: State of climate 2016 BAMS

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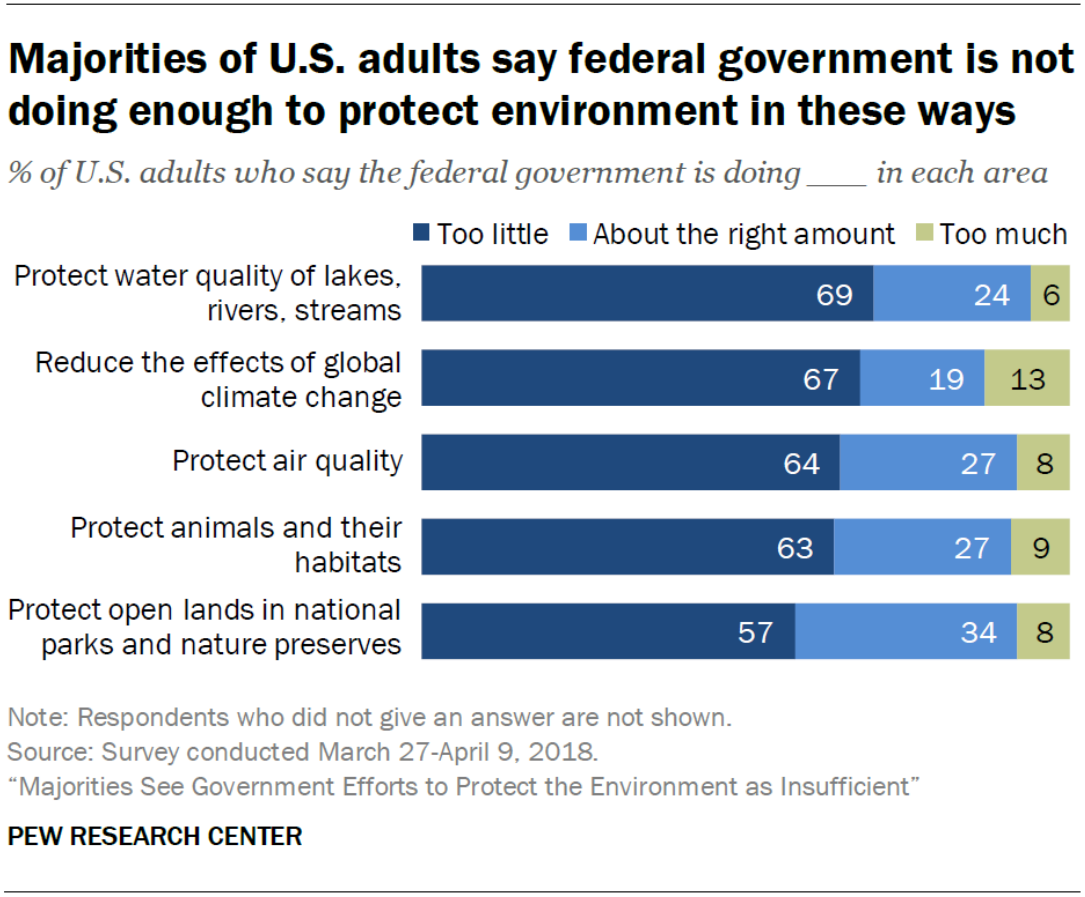

Source: Pew Research Center, May 14, 2018

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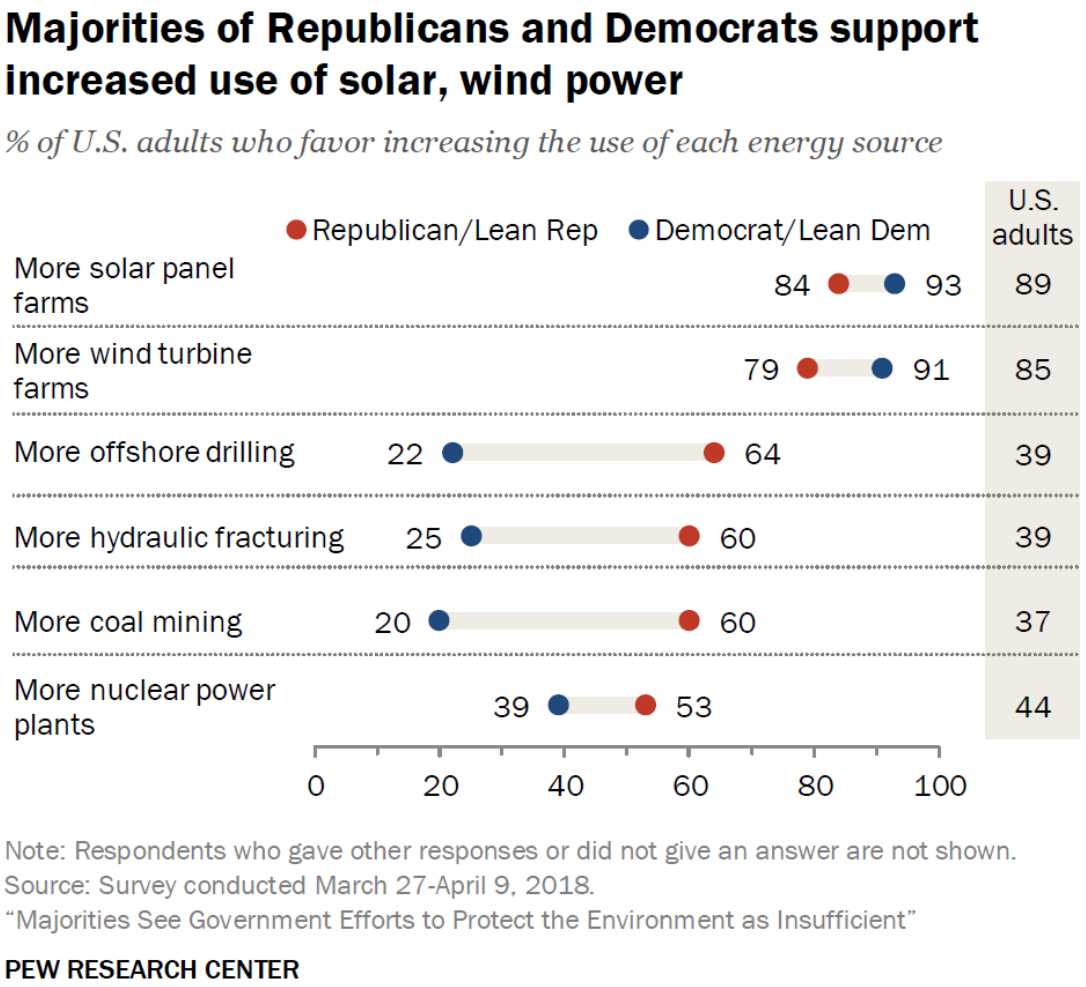
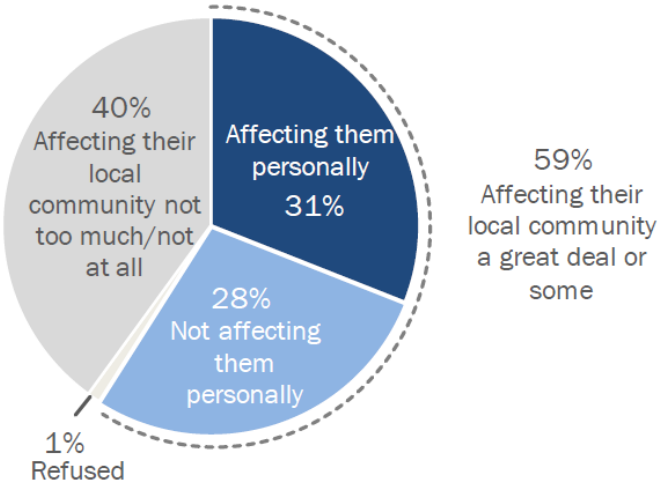


Source: Pew Research Center, May 14, 2018

Any changes since COP21?

