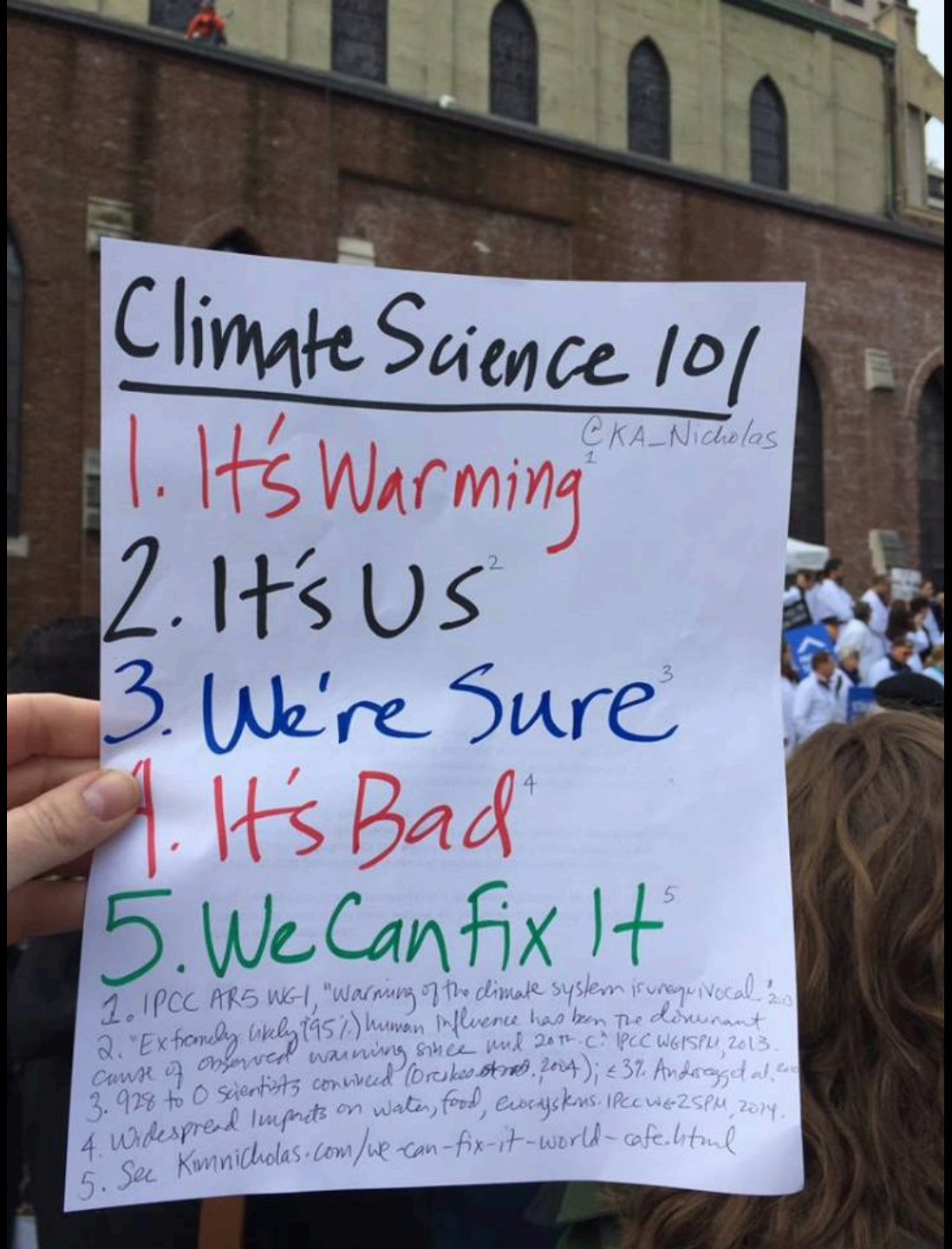

Union of Concerned Scientists
Science for a healthy planet and safer world.


Climate Science 101
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1. It's Warming[1]
2. It's Us[2]
3. We're Sure[3]
4. It's Bad[4]
5. We Can Fix It[5]
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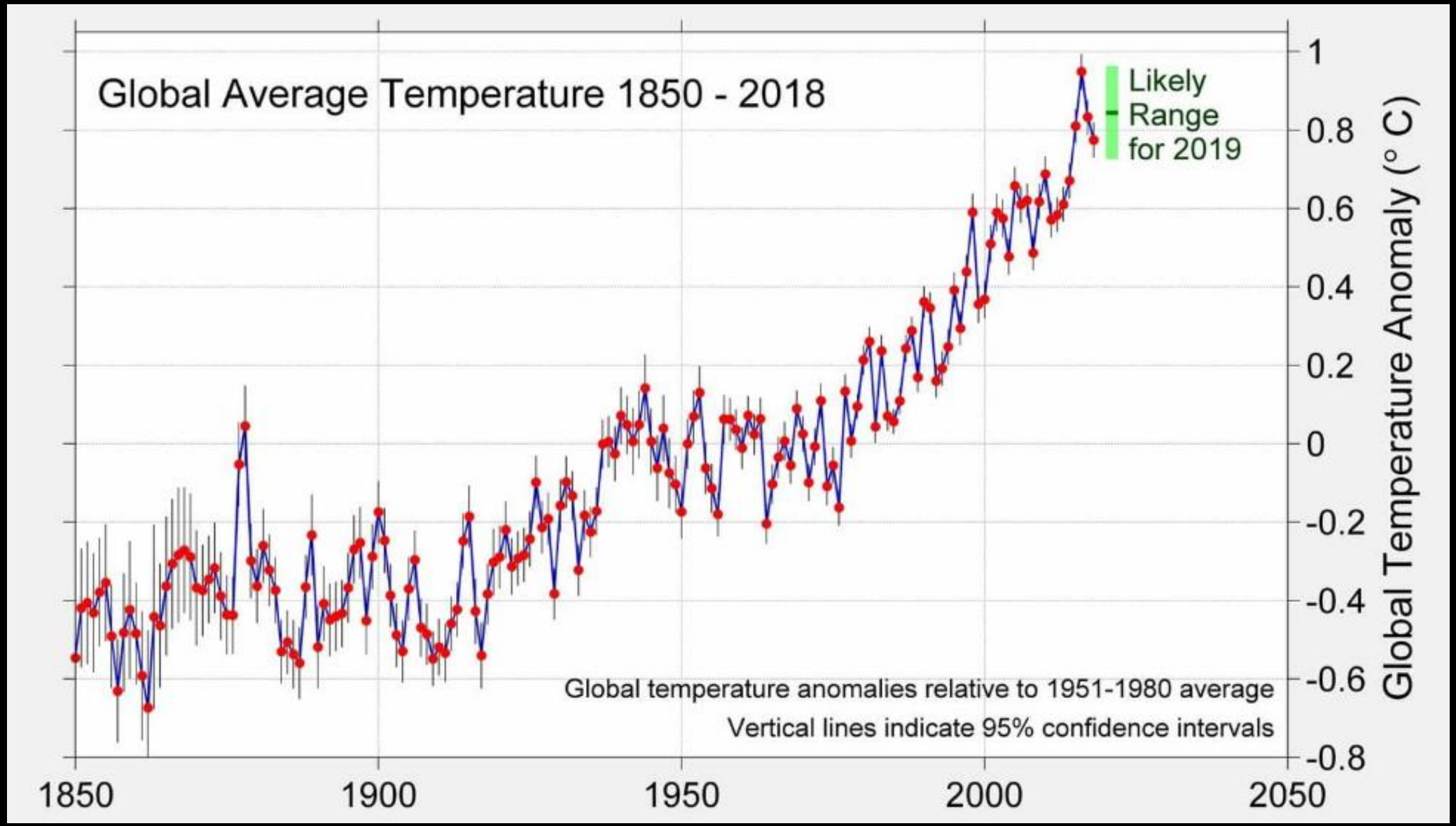
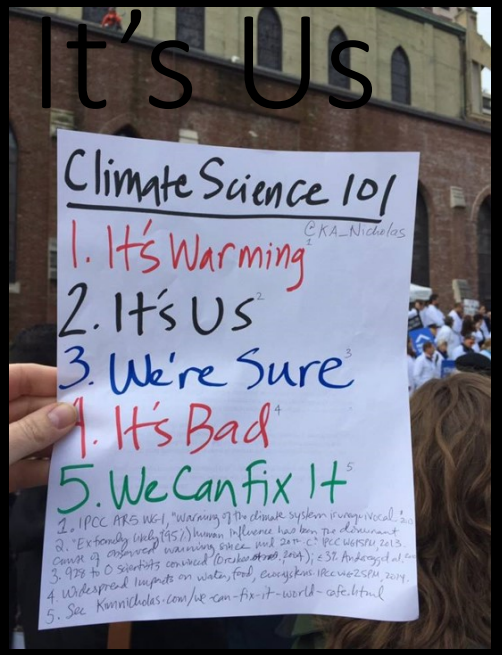
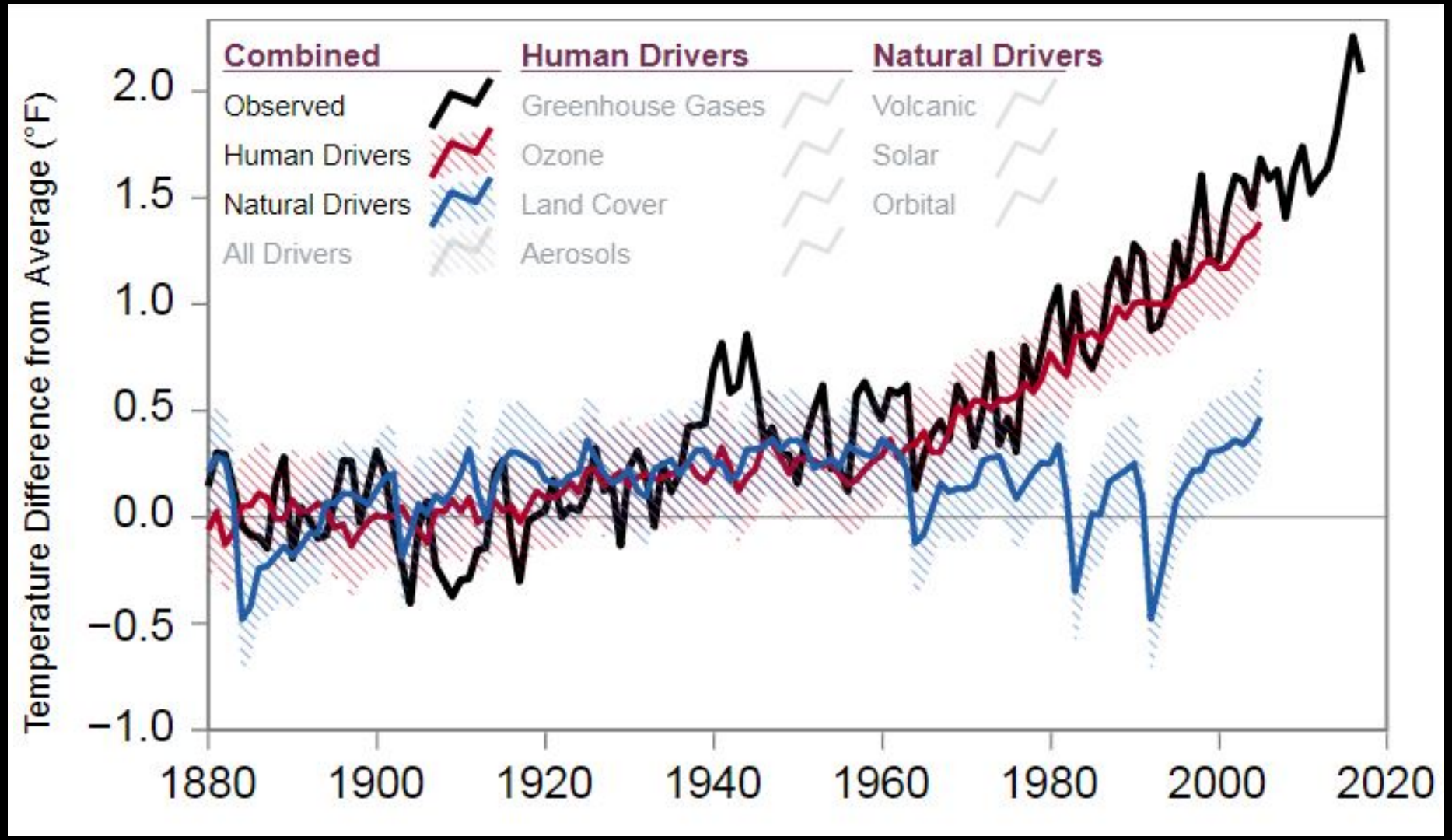
4. Widespread impacts on water, food, ecosystems. IPCC WG2SPM, 2014.
5. See Kimnicholas.com/we-can-fix-it-world-cafe.html



Berkeley Earth. (n/a)

