University of Maryland sustainability council

Meeting Summary
November 12, 2018

Council Members Present:

Carlo Colella, Vice President for Administration and Finance (Chair)
Linda Clement, Vice President for Student Affairs
David Cronrath, Associate Provost for Planning and Special Proejcts
Maureen Kotlas, Executive Director, Department of Environmental Safety, Sustainability & Risk
Scott Lupin, Assoc. Dir., Environmental Safety, Sustainability & Risk, and Director, Office of Sustainability
Bryan Quinn, Director of Technical Operation, Department of Electrical & Computer Engineering
Jana VanderGoot, Assistant Professor, Architecture
Amelia Avis, Undergraduate Student, Government and Politics and Policy
Timothy Reedy, PhD Student, International Education Policy

Guests:

Ross Salawitch, Professor, Atmospheric & Oceanic Science
Jonathan Allen, Undergraduate Student, President, Student Government Association

Meeting start time: 10:00am

Meeting Highlights

Welcome and Review of October 8, 2018 Meeting Minutes

Carlo Colella welcomed the Council members and called the meeting to order. Meeting summary from October 8, 2018 was approved.

Overview of IPCC Report

Ross Salawitch provided an update about the recently released IPCC report. The presentation can be viewed as Appendix A.

SGA Resolution for UMD Carbon Neutrality

Amelia Avis and Jonathan Allen from the Student Government Association (SGA) presented a letter to the Council about SGA's request to President Loh for the university to move up the campus carbon neutrality date from 2050 to 2025. The letter can be viewed as Appendix B.

Sustainability Fund Proposals

Amelia Avis presented two University Sustainability Fund projects to the Council for approval. Information about the projects are available as Appendix C.

The Council reviewed the following projects:

Eliminating the Climate Impact of Undergraduate Student Commuting Emissions
The Council voted on a request of $50,000. APPROVED contingent on a Council workgroup being created to determine how to fund this initiative annually.

Net Zero Energy Retrofit Initiative
The Council voted on a request of $29,000. APPROVED.

University System of Maryland Sustainability Summit

Scott Lupin reminded the Council that the University System of Maryland and Office of Sustainability will host a USM Sustainability Summit at The Stamp on Tuesday, December 4. Council members were encouraged to contact Scott if they are interested in attending.

Adjourn 12:00pm

IPCC 1.5°C Special Report

Ross Salawitch
Department of Atmospheric and Oceanic Science
Department of Chemistry and Biochemistry
Earth System Science Interdisciplinary Center
University of Maryland, College Park

rsalawit@umd.edu

UMCP Sustainability Council, 12 Nov 2018

Introductory Slide 1

Nov 2014: Presidents Obama & Xi announced

U.S. would reduce GHG emissions to 27% below 2005 by 2025

China would peak GHG emissions by 2030 with best effort to peak early

Paris Climate Agreement:

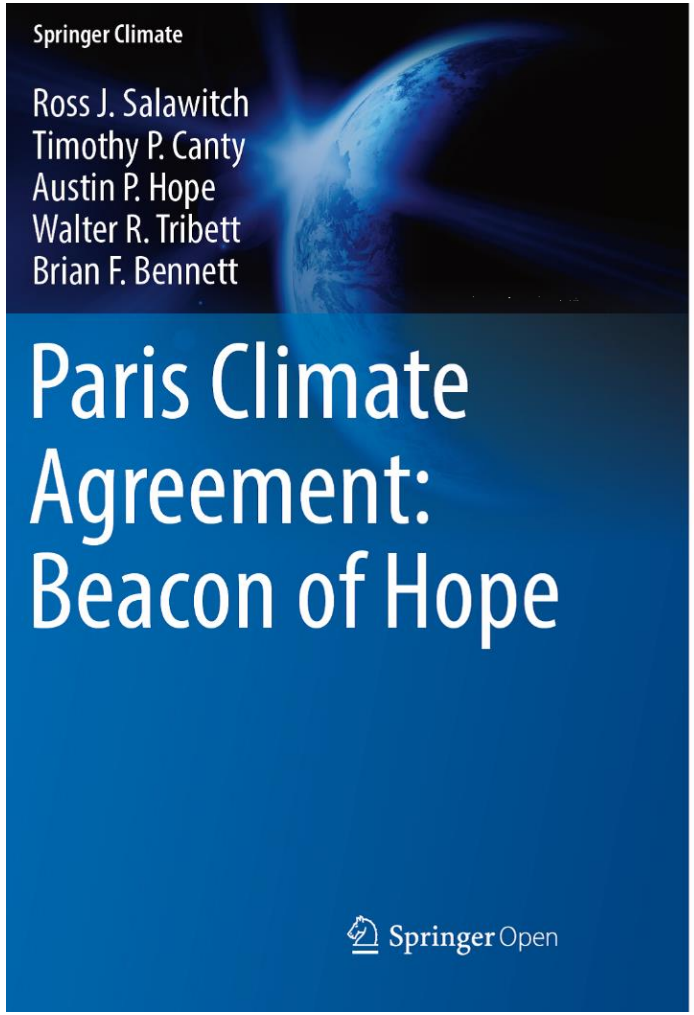
Article 2, Section 1, Part a):

Objective to hold "increase in GMST to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels"

INDC: Intended Nationally Determined Contributions to reduce GHG emissions

- **Submitted prior to Dec 2015 meeting in Paris**
- **Consist of either unconditional (promise) or conditional (contingent) pledges**
- **Generally extend from present to year 2030**

Introductory Slide 2



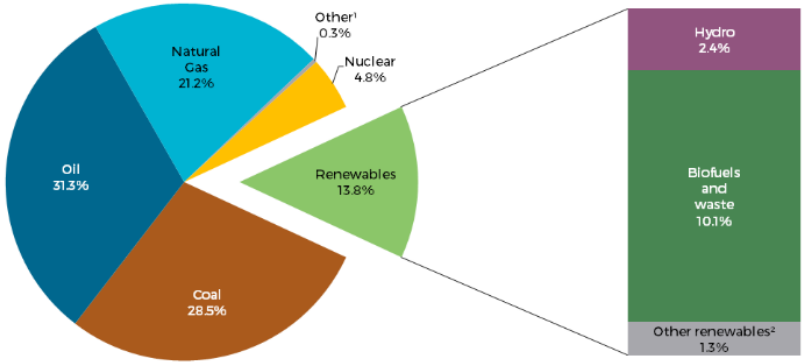
www.parisbeaconofhope.org

1) Available via open access at https://link.springer.com/book/10.1007/978-3-319-46939-3

2) If all of the Conditional and Unconditional INDCs were met ***and*** the gains in carbon intensity of the world's economies continued to improve by extrapolating the INDCs, then there would be a ~65% chance the rise in global mean surface temperature (GMST) could be kept below 2°C relative to pre-industrial

3) This requires half of total global energy, not just electricity, to be supplied by sources that release little of no GHGs by year 2060

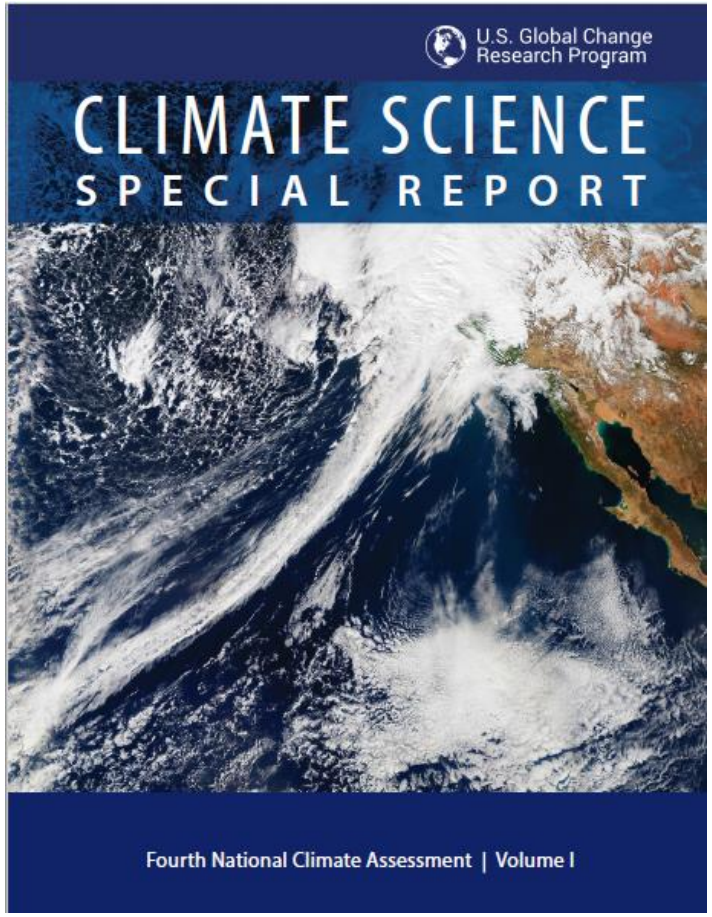
Figure 1: 2014 fuel shares in world total primary energy supply



In 2014, world obtained ~80% of its **energy** from combustion of fossil fuels

https://www.iea.org/newsroom/news/2016/july/renewable-energy-continuing-to-increase-market-share.html