A majority of U.S. adults say climate change affects their local area; 31% say it affects them personally

% of U.S. adults who say the effects of global climate change are ...



Source: Survey conducted March 27-April 9, 2018.
"Majorities See Government Efforts to Protect the Environment as Insufficient"

PEW RESEARCH CENTER

Source: Pew Research Center, May 14, 2018

How about engineering?

- Adapting
- Mitigating

How about engineering?

- Adapting
- Mitigating

Adapting infrastructures to

- Changes in temperature
- Changes in rainfall and snowfall
- Changes in storms
- Changes in sea level
- Changes in sea acidity
- …

Adapting infrastructures to

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- …

Permanent changes?

Adapting infrastructures to

Stationarity Is Dead: Whither Water Management?

Milly and co-authors, Science, 2008

World Federation of Engineering Organisations - Committee on Engineering and the Environment

Model Code of Practice: Principles of Climate Change Adaptation for Engineers (2015)

Integrating Climate Information

Model Code Principle # 4: Interpret Climate Information

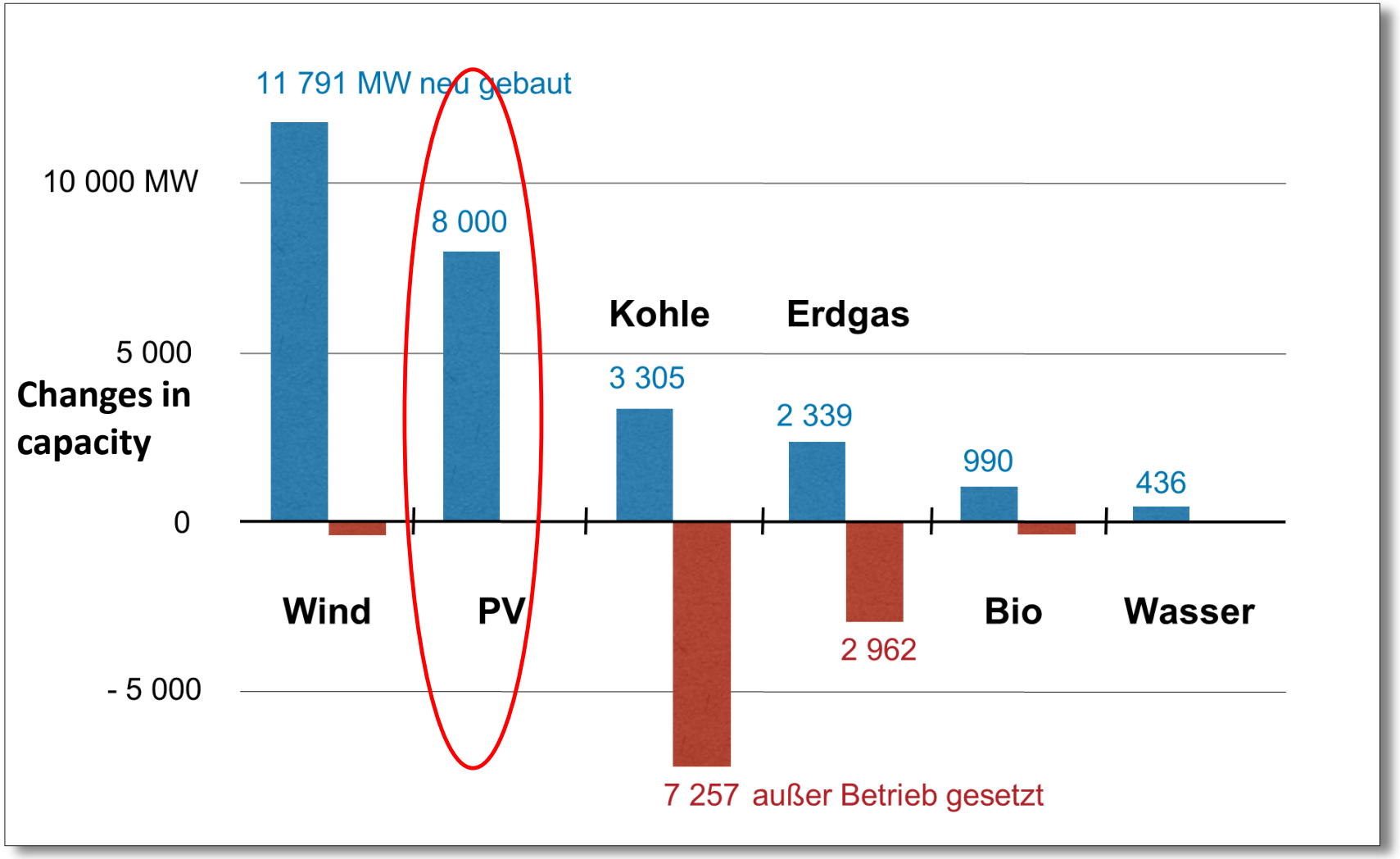
Consult with climate scientists and specialists

Source: http://www.wfeo.org

How about engineering?