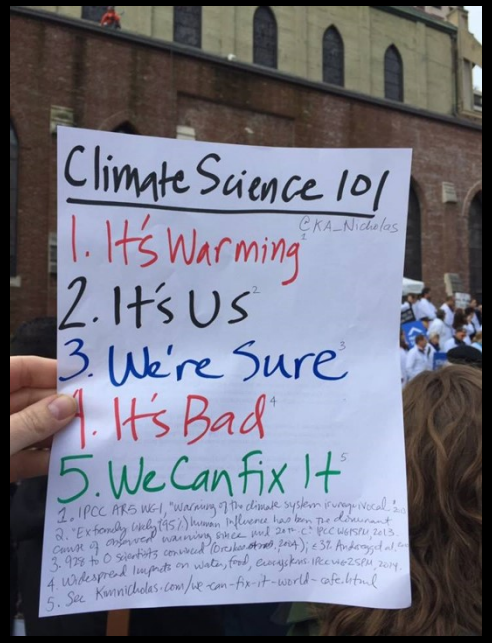
It's Us

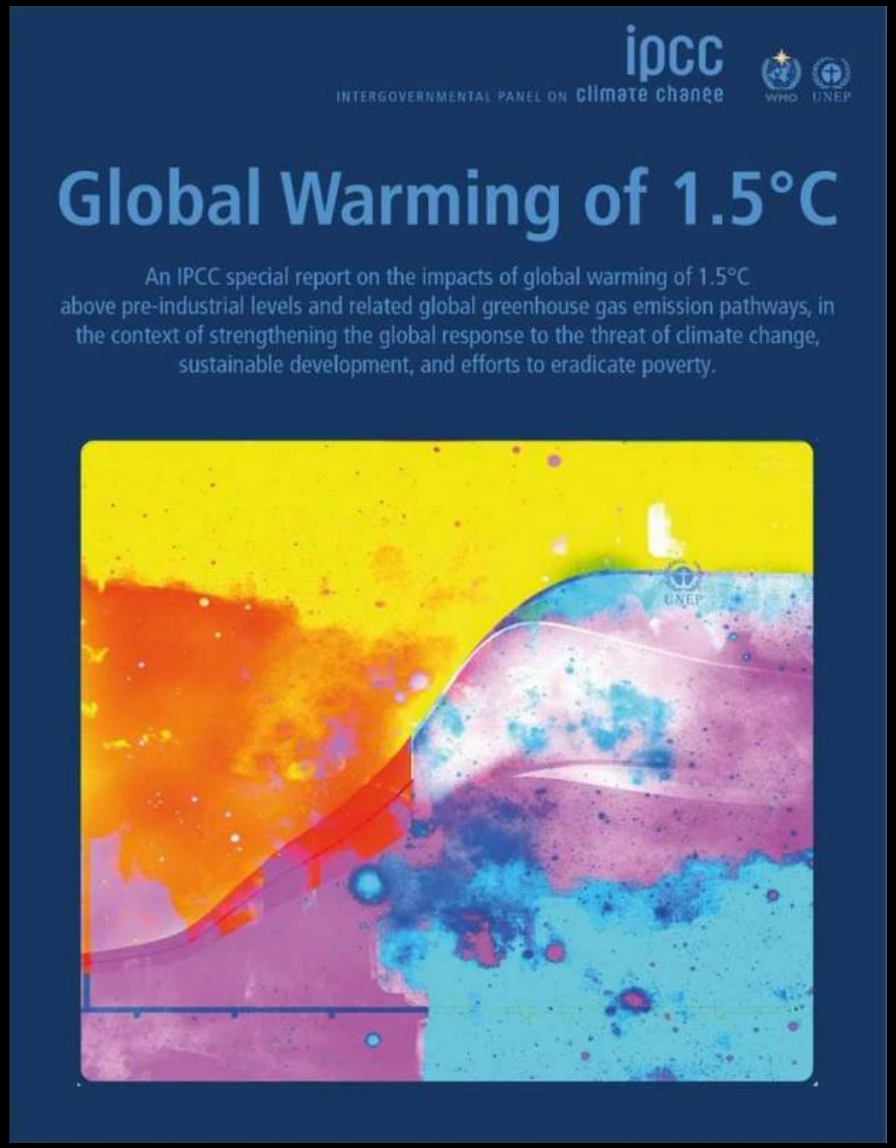


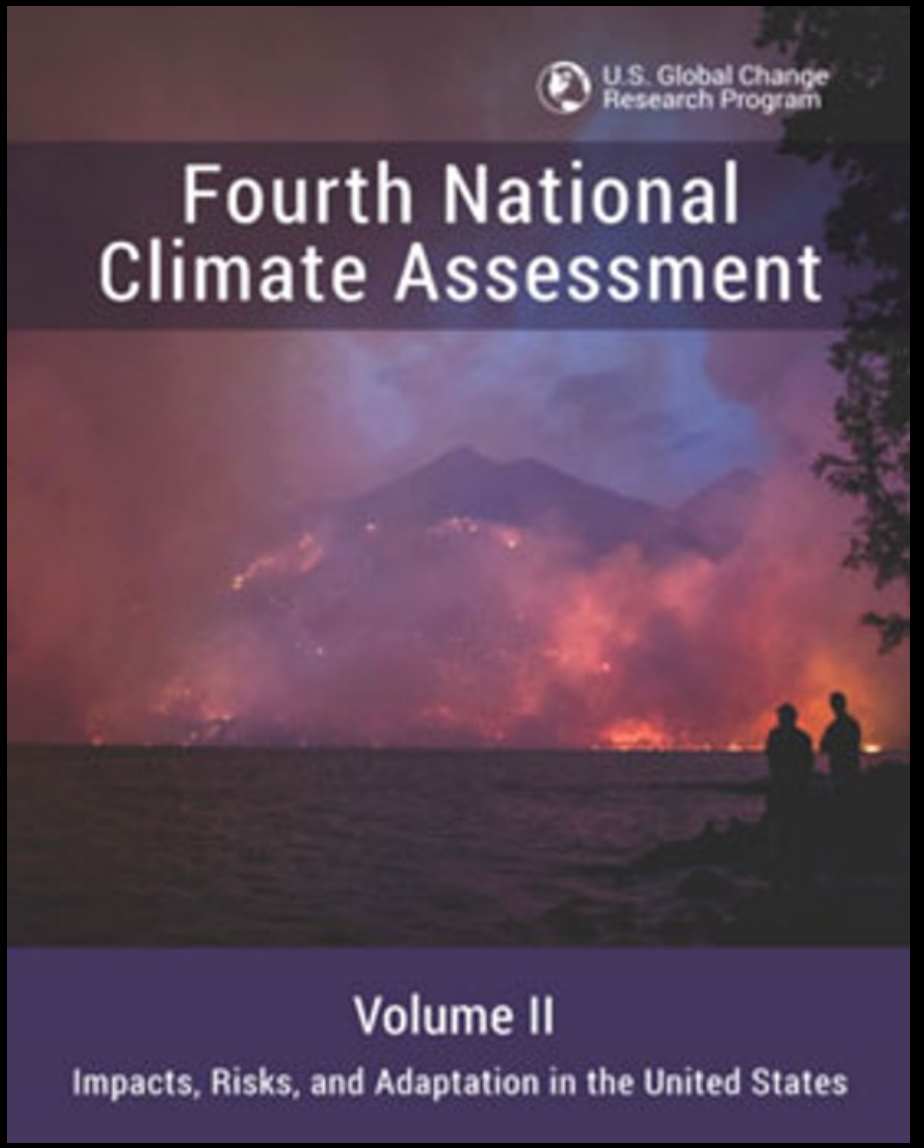


https://nca2018.globalchange.gov/chapter/2/

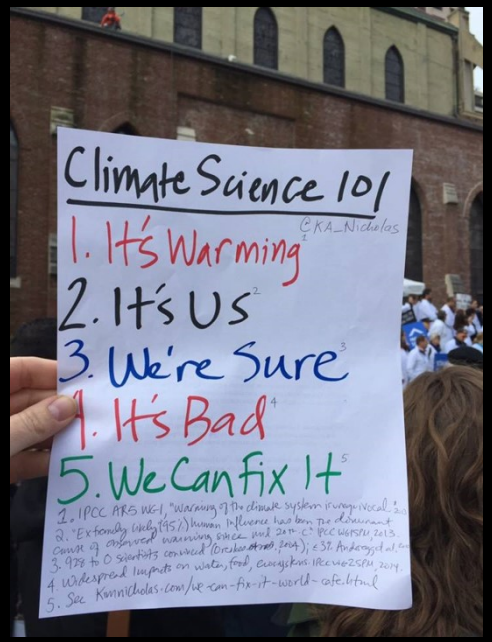
We're really, really sure

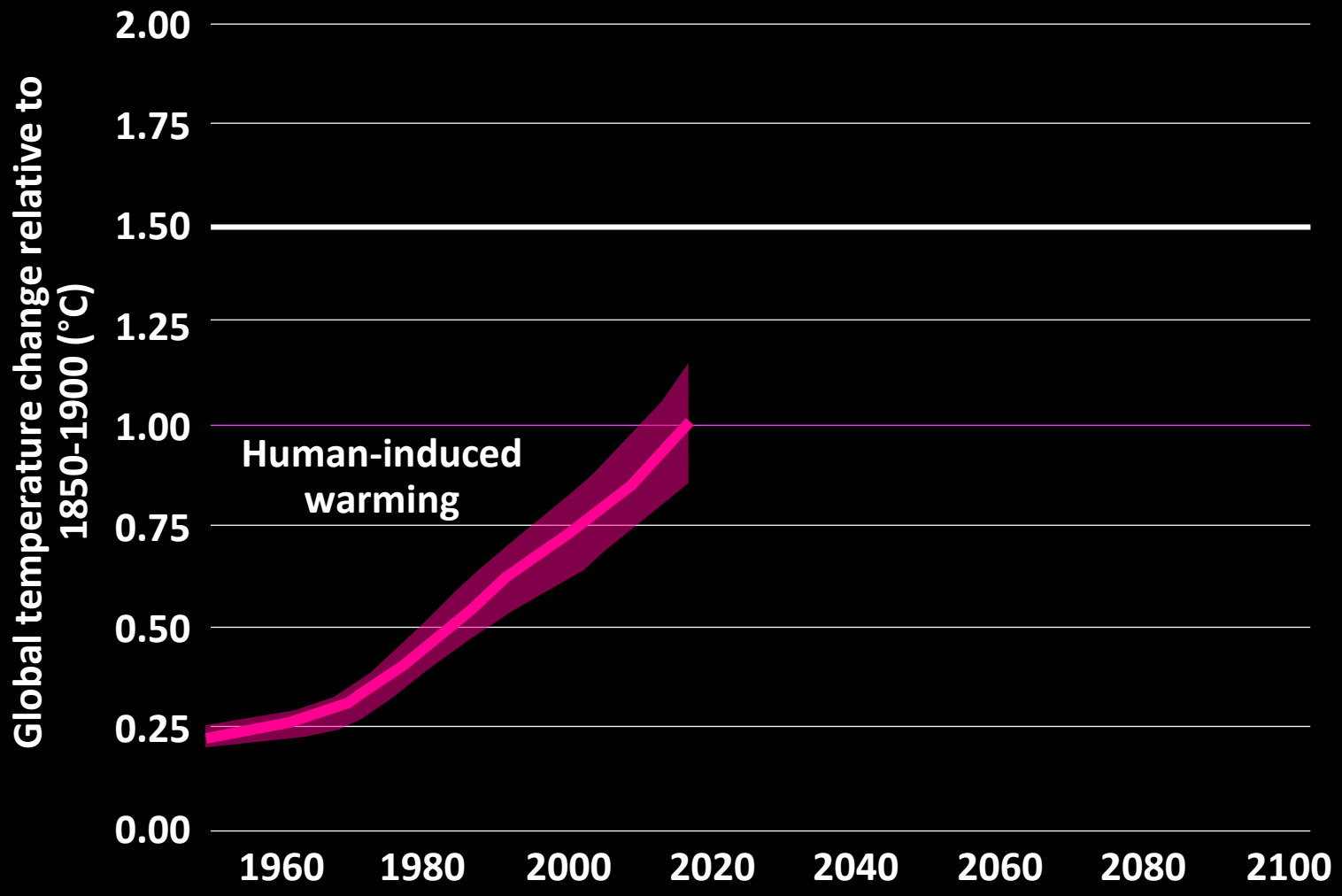






It's Bad

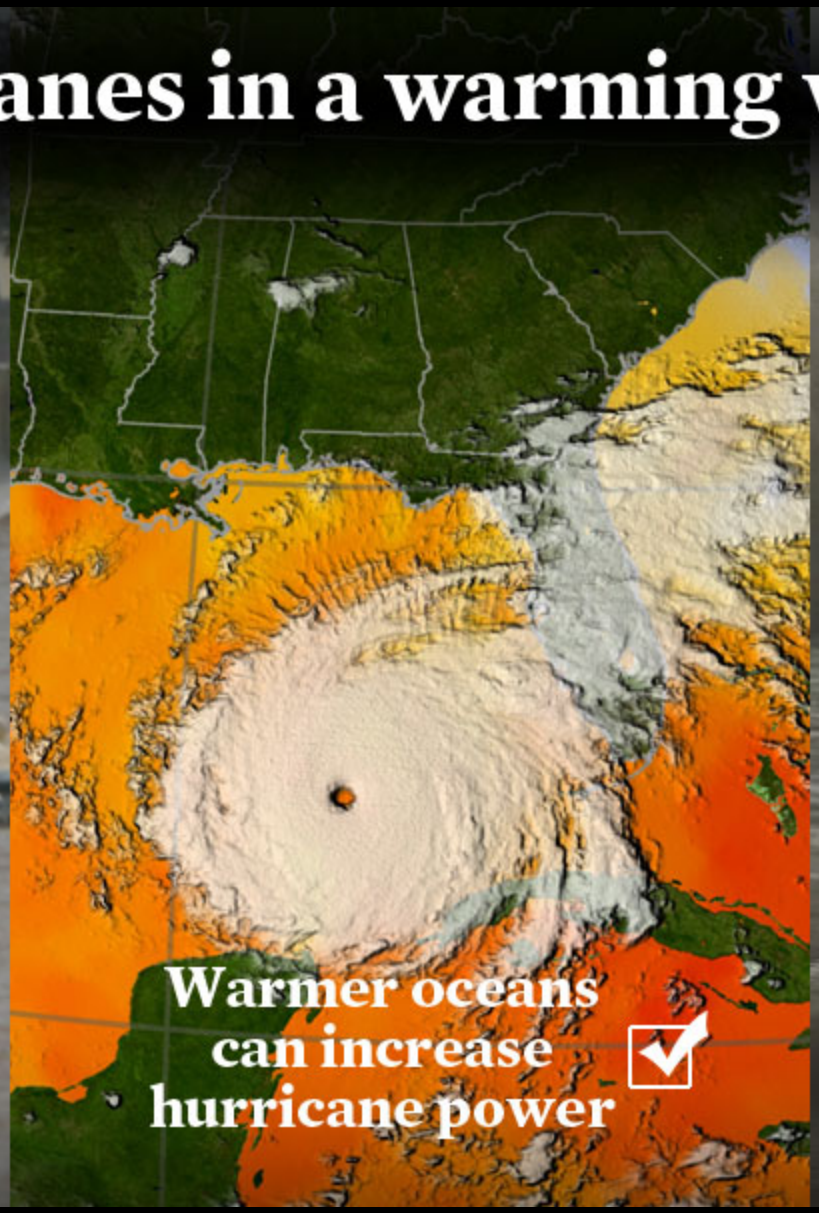




IPCC 2018 SR15 Fig FAQ 1.2

Hurricanes in a warming world...

Warmer air holds more moisture for rainfall ☑



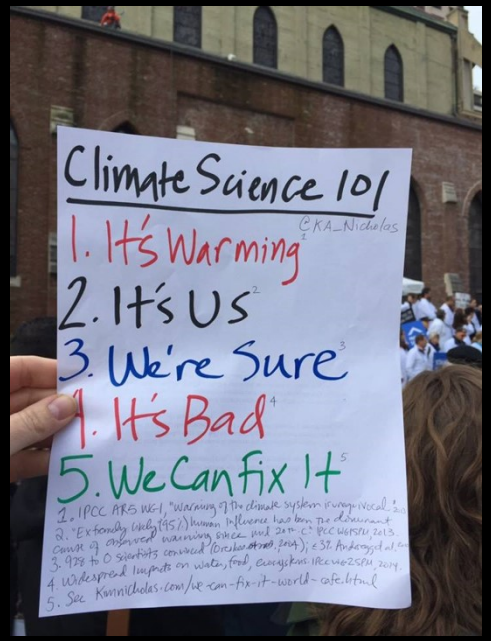
Warmer oceans can increase hurricane power ☑

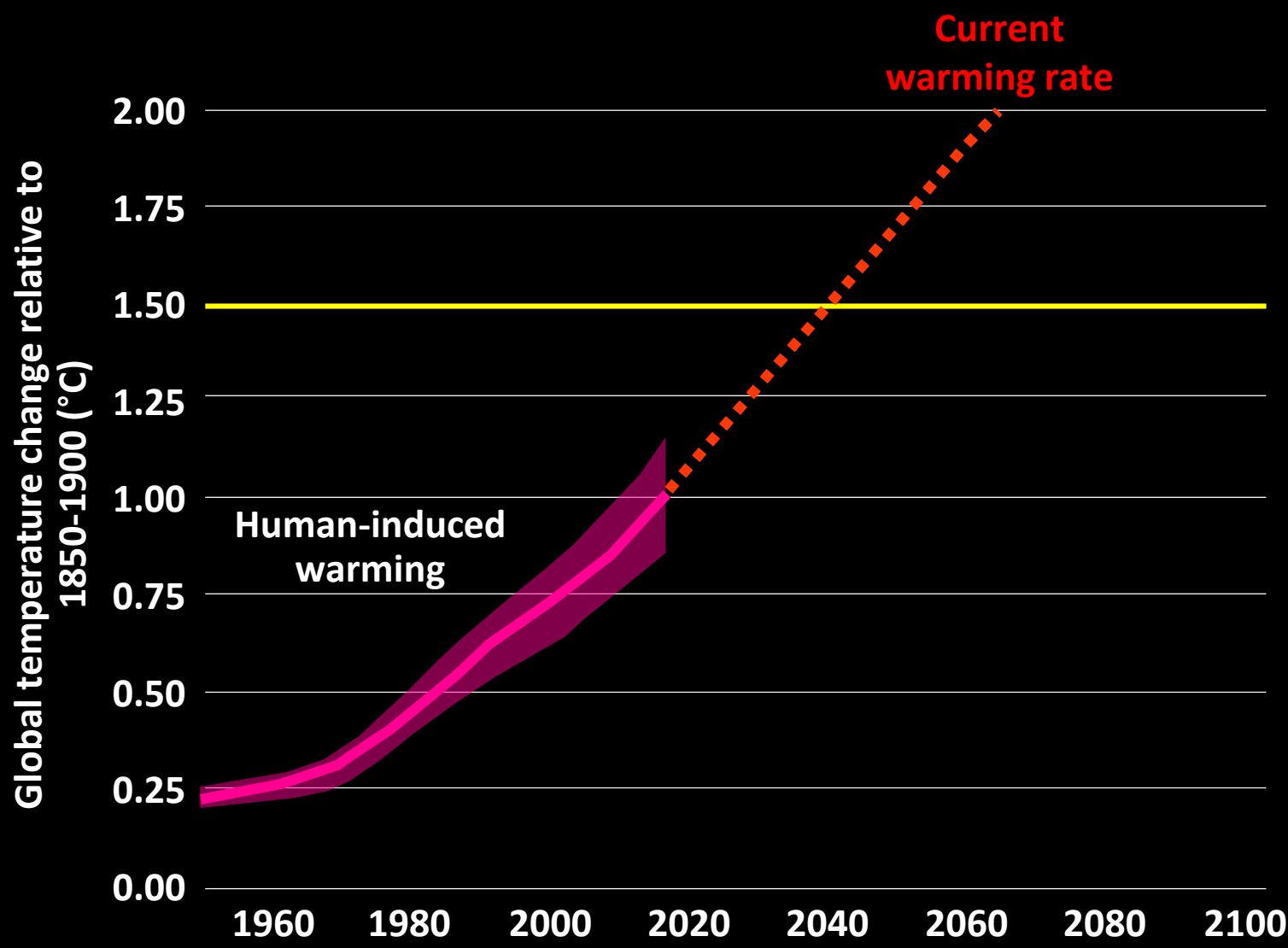
Rising seas increase storm surge ☑

photos: NOAA, NASA, NOAA

"Every year there's a new temperature record, it's getting worse and worse and you feel like a broken record saying it." (Photo: Rasmus Tonboe twitter)

It's Bad & Getting Worse





IPCC 2018 SR15 Fig FAQ 1.2

Killer Heat in the United States

Climate Choices and the Future of Dangerously Hot Days

AP/Ross D. Franklin

IOP Publishing Environ. Res. Commun. 1 (2019) 075002 https://doi.org/10.1088/2515-7620/ab27cf

Environmental Research Communications

PAPER

Increased frequency of and population exposure to extreme heat index days in the United States during the 21st century

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Supplementary material for this article is available online

Abstract

The National Weather Service of the United States uses the heat index—a combined measure of temperature and relative humidity—to define risk thresholds warranting the issuance of public heat alerts. We use statistically downscaled climate models to project the frequency of and population exposure to days exceeding these thresholds in the contiguous US for the 21st century with two emissions and three population change scenarios. We also identify how often conditions exceed the range of the current heat index formulation. These 'no analog' conditions have historically affected less than 1% of the US by area. By mid-21st century (2036–2065) under both emissions scenarios, the annual numbers of days with heat indices exceeding 37.8 °C (100 °F) and 40.6 °C (105 °F) are projected to double and triple, respectively, compared to a 1971–2000 baseline. In this timeframe, more than 25% of the US by area would experience no analog conditions an average of once or more annually and the mean duration of the longest extreme heat index event in an average year would be approximately double that of the historical baseline. By late century (2070–2099) with a high emissions scenario, there are four-fold and eight-fold increases from late 20th century conditions in the annual numbers of days with heat indices exceeding 37.8 °C and 40.6 °C, respectively; 63% of the country would experience no analog conditions once or more annually; and extreme heat index events exceeding 37.8 °C would nearly triple in length. These changes amount to four- to 20-fold increases in population exposure from 107 million person-days per year with a heat index above 37.8 °C historically to as high as 2 billion by late century. The frequency of and population exposure to these extreme heat index conditions with the high emissions scenario is roughly twice that of the lower emissions scenario by late century.