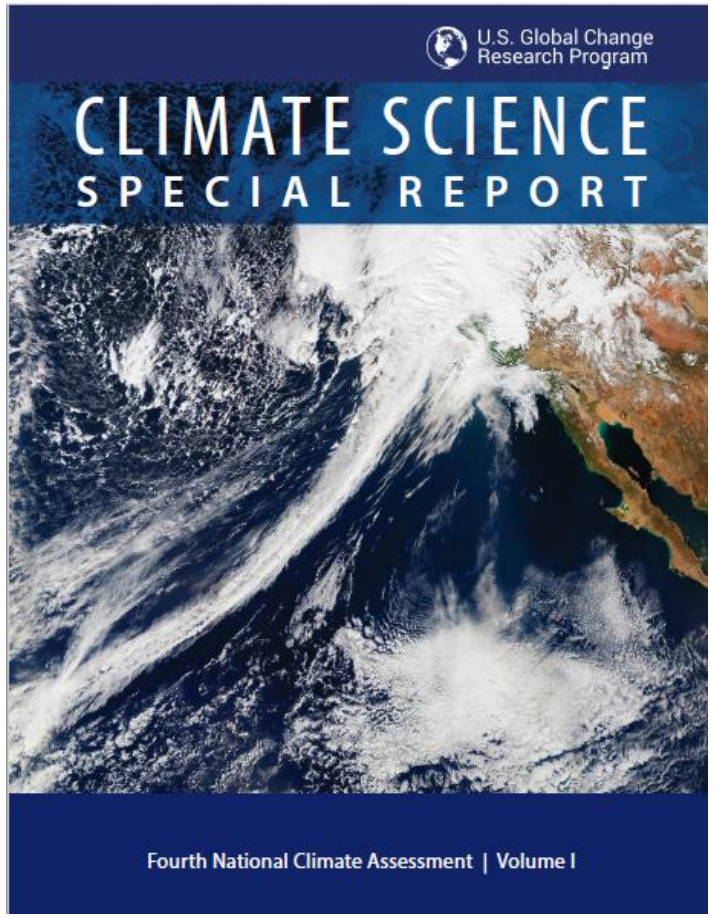
Introductory Slide 3



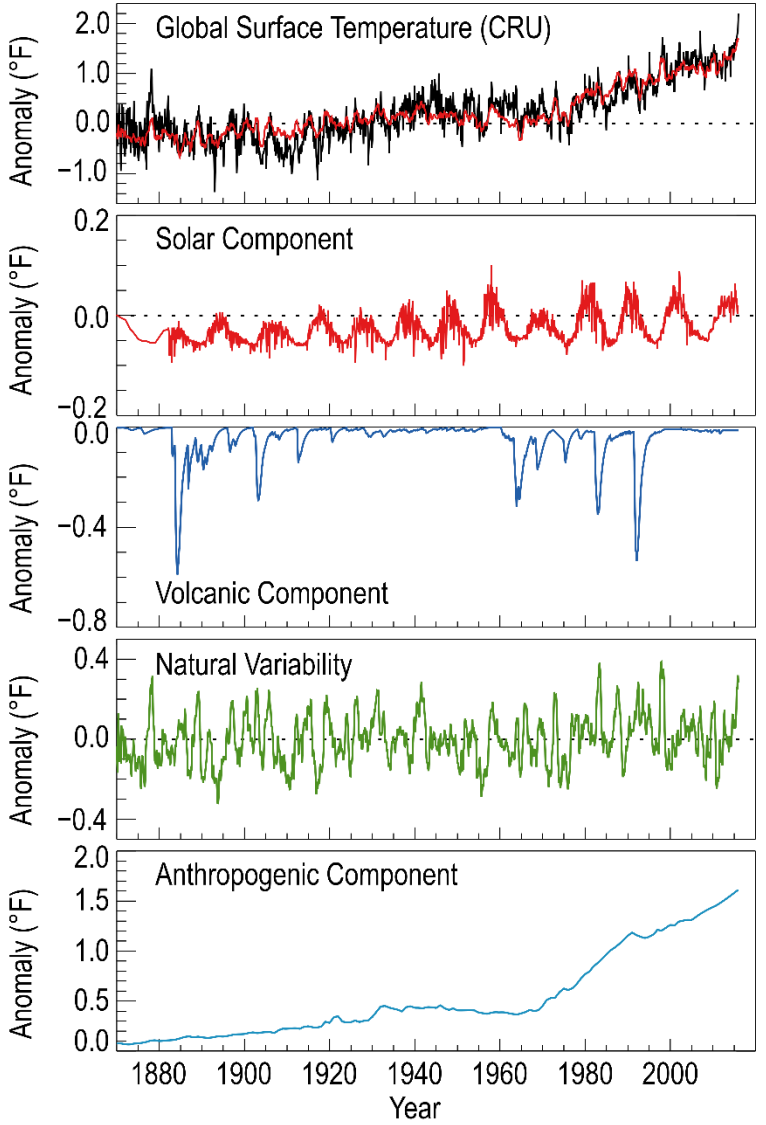
https://science2017.globalchange.gov

I was Review Editor of Ch 1 to 5

Introductory Slide 4



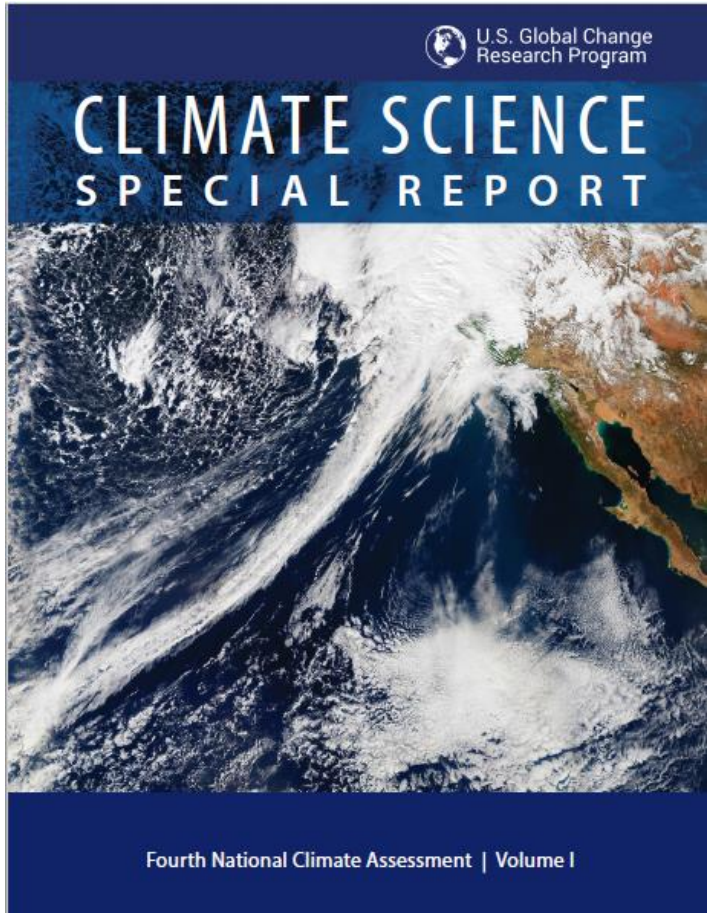
https://science2017.globalchange.gov

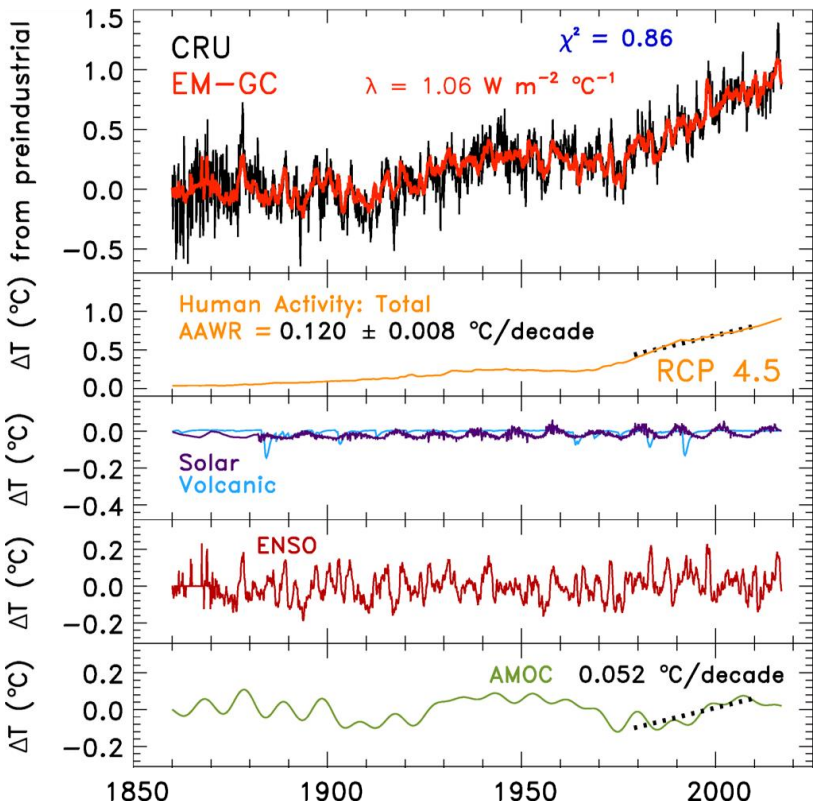


Top panel:
RED: model & BLACK: data
Change in GMST relative to 1961 – 1990 baseline in °F
for model where only contributions to natural variability are solar, volcanoes, and El Niño-Southern Oscillation

Figure 3.3 of the report, used in the Detection and Attribution chapter, based upon our research

Introductory Slide 4





Top panel:
RED: model & BLACK: data
Change in GMST relative to pre-industrial in °C
for model where contributions to natural variability are solar, volcanoes, El Niño-Southern Oscillation, and other ocean terms such as Atlantic Meridional Overturning Circulation

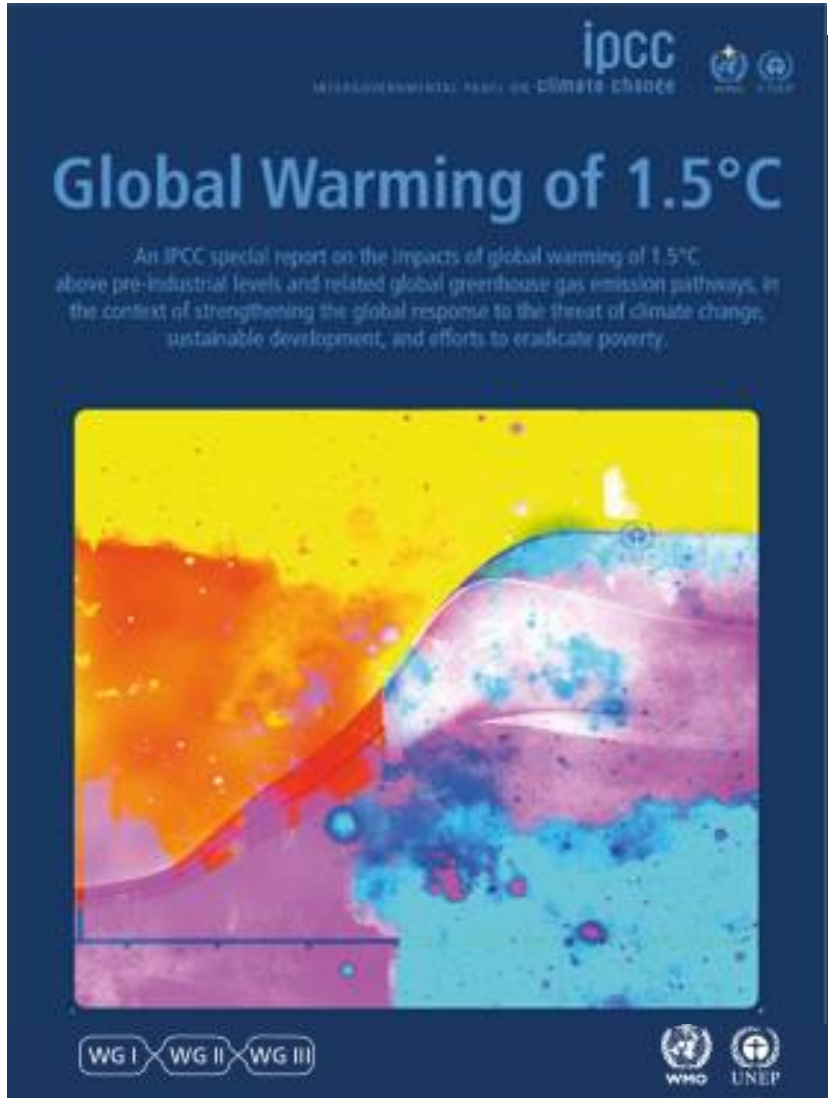
Figure shows:
Human-induced warming nearly 1°C since pre-indust.
Human-induced warming is 0.12°C/decade

Will cross 1.5°C threshold in ~4 decades under BAU

BAU: Business as Usual

https://science2017.globalchange.gov

IPCC 1.5°C Special Report, aka IPCC 1.5SR



Released in near-final form on 8 Oct 2018

Headline Statements (3 pages)
FAQ (21 pages)
Summary for Policy Makers (33 pages)
plus 5 chapters:

1: Framing and context (61 pages)
2: Mitigation pathways compatible with 1.5°C in the context of sustainable development (112 pages)
3: Impacts of 1.5°C global warming on natural and human systems (243 pages)
4: Strengthening and implementing the global response to the threat of climate change (198 pages)
5: Sustainable development, poverty eradication and reducing inequalities (97 pages)

Total: 769 page report (originally, had planned 5 chapters to be 185 pages; ended up being 3.8 times larger)

http://www.ipcc.ch/report/sr15/

Emphasis on actually limit warming to 1.5°C

IPCC 1.5SR identifies 5 Reasons For Concern (RFCs):

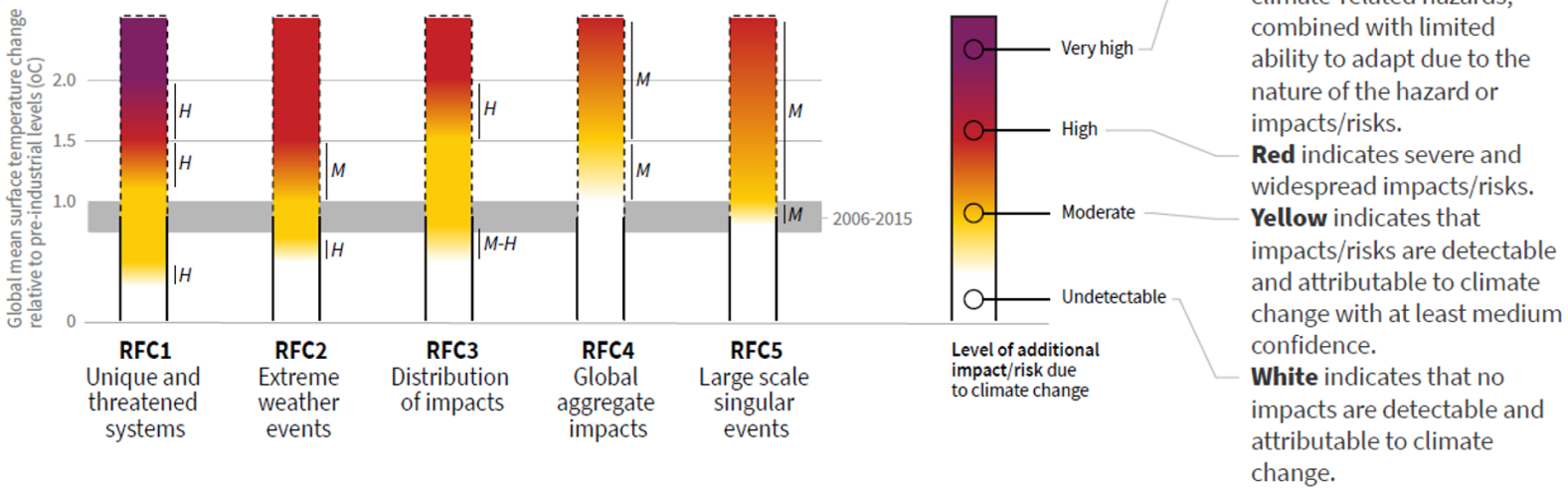
1) Unique and threatened systems
2) Extreme Weather Events
3) Distribution of Impacts
4) Global Aggregate Impacts
5) Large Scale Singular Events

and concludes that risks are much higher for 1.5°C warming than 2°C

How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems

Five Reasons For Concern (RFCs) illustrate the impacts and risks of different levels of global warming for people, economies and ecosystems across sectors and regions.

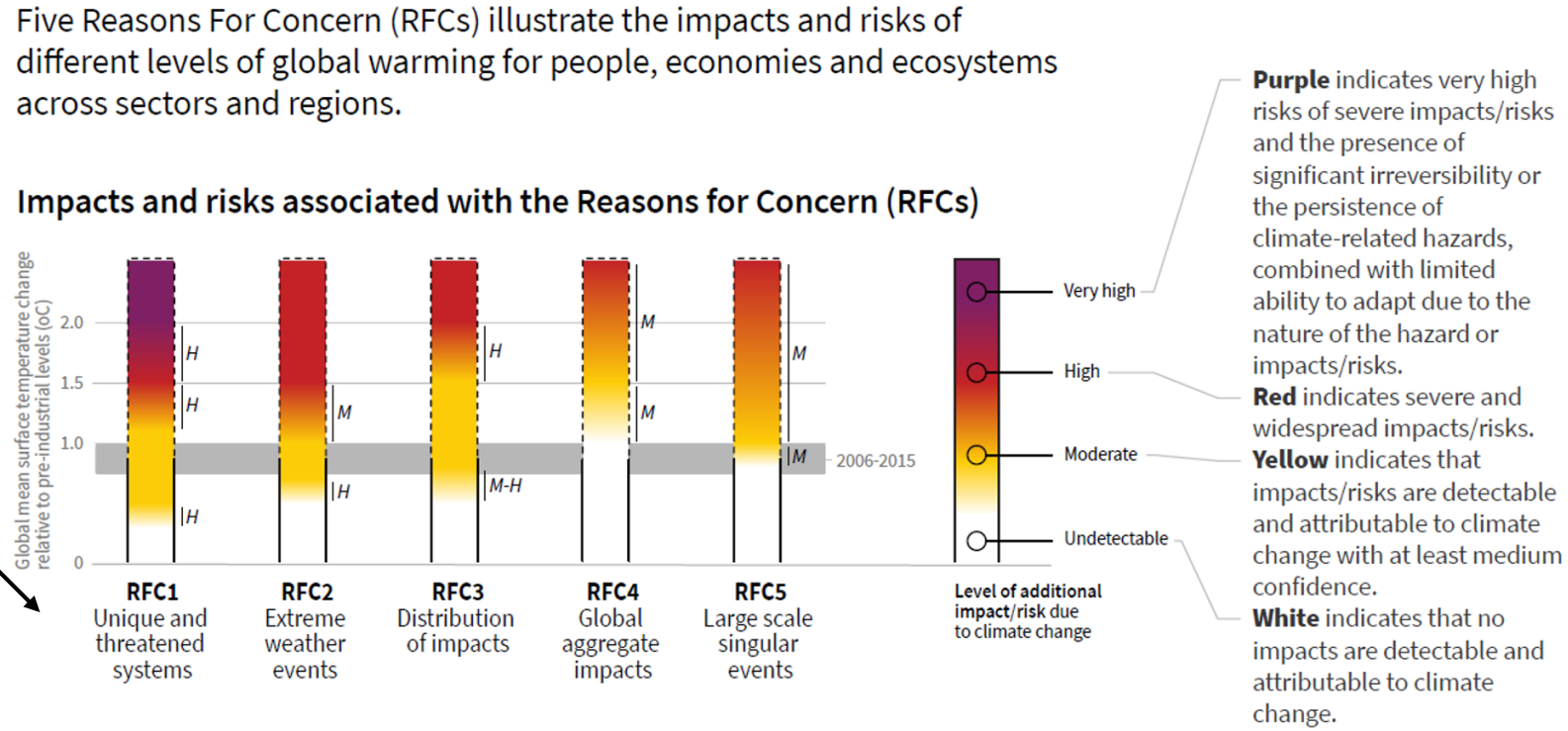
Impacts and risks associated with the Reasons for Concern (RFCs)



http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

Emphasis on actually limit warming to 1.5°C

Tropical coral reefs face high risks of becoming unsustainable if warming exceeds 1.5°C. Coral reefs mostly disappear at 2°C warming.



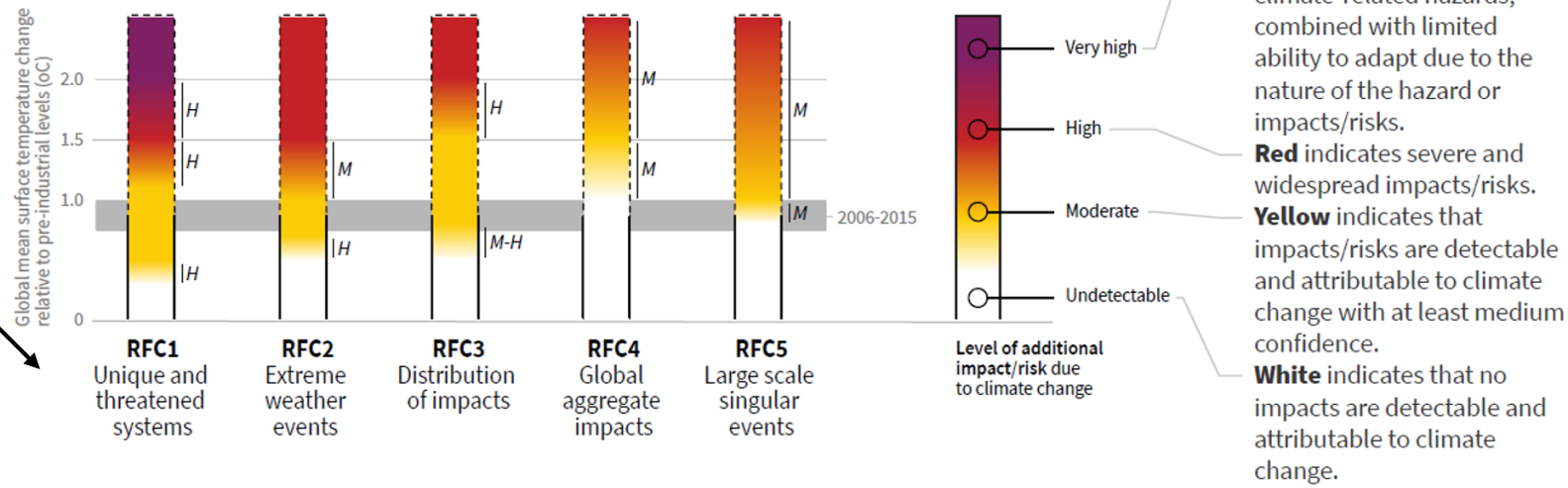
http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

Emphasis on actually limit warming to 1.5°C

Of 105,000 species studied, 6% of insects, 8% of plants and 4% of vertebrates are projected to lose over ***half of their climatically determined geographic range*** for global warming of 1.5°C, compared with 18% of insects, 16% of plants and 8% of vertebrates for global warming of 2°C.