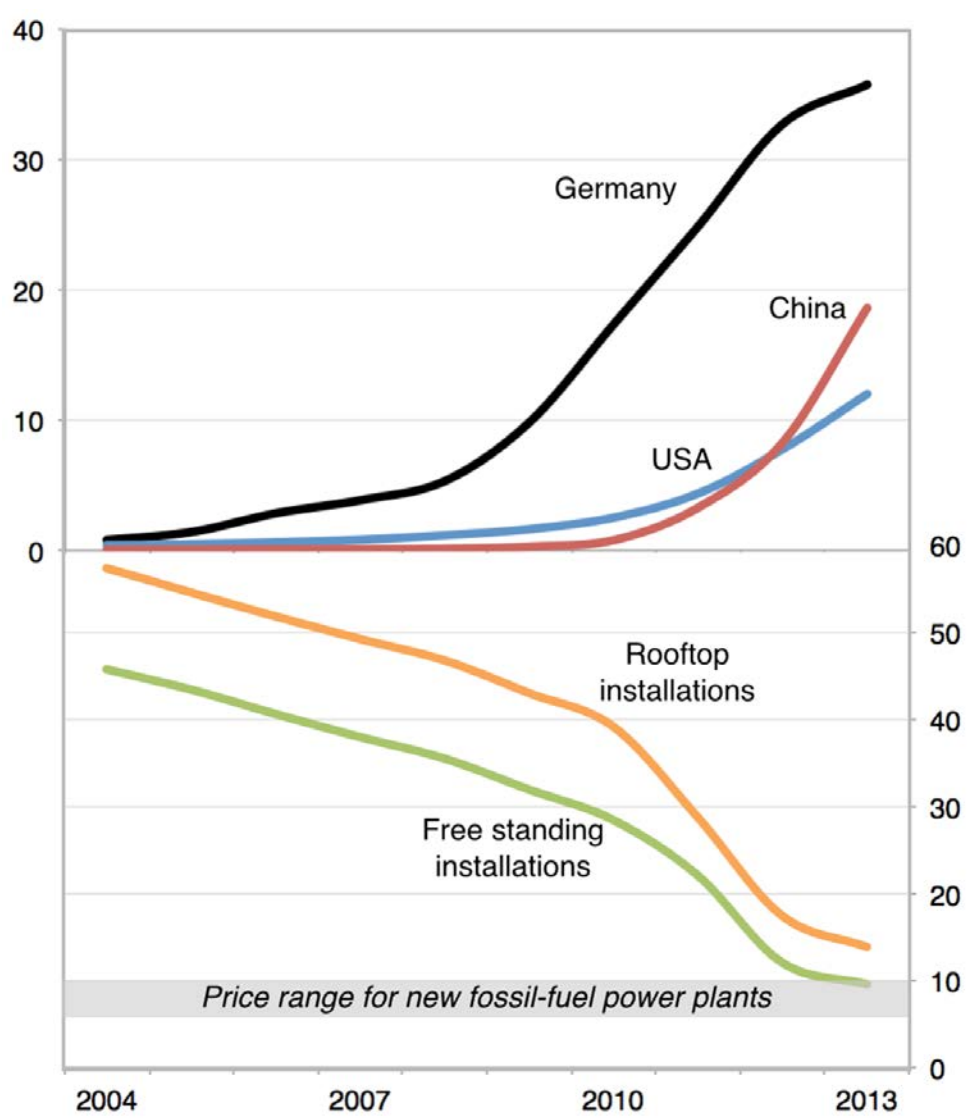
- Adapting
- Mitigating

Shifting energy sources (2014, EU)



Source: European Wind Energy Association, 2014. Courtesy: Prof. A. Patt, ETHZ

Photovoltaic capacity (PV)

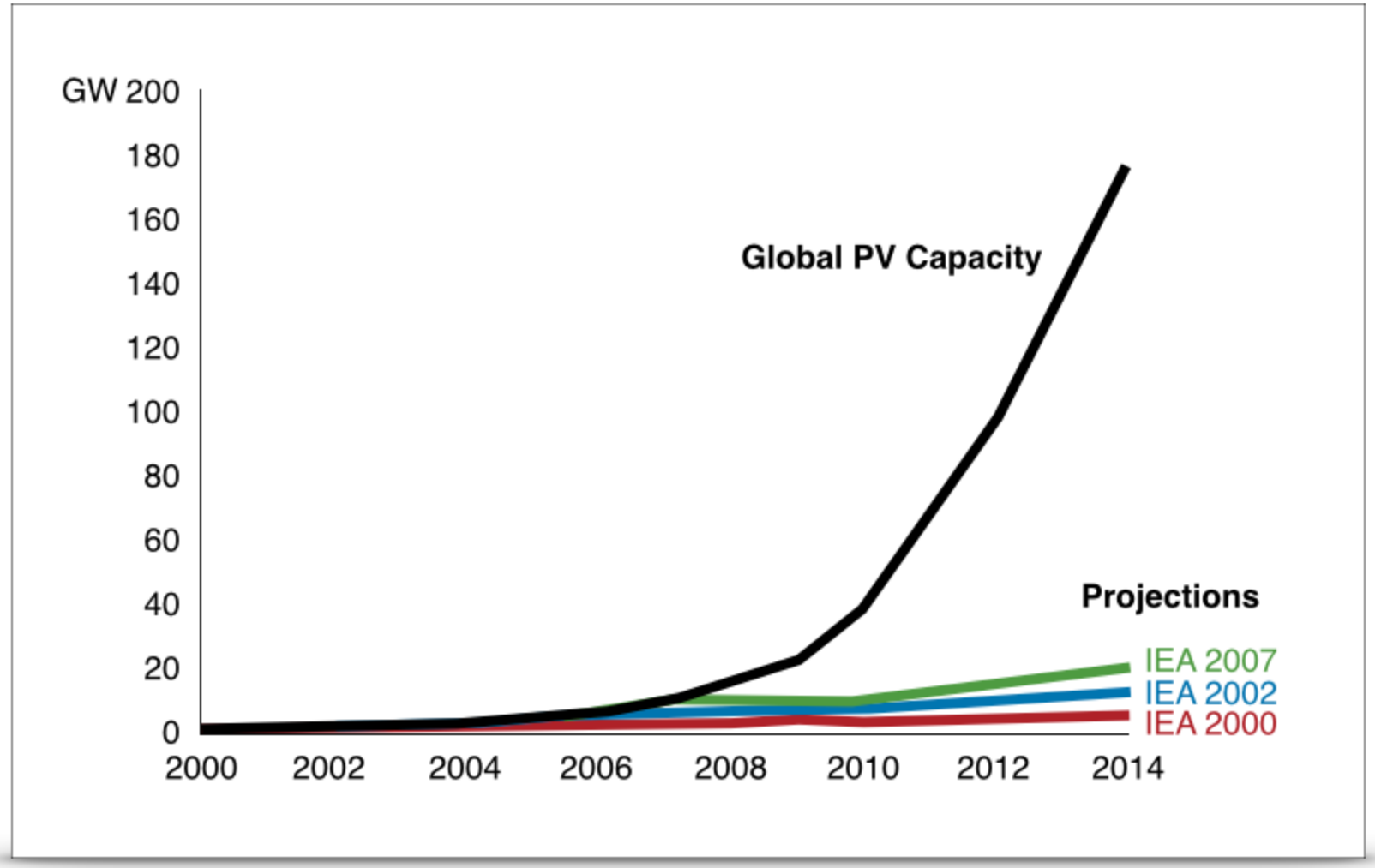


Photovoltaic capacity

German feed-in tariff

Data sources: IEA, Bundesnetzagentur. Courtesy Prof. A. Patt, ETHZ

An unexpected growth



Courtesy Prof. Anthony Patt, ETHZ

Area of solar collectors required to satisfy projected (by the IEA) global energy demand in 2030: 500,000 km^2