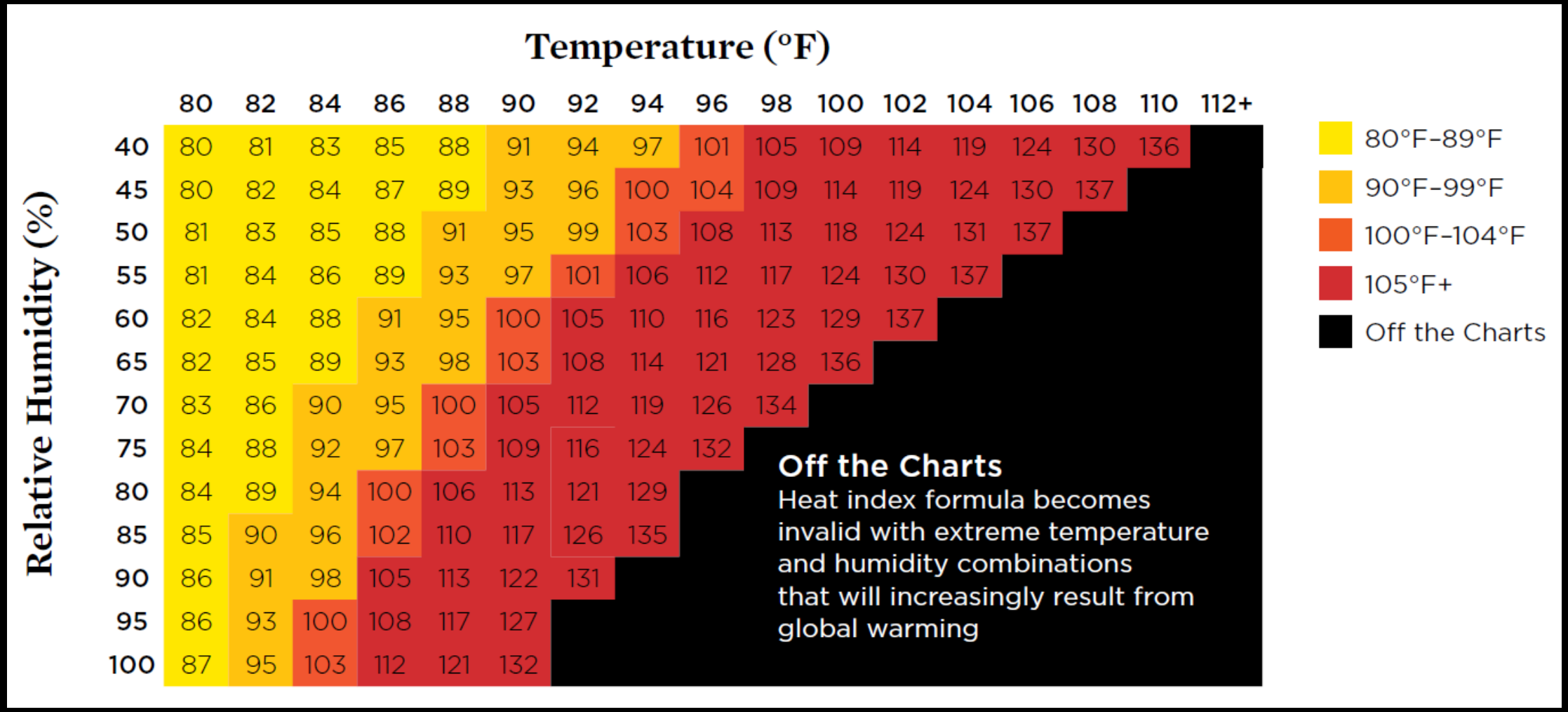
Introduction

For much of the contiguous United States, the frequency of extreme heat events has been increasing since the mid-1960s (Abatzoglou and Barbero 2014, Vose *et al* 2017) and the number of high temperature records has outpaced the number of low temperature records, particularly since the mid-1980s. Cities throughout the country have experienced not only more frequent extreme heat over the last 60 years, but also more intense and longer-lasting heat waves (Habeeb *et al* 2015), although the metric by which 'heat wave' is defined can influence whether or not a trend is detectable (Shiva *et al* 2019). Trends in daytime heat extremes over the past century across the US show a lack of long-term trends (Peterson *et al* 2013a). Hypothesized reasons for the lack of longer-term trends in heat extremes in the US are tied to land-surface feedbacks that modify the ratio of sensible to latent heat flux. For example, chronically dry land-surface conditions and higher Bowen ratios during the 1930s Dust Bowl are hypothesized to have promoted stronger warming of daytime temperature extremes across much of the central US (e.g., Abatzoglou and Barbero, 2014), while increased cropland intensification across portions

About the Killer Heat analysis

- High-resolution climate models
- Use temperature and humidity to calculate **heat index**
- Three future emissions scenarios
- Data for every community in the lower 48

About the Heat Index



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Heat Index Above 90°F

Outdoor workers become more susceptible to heat-related illness.

Heat Index Above 100°F

Children, elderly adults, pregnant women, and people with underlying conditions are at heightened risk of heat-related illness.

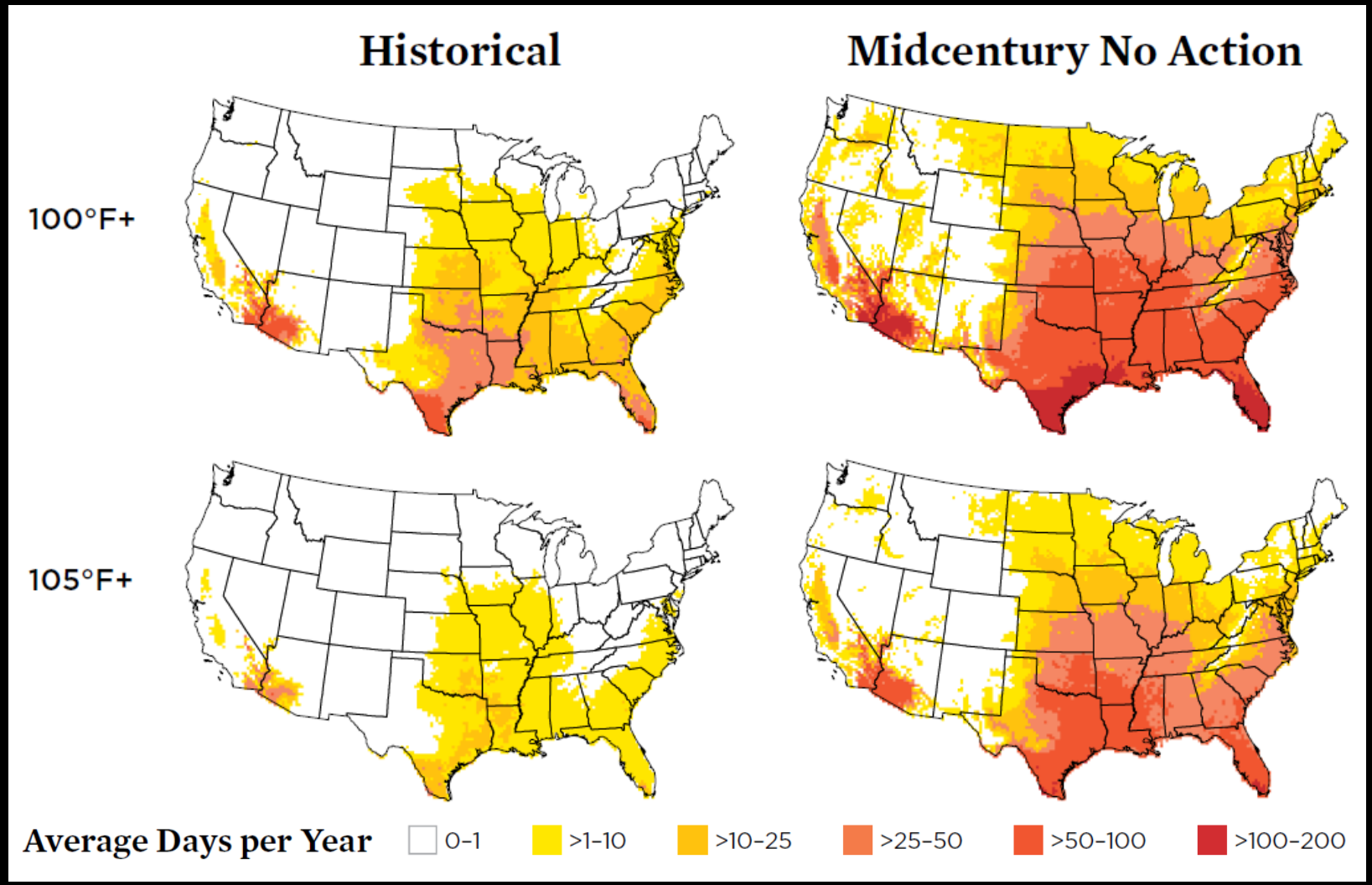
Heat Index Above 105°F

Anyone could be at risk of heat-related illness or even death as a result of prolonged exposure.

Heat Index Off the Charts

Undetermined: any level of exposure is presumed extremely dangerous for all people and likely to result in heat-related illness or even death.

Midcentury (2036-2065): Steep increase in extreme heat



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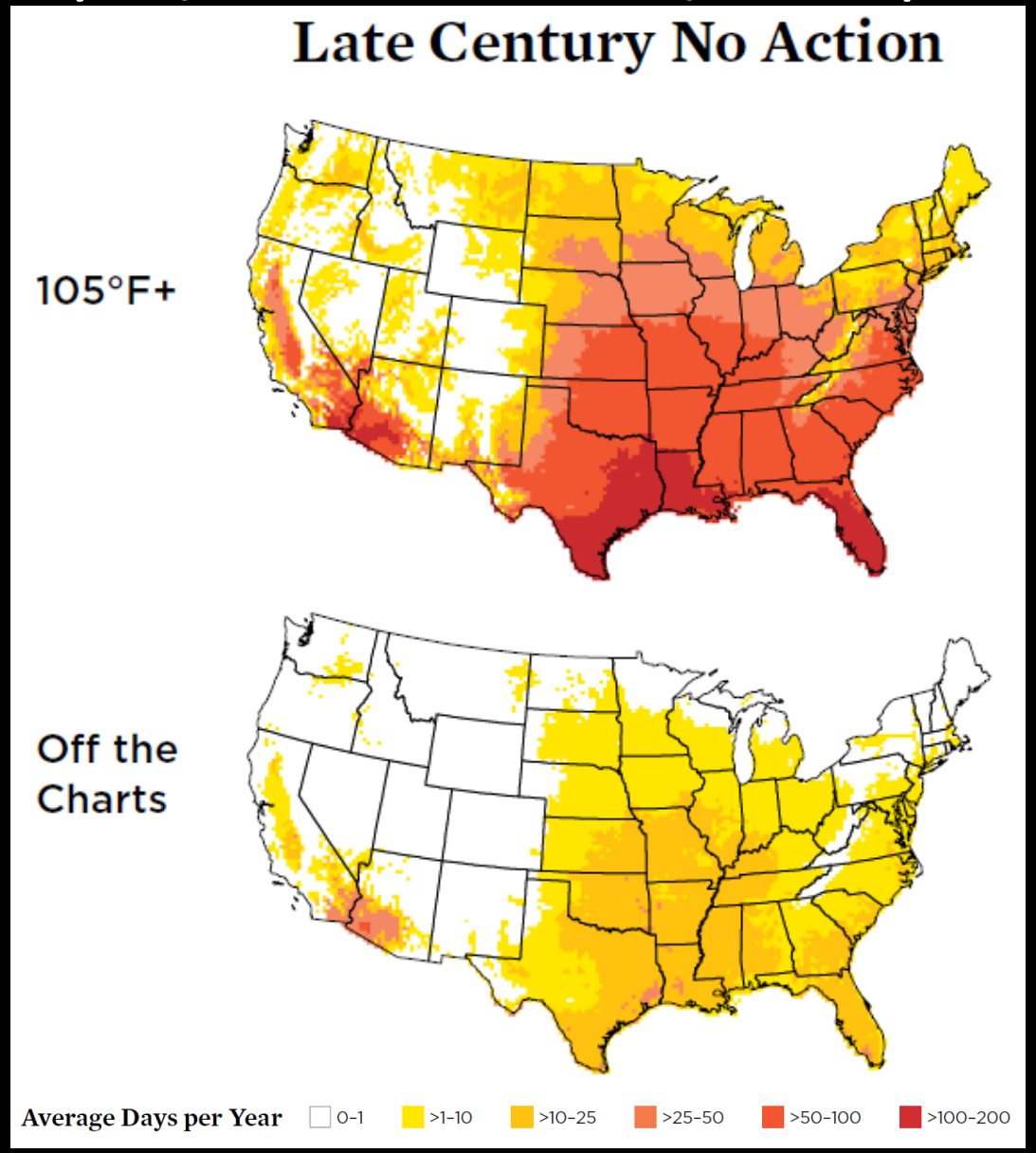
Late century (2070-2099): Unprecedented heat



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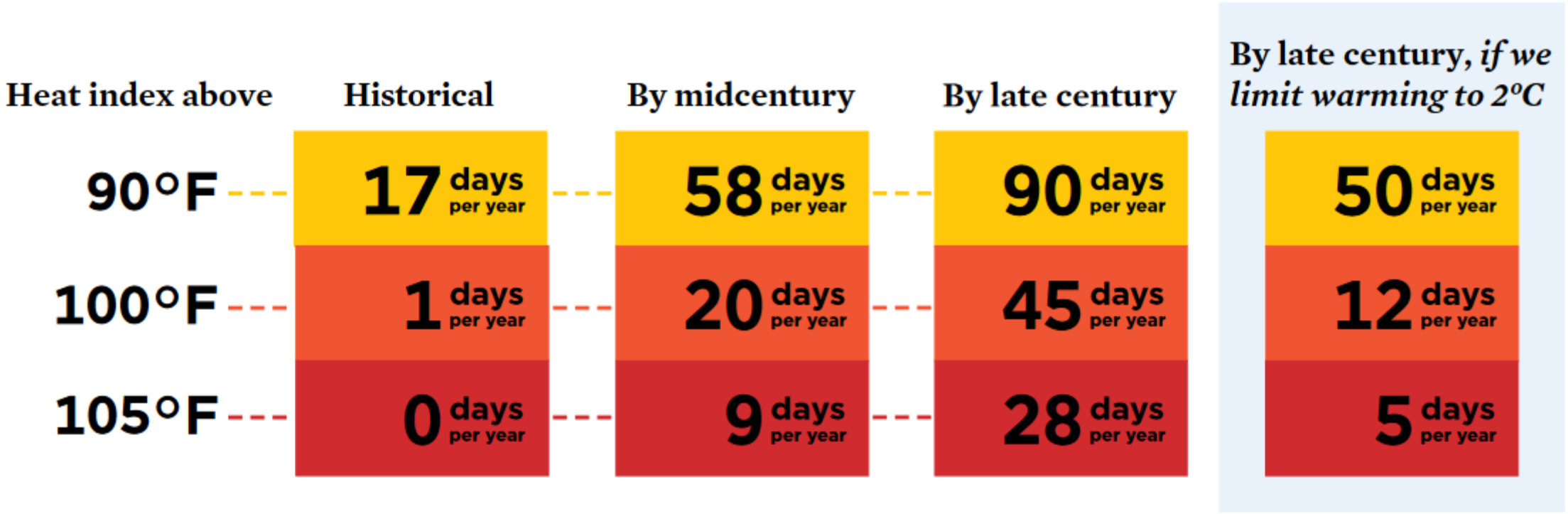
Annual Days of Extreme Heat Per Year in West Virginia's 2nd District



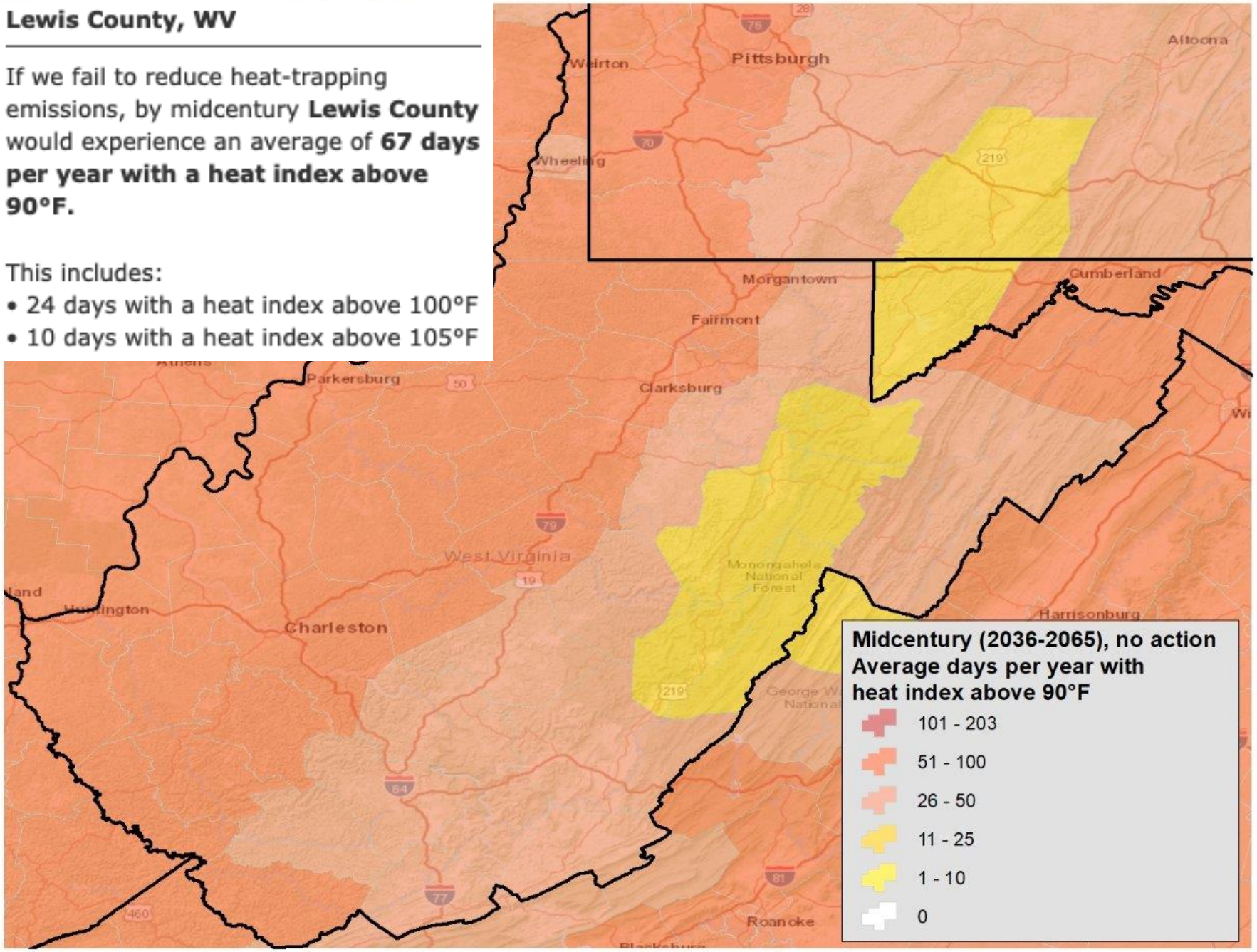
With no action to reduce global heat-trapping emissions, the average frequency of extreme heat in this district would rise as shown here. Taking rapid action to reduce emissions and cap future global warming at 2°C (3.6°F) would limit the increase in extreme heat days. For more information and detailed data, visit www.ucsusa.org/killer-heat.