Five Reasons For Concern (RFCs) illustrate the impacts and risks of different levels of global warming for people, economies and ecosystems across sectors and regions.

Impacts and risks associated with the Reasons for Concern (RFCs)

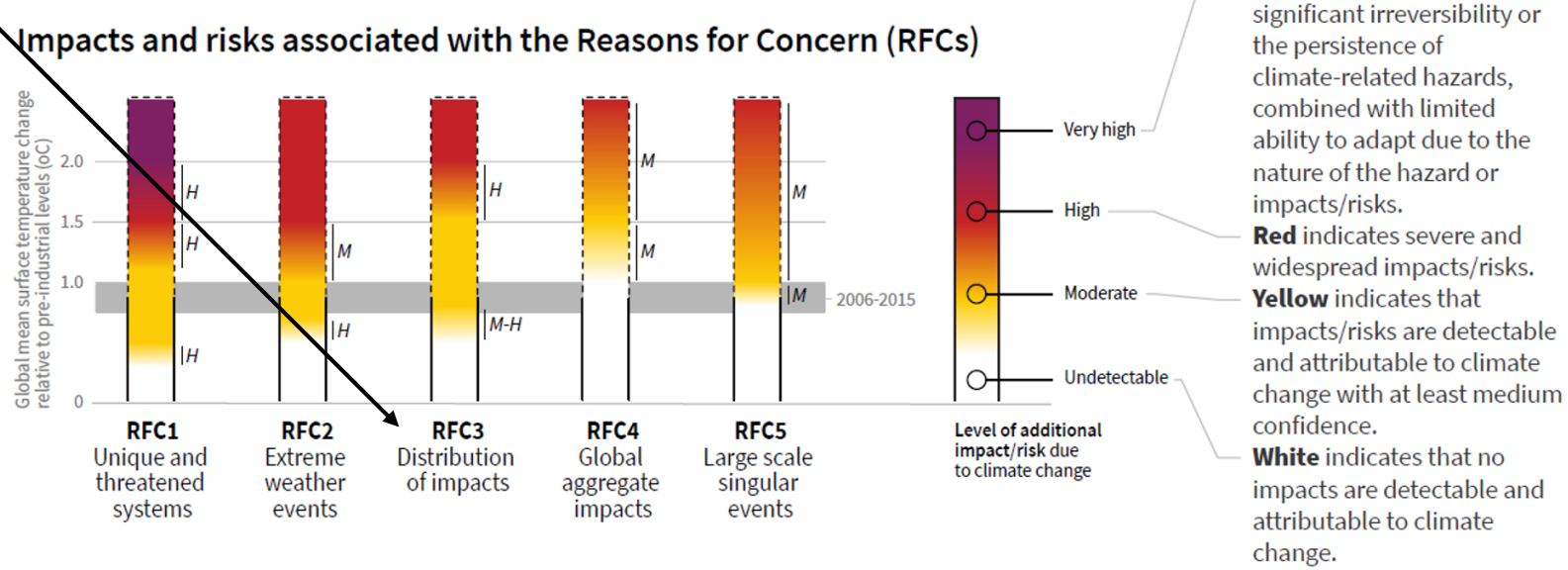


http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

Emphasis on actually limit warming to 1.5°C

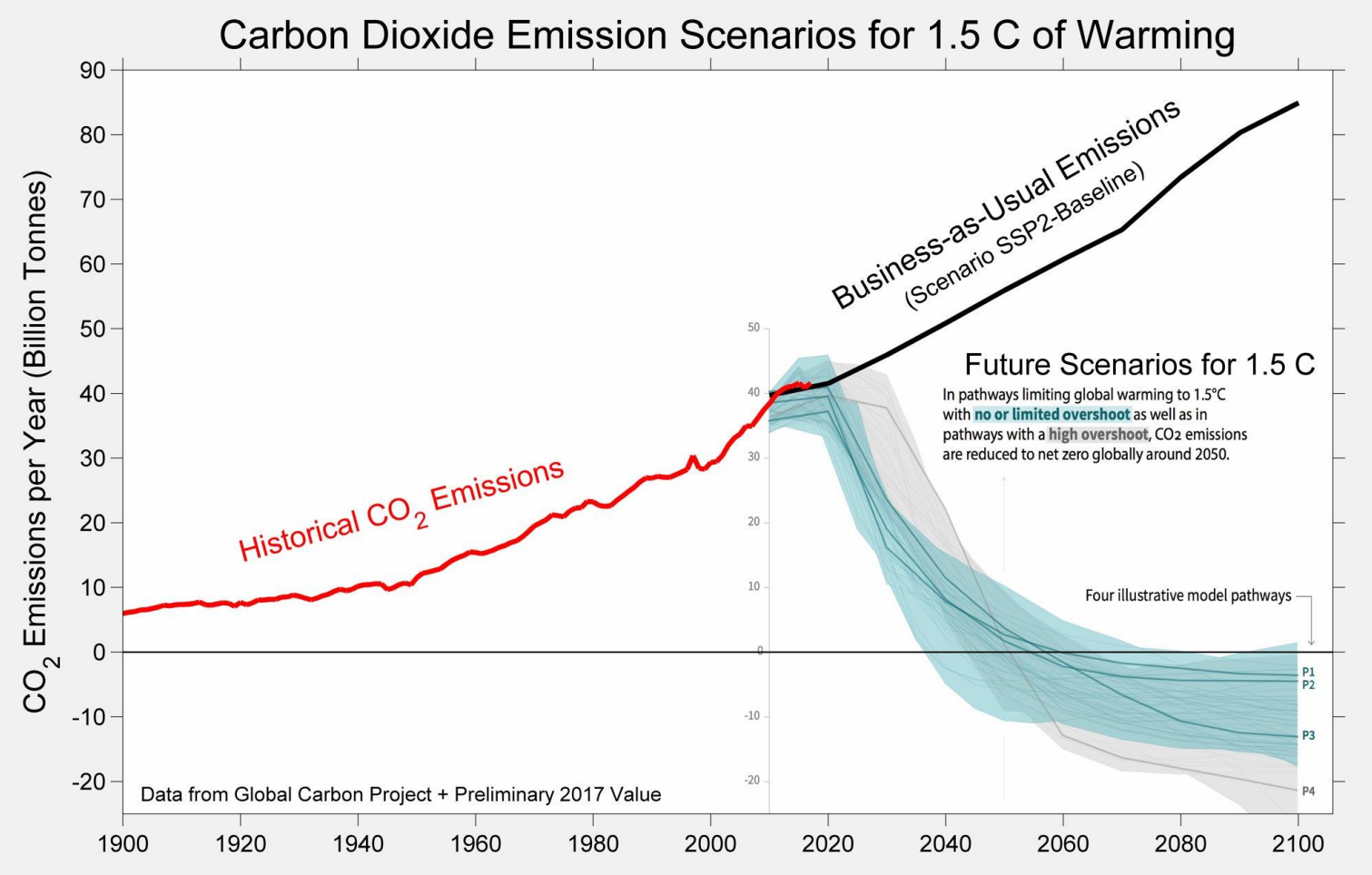
The probability of a sea-ice-free Arctic Ocean during summer is substantially lower at 1.5°C warming compared to 2°C. With 1.5°C warming, one sea ice-free Arctic summer is projected per century. This likelihood is increased to at least one per decade with 2°C global warming.

Five Reasons For Concern (RFCs) illustrate the impacts and risks of different levels of global warming for people, economies and ecosystems across sectors and regions.



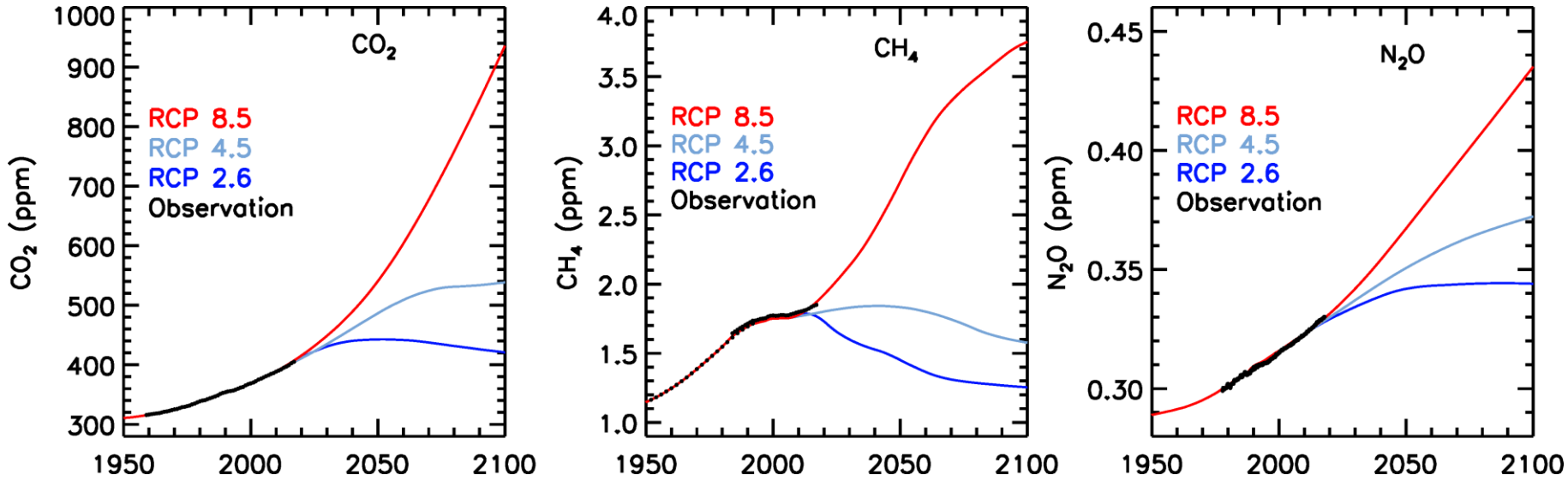
http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

Steep, near immediate reductions in GHG emissions are needed to cap global warming at 1.5°C



http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

Climate Science 101, Slide 1
Three Futures

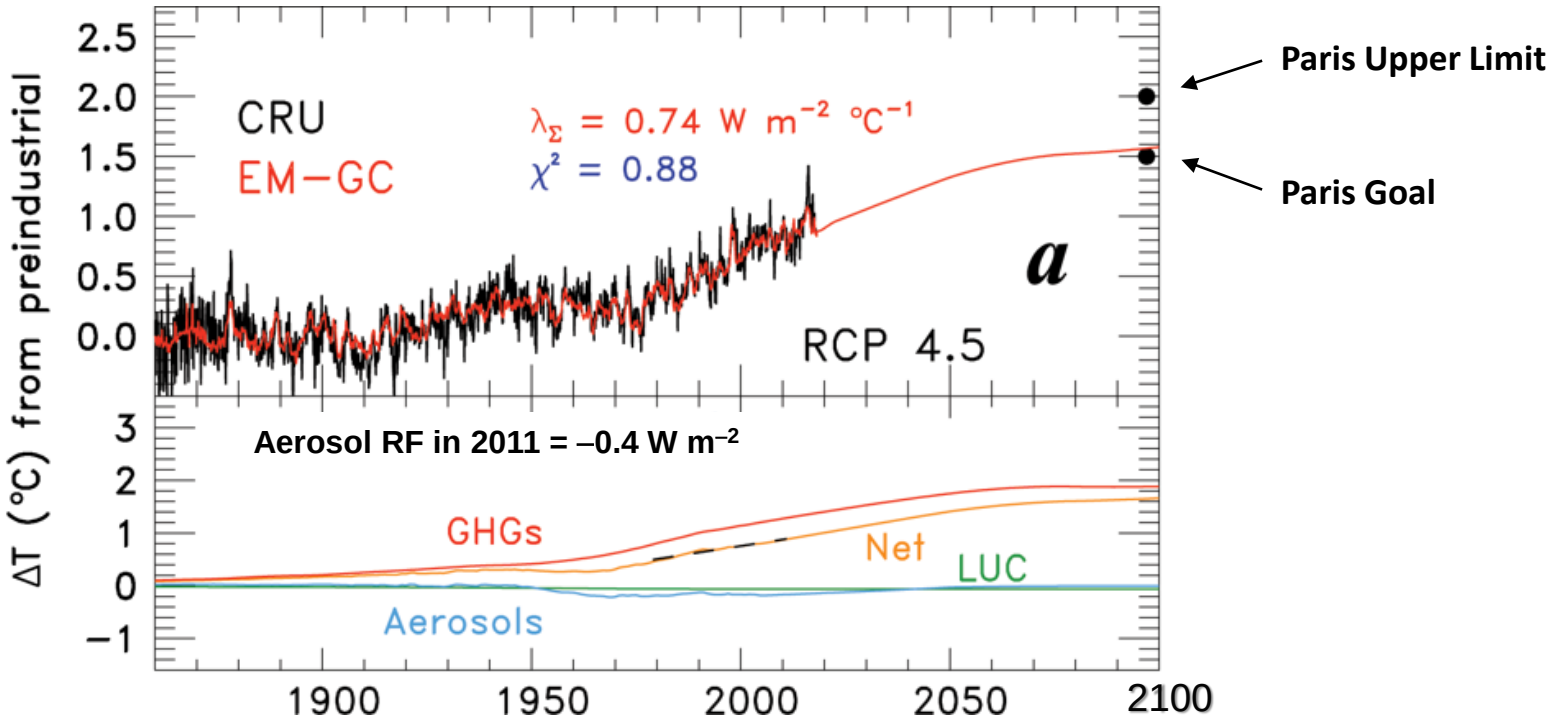


RCP: **R**epresentative **C**oncentration **P**athway

Number represents W m^{-2} RF of climate at end of century

Climate Science 101, Slide 2

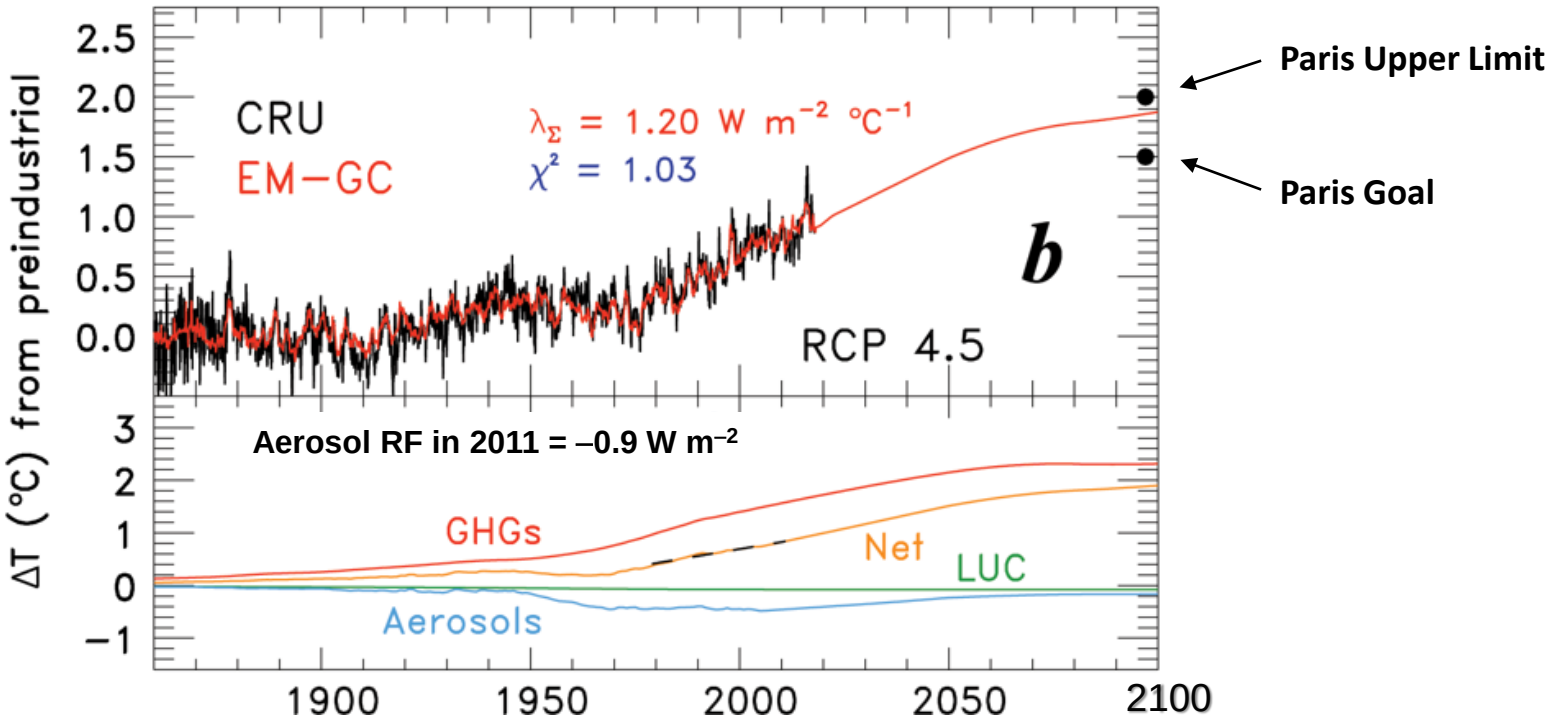
RCP 4.5, Low RF of Climate due to Aerosols



We assume that whatever value of climate feedback is inferred from the climate record will persist into the future. For Aerosol RF in 2011 of **–0.4 W m^{-2}** & assuming best estimate for H_2O and Lapse Rate feedback is correct, this simulation implies sum of other feedbacks (clouds, surface albedo) must be ***negative***.