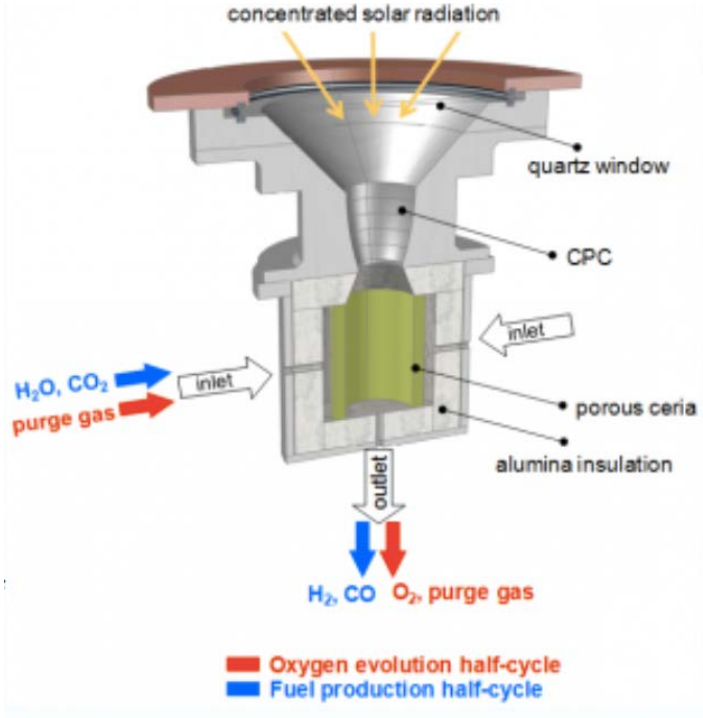
Sources: landartgenerator.org, US EIA. Courtesy Prof. A. Patt, ETHZ

Unprecedented engineering niches during the transition

PV → Energy 24 / 7 / 12

→ Heat

→ Mobility



Aldo Steinfeld, ETH, Switzerland

Toyota Fuel Cell Vehicle

Courtesy Prof. A. Patt, ETHZ

- First electric car ferry
- Entered service in 2015
- Manufactured by Siemens / Fjellstrand (Norway)

Source: vesselfinder.com. Courtesy Prof. A. Patt, ETHZ

What are engineers' new challenges?

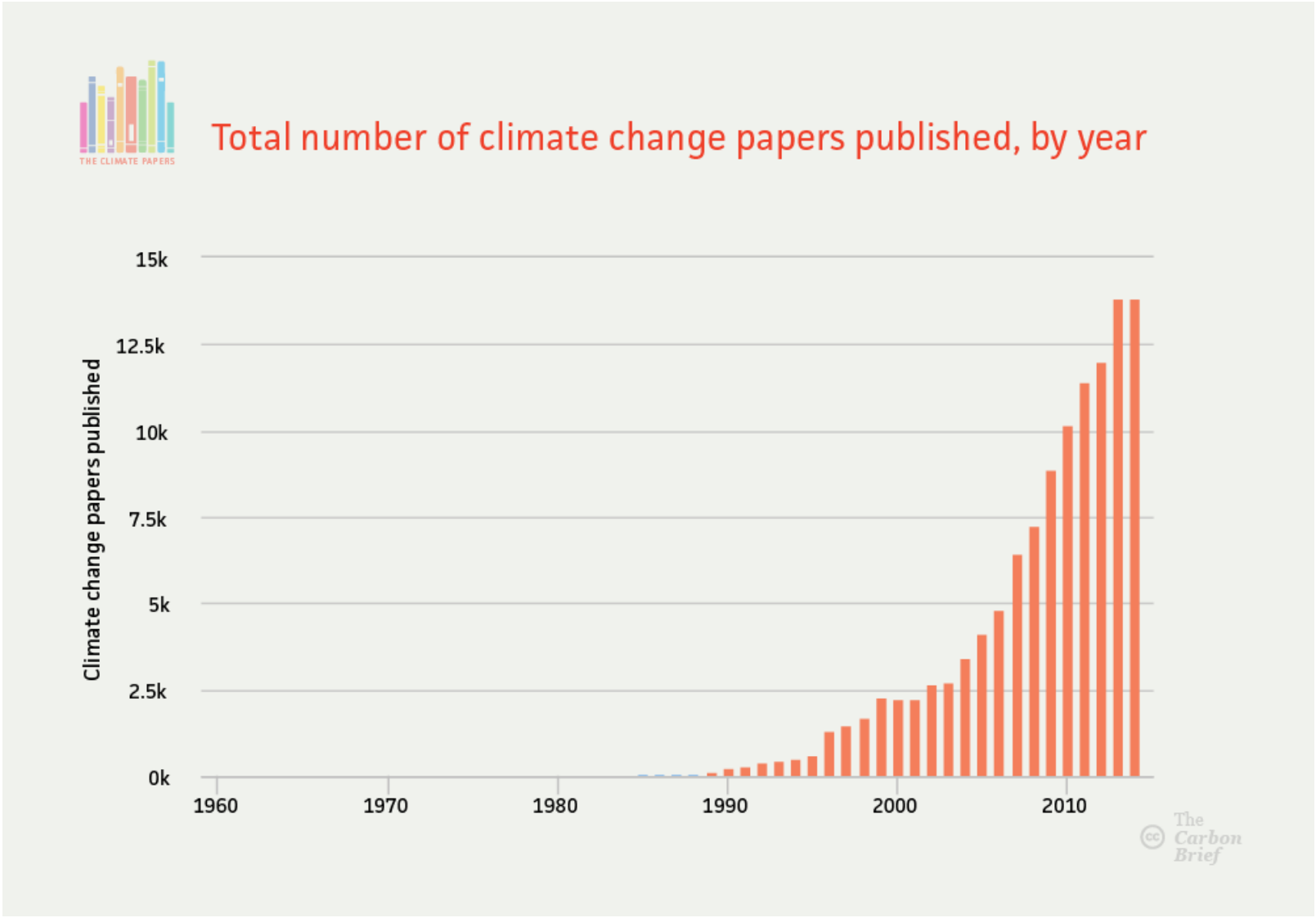
Discussion

- Your past and present experiences of climate change challenges
- Your thoughts on the challenges you foresee for the future