Lewis County, WV

If we fail to reduce heat-trapping emissions, by midcentury **Lewis County** would experience an average of **67 days per year with a heat index above 90°F.**

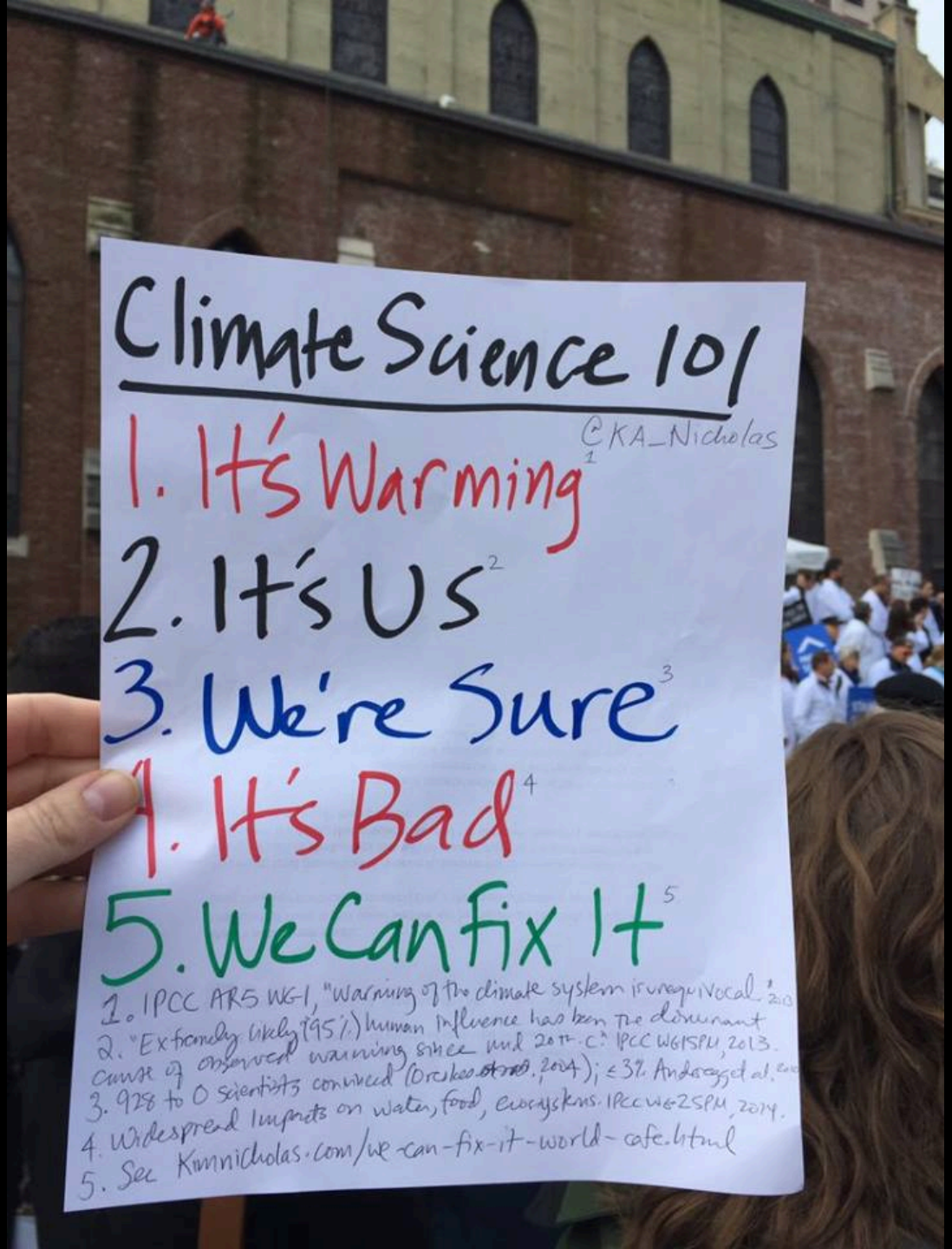
This includes:

- 24 days with a heat index above 100°F
- 10 days with a heat index above 105°F



Takeaways

- Failing to take action to reduce emissions would lead to a staggering expansion of dangerous heat.
- Aggressively reducing emissions could contain that expansion.
- The time to act is now.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5. See Kimnicholas.com/we-can-fix-it-world-cafe.html

Adaptation:
Keeping People Safe in the Immediate

Credit: AP Photo David Goldman

+

Mitigation:
Reaching net zero emissions by 2050


Credit: Ellysa Ho, iStock

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Mitigation: ***Reaching net zero emissions by 2050***

Transitioning away from fossil fuels

Mitigation: ***Reaching net zero emissions by 2050***

Shifting to cleaner vehicles

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Mitigation: *Reaching net zero emissions by 2050*

Building a clean energy economy

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Mitigation: ***Reaching net zero emissions by 2050***

Ensuring Fairness to Coal Country

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Bold Vision

- BlueGreen Alliance is a coalition of 6 labor unions and 8 environmental organizations on a mission to **Create Good Jobs, a Clean Environment, and a Fair and Thriving Economy**
- Vision addresses twin crises of climate change and income inequality

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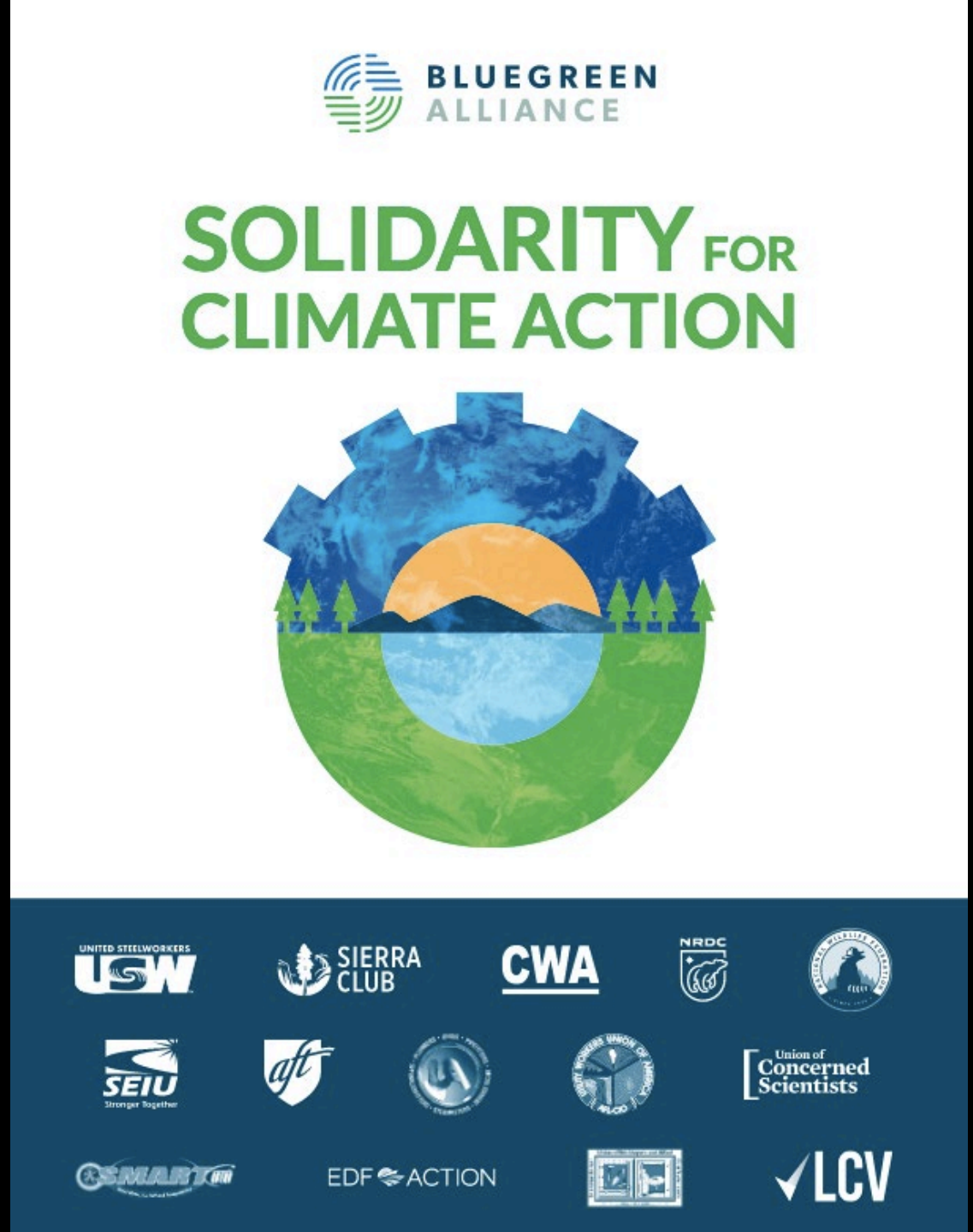

A Path Forward for Coal Country

We must ensure fairness to the workers in fossil fuel industries and the communities that depend on them.

- Open and Honest Reckoning with Reality
- Planning for the Future with Real Engagement from Affected People
- Massive investments in place-based and community-driven solutions

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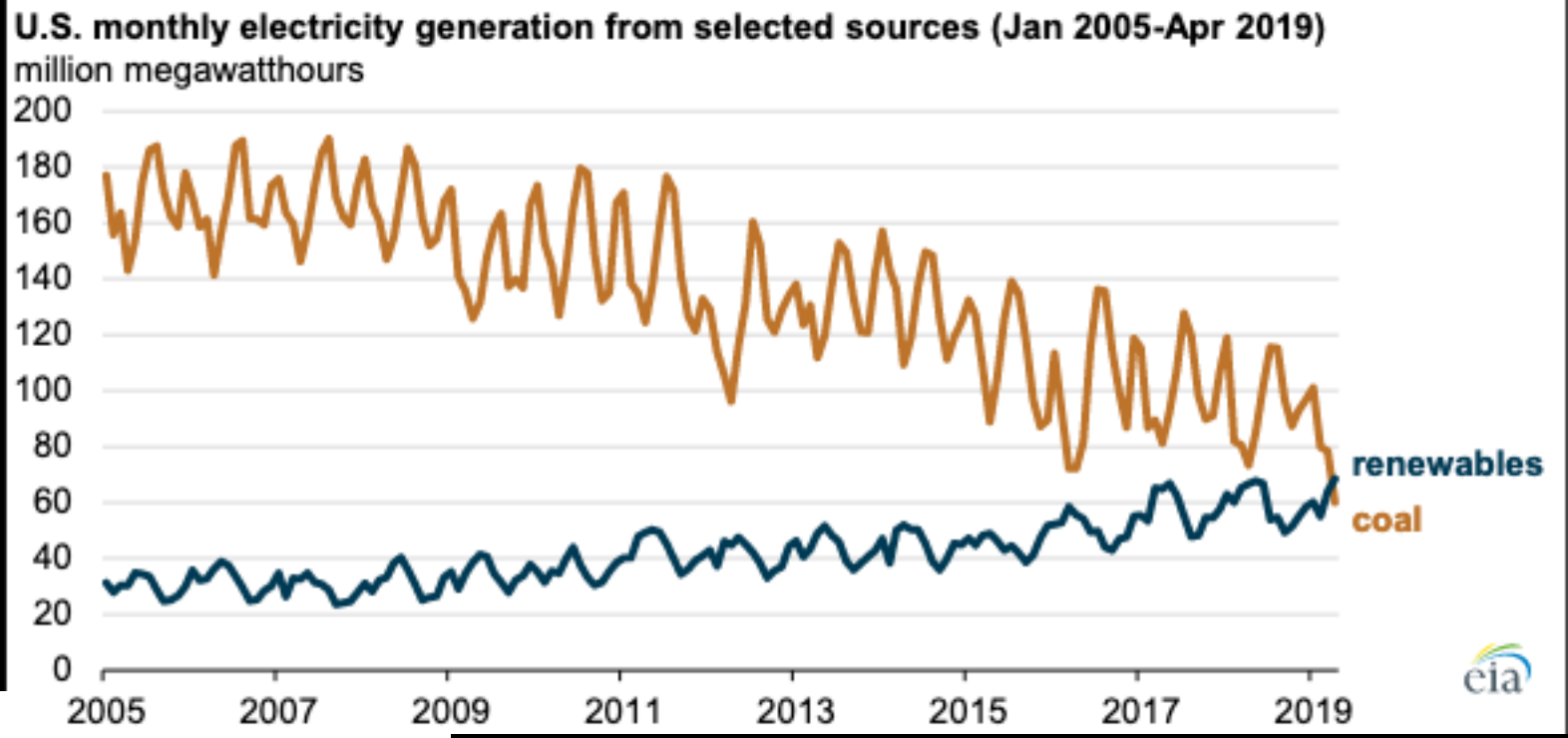
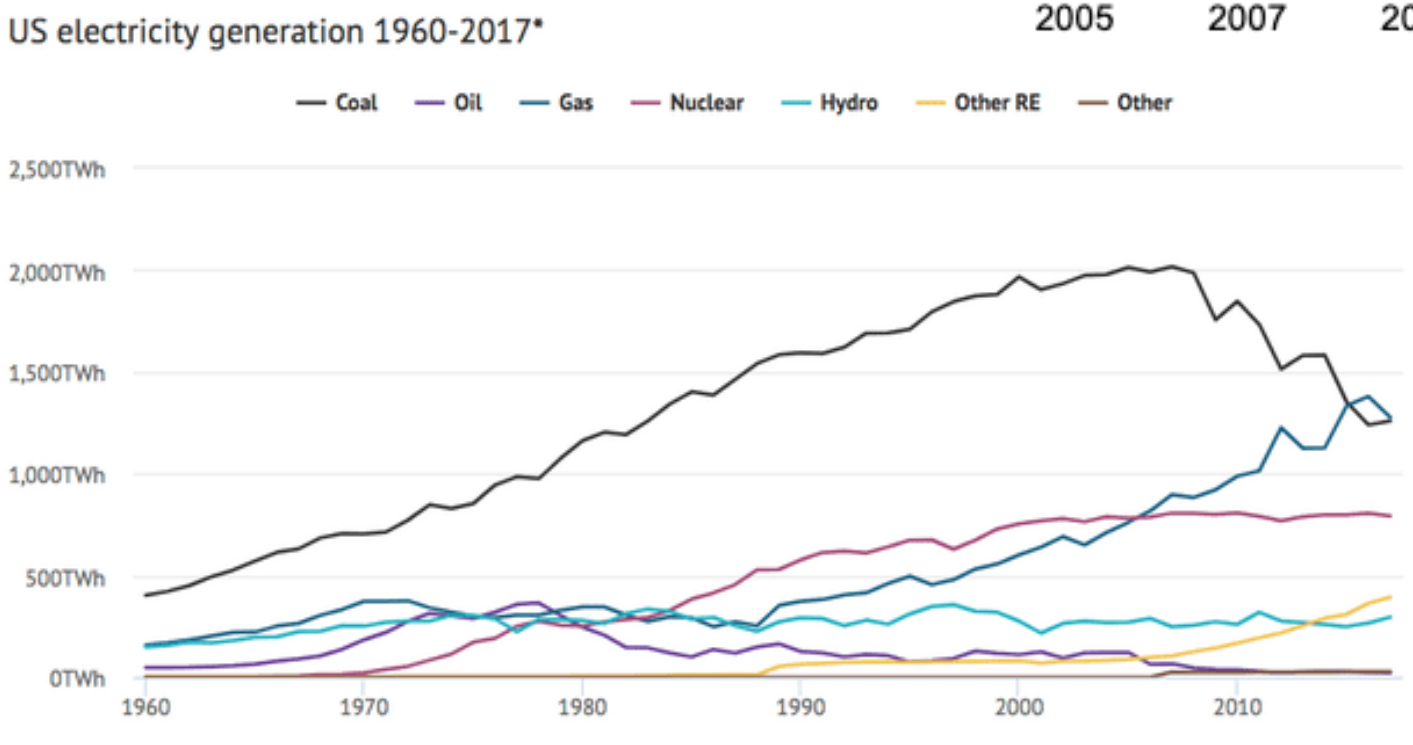
Honesty: Coal in Decline





