

The Science, Politics and Morality of Climate Change

John R. Christy

Alabama State Climatologist

The University of Alabama in Huntsville

2017



**THE UNIVERSITY OF
ALABAMA IN HUNTSVILLE**

Today, Climate Change is

A Science Issue

A Political Issue

A Moral Issue

Alabama and 25 other states are in a desperate fight with the Regulatory activities of the Federal Government regarding “Climate Change”

EPA rules on CO2 will further increase cost of energy and will not affect the climate [SCOTUS issued a Stay in 2016]

Alabama Factoid

Alabama generates 152.9 million MW-hrs of electricity

Alabama consumes 86.2 million MW-hrs of electricity

Alabama exports 66.7 million MW-hrs to neighbors who buy them (GA, TN mainly).

California generates 199.5 million MW-hrs of electricity

California consumes 259.5 millions MW-hrs of electricity

California imports 60.0 million MW-hrs from neighbors

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The actions in California and copied in other states are driven by the claim that human-caused climate change (CO2) is dangerous

The Threats to Economic Development are severe

**“America is
addicted to oil”**

**State of The Union
Address
Jan 31 2006**

**President George W.
Bush**



We are addicted to:

Long life

Good health/Medical advances

Technological Progress

Affordable Services

Freedom of mobility

Abundant and affordable food

Natural landscapes

Clean Water/Air

Affordable Energy

**Electrification
Transportation
Industry**

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Abundant and affordable food
Natural landscapes
Clean Water/Air**

Affordable Energy

**Electrification
Transportation
Industry**

Carbon 91%
(coal, natural gas, oil)

Nuclear 5%
Hydroelectric power 3%

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Clean Water/Air**

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**Electrification
Transportation
Industry**

Carbon 91%
(coal, natural gas, oil)

Nuclear 5%
Hydroelectric power 3%

CO2: Non-Toxic
Invigorates Biosphere
Increases food production
Climate?????

We are addicted to:

Long life
Good health/Medical advances
Technological Progress
Affordable Services
Freedom of mobility
Abundant and affordable food
Natural landscapes
Clean Water/Air

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Climate Change is a Science Issue

All Science is Numbers

**Paraphrase of Lord Kelvin
(Sir William Thomson)**

How do you test the “Settled Science” of the the popular view of Climate Change?

How do you prove humans are affecting the climate? Not just a question of “what” but “why”.

One attempt: Take a Climate Model Simulation and show you can reproduce the current climate only when extra CO₂ is added into the model.

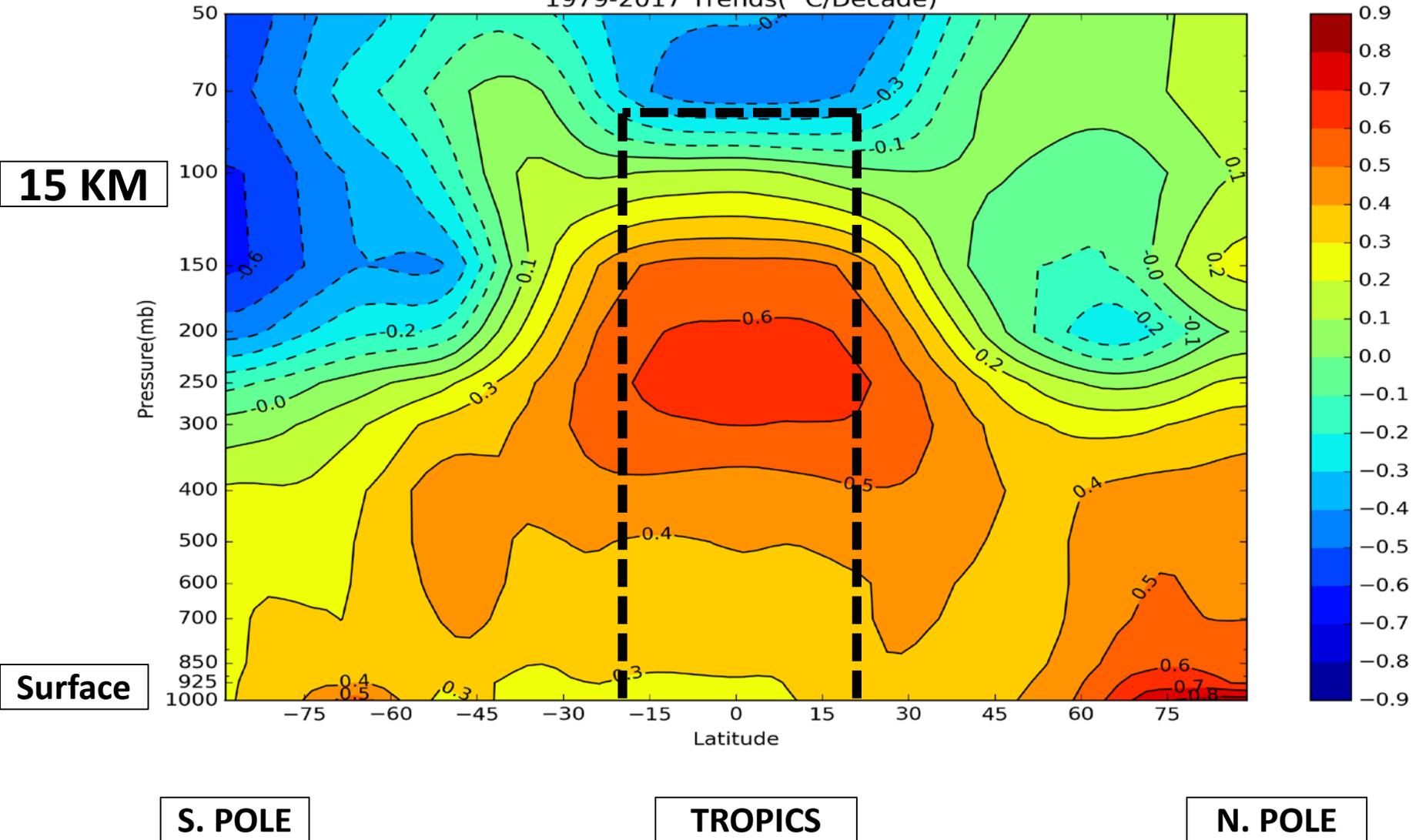
This is a Hypothesis – a “claim”

We will look at the largest response according the theory- the temperature of the tropical atmosphere- The “claim” is:

Atmospheric Temperature Trends °C/decade Canadian Climate "Model Experiment" 1979-2017

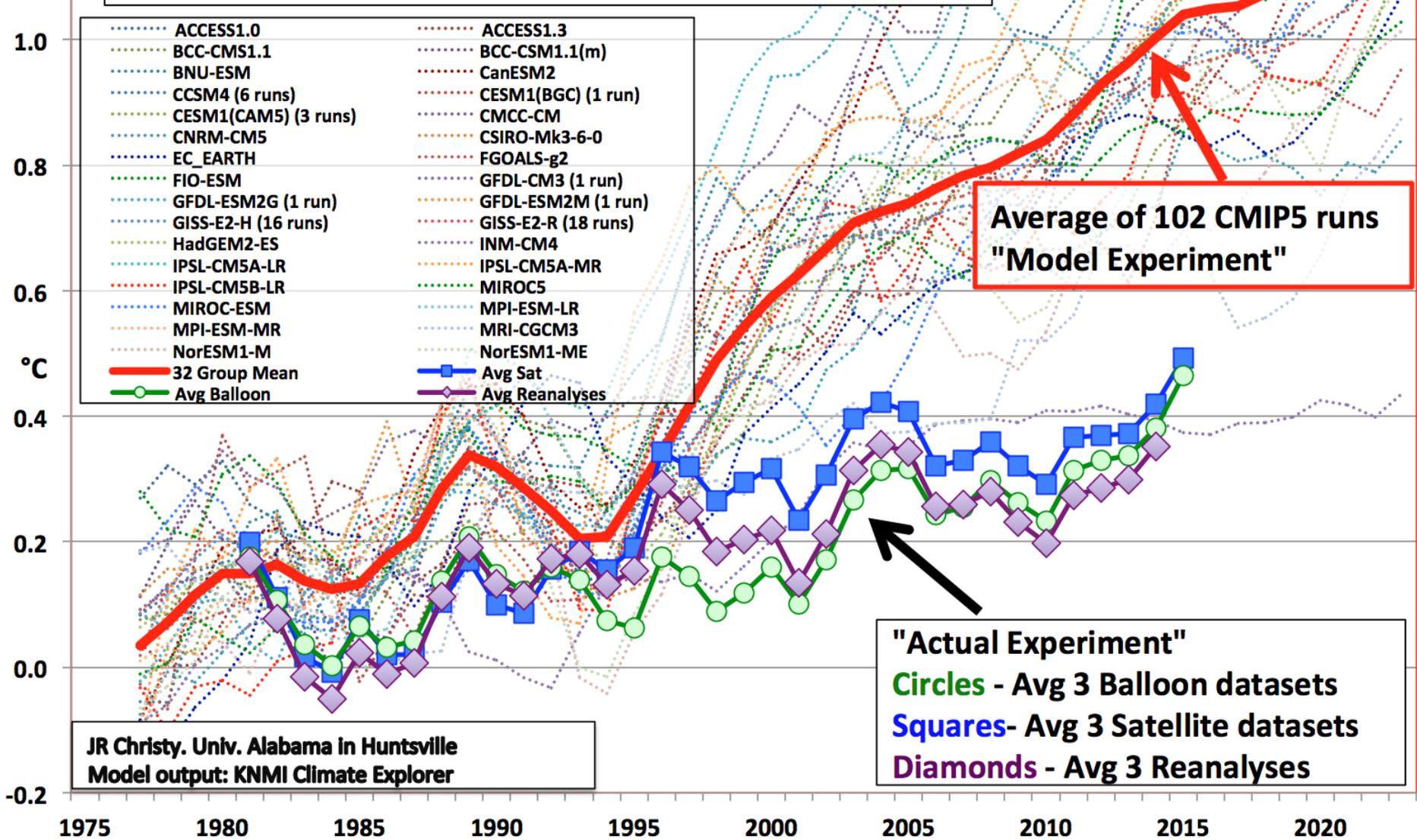


Canadian model run 3
1979-2017 Trends(°C/Decade)



Tropical Mid-Tropospheric Temperature Variations Models vs. Observations

5-Year Averages, 1979-2017 Trend line crosses zero at 1979 for all time series



**Average of 102 CMIP5 runs
"Model Experiment"**

"Actual Experiment"
Circles - Avg 3 Balloon datasets
Squares- Avg 3 Satellite datasets
Diamonds - Avg 3 Reanalyses