Adaptation Mitigation

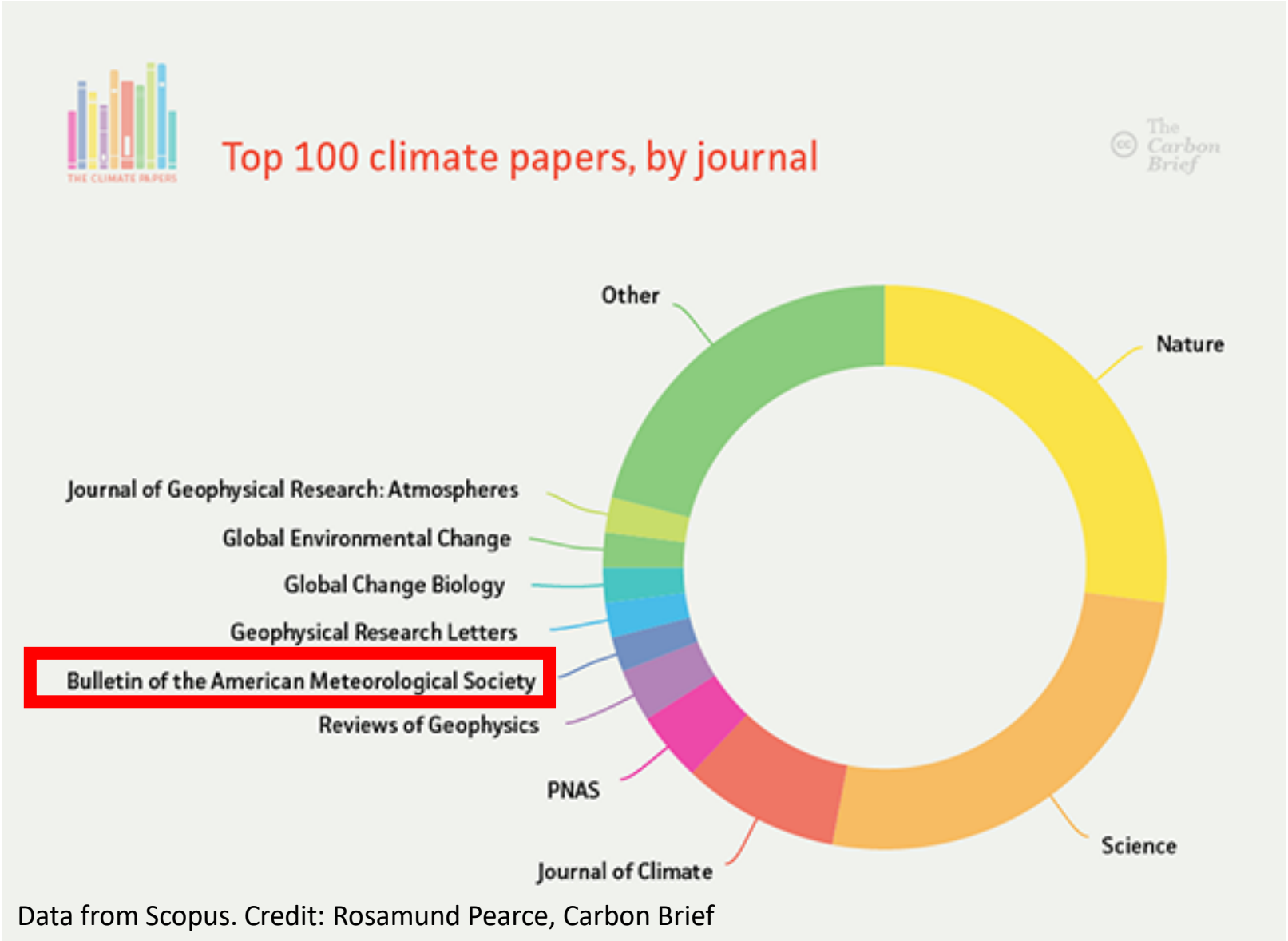
How is climate science today?

How much do we have of it?



Data from Scopus. Credit: Rosamund Pearce, Carbon Brief. Courtesy Prof. D. Hill, Leeds Univ.

How accessible is it?



Data from Scopus. Credit: Rosamund Pearce, Carbon Brief

How understandable is it?

nature climate change

ARTICLES

PUBLISHED ONLINE: 12 OCTOBER 2015 | DOI: 10.1038/NCLIMATE2824

Linguistic analysis of IPCC summaries for policymakers and associated coverage

Ralf Barkemeyer[1]*, Suraje Dessai[2], Beatriz Monge-Sanz[3], Barbara Gabriella Renzi[4] and Giulio Napolitano[5]

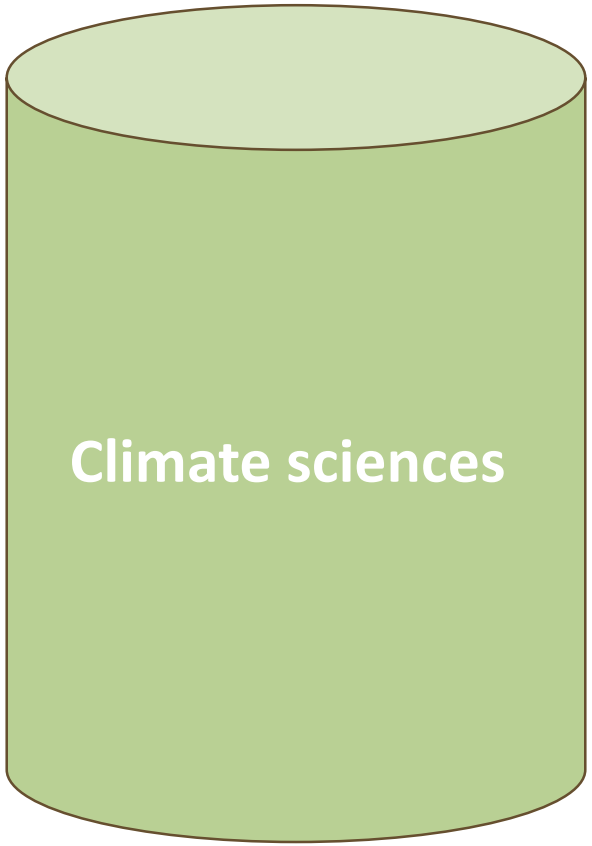
The Intergovernmental Panel on Climate Change (IPCC) Summary for Policymakers (SPM) is the most widely read section of IPCC reports and the main springboard for the communication of its assessment reports. Previous studies have shown that communicating IPCC findings to a variety of scientific and non-scientific audiences presents significant challenges to both the IPCC and the mass media. Here, we employ widely established sentiment analysis tools and readability metrics to explore the extent to which information published by the IPCC differs from the presentation of respective findings in the popular and scientific media between 1990 and 2014. IPCC SPMs clearly stand out in terms of low readability, which has remained relatively constant despite the IPCC's efforts to consolidate and readjust its communications policy. In contrast, scientific and quality newspaper coverage has become increasingly readable and emotive. Our findings reveal easy gains that could be achieved in making SPMs more accessible for non-scientific audiences.