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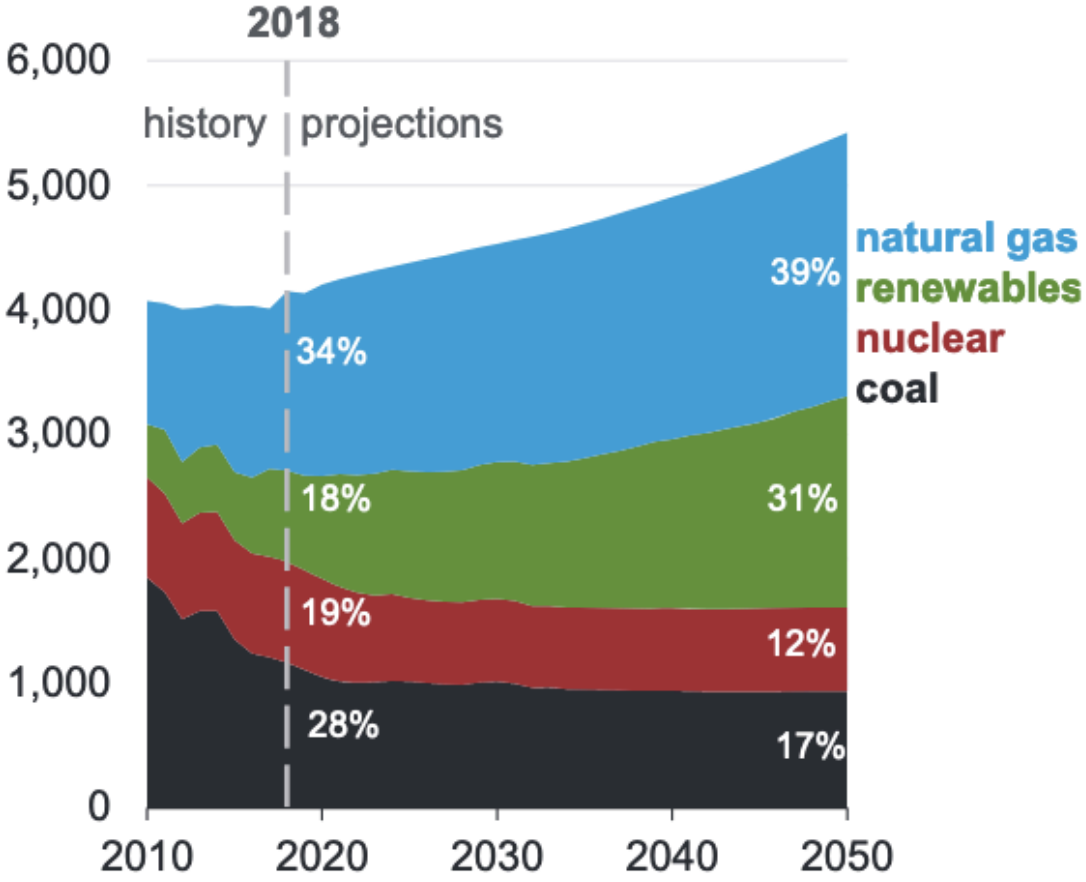
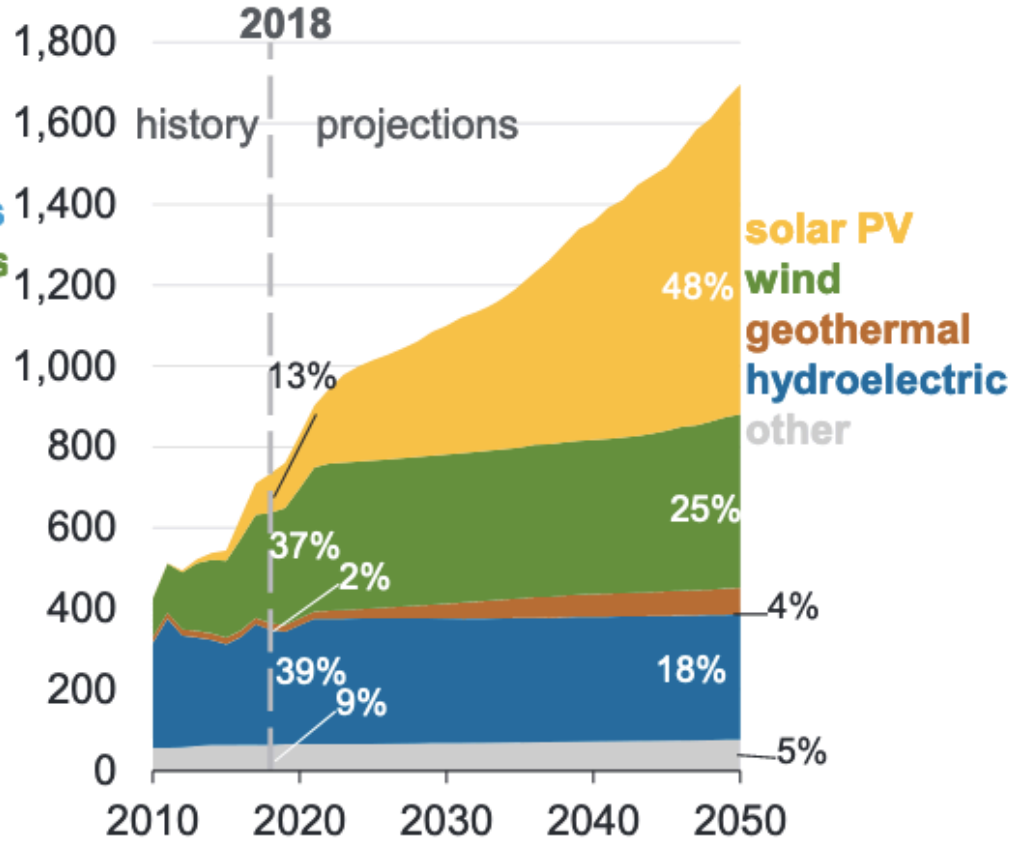
Electricity generation from natural gas and renewables increases, and the shares of nuclear and coal generation decrease—

Electricity generation from selected fuels (Reference case)
billion kilowatthours



Renewable electricity generation, including end-use (Reference case)
billion kilowatthours

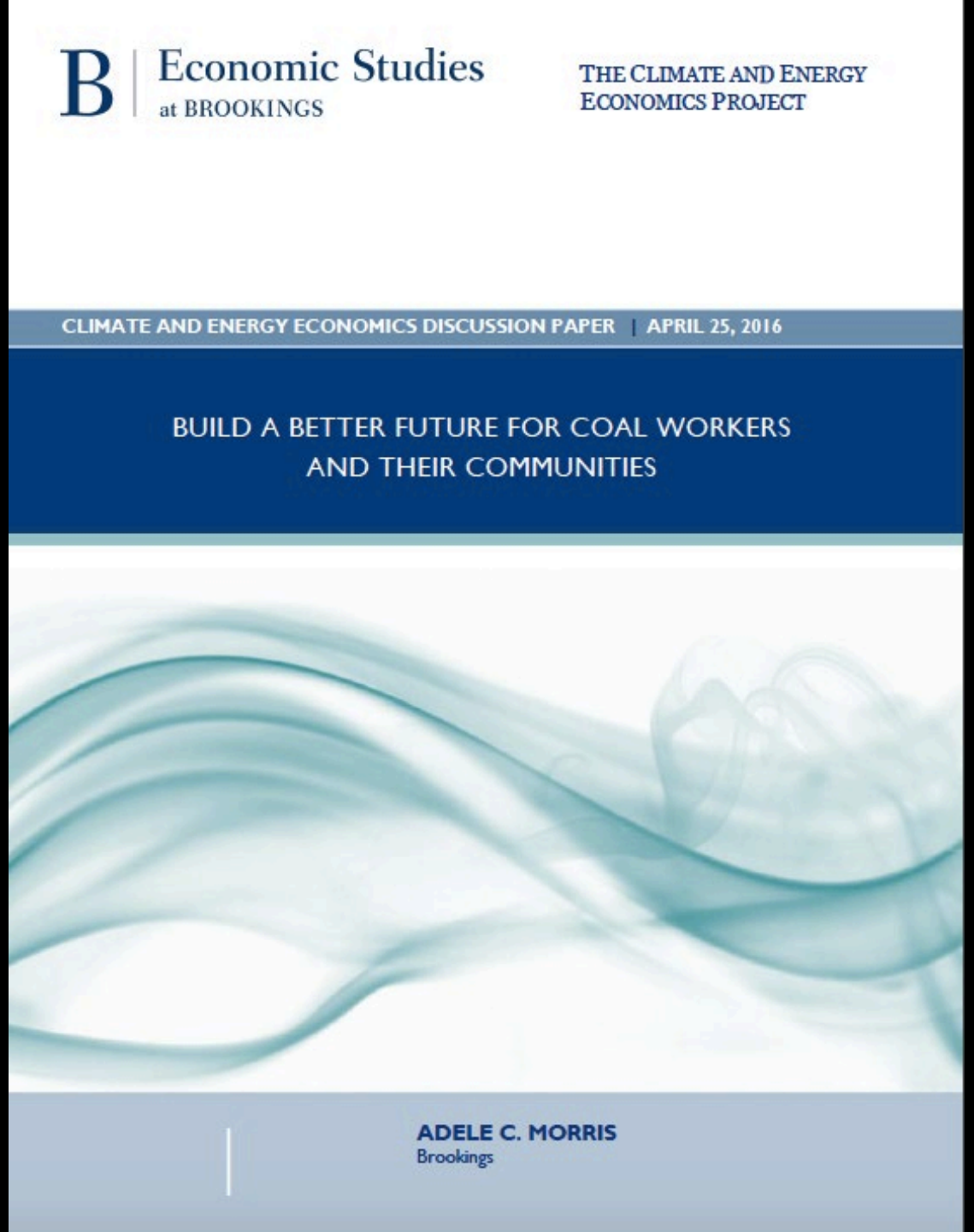


Planning and Community Engagement

- POWER Initiative: Partnerships for Opportunity and Workforce and Economic Revitalization
- Since 2015, the Appalachian Regional Commission has invested over $148 million in 185 projects touching 312 counties
- Together, these investments are projected to create or retain more than **17,500 jobs**, create or improve more than **7,200 businesses**, and leverage more than **$772 million** in additional private investment into Appalachia's economy.

Massive Investments

- Federal government will need to make large investments in worker training and community economic development in Coal Country
- A small portion of revenue generated from a price on carbon could support these critical needs



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A JUST AND FAIR TRANSITION
FOR CANADIAN COAL POWER WORKERS AND COMMUNITIES

Task Force on Just Transition for Canadian Coal Power Workers and Communities

December 2018

Summary of Recommendations

Embed Just Transition Principles in Planning, Legislative, Regulatory, and Advisory Processes to ensure Ongoing and Concrete Actions throughout the Coal Phase-out Transition:

1. Develop, communicate, implement, monitor, evaluate, and publicly report on a just transition plan for the coal phase-out, championed by a lead minister to oversee and report on progress.
2. Include provisions for just transition in federal environmental and labour legislation and regulations, as well as relevant intergovernmental agreements.
3. Establish a targeted, long-term research fund for studying the impact of the coal phase-out and the transition to a low-carbon economy.

Ensure Locally Available Supports:

4. Fund the establishment and operation of locally-driven transition centres in affected coal communities.

Provide Workers a Pathway to Retirement:

5. Create a pension bridging program for workers who will retire earlier than planned due to the coal phase out.

Transition Workers to Sustainable Employment:

6. Create a detailed and publicly available inventory with labour market information pertaining to coal workers, such as skills profiles, demographics, locations, and current and potential employers.
7. Create a comprehensive funding program for workers staying in the labour market to address their needs across the stages of securing a new job, including income support, education and skills building, re-employment, and mobility.

Invest in Community Infrastructure:

8. Identify, prioritize, and fund local infrastructure projects in affected communities.

Fund Community Planning, Collaboration, Diversification, and Stabilization:

9. Establish a dedicated, comprehensive, inclusive, and flexible just transition funding program for affected communities.
10. Meet directly with affected communities to learn about their local priorities, and to connect them with federal programs that could support their goals.

Thank You

Jeremy Richardson | JRichardson@ucsusa.org

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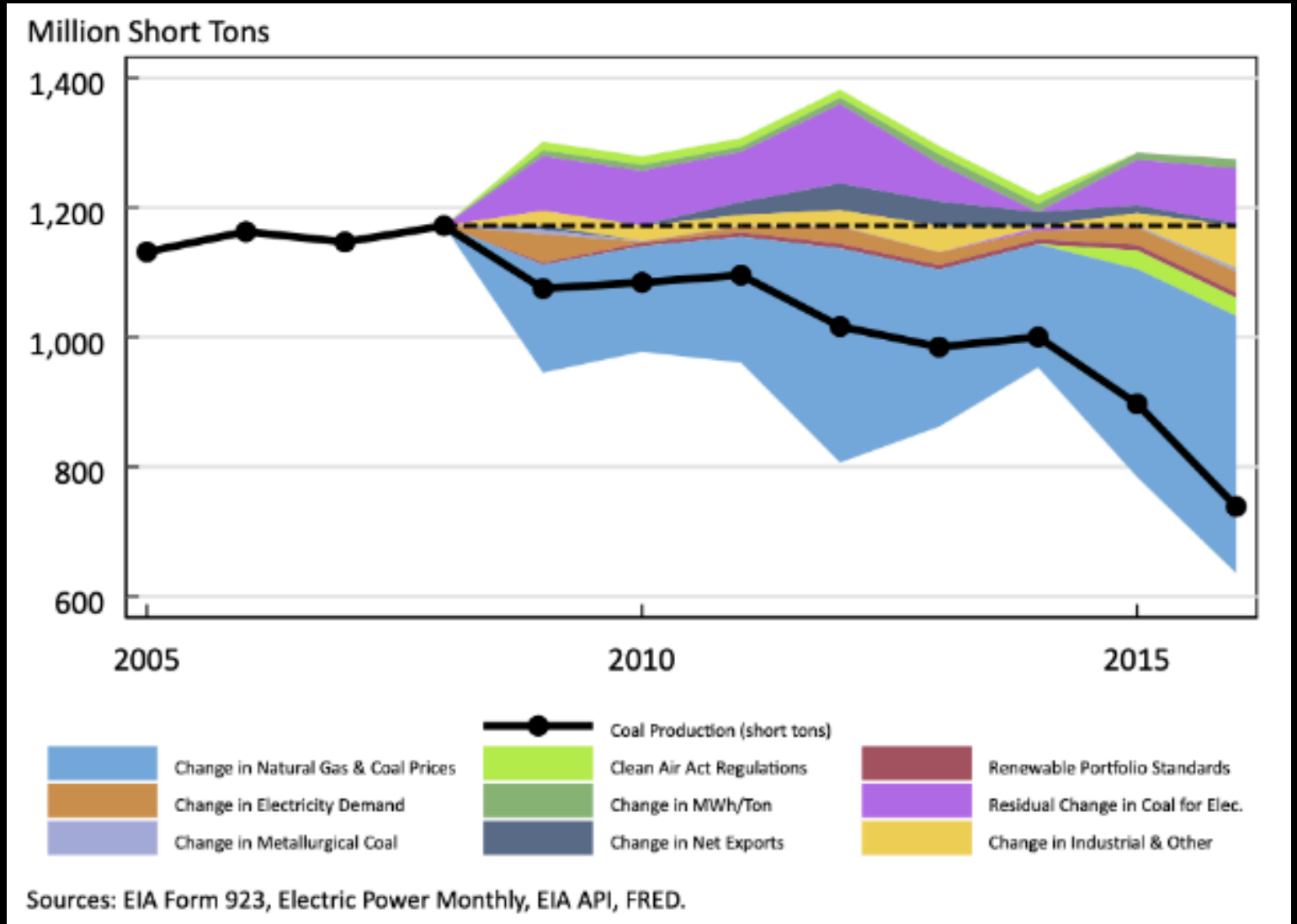
Extra slides