JR Christy, Univ. Alabama in Huntsville
Model output: KNMI Climate Explorer

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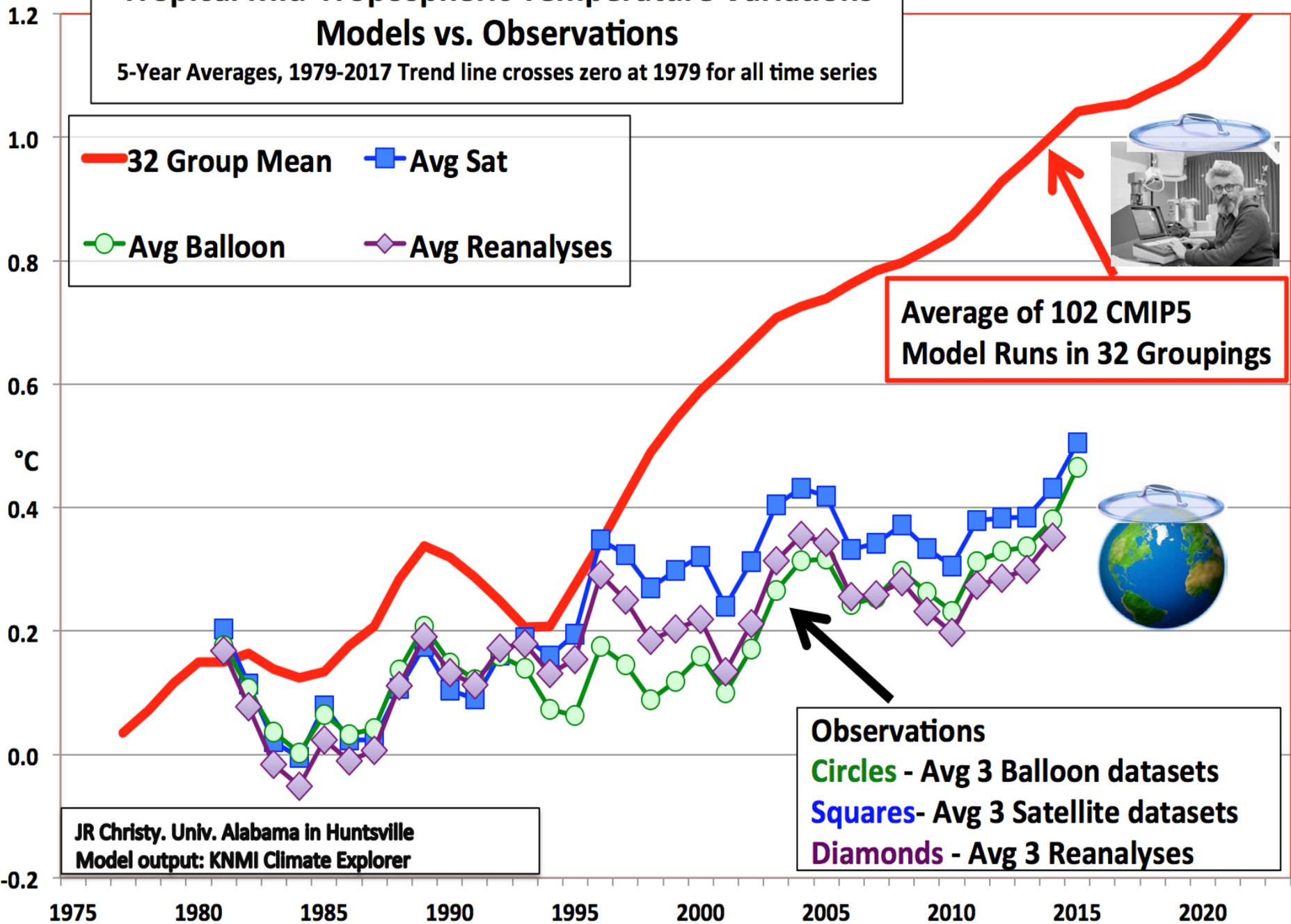
32 Group Mean **Avg Sat**
Avg Balloon **Avg Reanalyses**

**Average of 102 CMIP5
Model Runs in 32 Groupings**

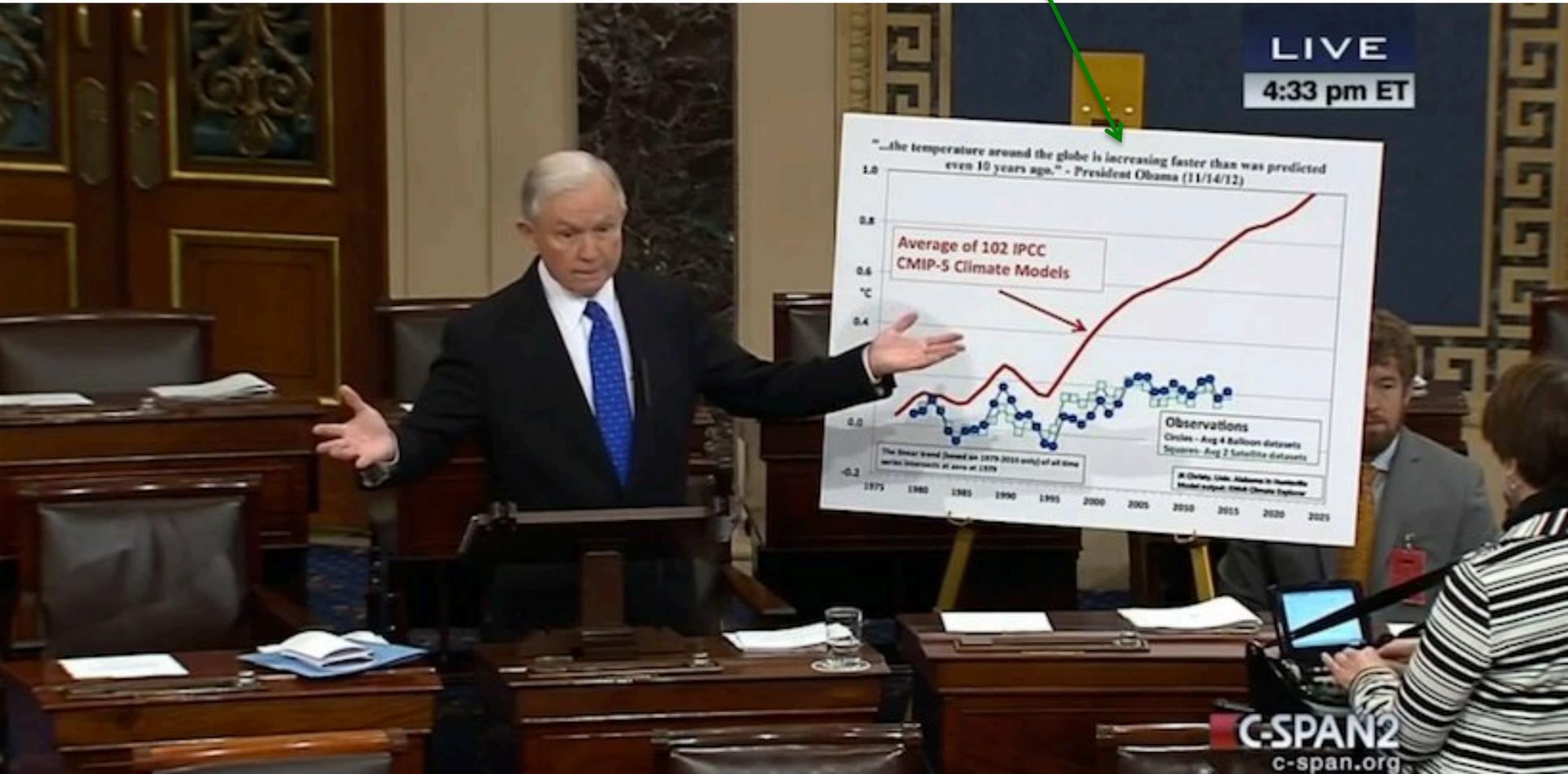


Observations
Circles - Avg 3 Balloon datasets
Squares - Avg 3 Satellite datasets
Diamonds - Avg 3 Reanalyses

JR Christy, Univ. Alabama in Huntsville
Model output: KNMI Climate Explorer



“The temperature around the globe is increasing faster than was predicted just 10 years ago”, President Obama Nov. 14 2012