Climate Science 101, Slide 3

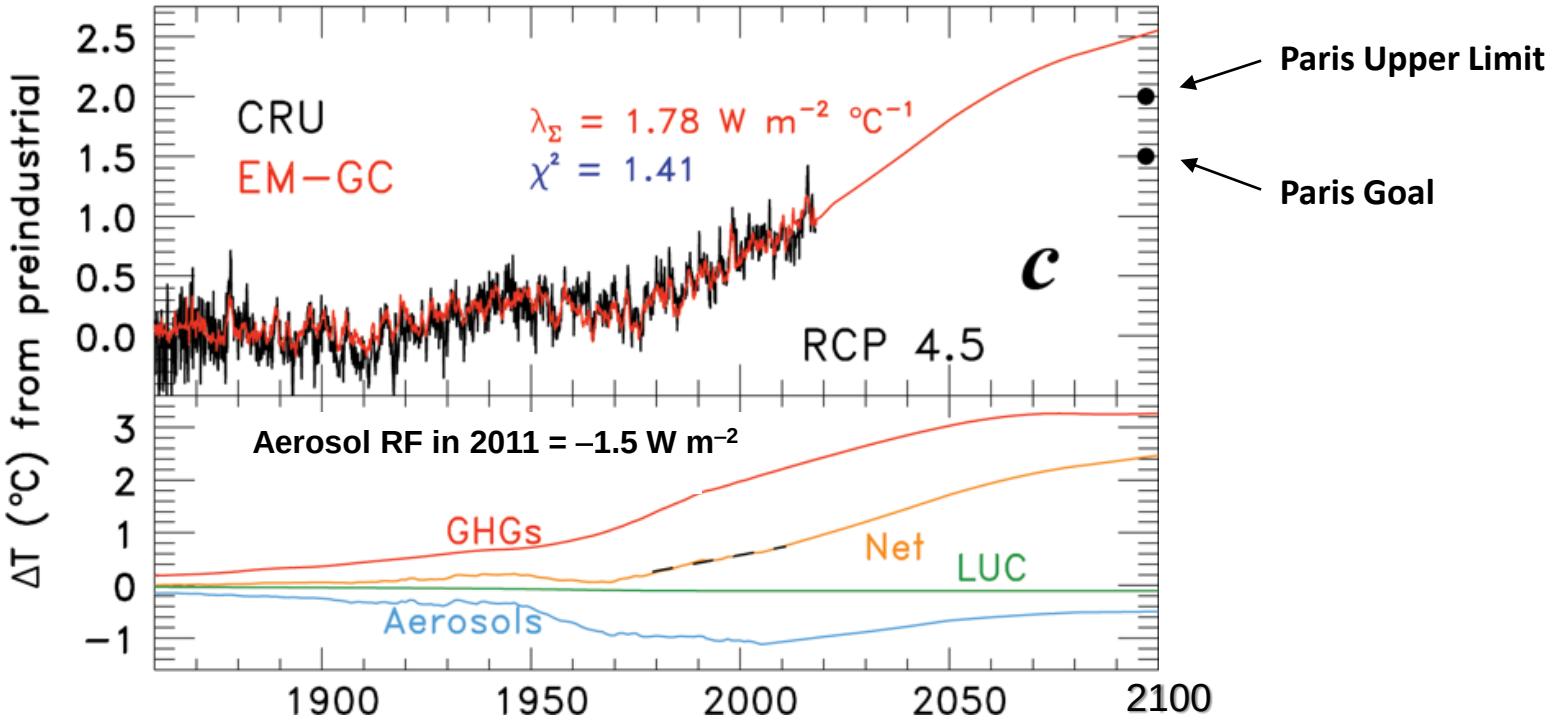
RCP 4.5, Moderate RF of Climate due to Aerosols



We assume that whatever value of climate feedback is inferred from the climate record will persist into the future. For Aerosol RF in 2011 of **–0.9 W m^{-2}** & assuming best estimate for H_2O and Lapse Rate feedback is correct, this simulation implies sum of other feedbacks (clouds, surface albedo) must be ***slightly positive***.

Climate Science 101, Slide 4

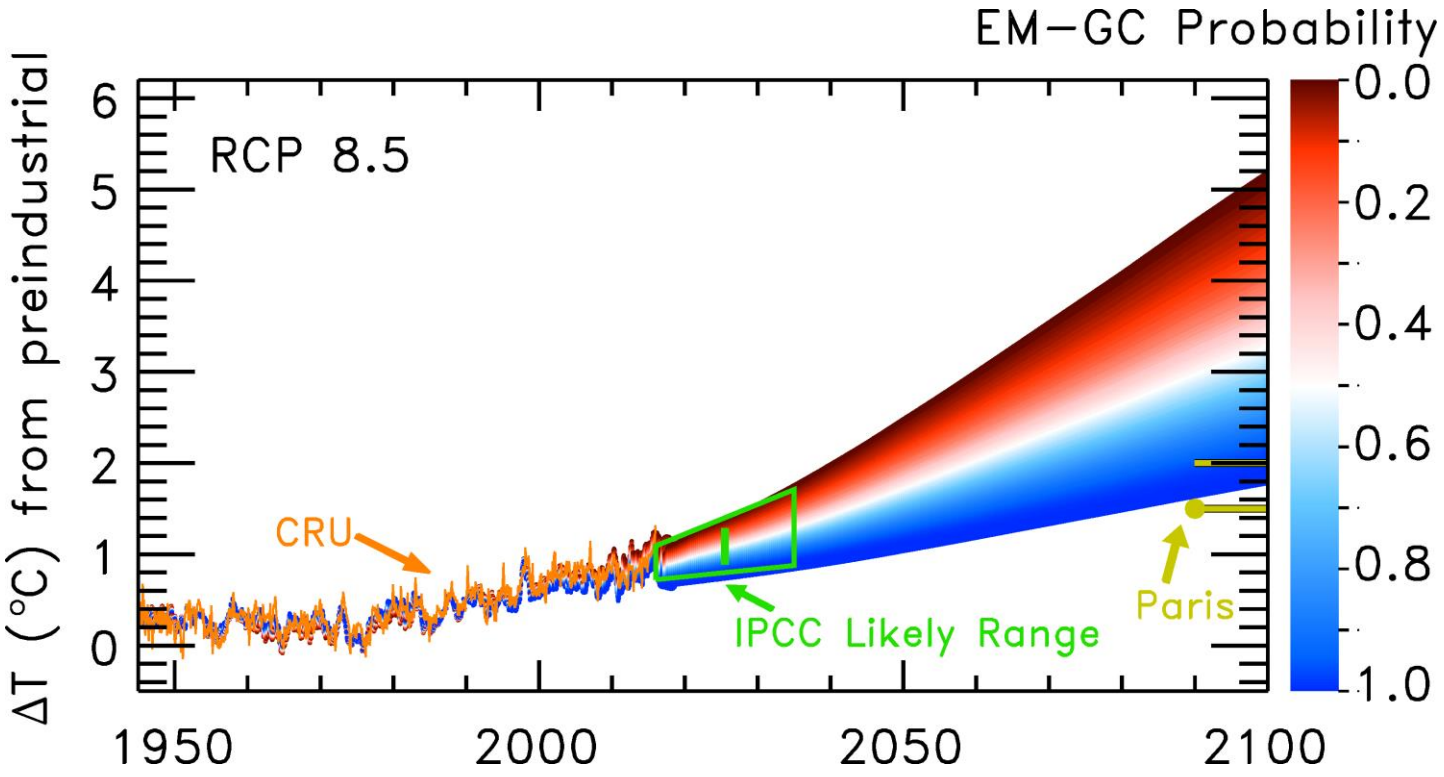
RCP 4.5, High RF of Climate due to Aerosols



We assume that whatever value of climate feedback is inferred from the climate record will persist into the future. For Aerosol RF in 2011 of **–1.5 W m^{-2}** & assuming best estimate for H_2O and Lapse Rate feedback is correct, this simulation implies sum of other feedbacks (clouds, surface albedo) must be ***strongly positive***.

Climate Science 101, Slide 5

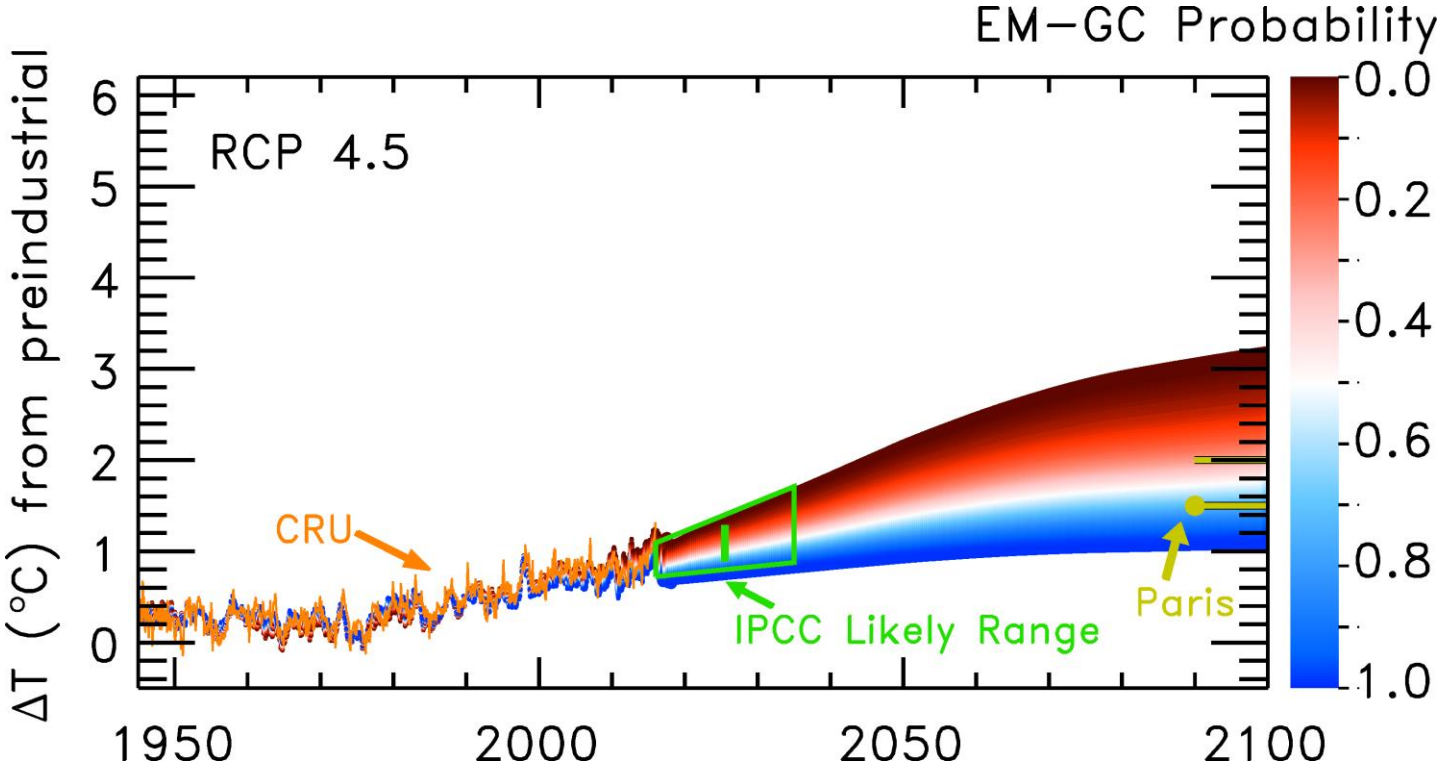
Probabilistic Forecasts of Global Warming are Central to IPCC 1.5SR



If GHGs follow RCP 8.5, **0%** chance rise GMST stays below **1.5°C** and **1%** chance stays below **2.0°C**

Climate Science 101, Slide 6

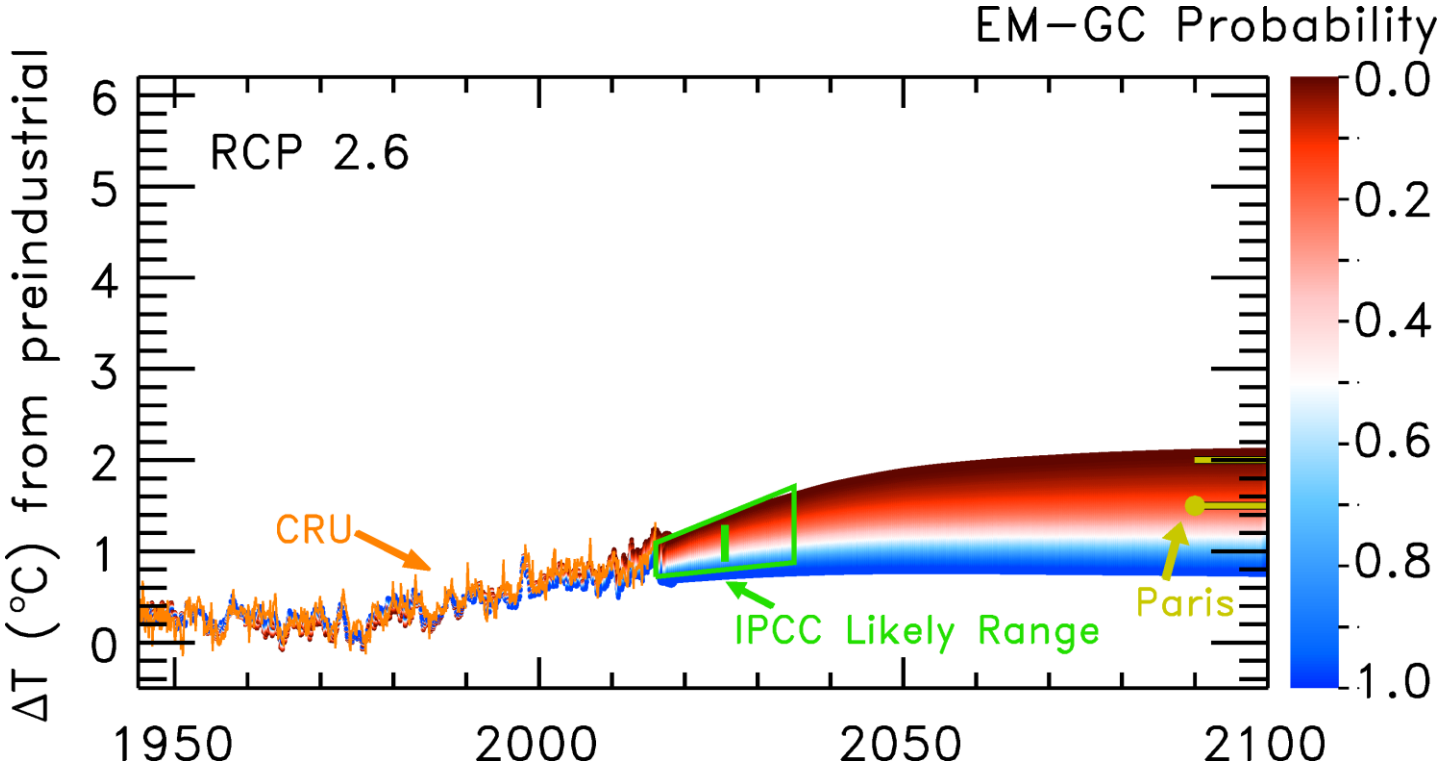
Probabilistic Forecasts of Global Warming are Central to IPCC 1.5SR