Study: 92% of 2008-2016 coal decline from falling prices for natural gas



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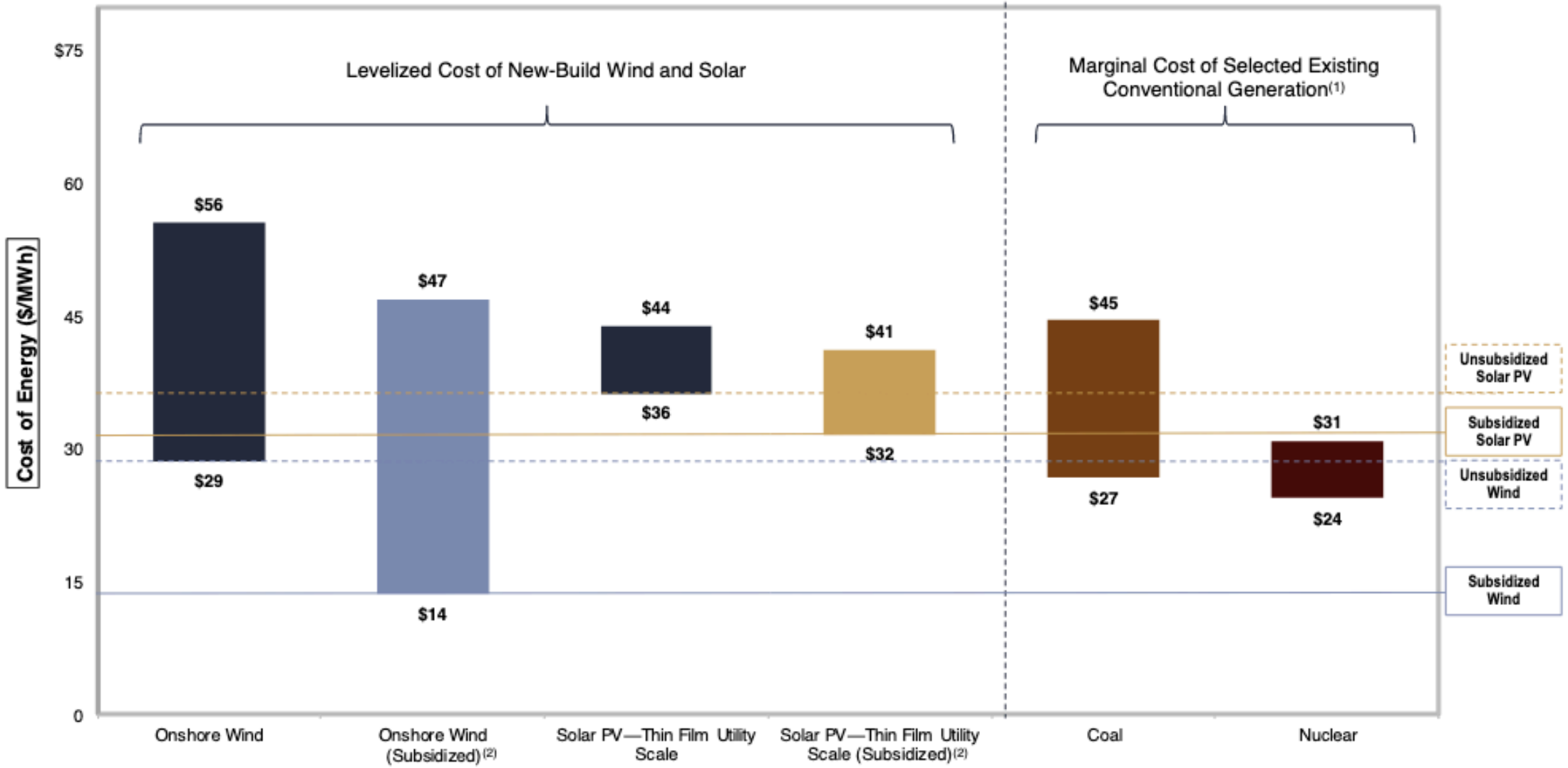
Levelized Cost of Energy Comparison—Alternative Energy versus Marginal Cost of Selected Existing Conventional Generation

Certain Alternative Energy generation technologies, which became cost-competitive with conventional generation technologies several years ago, are, in some scenarios, approaching an LCOE that is at or below the marginal cost of existing conventional generation technologies



Carbon Capture and Sequestration

- Technology that could be retrofitted to emitting facilities
- A few examples in commercial operation (e.g., Boundary Dam)
- High profile failures (Kemper)
- Costs are prohibitive; 90% capture costs 2/3 more than coal without CCS
- RD&D essential: will be needed for industrial processes that are hard to decarbonize

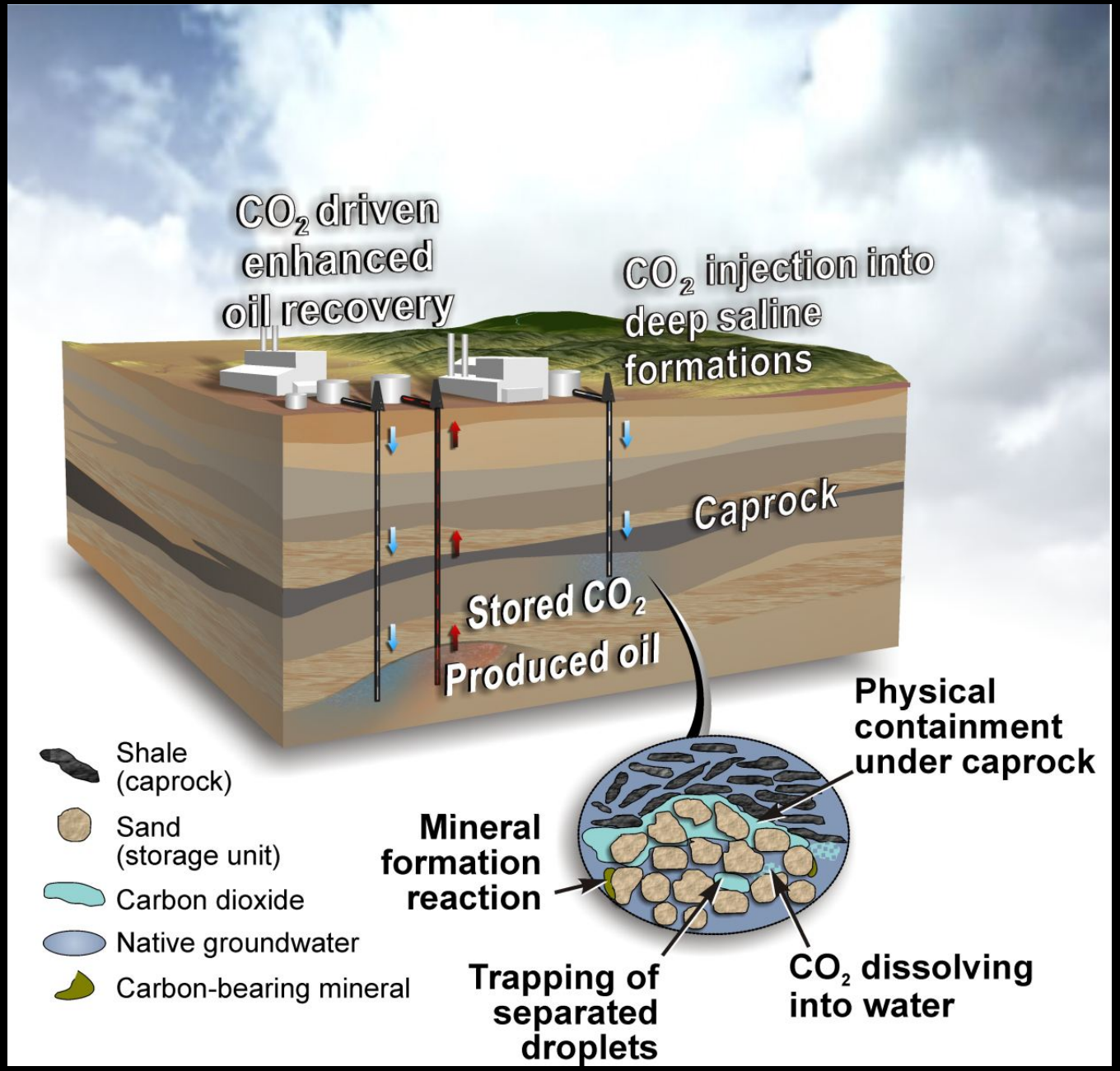


Figure 4: U.S. Fossil Fuel Subsidies by Energy Type, 2015-2016

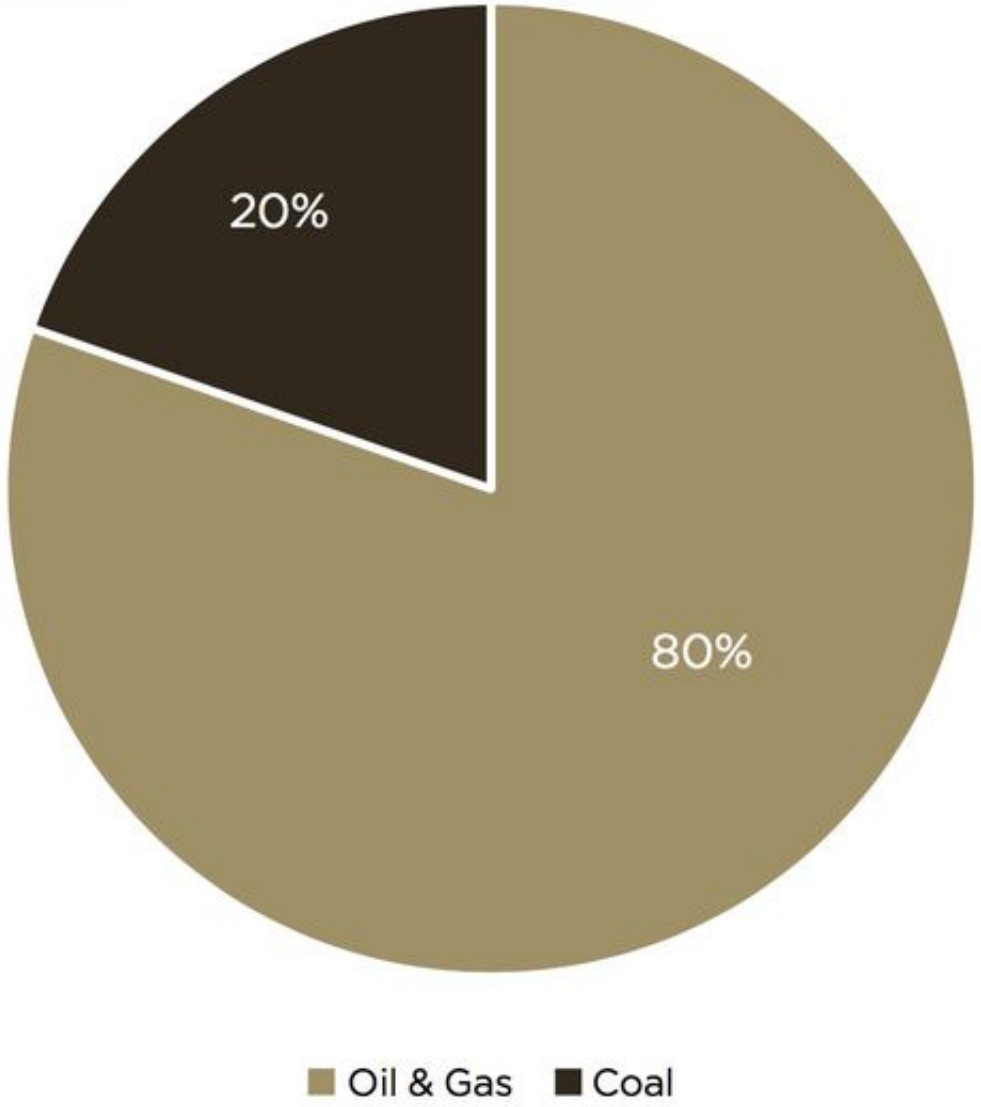
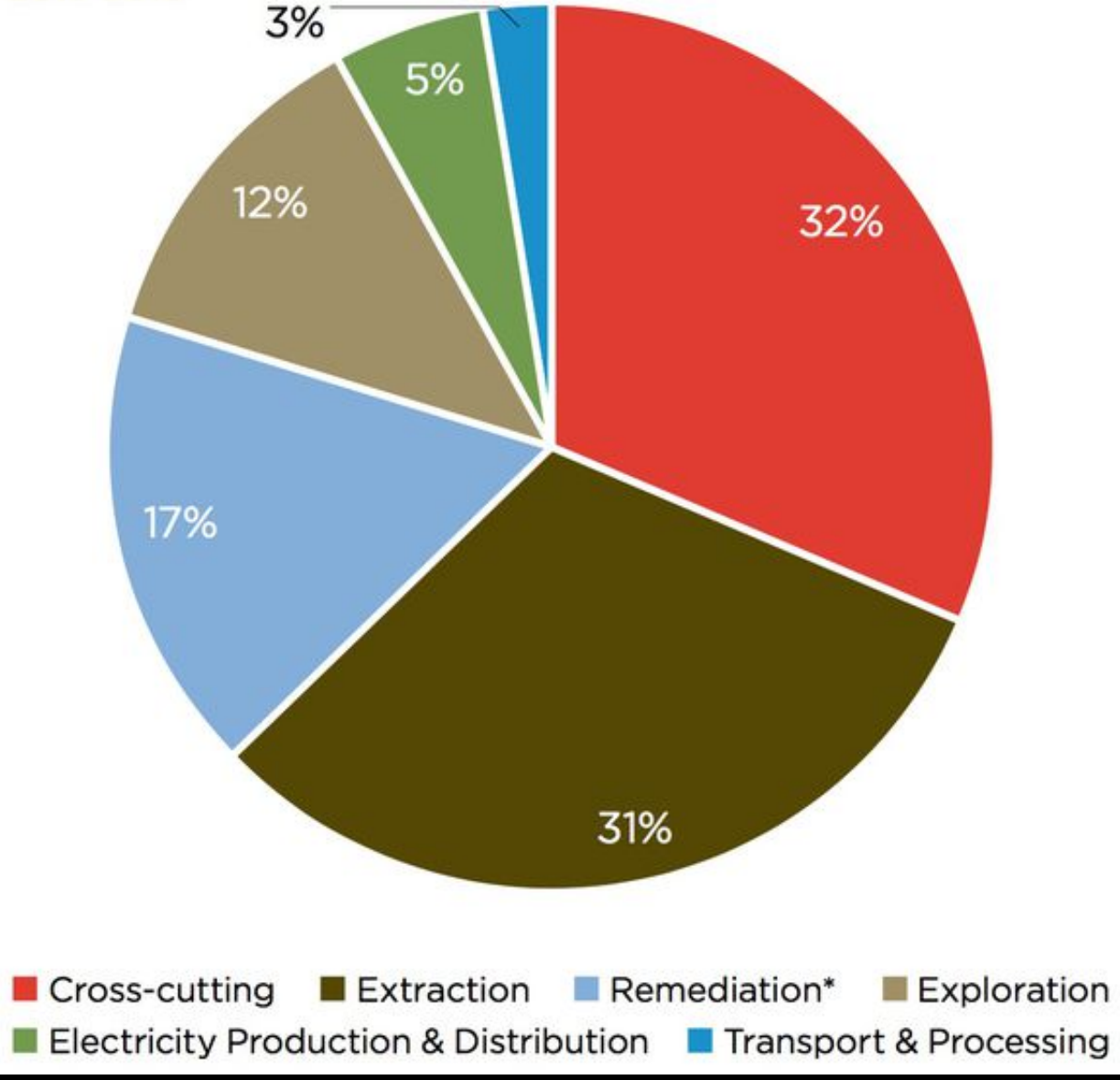
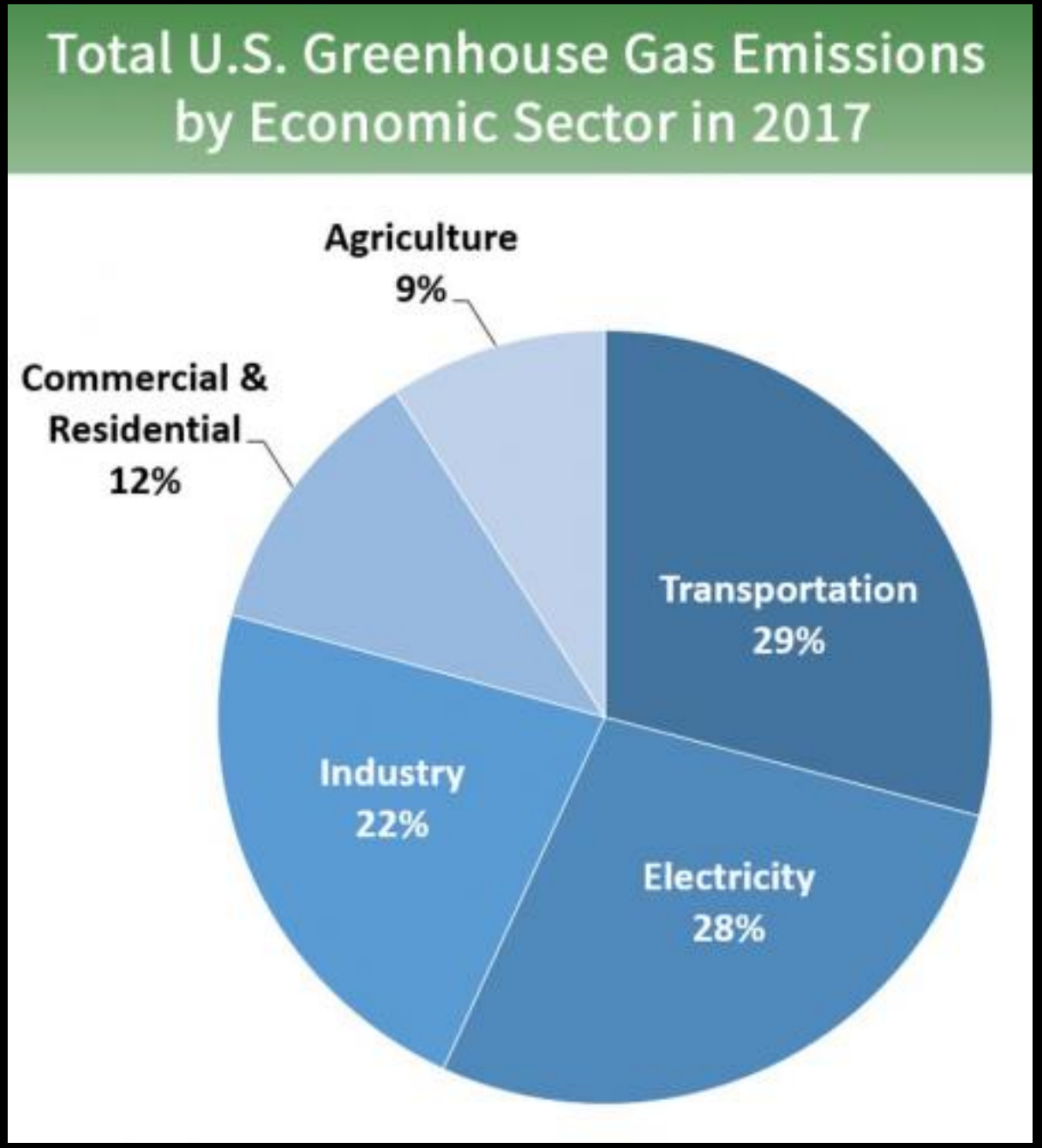