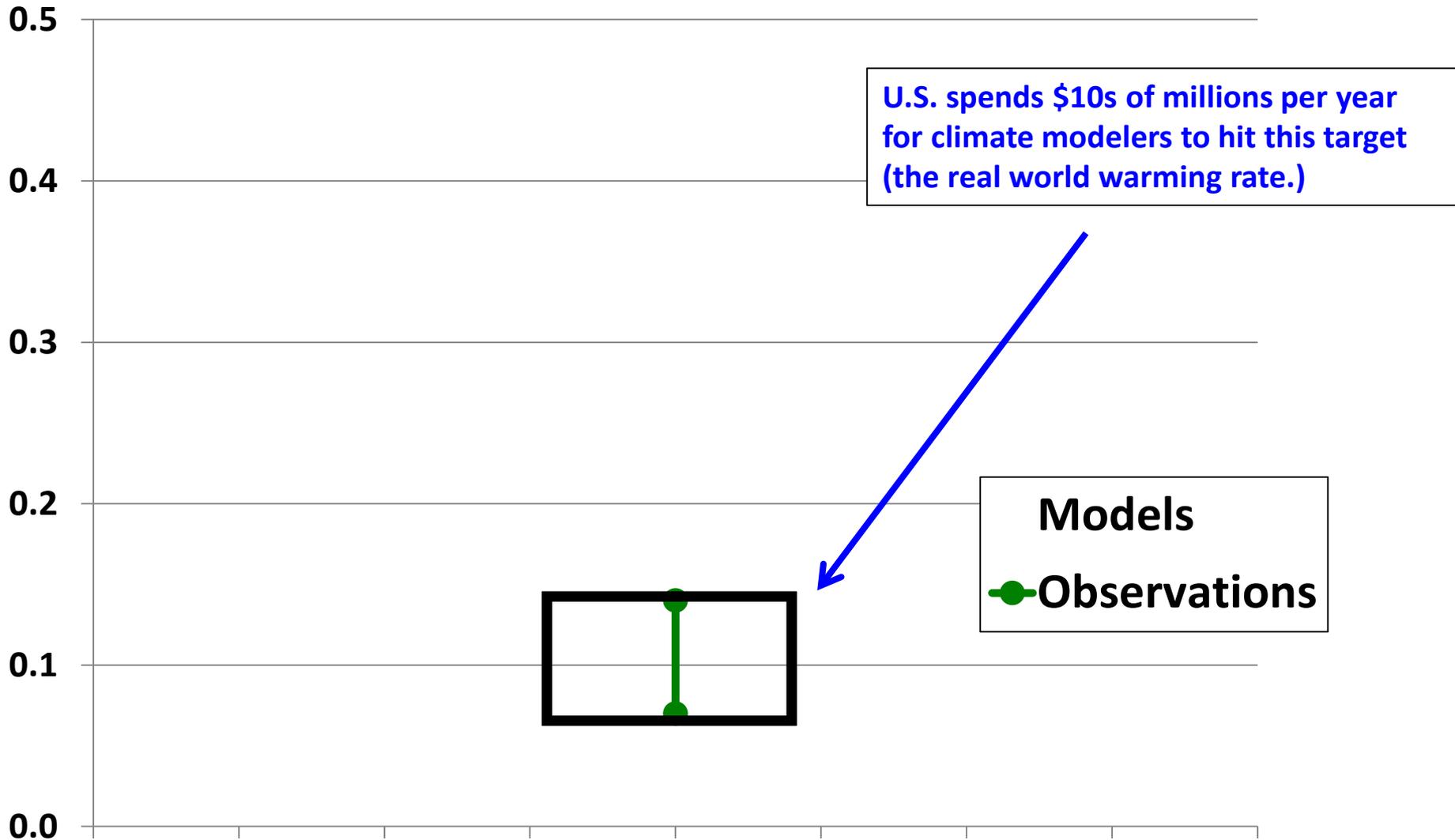


Sen. Jeff Sessions Floor Speech 27 Jan 2015

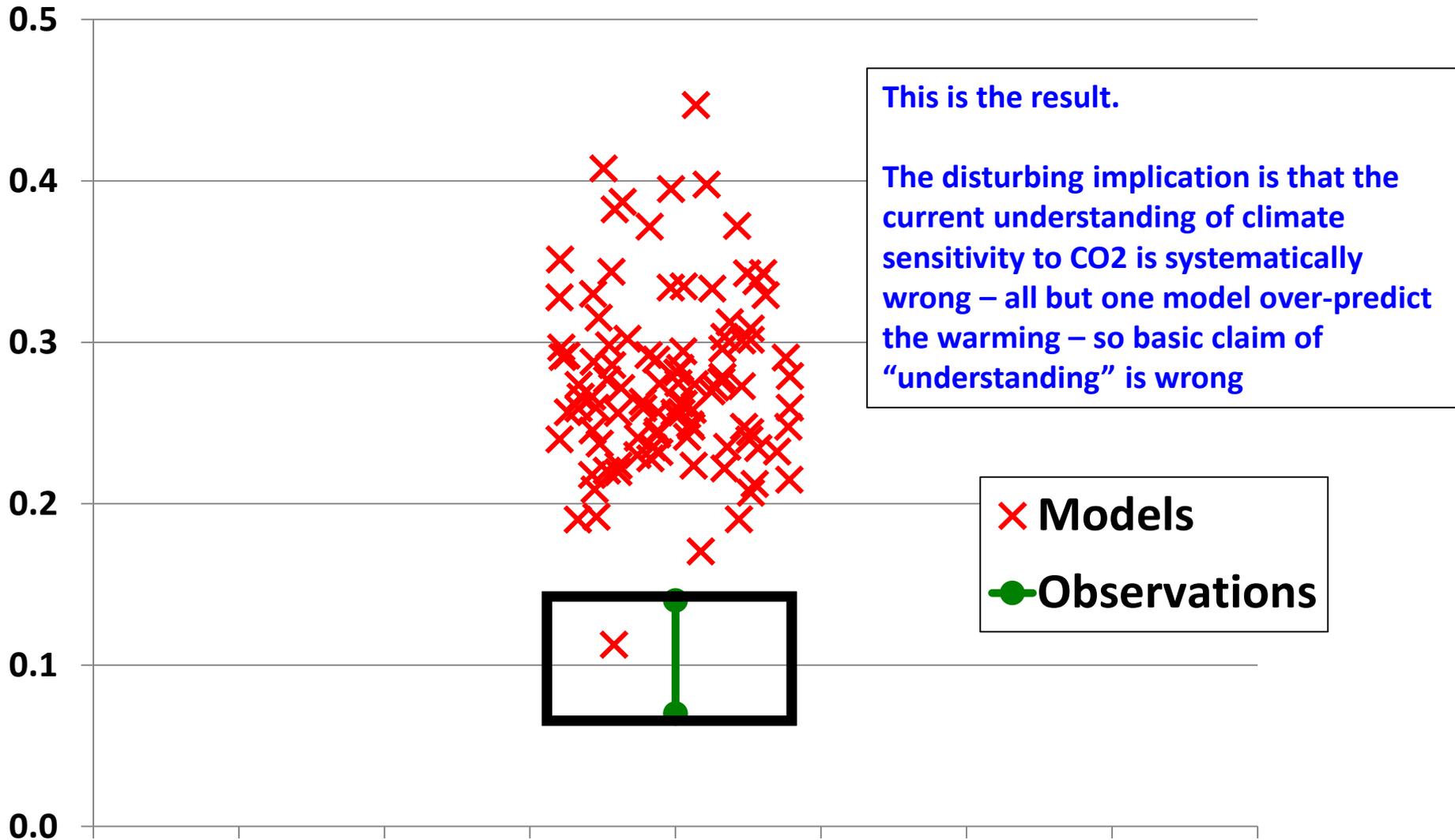
At ~ 2 a.m. after “March for Science”



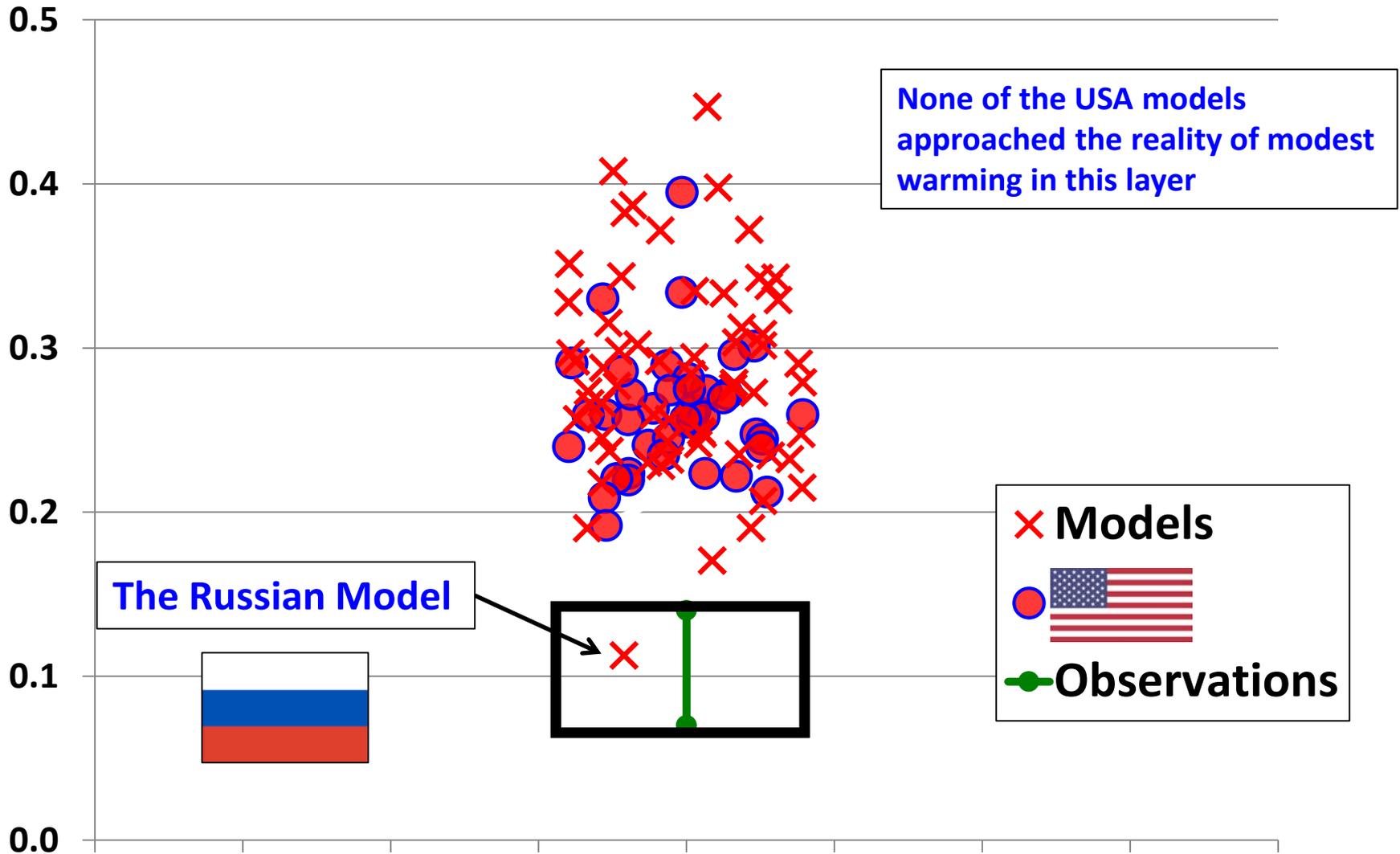
Tropical Tropospheric Temperature Trend (°C/decade) 1979-2017 Models 102 CMIP-5 Models vs. Observations