If GHGs follow RCP 4.5, **21%** chance rise GMST stays below **1.5°C** and **65%** chance stays below **2.0°C**

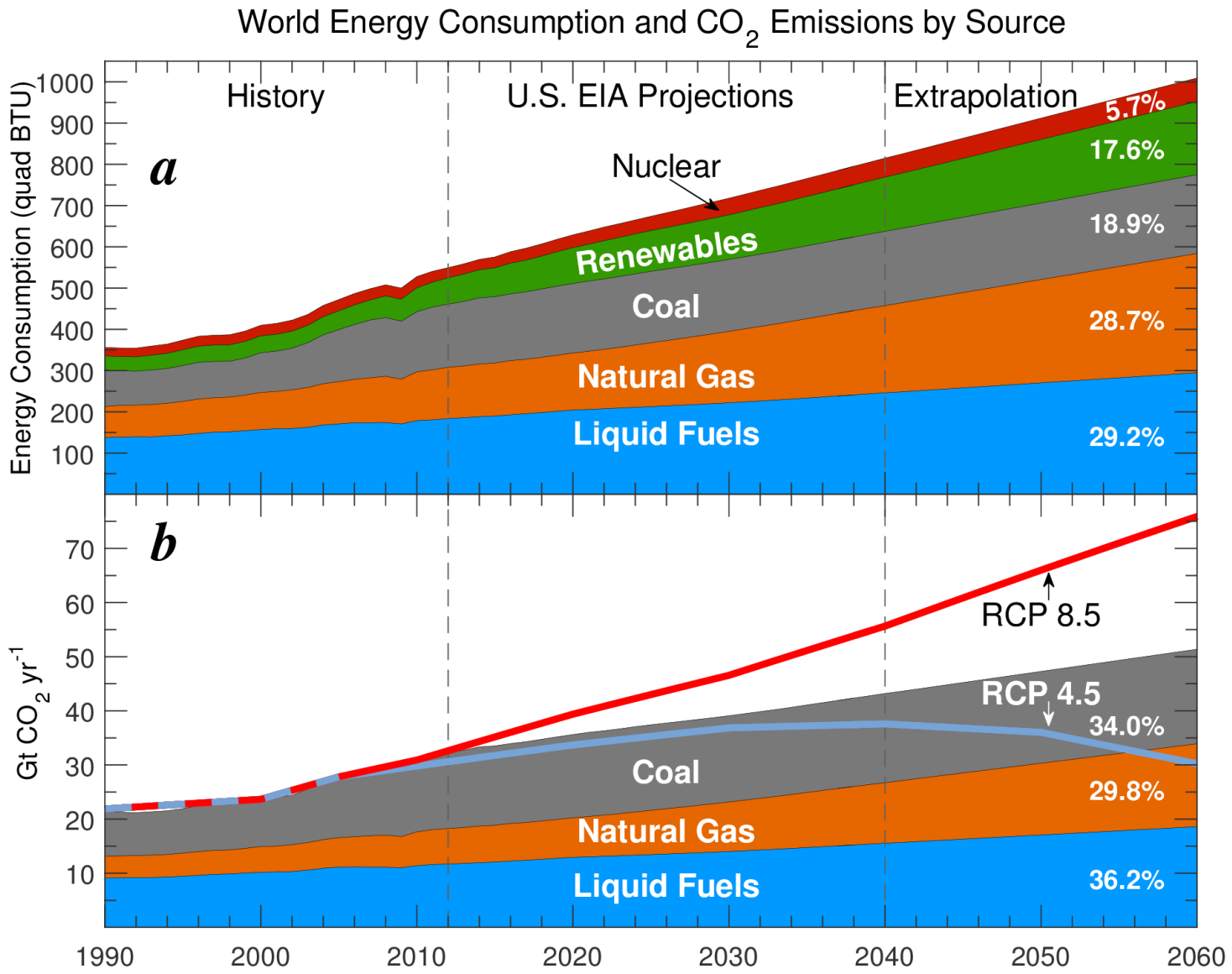
Climate Science 101, Slide 7

Probabilistic Forecasts of Global Warming are Central to IPCC 1.5SR



If GHGs follow RCP 2.6, **80%** chance rise GMST stays below **1.5°C** and **98%** chance stays below **2.0°C**

Global GHG emissions compared to RCPs



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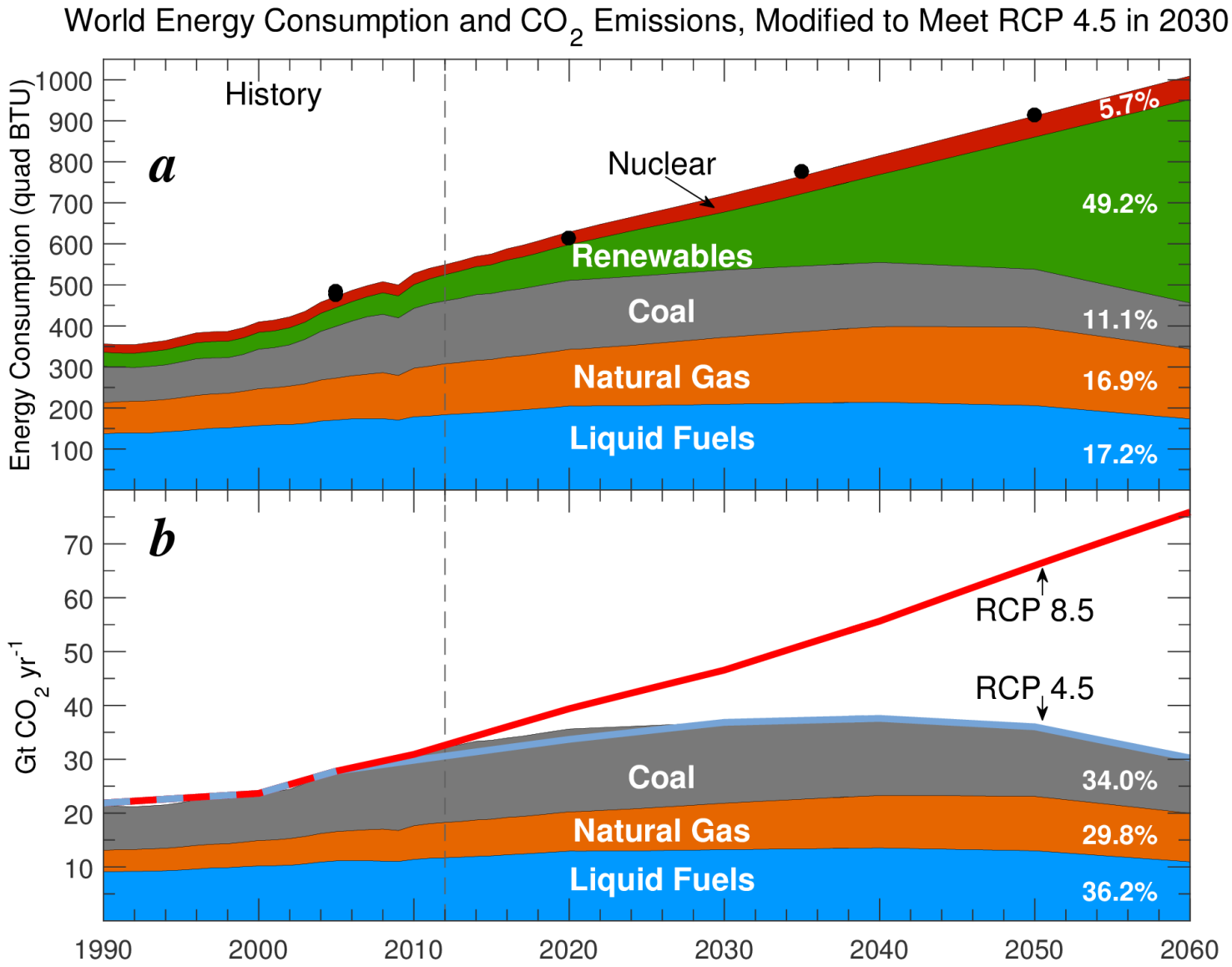

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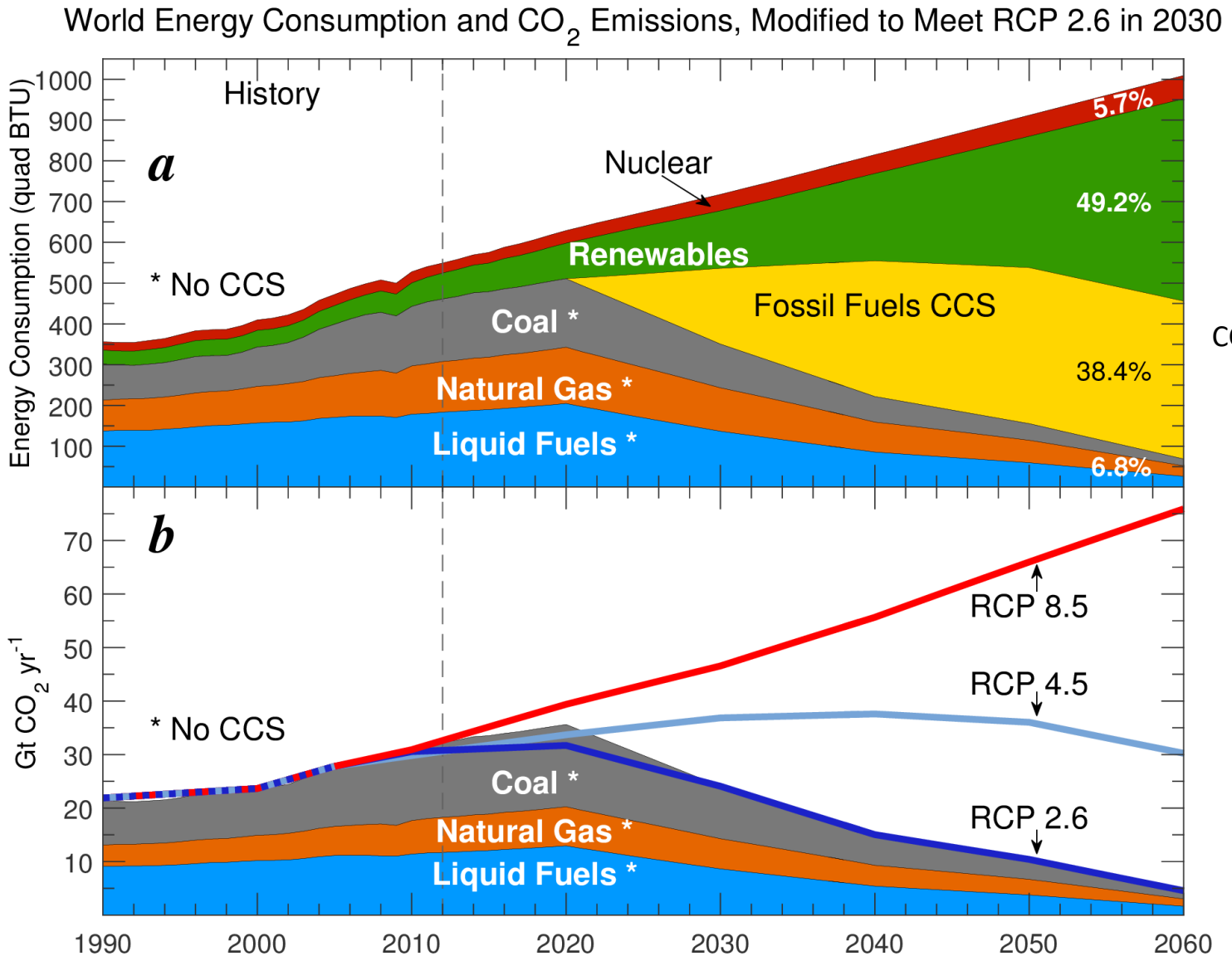
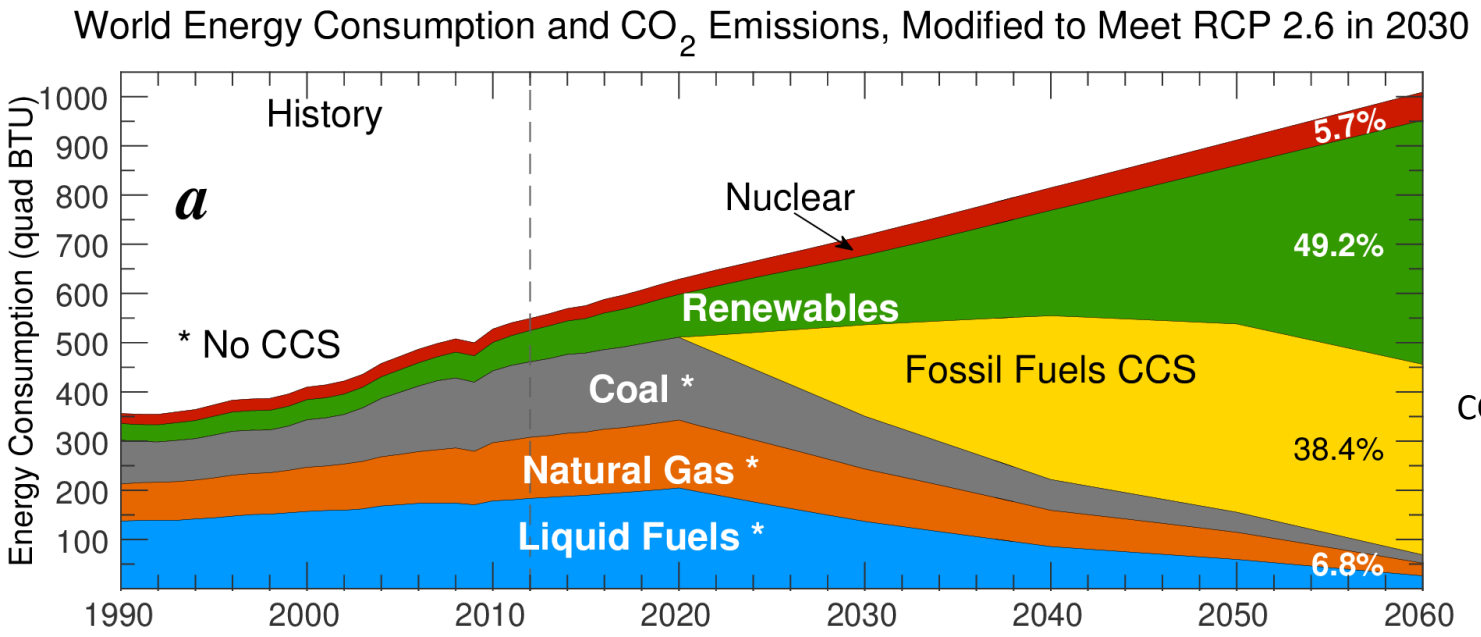


CCS: Carbon Capture and Sequestration

Global GHG emissions compared to RCPs



CCS: Carbon Capture and Sequestration

C3. All pathways that limit global warming to 1.5°C with limited or no overshoot project the use of carbon dioxide removal (CDR) on the order of 100–1000 GtCO2 over the 21st century. CDR would be used to compensate for residual emissions and, in most cases, achieve net negative emissions to return global warming to 1.5°C following a peak (*high confidence*). CDR deployment of several hundreds of GtCO2 is subject to multiple feasibility and sustainability constraints (*high confidence*). Significant near-term emissions reductions and measures to lower energy and land demand can limit CDR deployment to a few hundred GtCO2 without reliance on bioenergy with carbon capture and storage (BECCS) (*high confidence*).