Figure 5: U.S. Fossil Fuel Subsidies by Stage of Production, 2015-2016



Total U.S. Greenhouse Gas Emissions by Economic Sector in 2017

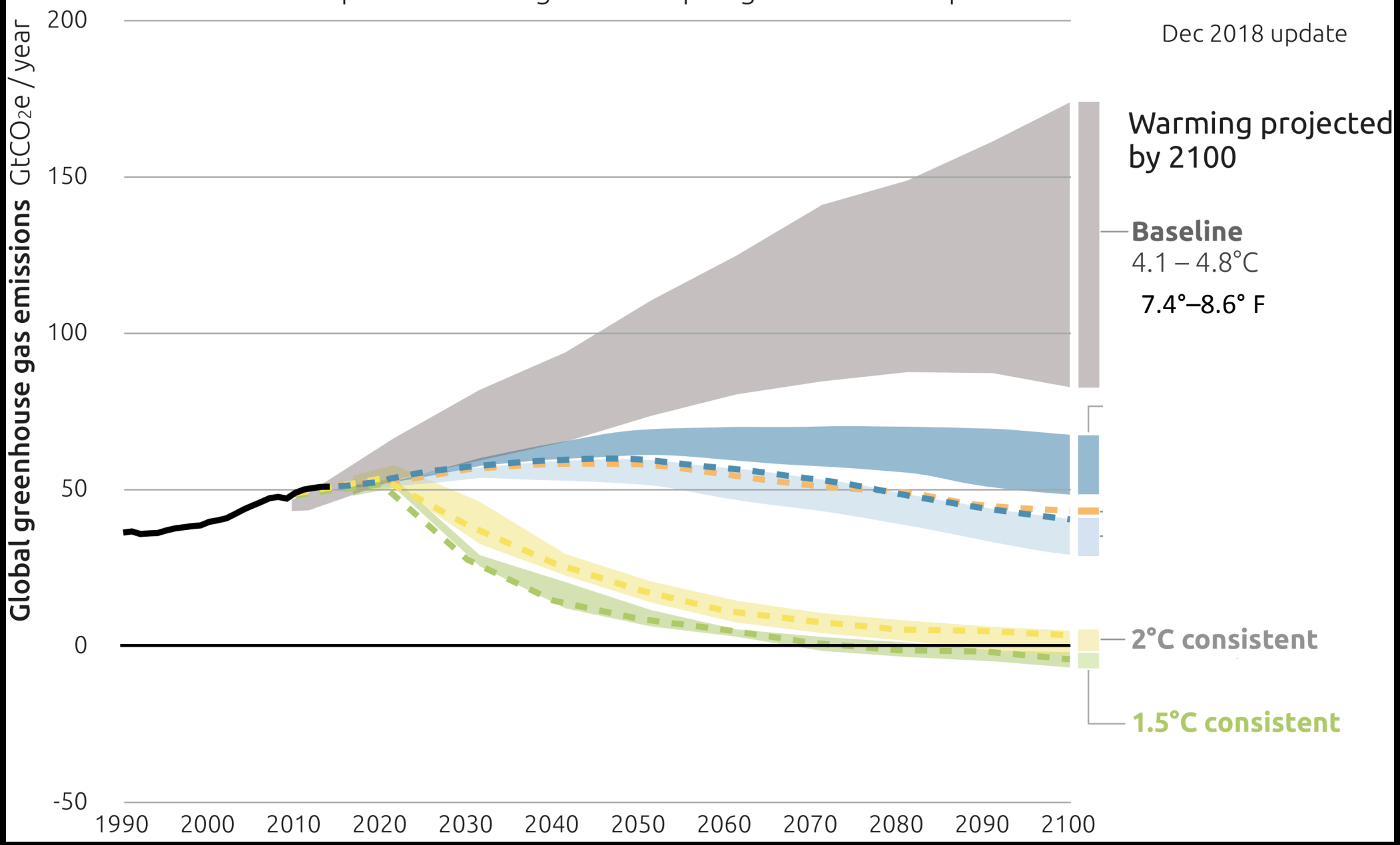


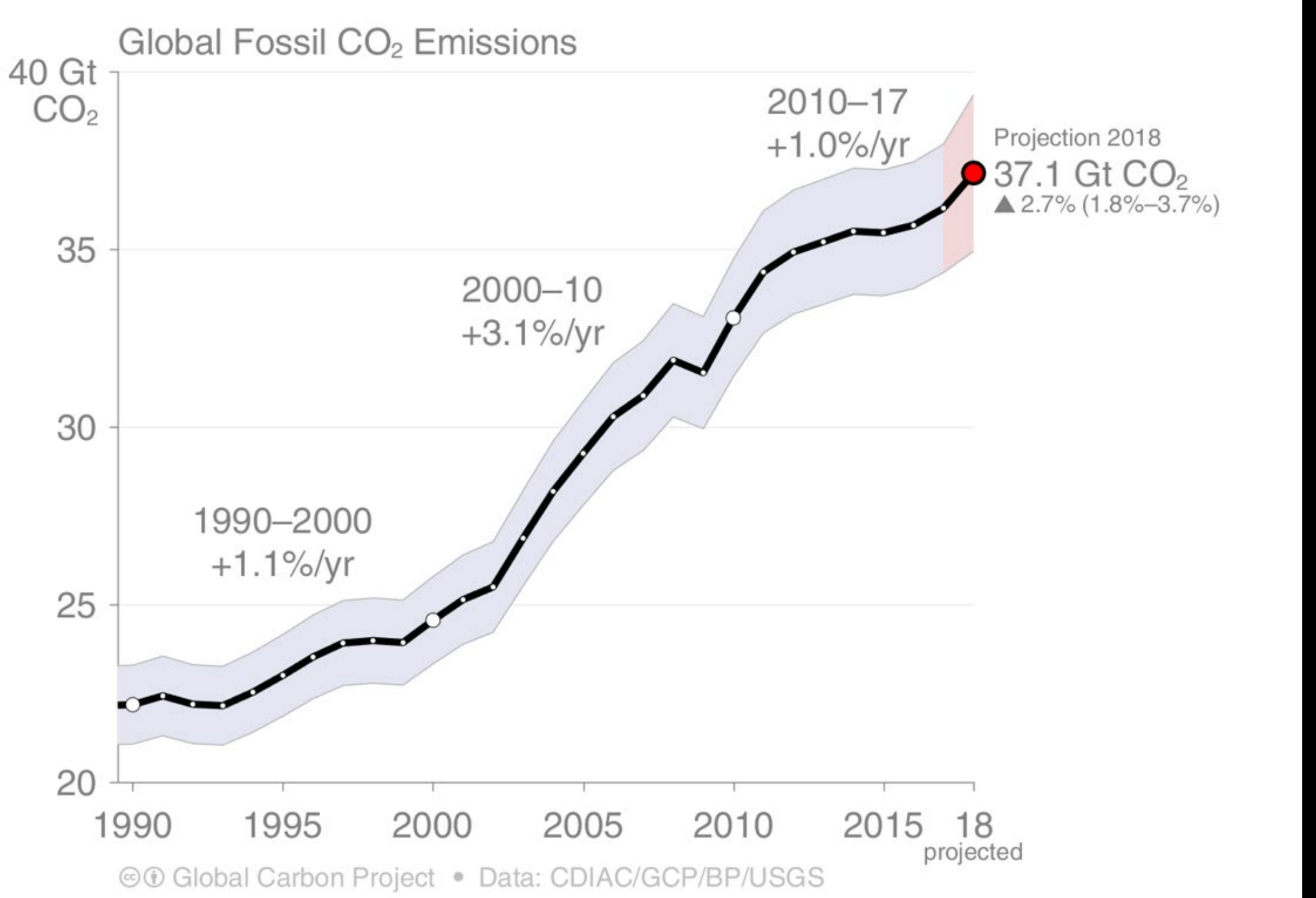
2100 WARMING PROJECTIONS

Emissions and expected warming based on pledges and current policies

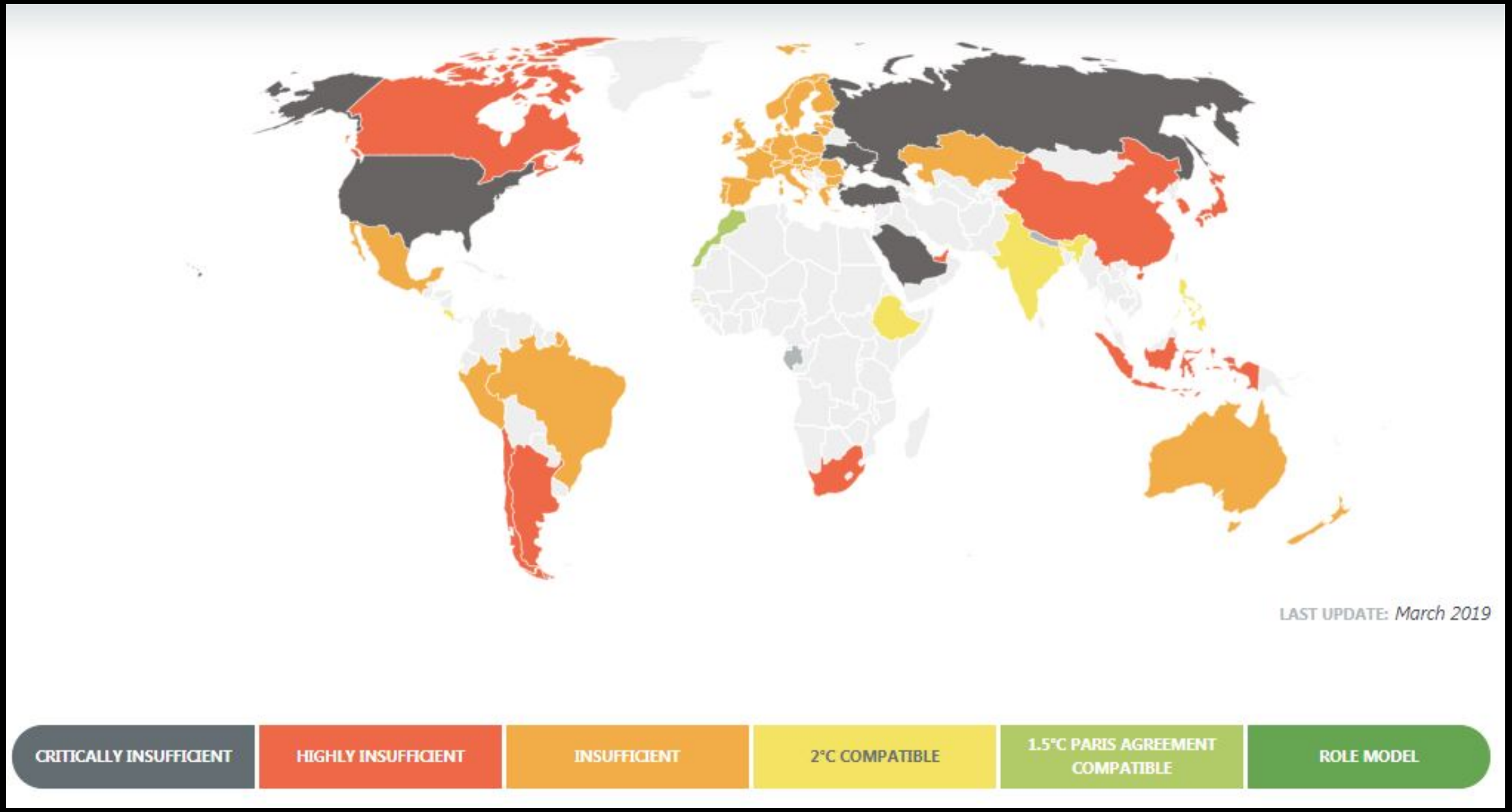
Climate Action Tracker

Dec 2018 update

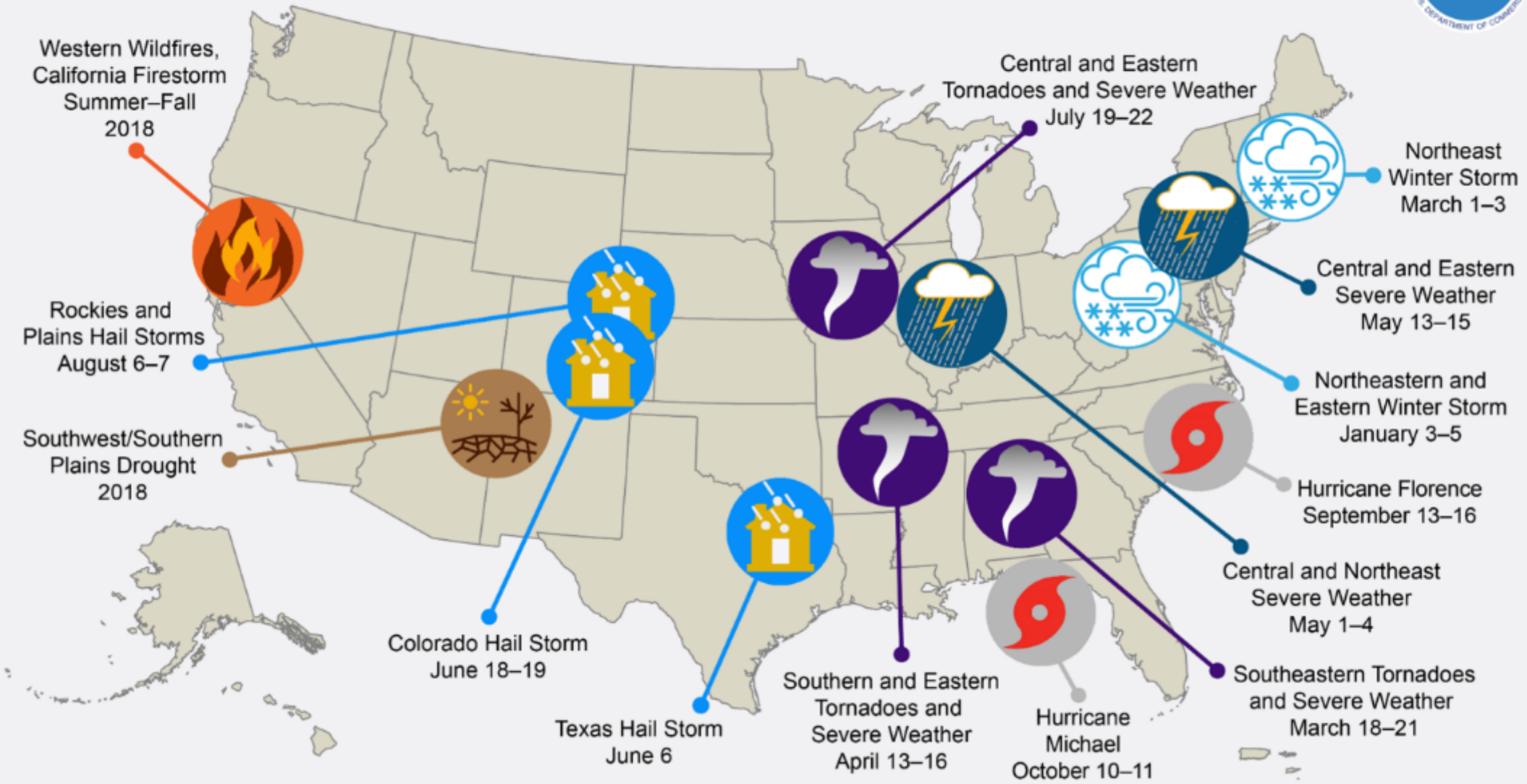



Global Fossil CO_2 Emissions
40 Gt CO_2
35
30
25
20
1990–2000
+1.1%/yr
2000–10
+3.1%/yr
2010–17
+1.0%/yr
Projection 2018
37.1 Gt CO_2
▲ 2.7% (1.8%–3.7%)
1990
1995
2000
2005
2010
2015
18
projected
Global Carbon Project • Data: CDIAC/GCP/BP/USGS

How are we doing?