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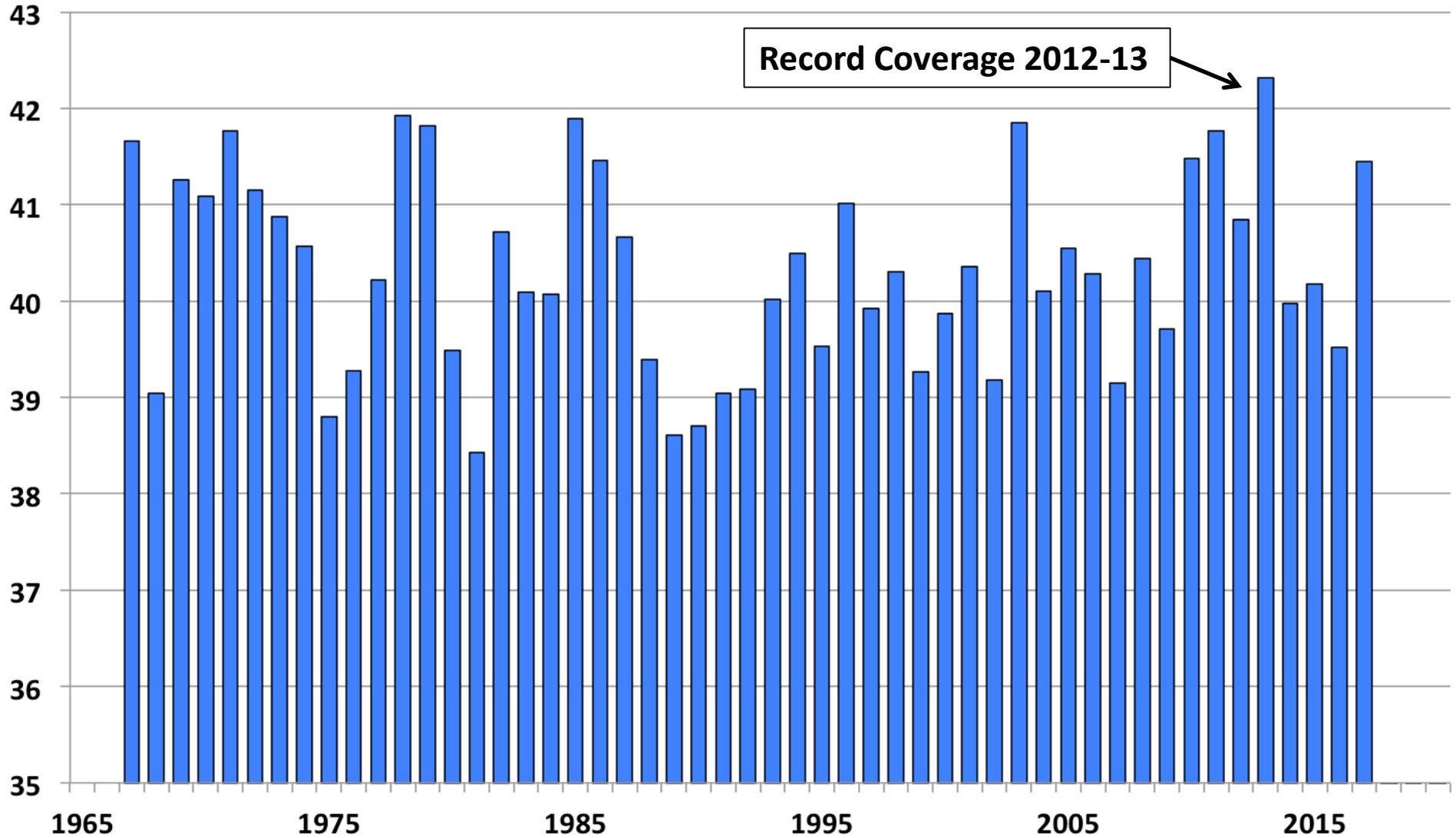
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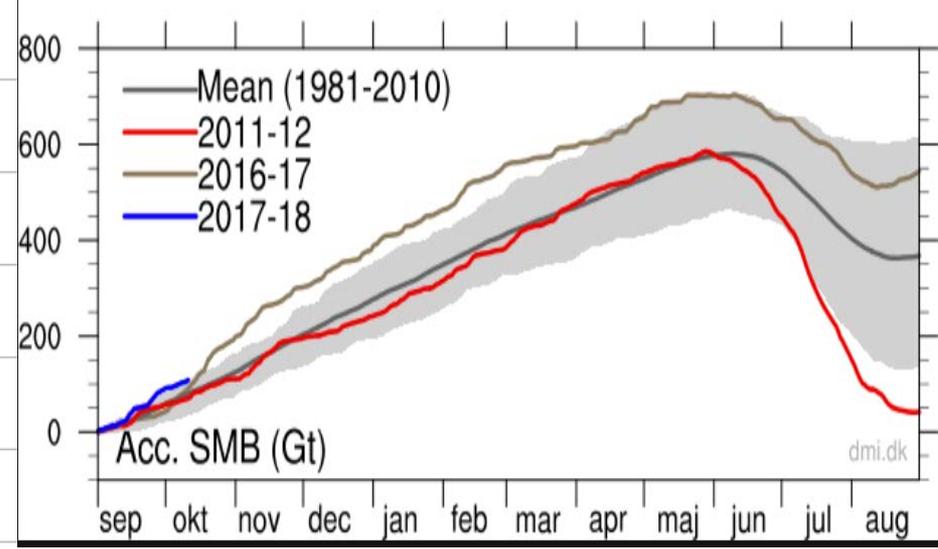
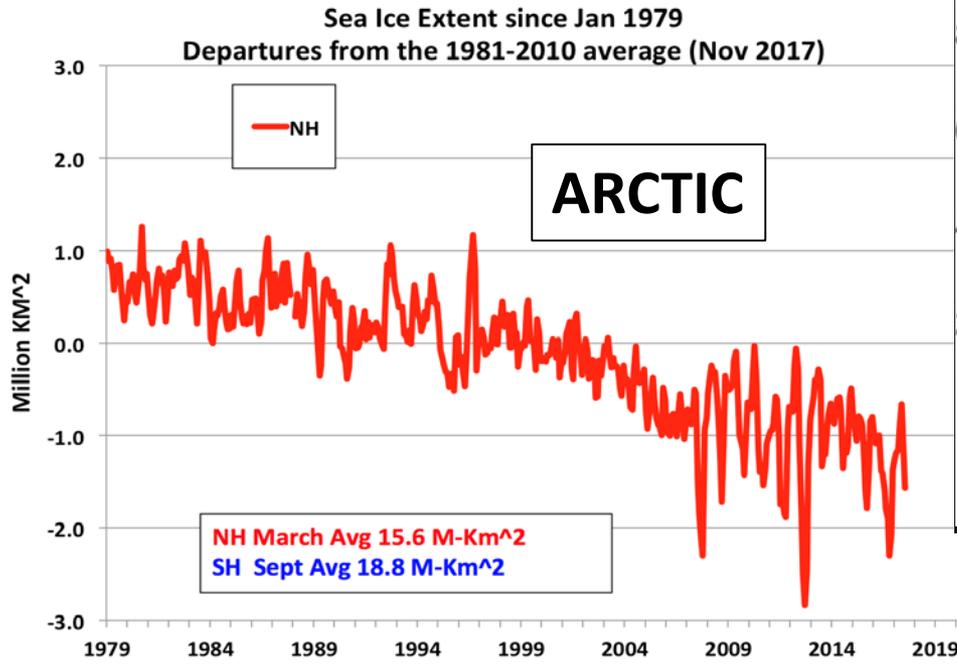


Other Evidence?

**Disappearing
Snow and Sea Ice**

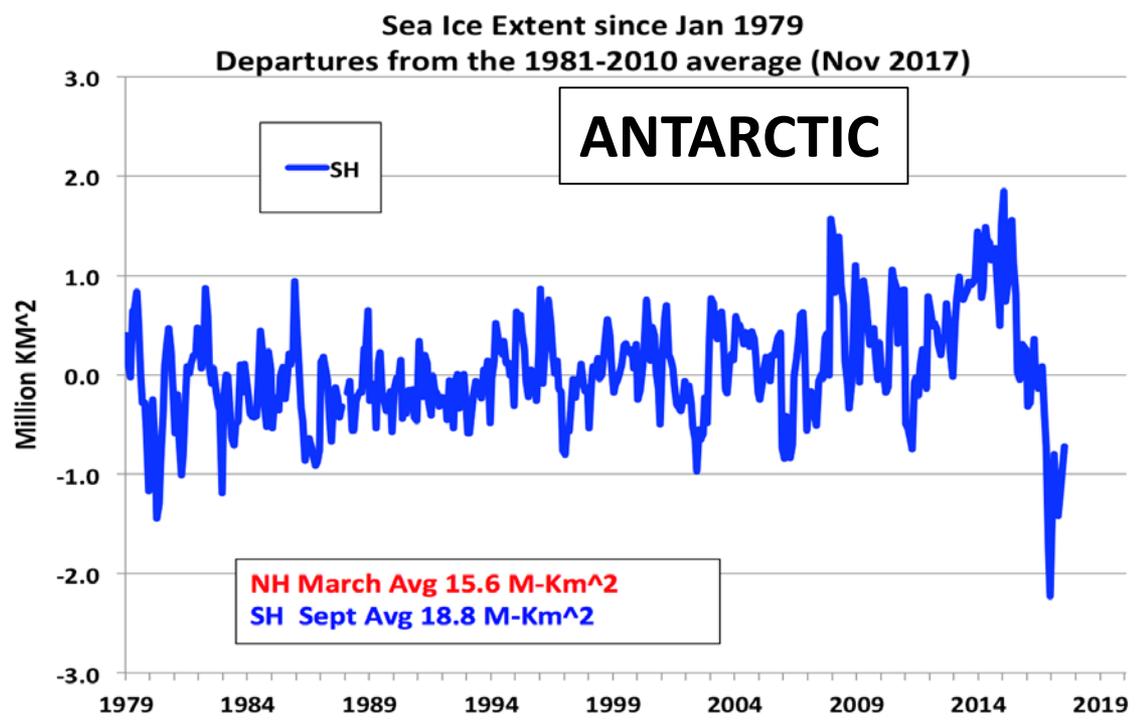
NH SNOW EXTENT Million KM² Average November to April