Given the magnitude of the problem, as well as the diverse set of audiences the IPCC reports to, the way in which findings have been communicated to—and received by—the media has sparked considerable controversy[1,2], epitomizing the sharp divide between communicating within the scientific community and conveying findings to the media[3]. Crucially, IPCC SPMs can be seen as reporting from experts in one field (scientists) to experts in different fields (scientists from other fields and policymakers), with all the disciplines and sub-disciplines each of these fields contain. The IPCC's efforts to consolidate and readjust its communications policy illustrate the challenges this creates. The IPCC's remit is to synthesize and communicate the current state of climate research to governments and policymakers at all levels[4]. Its findings should be communicated in a way that can be understood by a non-scientific audience[5]. One of its key principles is to be policy-relevant, but not policy-prescriptive[6]. We would therefore expect SPMs to reflect these principles by adopting a clear and neutral language that can be understood by a non-specialist audience. At the same time, it is of crucial importance how the print media interpret the results presented by the IPCC, as pivotal agents in science communication[7]

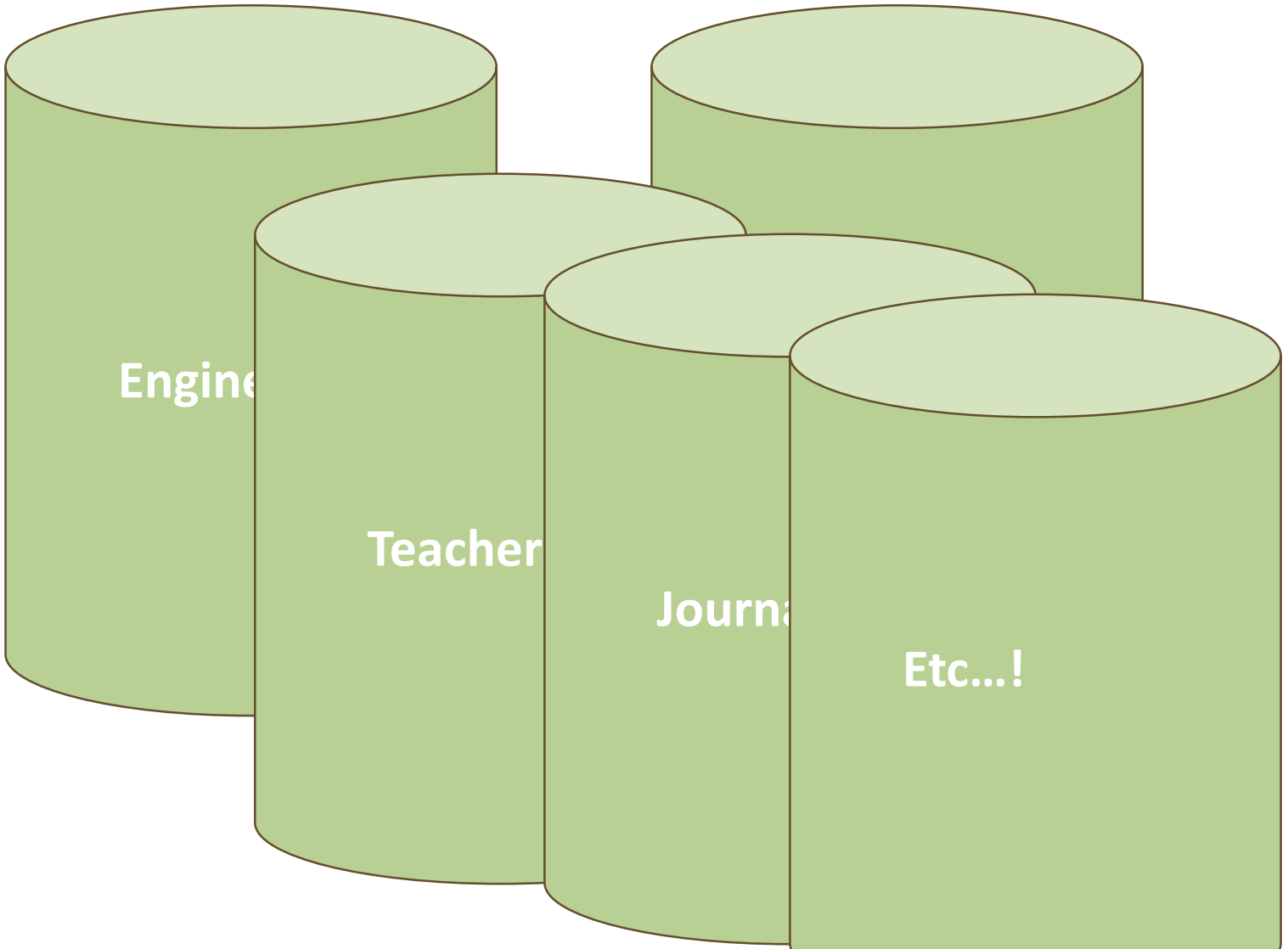
is based on the assumption that text containing longer sentences and more complex words is more difficult to comprehend. The content analysis software DICTION[16] allows us to assess the degree of optimism—and therefore the tone—of different bodies of text. Both are widely established metrics that have been used in a variety of contexts ranging from paediatrics[17] to accounting research[18,19].

FRE scores by publication type for the period 1990–2014 are presented in Fig. 1. Average scores reflect that all four publication types target different audiences, employ a different language and transmit different messages. Mean scores across tabloid newspapers (*Daily News, The Mirror, The Sun*) and quality newspapers (*New York Times, Washington Post, The Independent, The Times*) are relatively low compared to the way in which these publications cover other issues[14]. This is unsurprising given that the launch of an IPCC report is a very specific event referring to a complex phenomenon. For scientific publications, only editorials and news articles of *Nature* and *Science* were considered. They occupy a middle-ground between IPCC SPMs and quality newspaper coverage. IPCC SPMs and tabloid coverage on the launch of the reports clearly stand out, with mean FRE scores of 20 and 50, respectively (Fig. 1).