Summary

IPCC 1.5SR http://www.ipcc.ch/report/sr15 released 8 Oct 2018 concludes:

1) Worse effects of climate change will be avoided if rise in GMST can be limited to 1.5°C

2) For pathways with no or limited overshoot of 1.5°C, global net anthropogenic emissions of GHGs must decline by about **45%** from 2010 levels **by 2030**, reaching **net zero around 2050**

3) Carbon capture and sequestration must be part of the policy framework for limiting warming to 1.5°C

Note: latest science (i.e, update to IPCC SRCCS) indicates median cost of CCS is $80 ton per ton of CO_2

At current fossil fuel price levels in the United States, it costs:

utilities	$20	to purchase coal that upon combustion will release a ton of CO_2
utilities	$65	to purchase natural gas that upon combustion will release a ton of CO_2
consumers		to purchase auto gasoline that upon combustion will release a ton of CO_2

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U.S. Petroleum

Page 76 of Earth the Sequel by Fred Krupp and Miriam Horn states "U.S. vehicle fleet pumps 1.3 billion tons of CO_2 into the atmosphere every year, and $820 million in capital is exported *every day* for the oil needed to do so" in year 2008:

10 years later, how much does the U.S. export in capital for the oil (i.e., gasoline) needed for our vehicle fleet?

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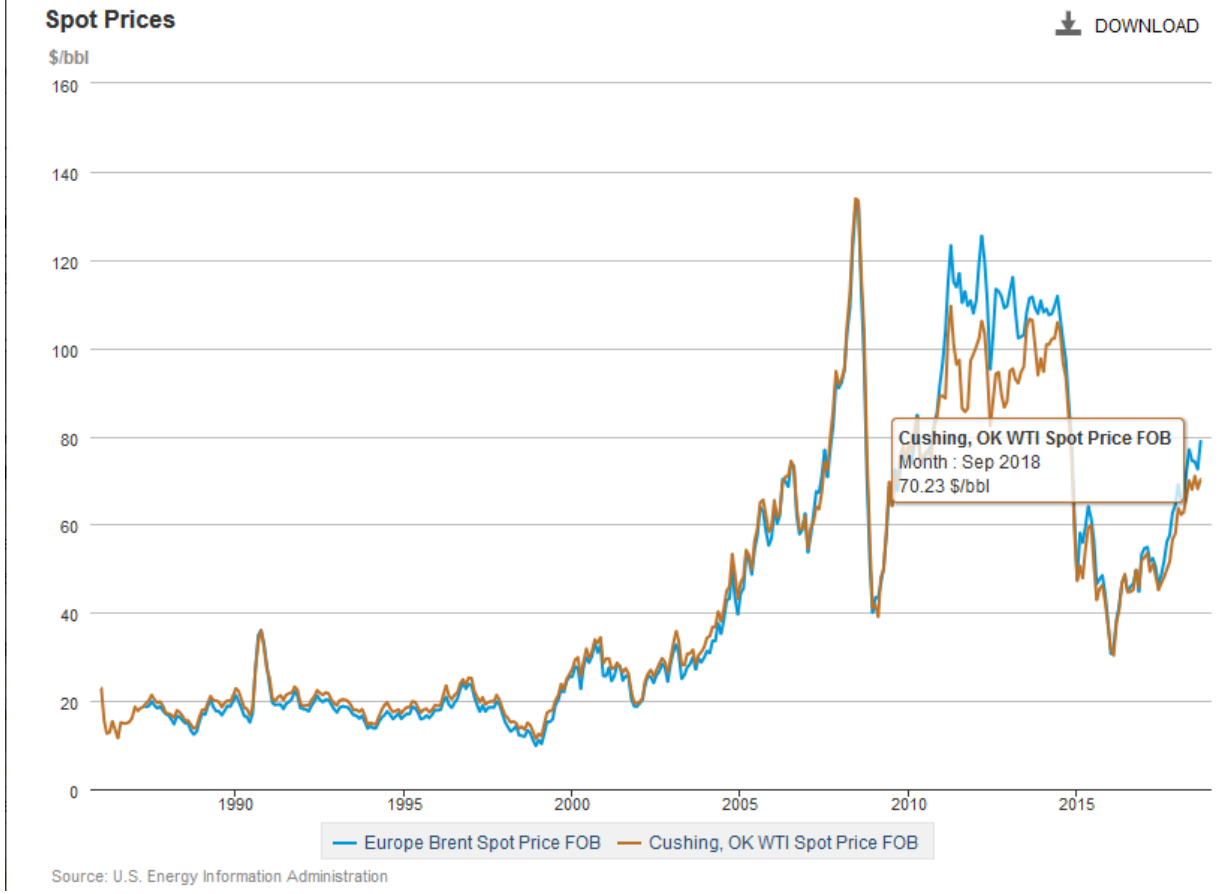

Price of oil $70 / barrel in Sept 2018

https://www.eia.gov/dnav/pet/pet_pri_spt_s1_m.htm

U.S. Petroleum

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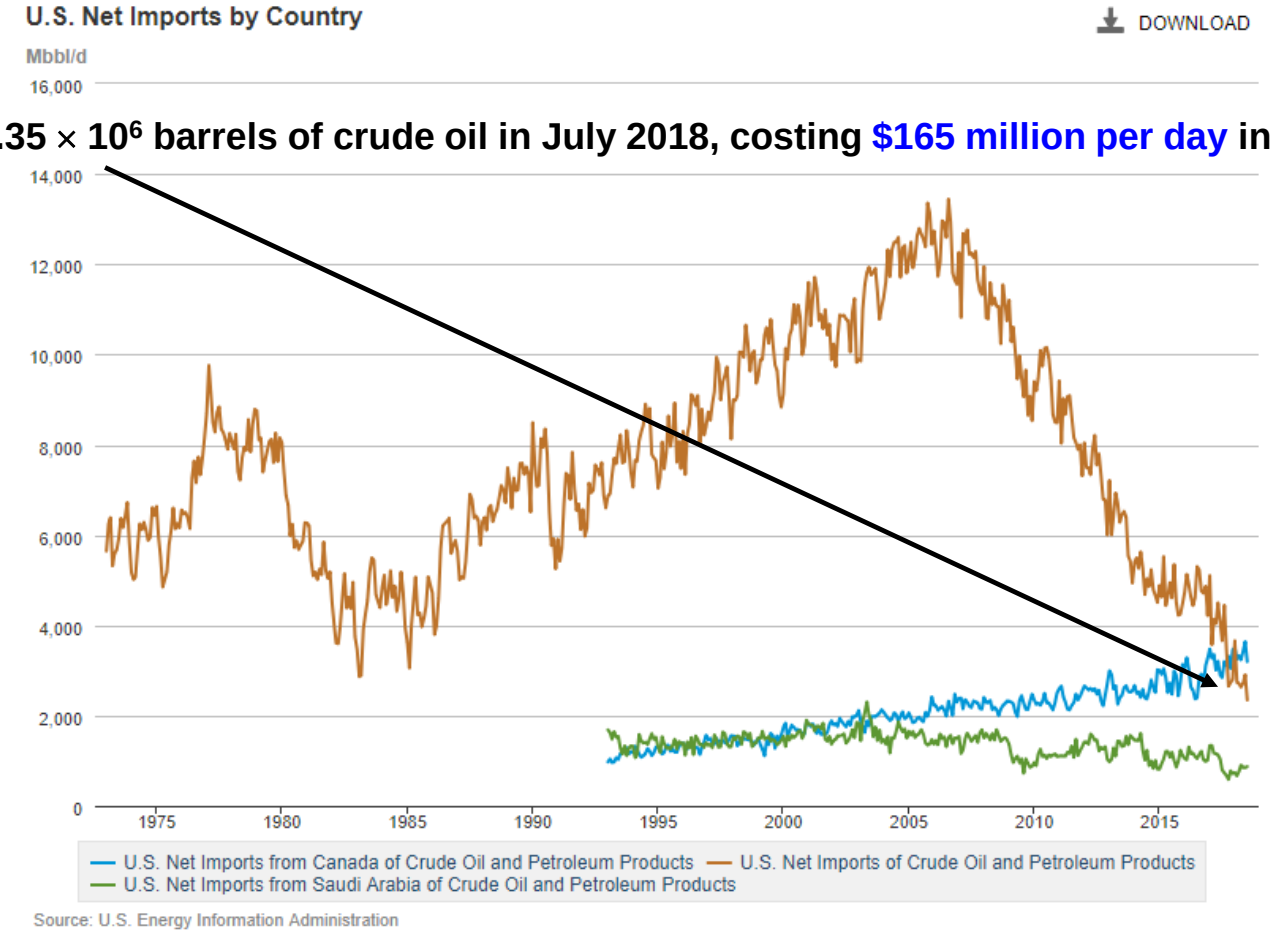
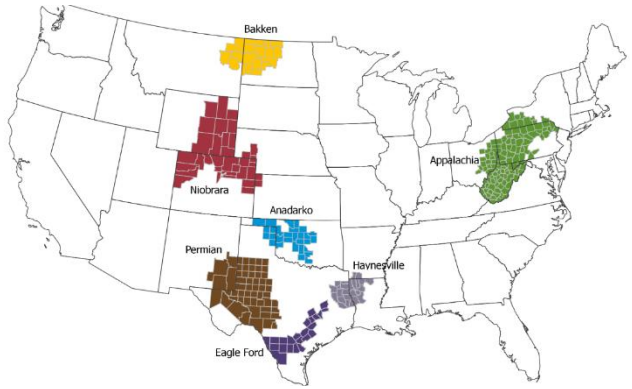
U.S. imported 2.35×10^6 barrels of crude oil in July 2018, costing $165 million per day in capital per day



https://www.eia.gov/dnav/pet/pet_move_neti_a_EP00_IMN_mbblpd_m.htm

U.S. Petroleum

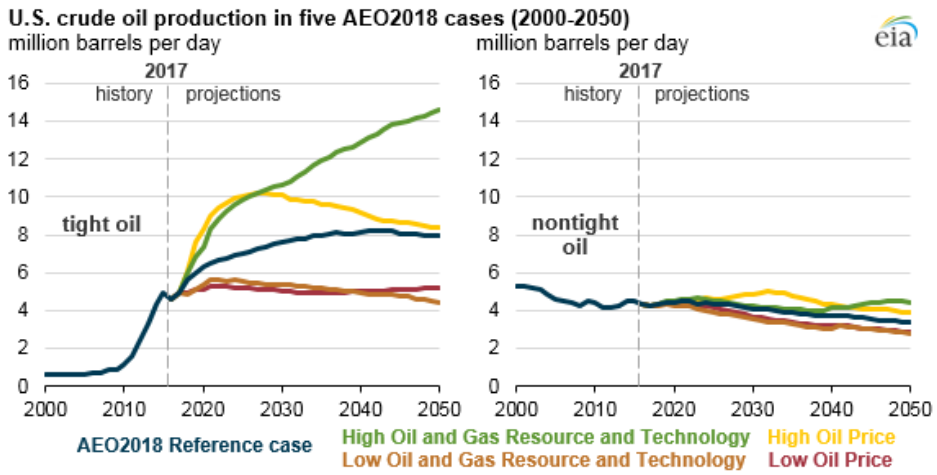
U.S. has greatly expanded production of so-called tight oil https://en.wikipedia.org/wiki/Tight_oil from the Permian, Bakken, and Eagle Ford deposits since 2008:



https://www.cnbc.com/2018/06/13/permian-will-soon-pump-enough-oil-to-be-opecs-2nd-biggest-producer.html

FEBRUARY 22, 2018

Tight oil remains the leading source of future U.S. crude oil production



https://www.eia.gov/todayinenergy/detail.php?id=35052

Electric Buses in China: Will This Work in U.S. Given Abundant Domestic Petroleum?

How China Took Charge of the Electric Bus Revolution

CITYLAB

DESIGN / TRANSPORTATION / ENVIRONMENT / EQUITY / LIFE

The Chinese city of Shenzhen's entire 16,000-strong bus fleet is now battery powered. // Getty Images

LINDA POON MAY 8, 2018

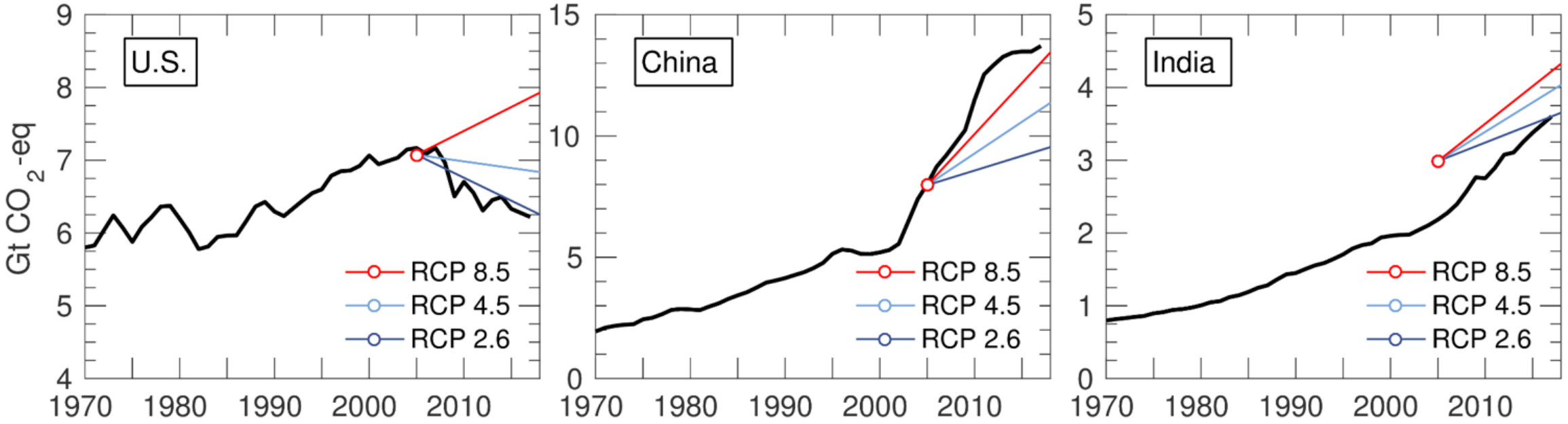
Between the gleaming towers of the Chinese city of Shenzhen, some 16,000 buses shuttle commuters to and from their destinations. But they're not like the diesel-guzzling behemoths that run the streets of most cities. They're quieter, and they run entirely on electricity.