Greenland Ice Accumulation

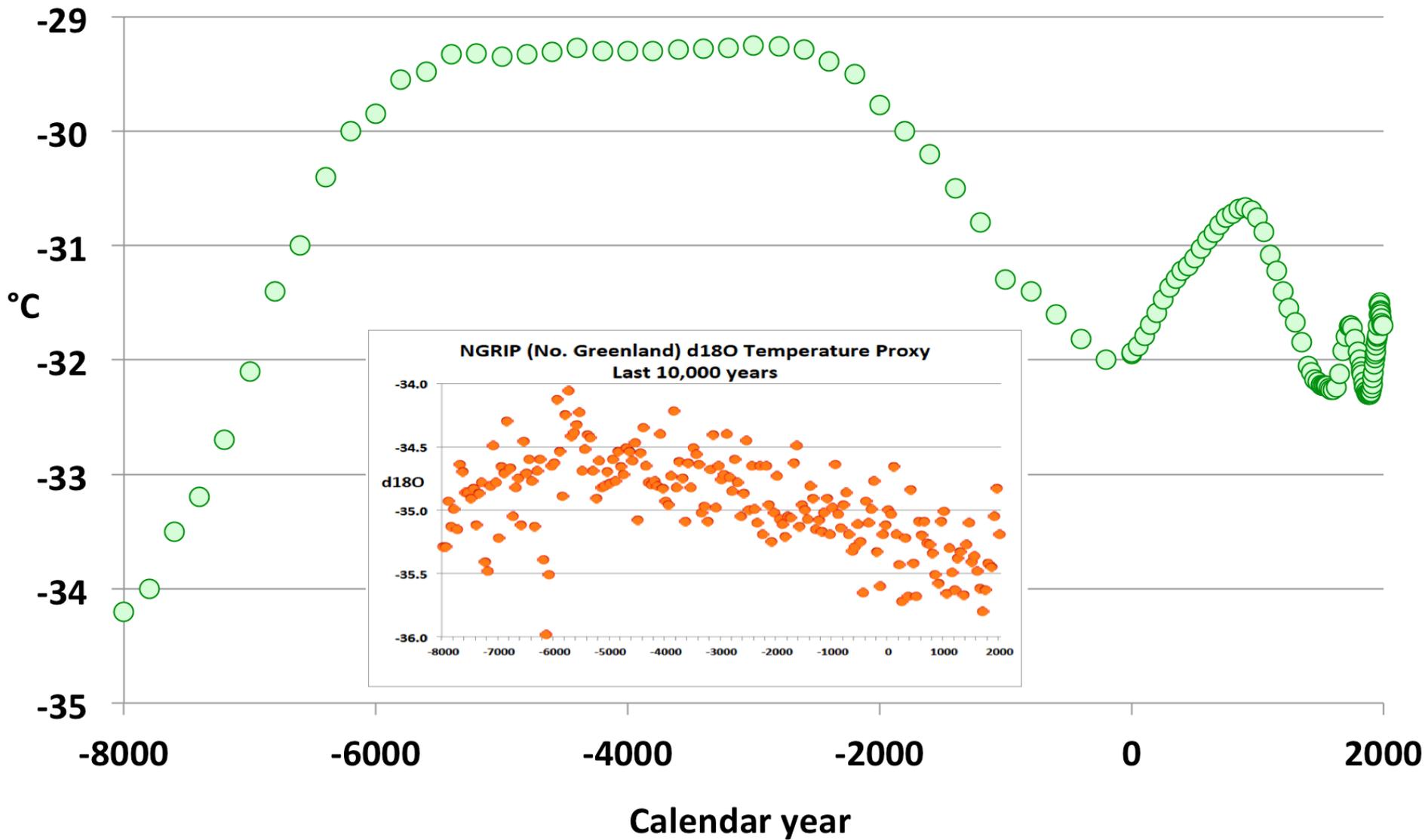
Sea Ice Anomalies
NOAA Snow and
Ice Data Center



Greenland Air Temperature Last 10,000 Years

Borehole Reconstruction

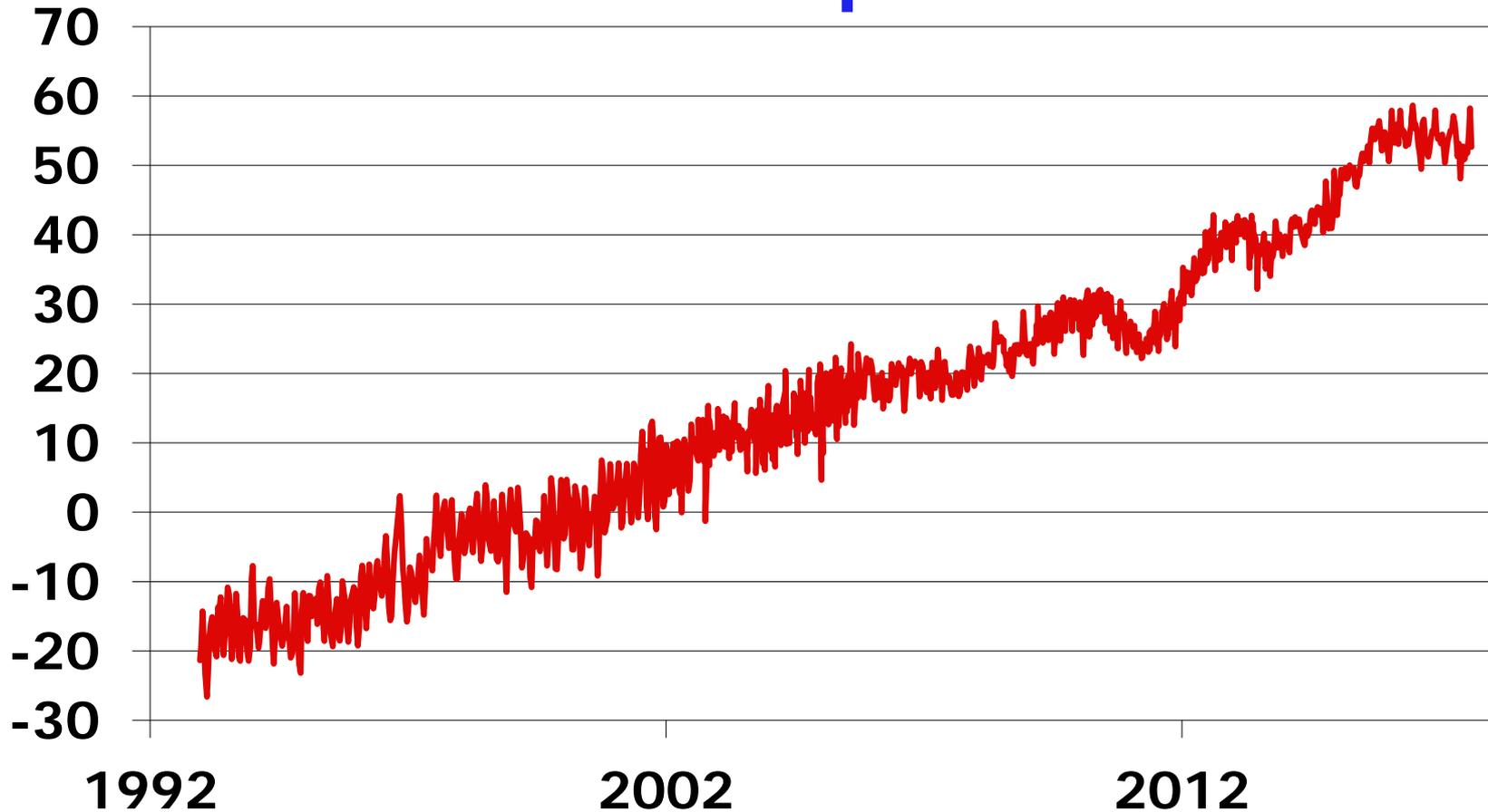
Dahl-Jensen et al. 1998



Sea Level Rise

Satellite-based Sea Level 1992- 2017 (mm)

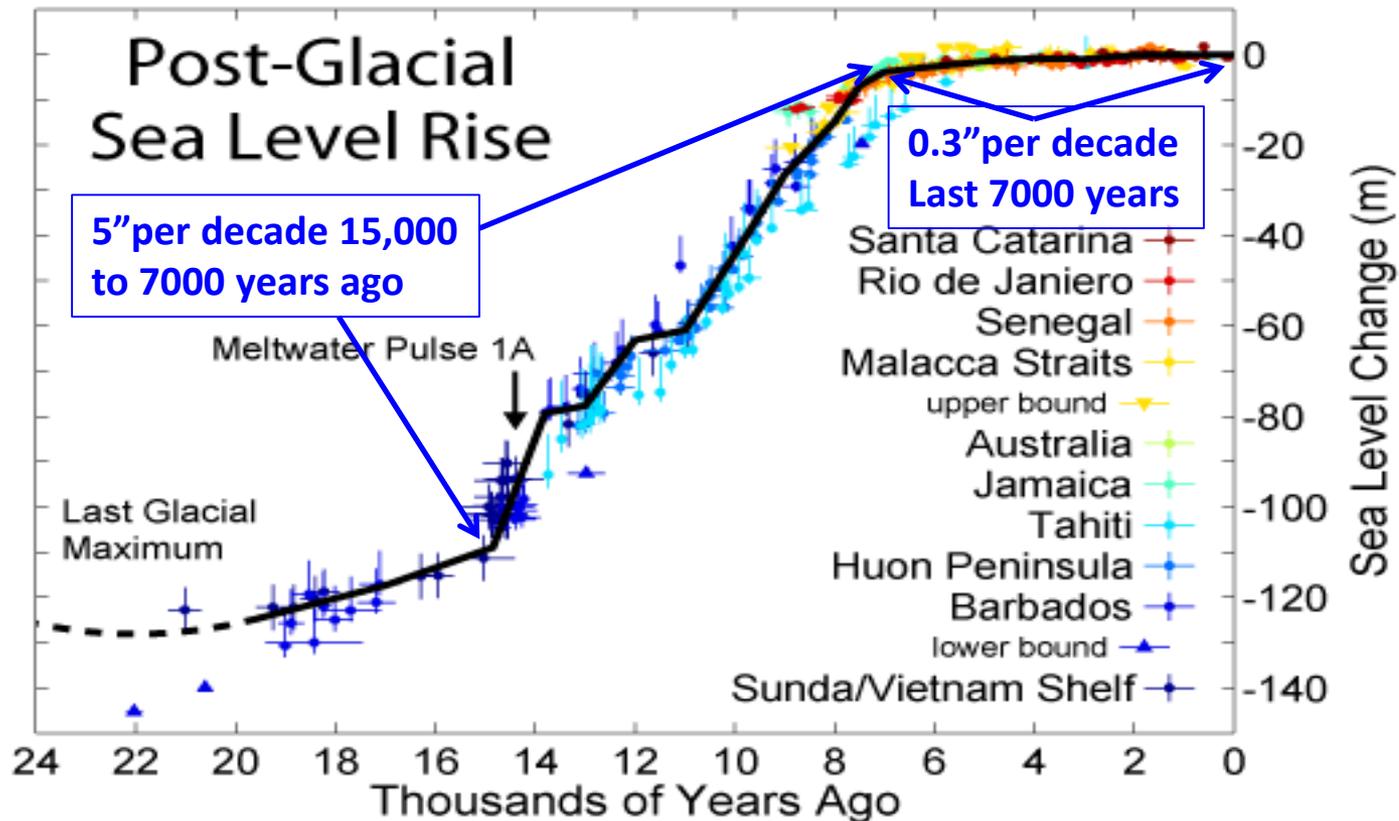
About 1 inch per decade



Sea Level Rises as Land-ice melts.