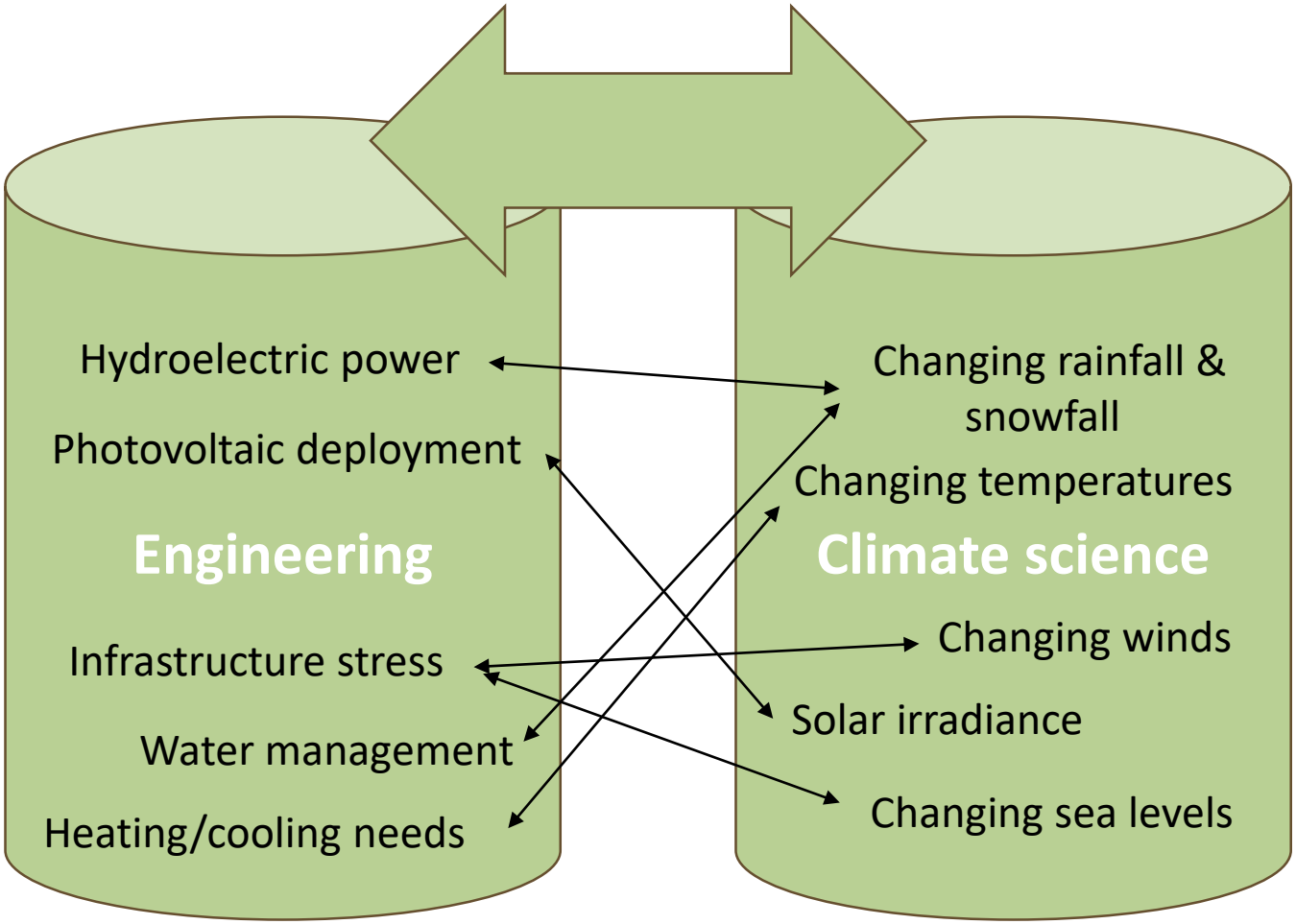
Why don’t you hear more about it?



Silos of knowledge



Silos tomorrow?

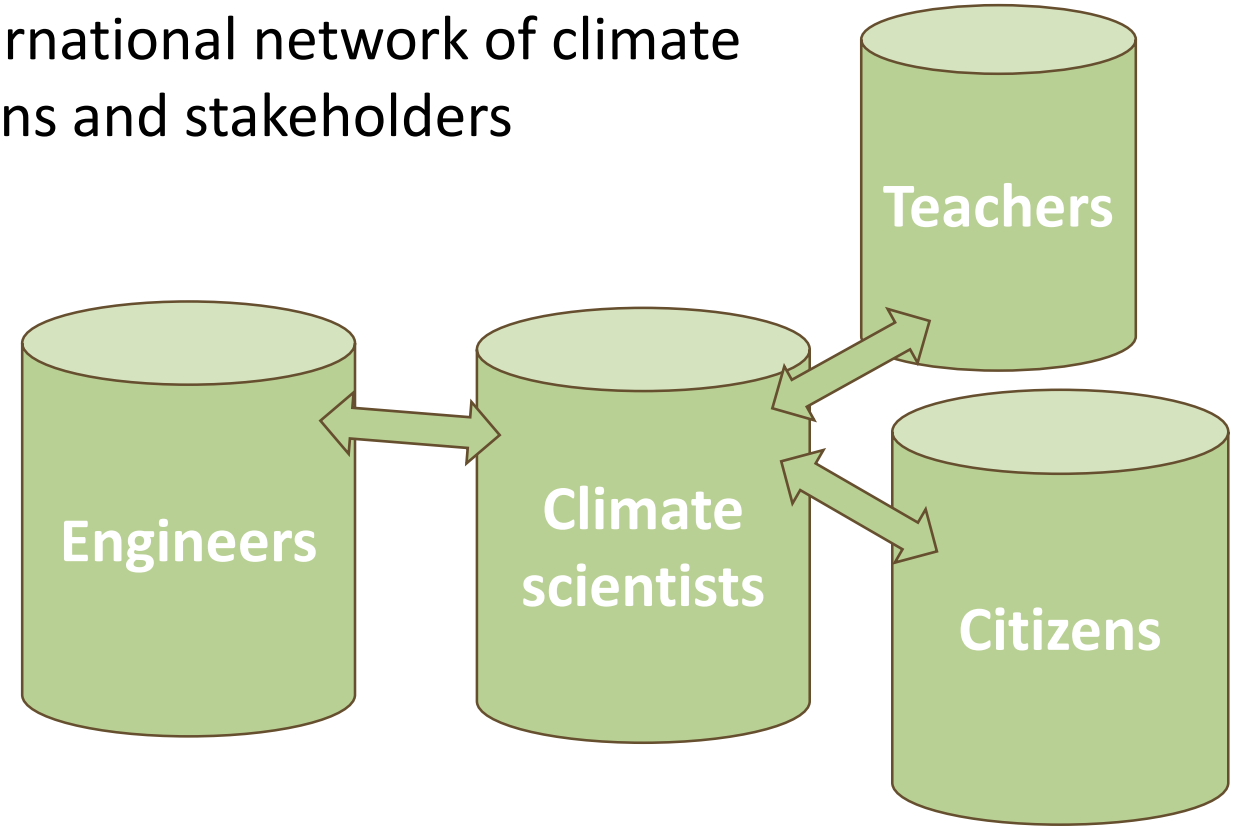


What is Climanosco?

Non-profit association founded in Zurich in 2015

Mission:

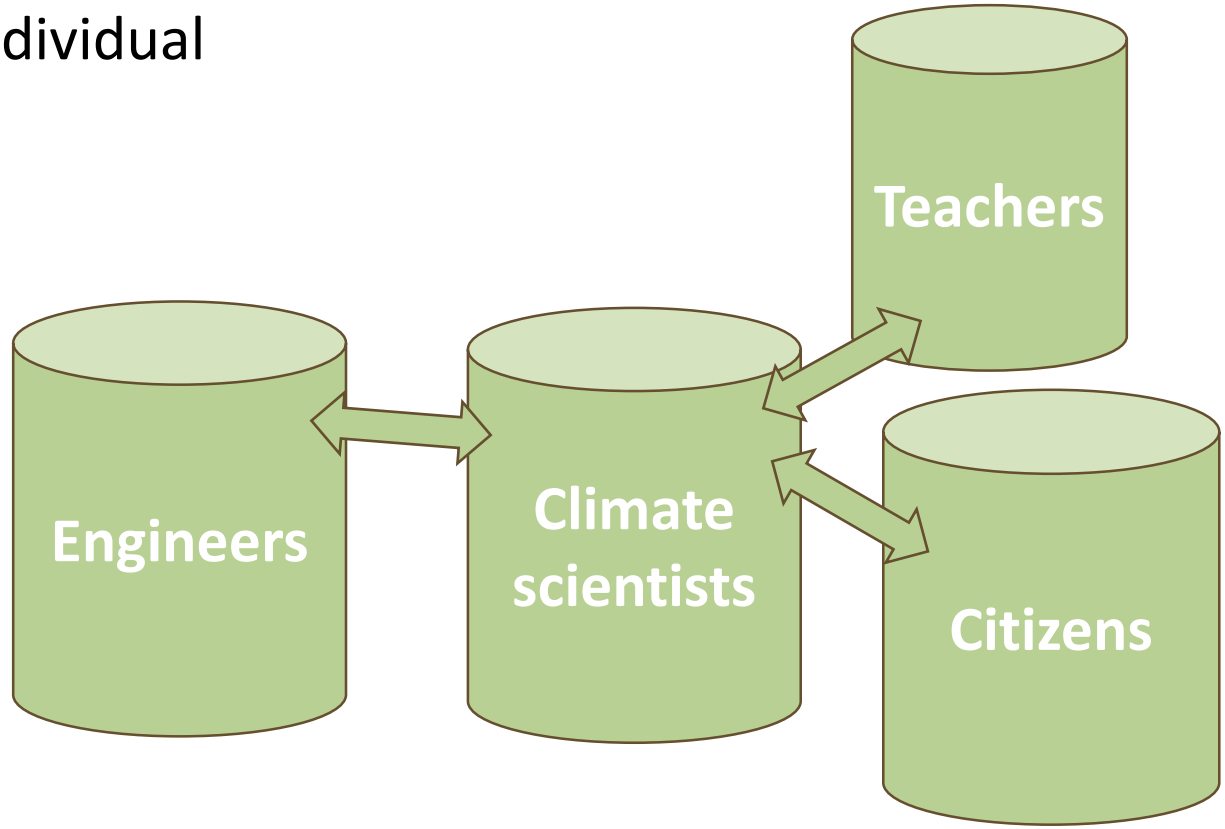
- Make climate science accessible to everyone
- Develop an international network of climate scientists, citizens and stakeholders



What is Climanosco?

Our three guiding principles:

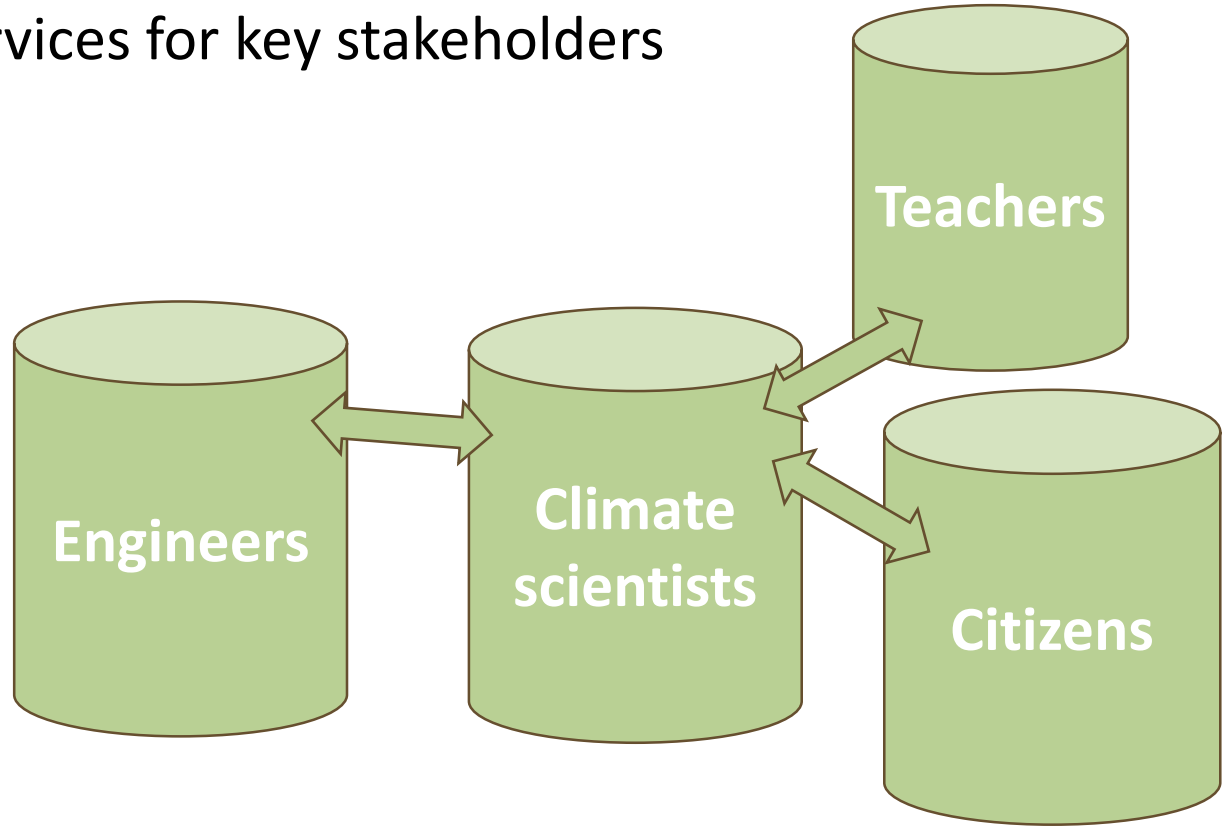
- Highest scientific standards
- Independent and neutral
- Based on the individual



What is Climanosco?

Where do we stand today?

- We publish accessible climate science
- We develop our network
- We develop services for key stakeholders



How can scientists support engineers?

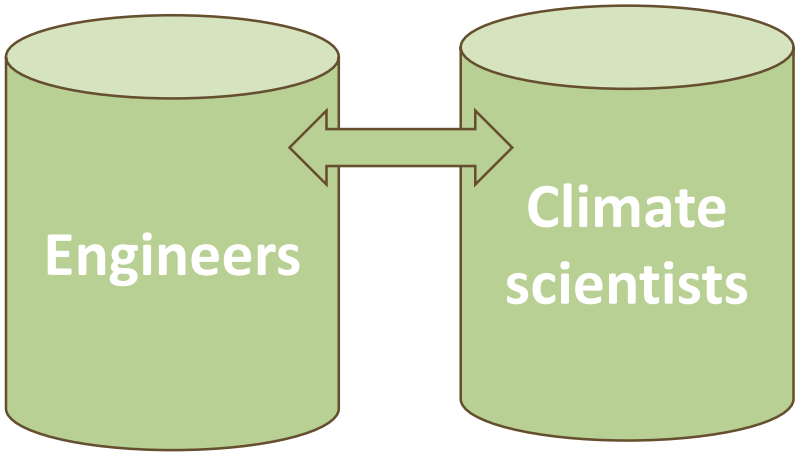
Discussion

- What would help YOU when facing climate change challenges?
- What would give you an edge in your career?
- What type of support would be most useful?

How can Climanosco support Engineers?

First ideas of services:

- Offer direct access to climate researchers with specific expertise
- Offer tailored data, reports or other material
- Offer tailored training courses or workshops
- Offer an online exchange forum



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We want to hear from you!

www.climanosco.org

contact@climanosco.org