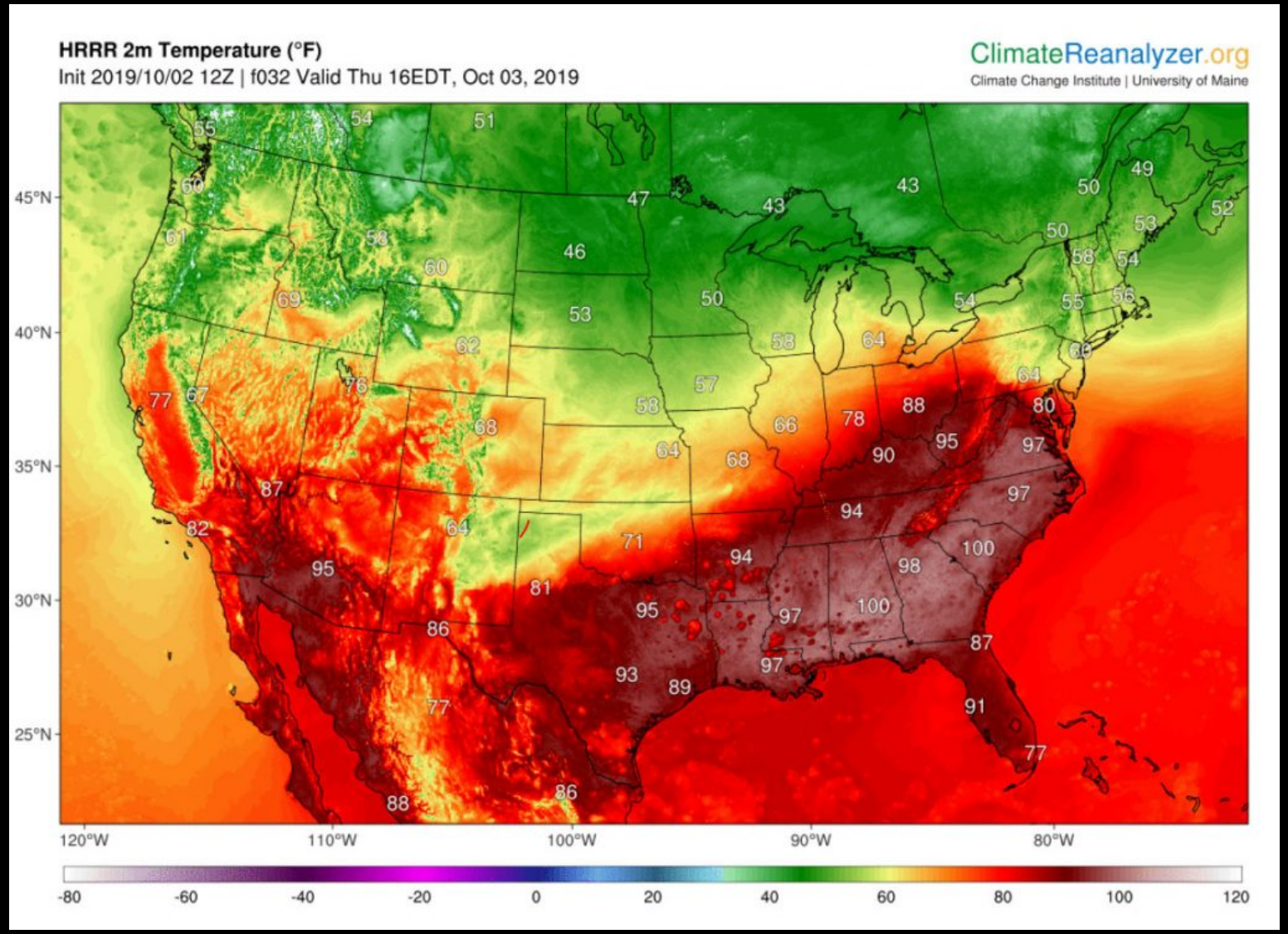
U.S. 2018 Billion-Dollar Weather and Climate Disasters



*This map denotes the approximate location for each of the **14 separate billion-dollar weather and climate disasters** that impacted the United States **during 2018**.*

NOAA

Why did we do this analysis?



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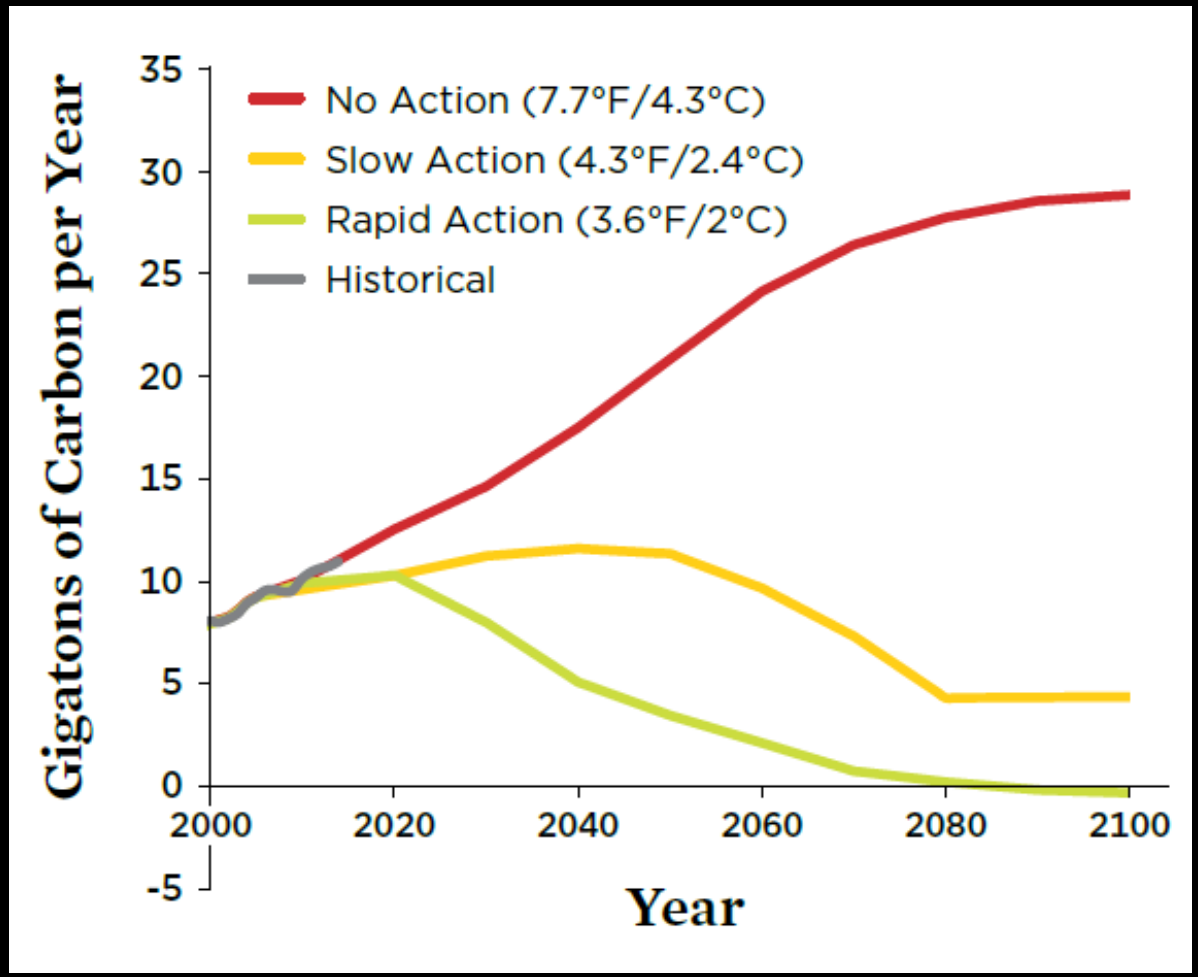
About the scenarios



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Cities with frequent, dangerous heat

Midcentury No Action

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Taking action now limits expansion of extreme heat

Cities Experiencing Heat Index >105°F

- More than 30 Days per Year
- More than 30 Days per Year, Historically
- Fewer than 30 Days per Year

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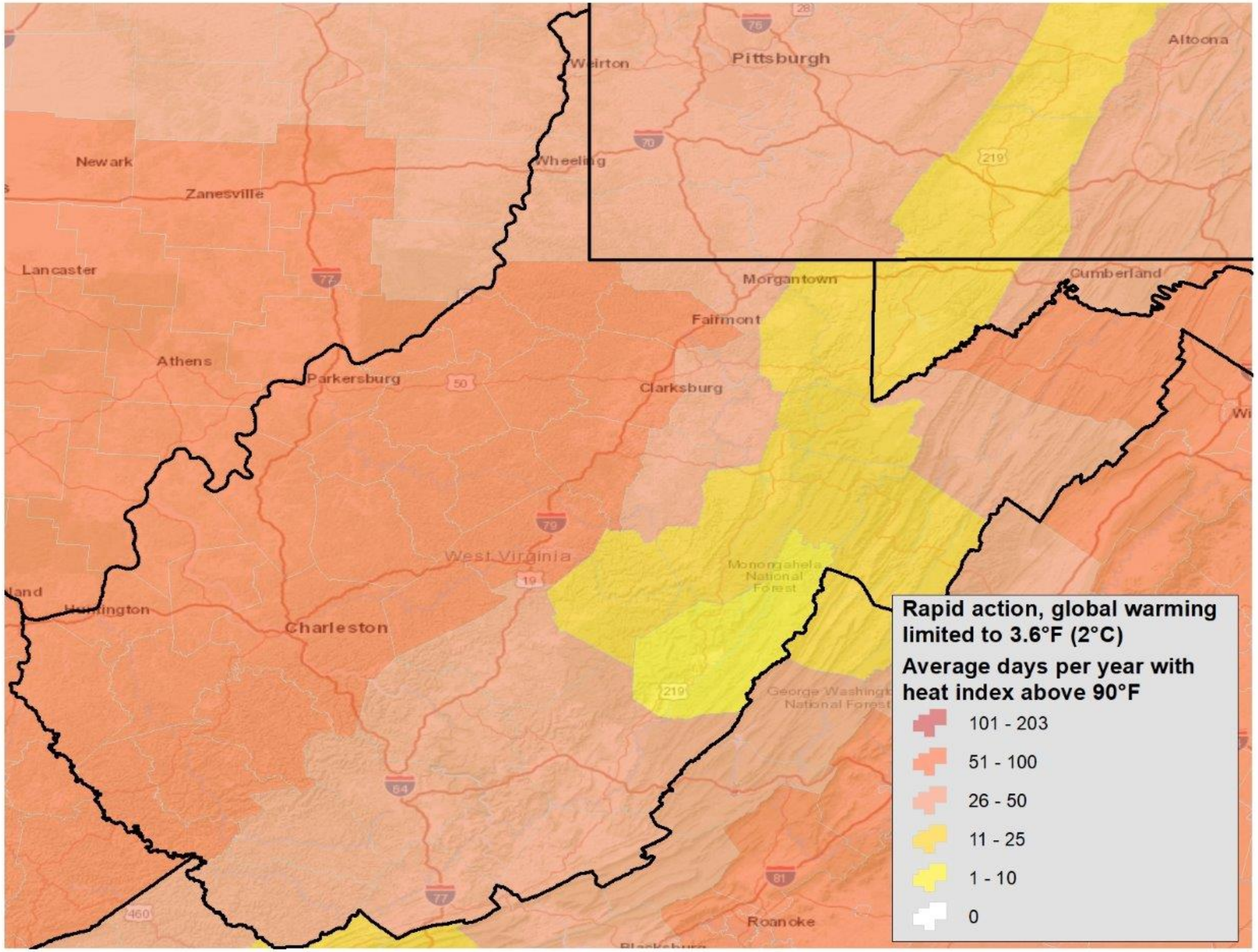
Keeping people safe

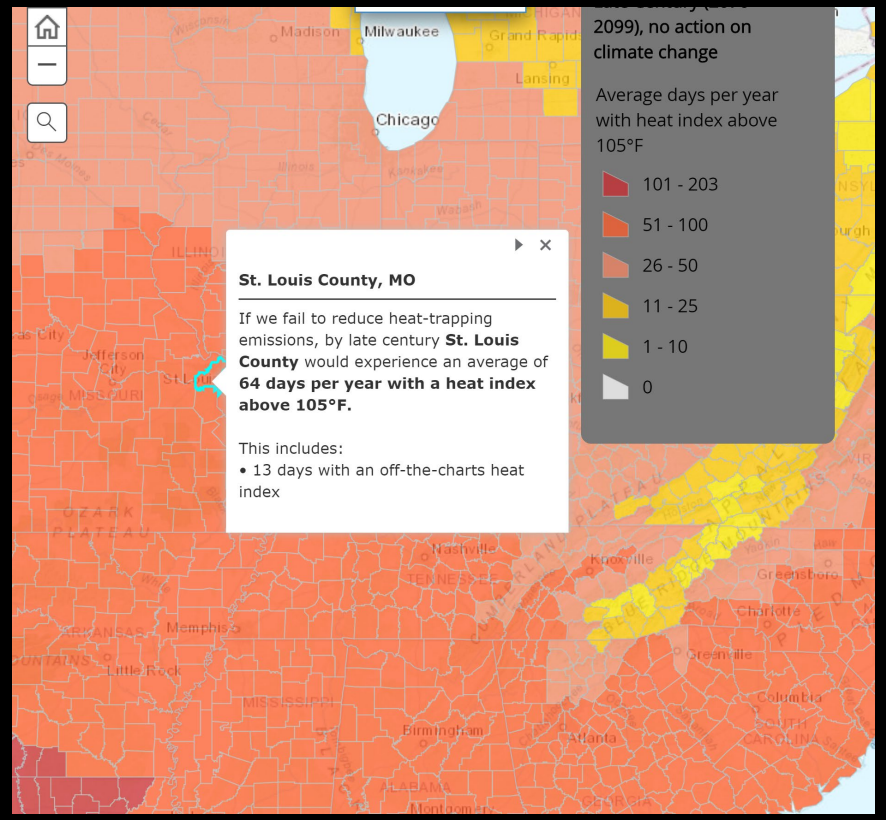
- Improved heat early-warning systems
- State/local heat adaptation and emergency reponse plans
- Cooling standards for public housing
- Investments in community cooling infrastructure, trees, shading, cool roofs
- Bill assistance programs for low-income households
- Investments in heat- and climate-smart infrastructure
- Reforming utility disconnect policies


Pittsburgh
Altoona
Weirton
Wheeling
Newark
Zanesville
Lancaster
Morgantown
Cumberland
Fairmont
Athens
Parkersburg
Clarksburg
West Virginia
Monongahela National Forest
Charleston
George Washington National Forest
Roanoke
Rapid action, global warming limited to 3.6°F (2°C)
Average days per year with heat index above 90°F
101 - 203
51 - 100
26 - 50
11 - 25
1 - 10
0

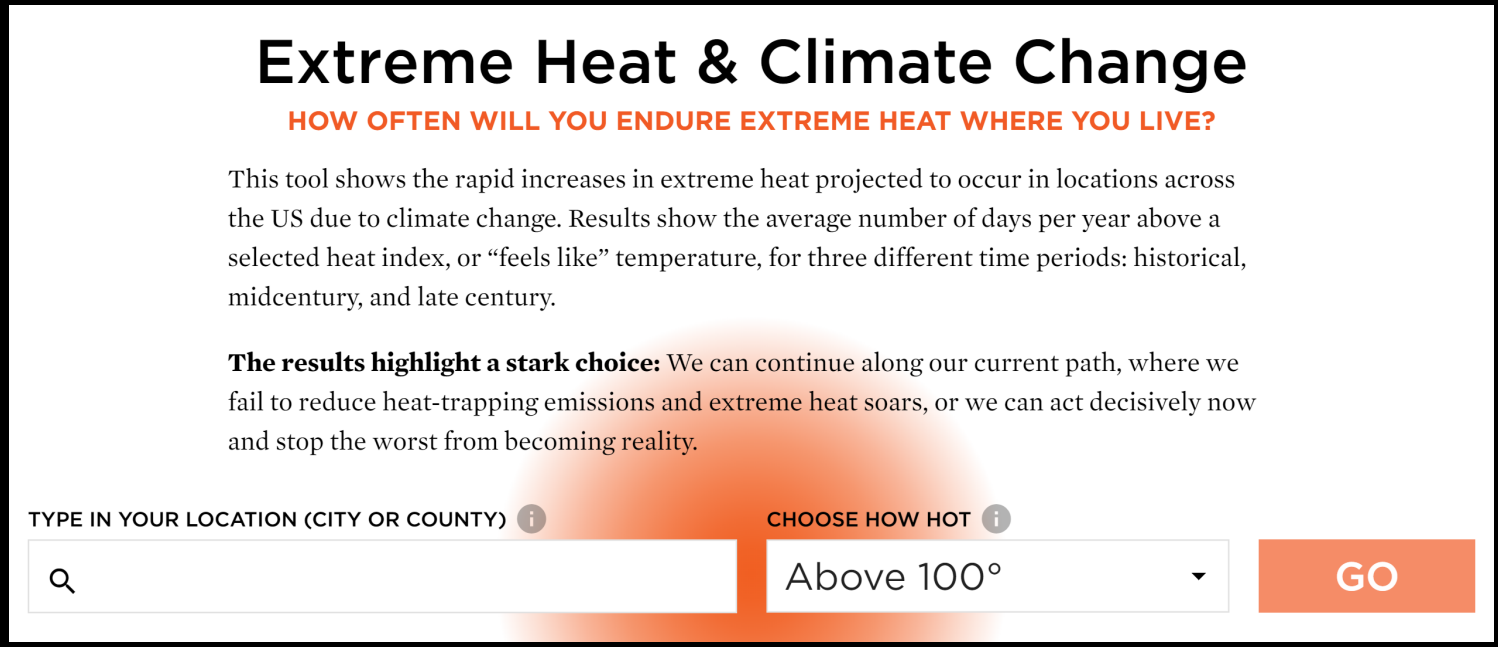
Resources

Lots of localized info at http://www.ucsusa.org/killer-heat

Interactive maps



Interactive data widget



+ Spreadsheets with all the data
+ Spanish language webpage and materials

https://es.ucsusa.org/nuestro-trabajo/calentamiento-global/calor-fatal-estados-unidos

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