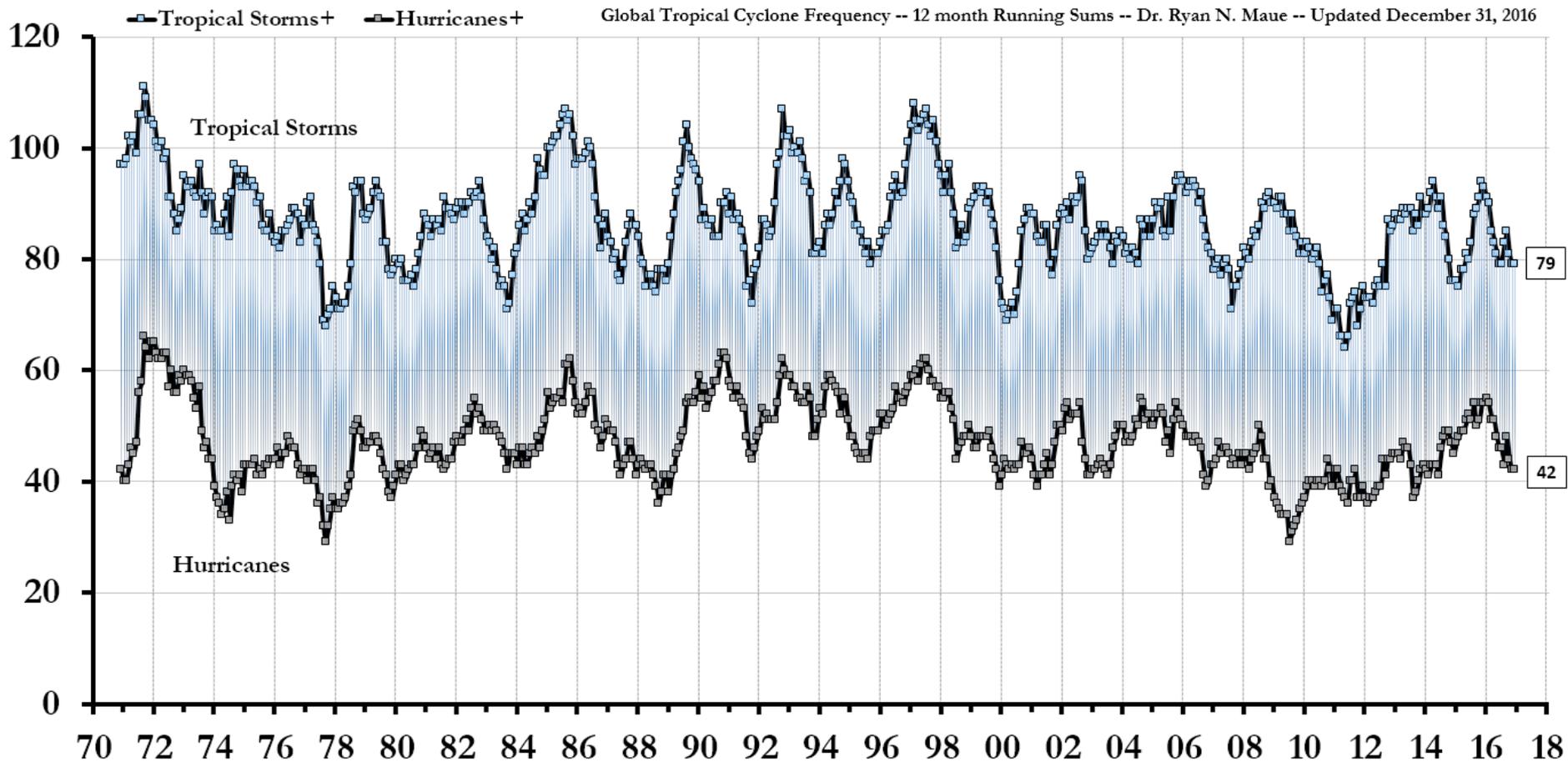
The major low-latitude ice-age ice sheets finished melting about 8,000 years ago (i.e. Illinois, New York, etc.) and since then the remnant mountain glaciers and parts of Greenland and Antarctica are still adding some melt-water. [The warm period 130,000 years ago saw sea levels 20 ft higher than today, i.e. naturally.]

Sea level also rises for other reasons such as increases in eroded soil material flowing into the ocean and thermal expansion of the water itself.

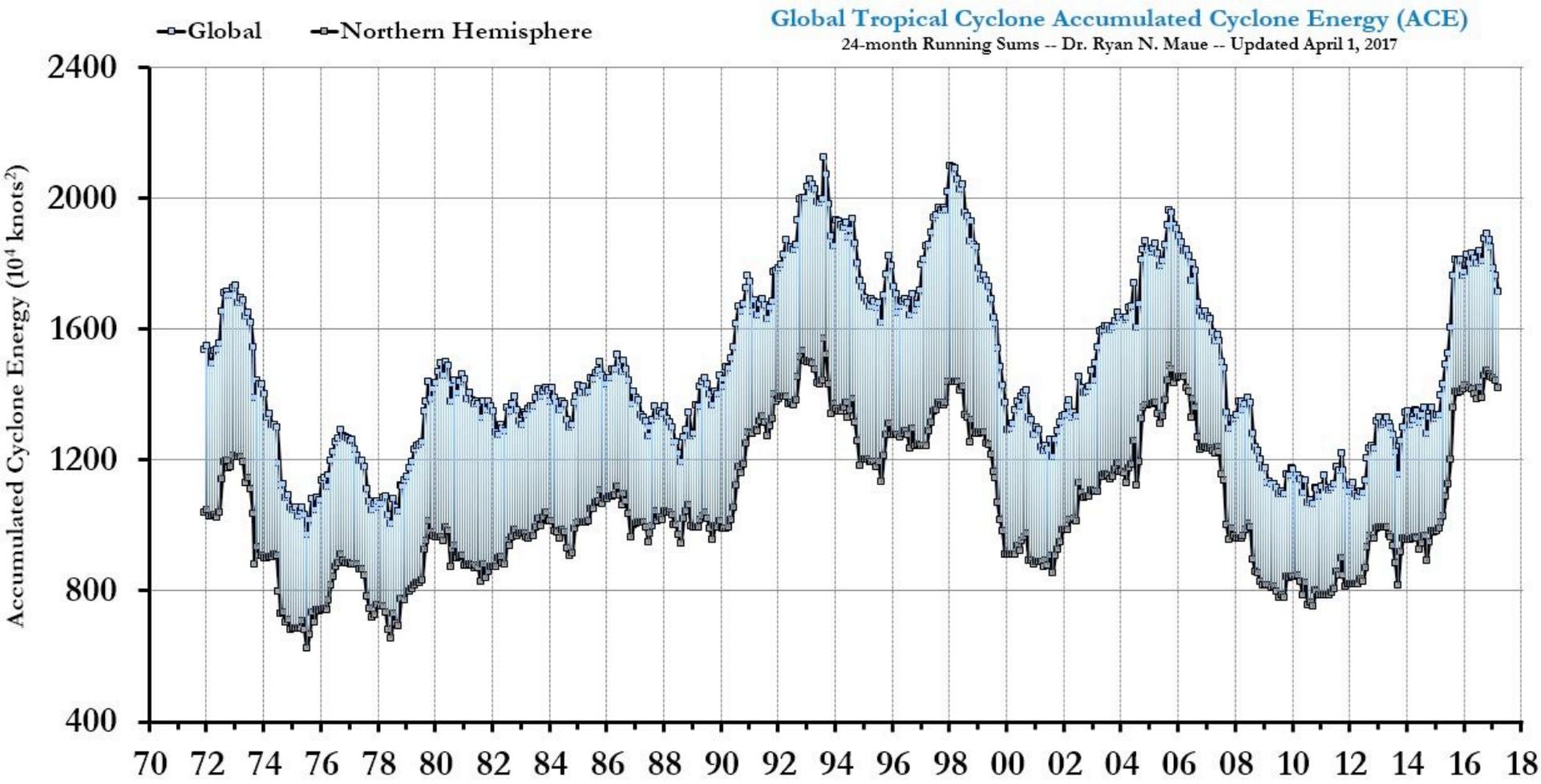


Extreme Weather

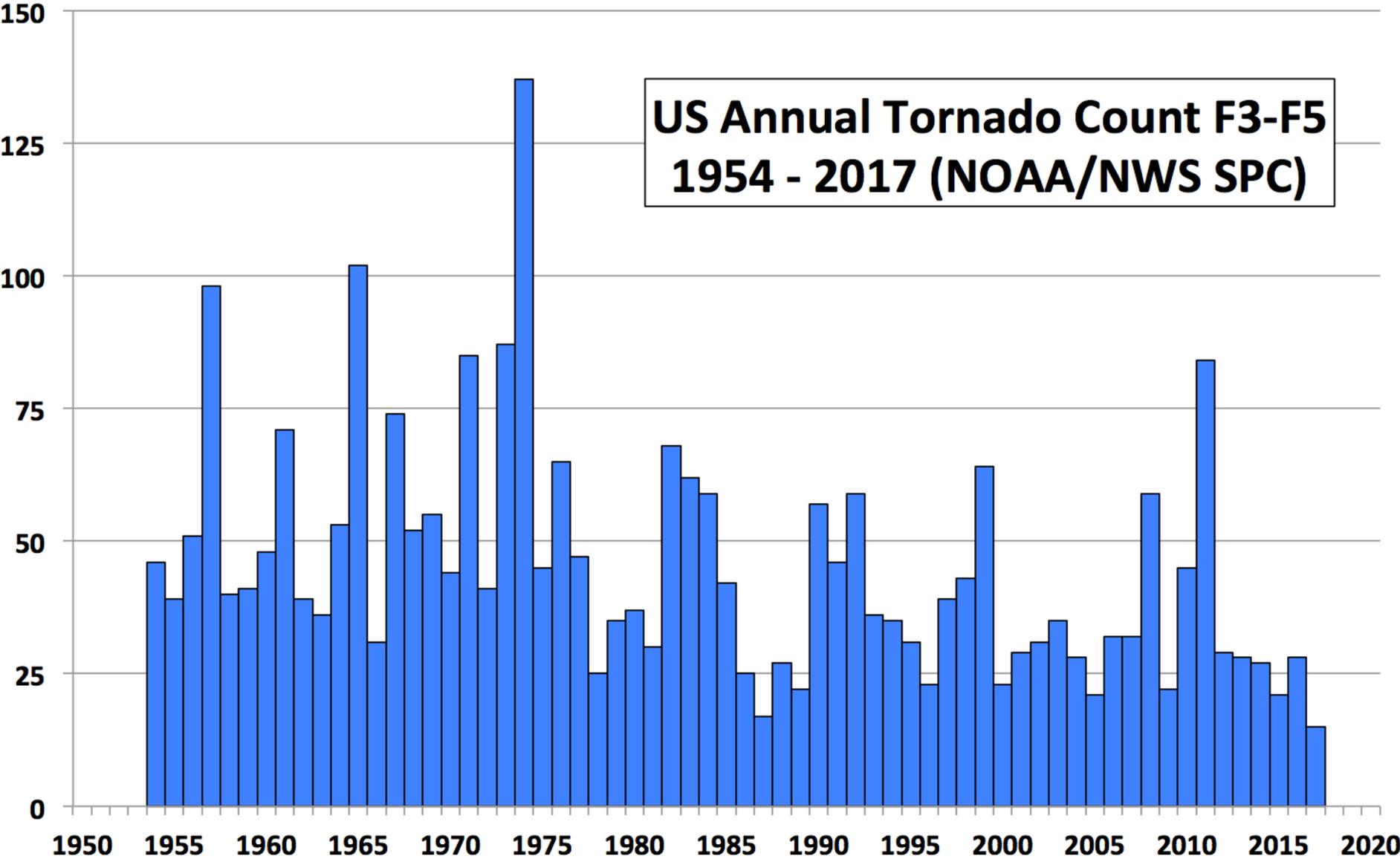
Global Hurricanes (1971 to 2016)