Globally, there are an estimated 385,000 fully electric buses, and according to a recent Bloomberg New Energy Finance report, 99 percent of them are in China. As Shenzhen moves on to making all its taxis go electric as well, other Chinese cities are beginning to follow suit, replacing their gas-powered bus fleets by the hundreds.

https://www.citylab.com/transportation/2018/05/how-china-charged-into-the-electric-bus-revolution/559571/

Extra Slides to Follow

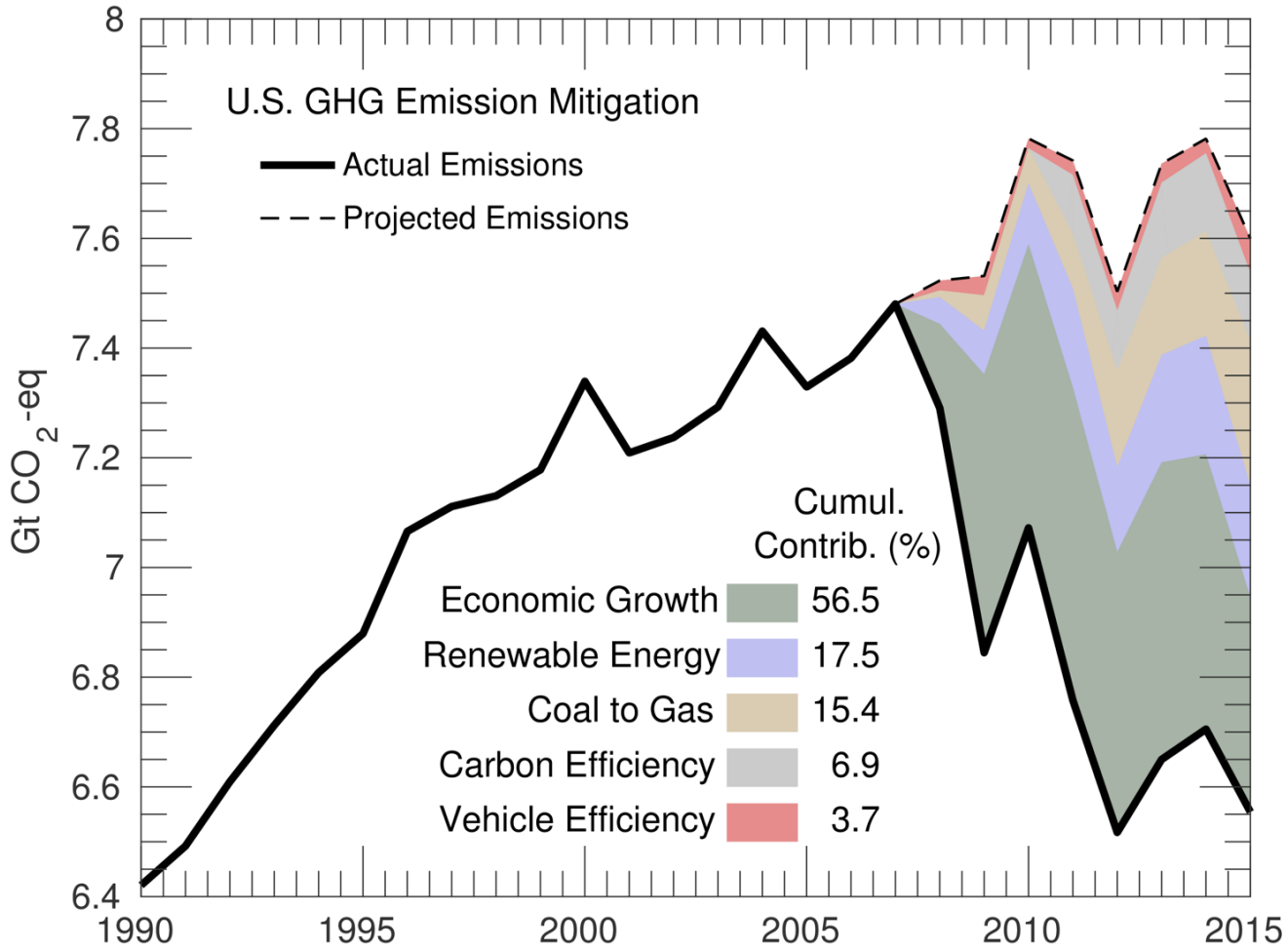
A Look at the Top Three Emitters, Relative to RCP Projection for Each Country



until 2017

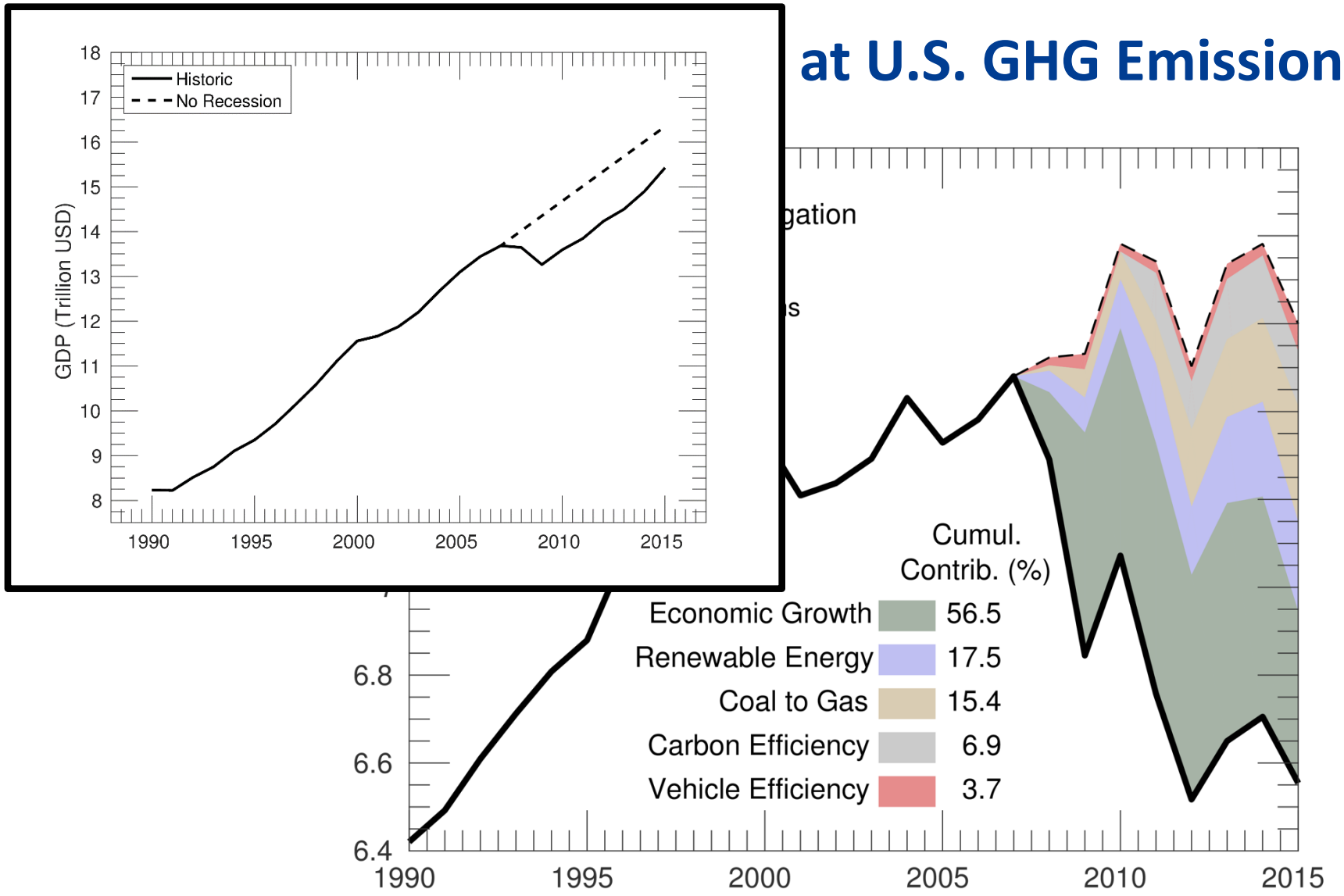
2017 emissions from Jackson et al., *Envir. Res. Lett.*, 2017

An Even Closer Look at U.S. GHG Emissions



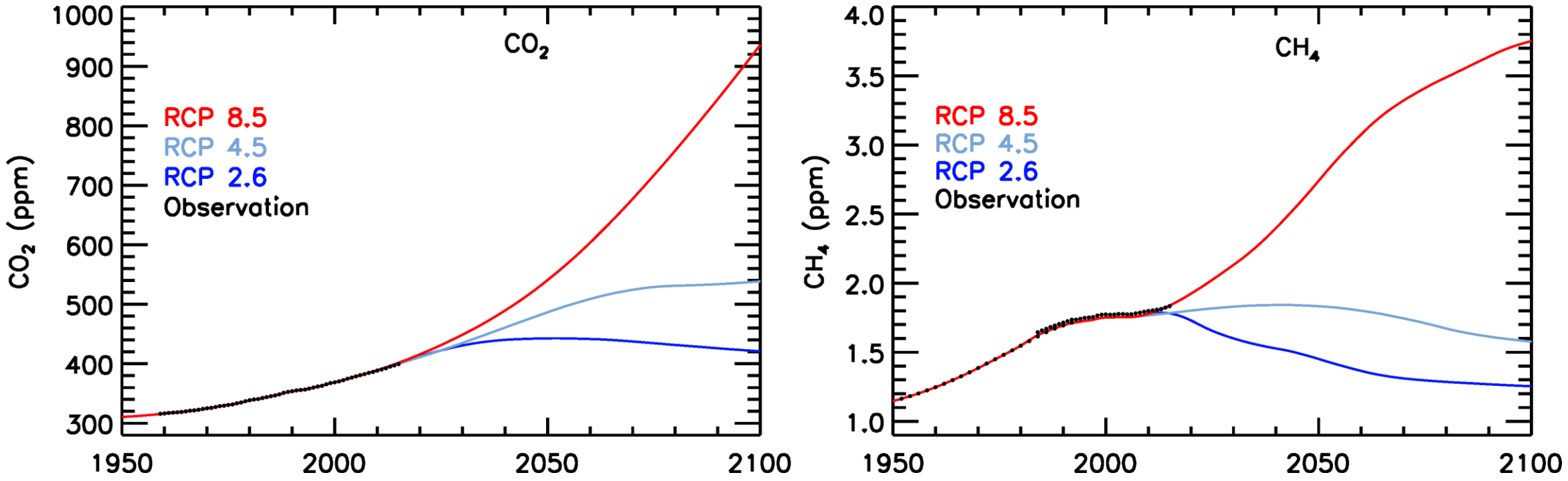
Tribett et al., *manuscript in prep,* 2018

at U.S. GHG Emissions



Tribett et al., *manuscript in prep,* 2018

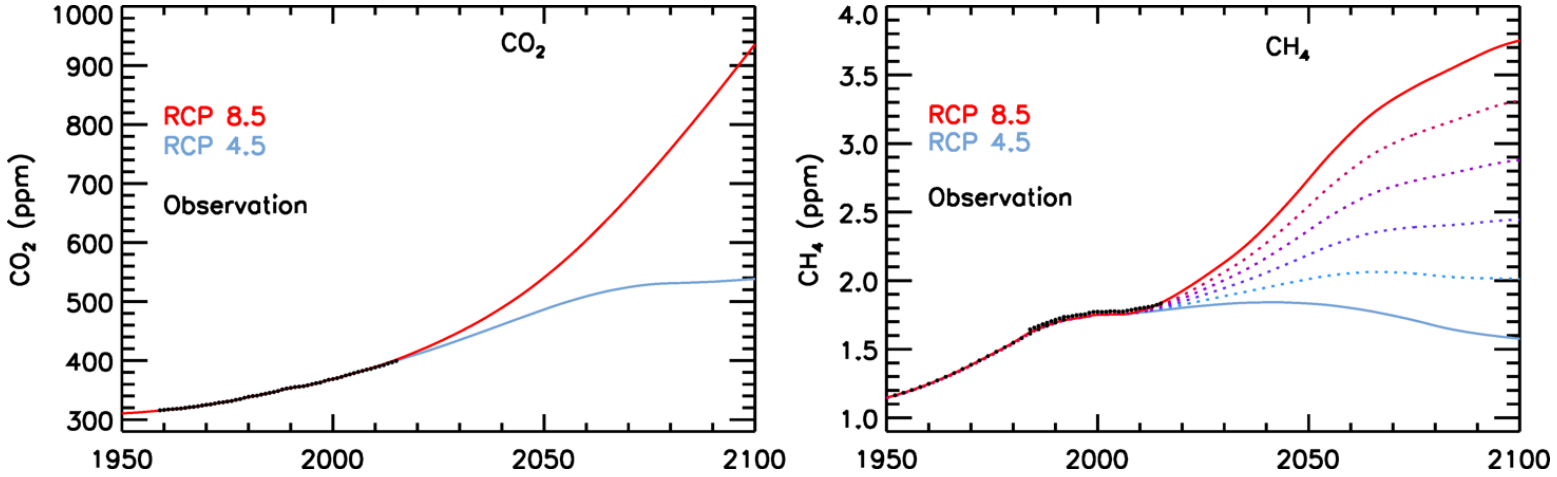
Three Futures

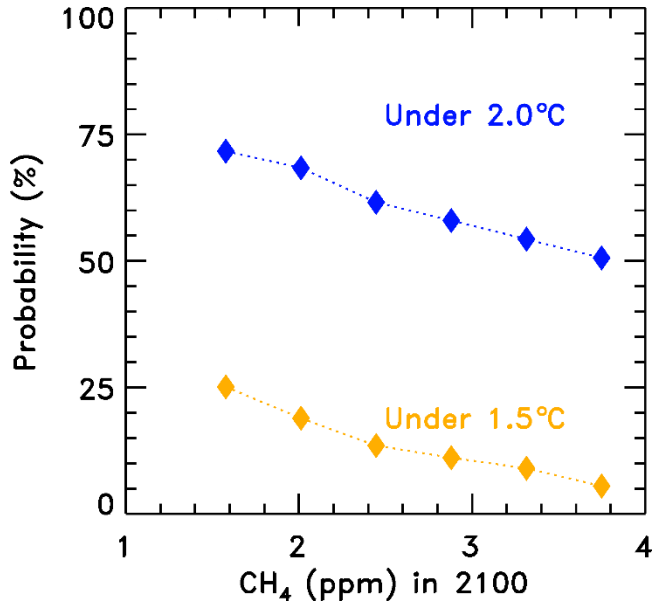


RCP: Representative Concentration Pathway

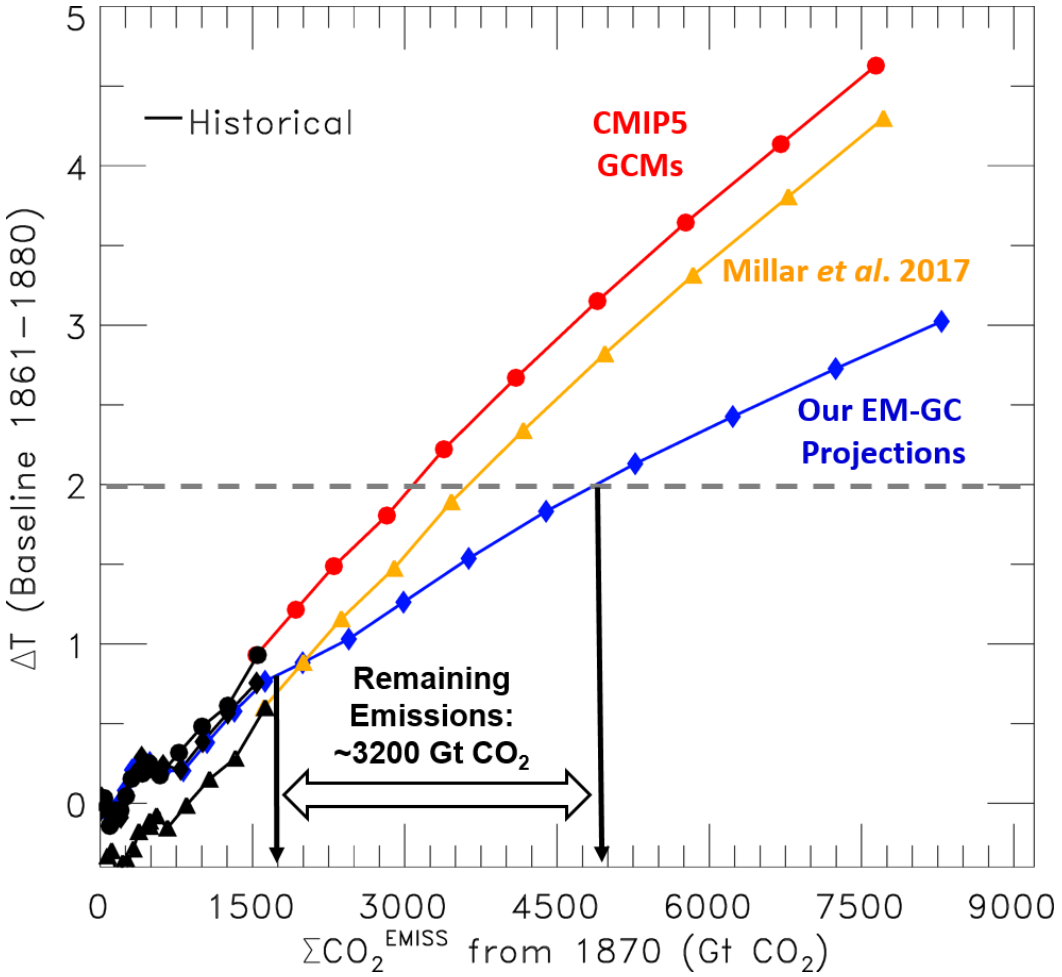
Number represents W m^{-2} RF of climate, units of Watts per square meter, that occurs at end of this century

Atmospheric Methane

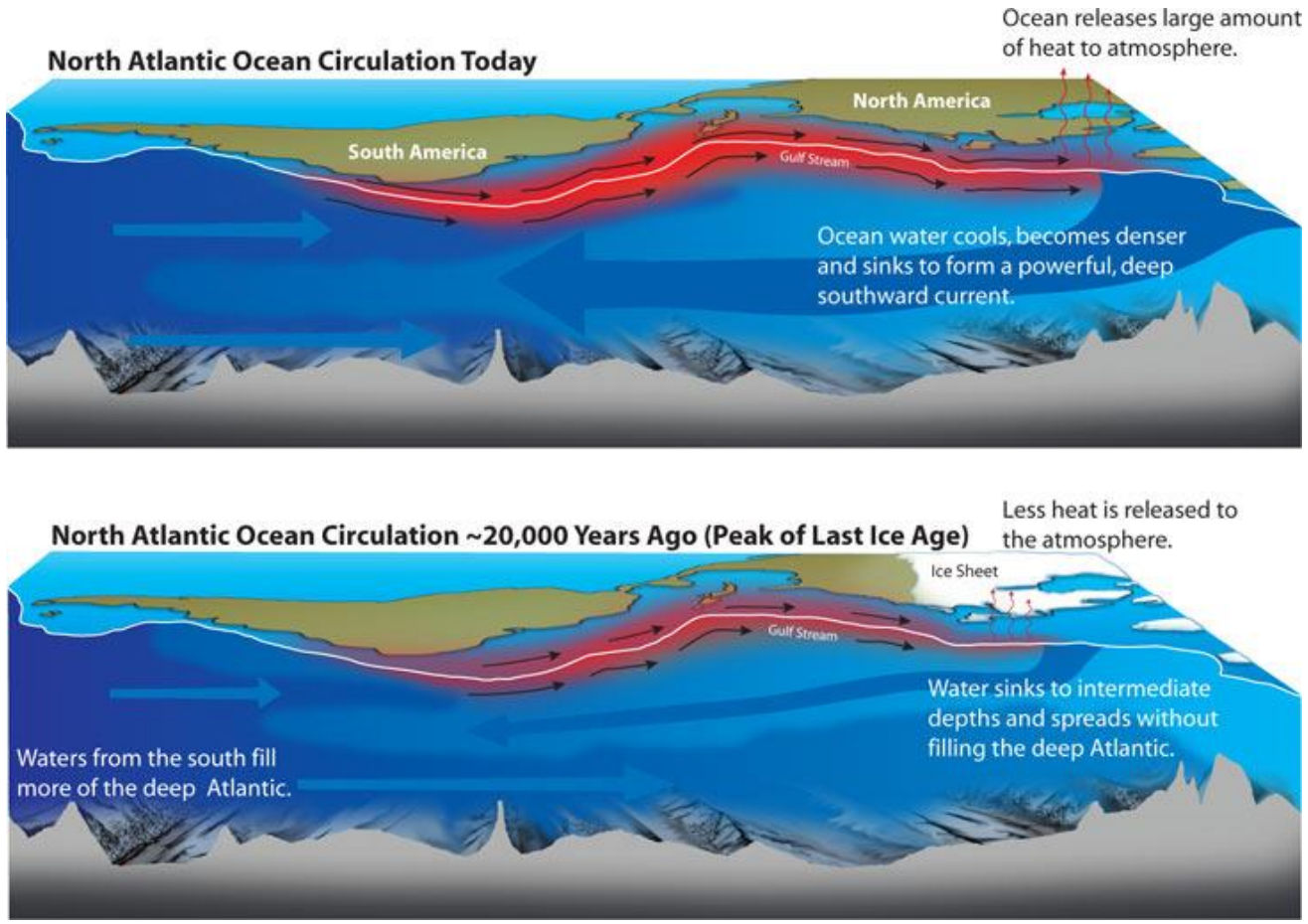




Cumulative Carbon Emissions

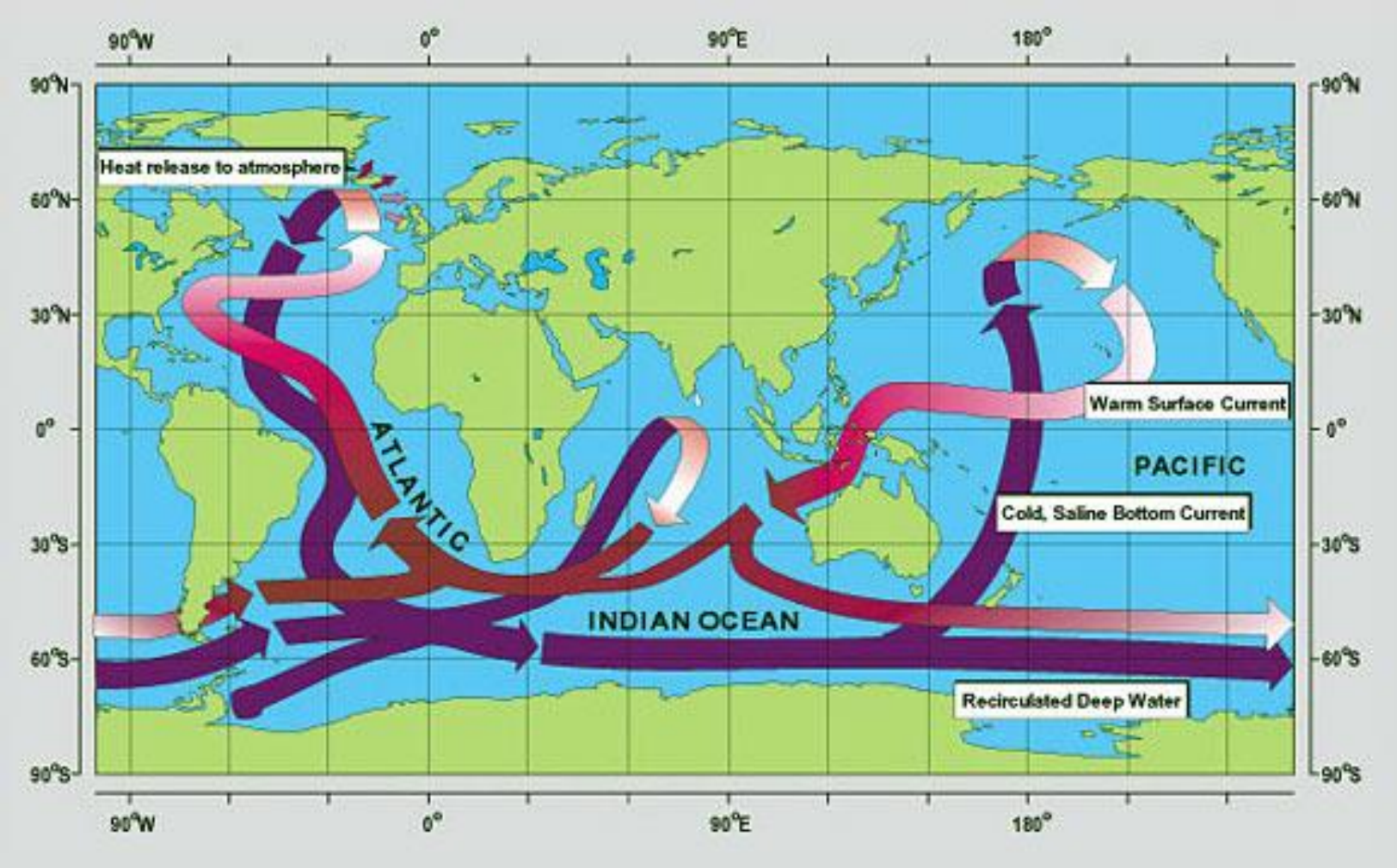


Atlantic Meridional Overturning Circulation



http://www.whoi.edu/oceanus/feature/the-once-and-future-circulation-of-the-ocean

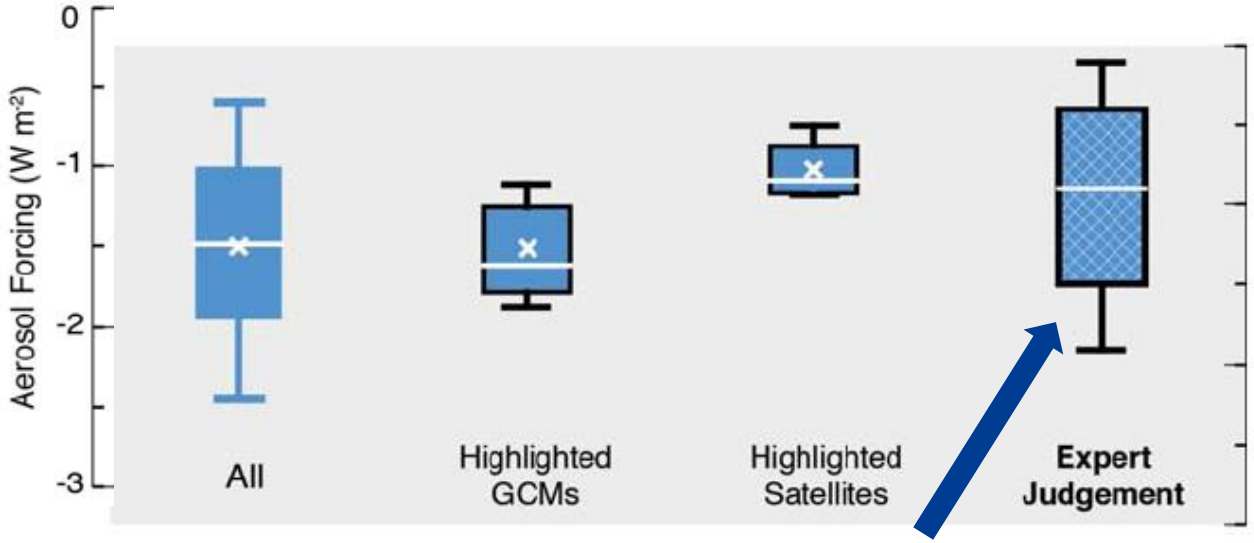
Atlantic Meridional Overturning Circulation



http://www.whoi.edu/oceanus/feature/the-once-and-future-circulation-of-the-ocean

RF of Climate Due to Tropospheric Aerosols

Figure 7.19B, IPCC 2013



IPCC (2013) best estimate of NAA RF_{2011} is
Slightly less than −0.9 W m^{-2}
Likely range: −0.4 to −1.5 W m^{-2}

Box & Whisker Plots:
mean (X), median (middle line)
17th and 83th percentiles
(likely range; boundaries)
5th and 95th percentiles (whiskers)

Total Anthropogenic Aerosol Radiative Forcing,
Year 2011 relative to pre-industrial

November 5, 2018

Dear President Loh and the University Sustainability Council,

We, as representatives of the Student Government Association (SGA), urge you to move the carbon neutrality deadline in the Climate Action Plan from 2050 to 2025.

The University of Maryland has established itself as a leader in sustainability. UMD was listed as one of the Top 25 Best Green Colleges in the United States for our commitments to waste reduction, renewable energy, investments in sustainable solutions, and much more. Our renowned faculty and dedicated student body consistently make impressive strides in climate action and decarbonization. With the October 23rd release of the 2018 SustainableUMD Magazine, the Office of Sustainability announced that UMD reduced its emissions 49 percent between 2005 and 2017, essentially meeting the University's 2020 goal three years ahead of schedule. These are significant accomplishments, but we must now take the next step: we must commit to reaching carbon neutrality by 2025 to address the ever-growing threat of climate change.

We are proud of this University's accomplishments, but we now face a new, more urgent call to action. The recent United Nations Intergovernmental Panel on Climate Change's "Special Report on Global Warming of 1.5°C" found that to avoid the catastrophic consequences of climate change, net human-caused emissions of carbon dioxide (CO2) must be reduced globally by 45 percent by 2030. If this is not achieved, future generations of students will face the threat of catastrophic weather events, rising sea levels, disease, and crop failure, resulting in geopolitical challenges unlike anything we have ever experienced.

If the University of Maryland intends to continue being a leader on climate action, then it must achieve carbon neutrality by 2025, the carbon neutrality deadline set by at least 20 other leading research universities in the United States. The University of California System, Oregon State University, Loyola University Chicago, Duke University, and the Universities of Florida, Vermont, and Montana have all committed to carbon neutrality by 2025 or earlier. American University achieved carbon neutrality earlier this year. As one of the nation's premier research institutions, the University of Maryland should make the same decisive climate commitment.

Three main sources of emissions stand in the way of UMD achieving its carbon neutrality goal:

1) Commuter vehicles
2) UMD fleet vehicles
3) The combined heat and power plant

The SGA already took a significant step toward helping the University meet its goal. On October 31, 2018, the SGA Legislature voted unanimously in support of purchasing verified carbon offsets to eliminate the climate impact of undergraduate commuter vehicles. This action will help the University reduce emissions by around 11,000 metric tons of CO_2 equivalent and get seven percent closer to carbon neutrality. This is the first time since the establishment of the Sustainability Fund in 2010 that the SGA has voted to use the student body's own Sustainability Fee money to directly decrease greenhouse gas emissions and make a positive climate impact. We are excited about the opportunity for students to directly invest in climate solutions and contribute to the University's climate goals, and we hope the administration can reciprocate by accelerating the implementation of its own carbon neutral strategies.

November 5, 2018

The SGA urges you to support our plan of offsetting undergraduate commuting emissions while the University and commuter students continue transitioning toward cleaner commuting choices. We believe that the campus community can find an agreeable way to offset graduate student, faculty, and staff commuting emissions by 2025. We are also confident that the University can make progress toward decarbonizing its fleet and using more electric vehicles over the next six years.

The University's major challenge is implementing a new district energy system that can operate with net zero carbon emissions by 2025. Fortunately, the University is already planning for the replacement of the existing combined heat and power plant, so the time is now to find a carbon-neutral district energy solution. We are encouraged by a proposal to capture emissions from our combined heat and power plant and convert them to profitable algae products as this offers an innovative and revenue-generating solution for the University to tackle its most difficult emissions problem.

We thank you for your support of numerous sustainability projects in the past. We hope that the student body can count on your full support for a 2025 carbon neutrality deadline, and for continued action towards a low-carbon future.

Best,

Jonathan Allen
Student Body President

Amelia Avis
Director of Sustainability

cc:
Carlo Colella, Vice President, Division of Administration and Finance
Scott Lupin, Director, Office of Sustainability

Sustainability Fund Proposals

November 2, 2018

Net Zero Energy Retrofit Initiative

Proposers: Professors Ming Hu, Hiro Iseki, Ralph Bennett (School of Architecture, Planning and Preservation)

Purpose: A research, design and implementation program that will provide a holistic and comprehensive framework for optimal NZE retrofits on existing UMD buildings. The team will partner with FM and provide two full building case-studies over two years to produce a set of practical renovation strategies to achieve NZE.

Committee Notes: Great involvement for undergraduate and graduate student researchers, excellent campus impact. Facilities would find these findings extremely useful

This budget is for a two-year project.

Stage	Comments	DOLLAR
One – BIM		
1. Filed measurement / auditing	Fund two RA	4000
2. Occupancy Survey	Fund one RA	2000
3. BIM model	Fund one RA	2000
4. Potential equipment		2000
Sub Total		10000
Two- BPM		
1. Building performance Simulation	Fund two RA	6000
2. Test EV integration (simulation)	Fund one RA	2000
3. Test EV integration (installation)	Fund installer, faculty time, students	4000
4. Potential EV equipment	Nissan LEAF (lease), We might also need HEMS and other equipment	4000 ($250/month)
Sub Total		16000
Three – BEM		
1. Environmental model	Fund one RA and buy data	4000
2. Cost estimation	Fund one RA and buy data	3000
3. Printing / publishing		3000
Sub Total		10000
Travel for presentations/conference	Students and faculty	3000
Sub Total		3000
GRAND TOTAL		$39,000

Committee Decision:

- Eliminate three line items (feasibility, non-sustainability)
- Award partial funding for **$29,000**