Global Hurricane Energy (1971 to 2017)

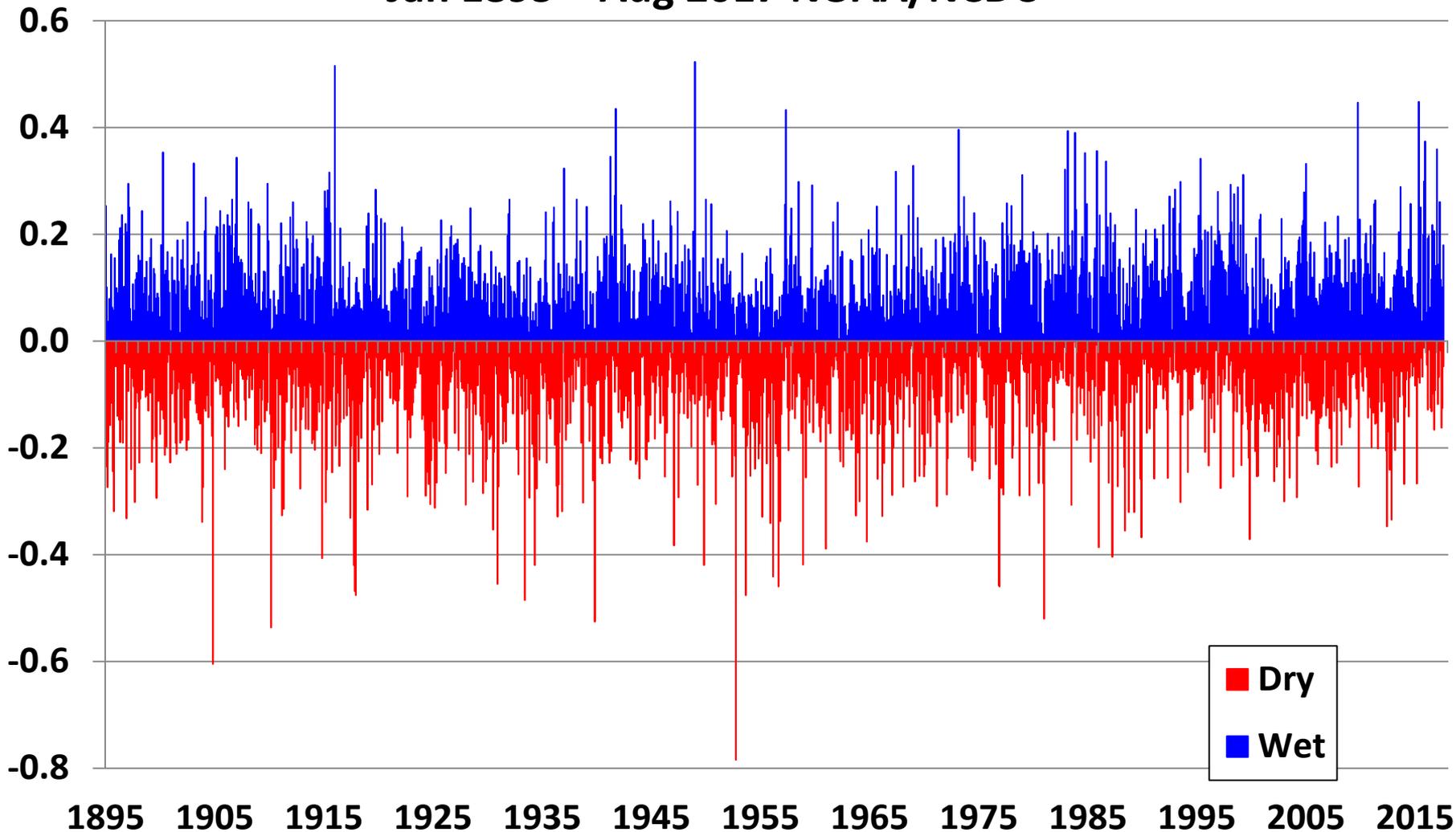


**US Annual Tornado Count F3-F5
1954 - 2017 (NOAA/NWS SPC)**

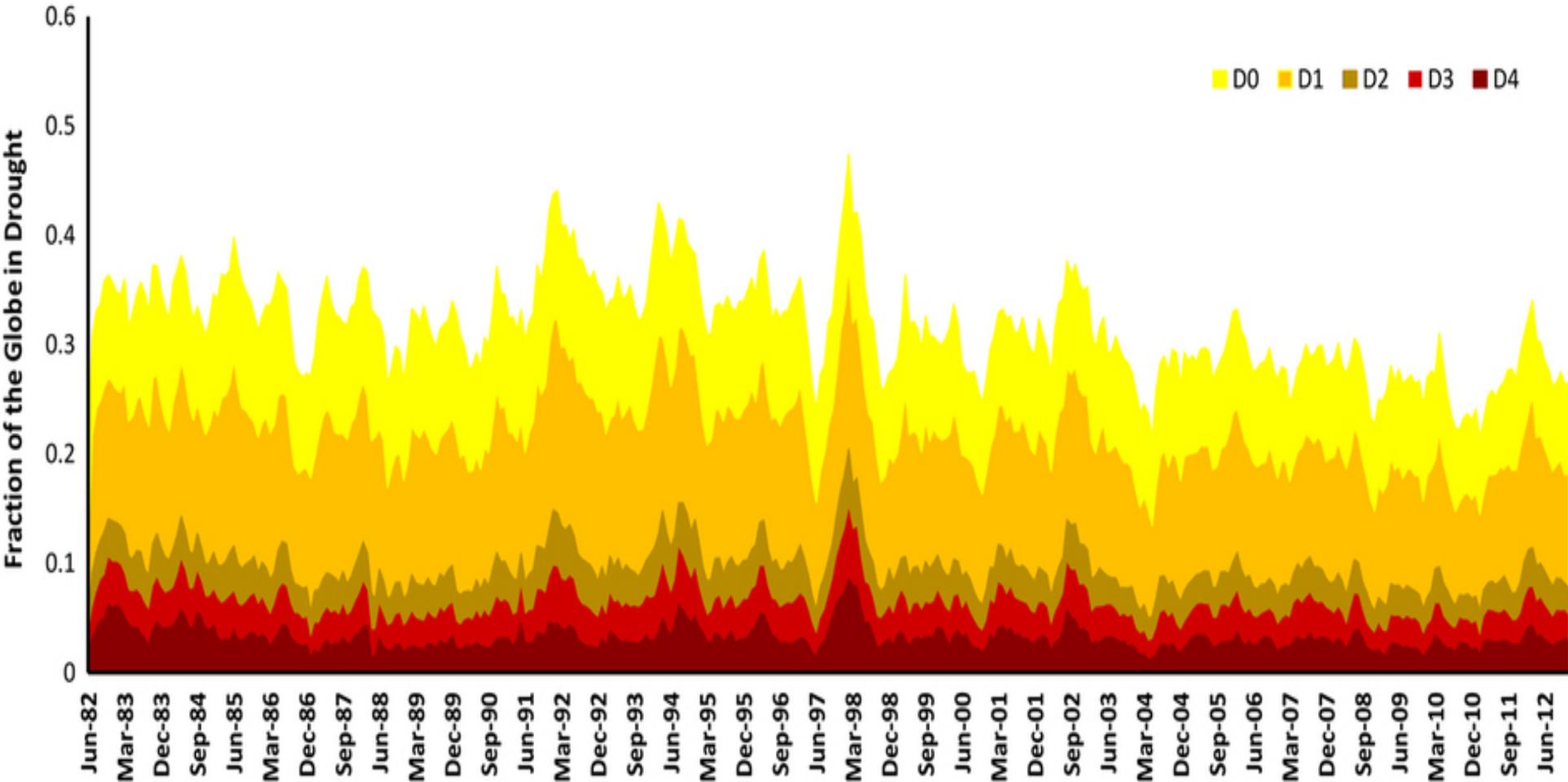


Monthly Fraction of US with Very Wet (floods) or Very Dry (drought) Conditions

Jan 1895 – Aug 2017 NOAA/NCDC



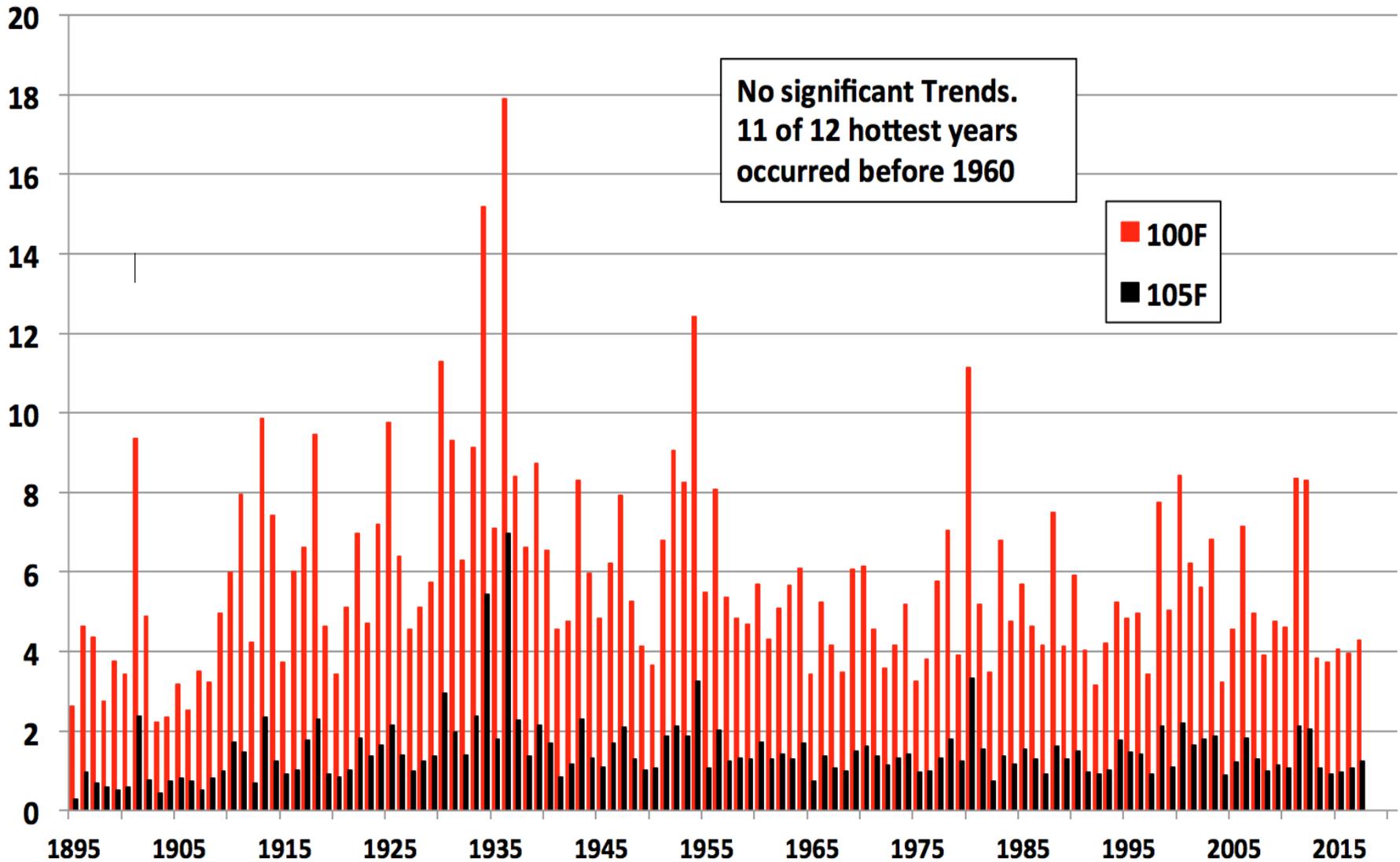
Global Drought Indices 1982-2012



Hao et al. 2014

Average per station (1114 USHCN Stations) 1895-2017

Number of days daily Maximum temperature above 100°F and 105°F

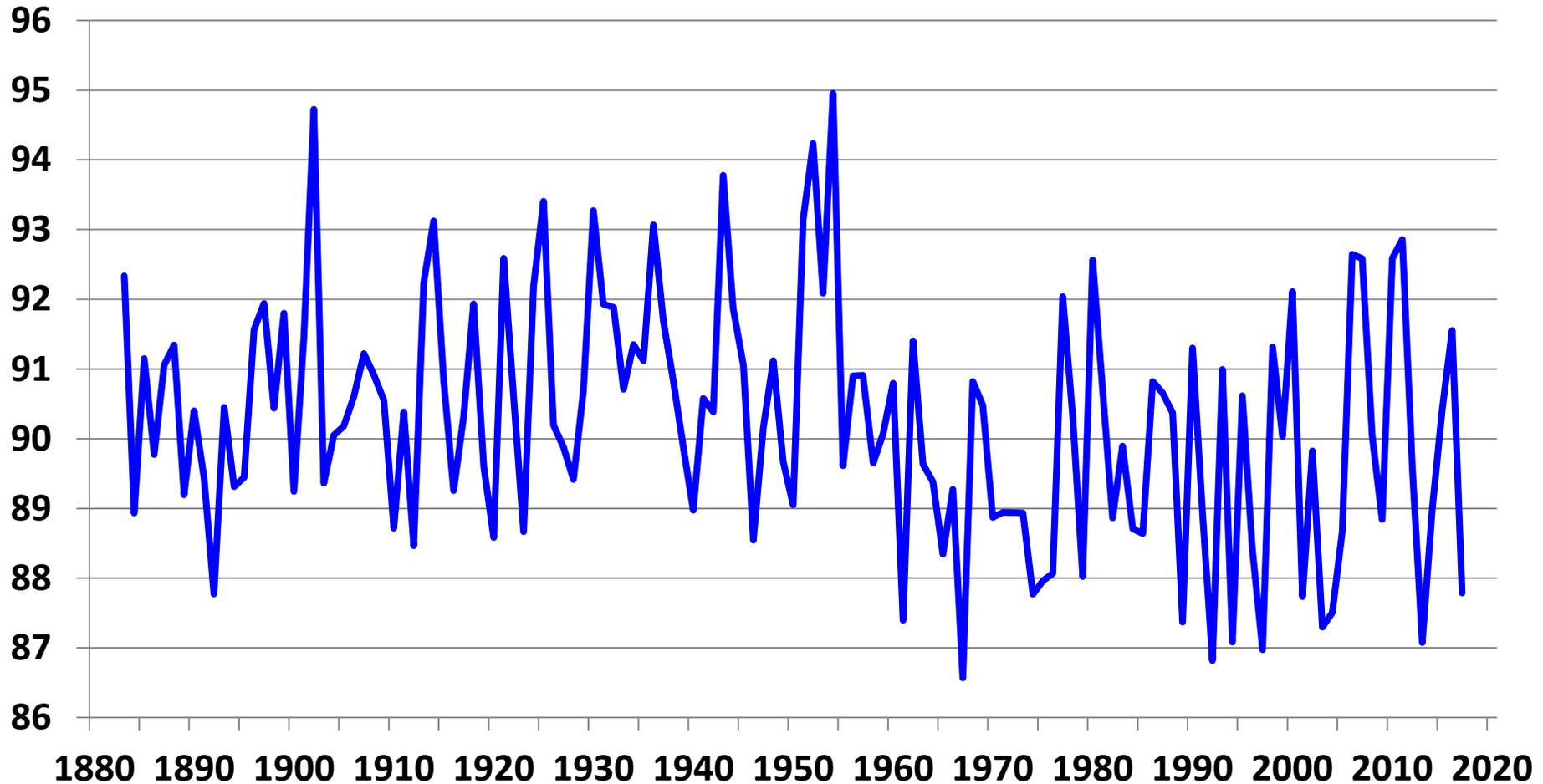


No significant Trends.
11 of 12 hottest years
occurred before 1960

100F
105F

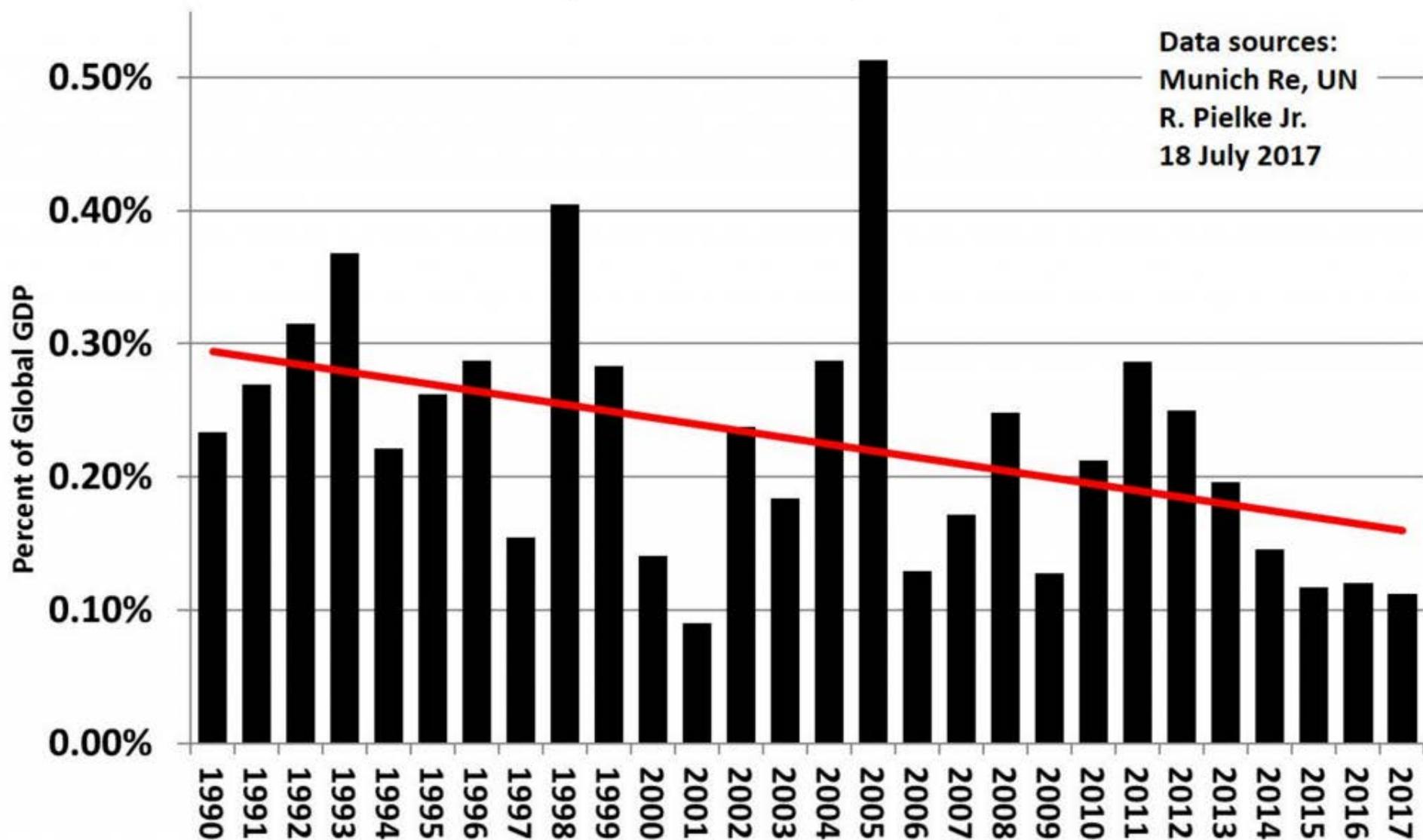
John R. Christy
University of Alabama in Huntsville
Station files from NOAA/NCEI accessed 2Nov2017

Alabama Summer Daily Maximum Temperature (° F) Average of 4, 100-mile-diameter regions centered on MOB, MGM, BHM and HSV, 1883-2017



Global Weather-Related Disaster Losses as a Proportion of Global GDP: 1990-2017

(note: 2017 thru June)



**Views of “dangerous” Climate
Change rely on models that fail
simple testing and are not based
on the evidence we have**

Climate Change is a Political Issue

Climate Change is a Political Agenda



U.S. Secretary of State John Kerry during a speech on climate change in Jakarta on Sunday. Agence France-Press/Getty Images

*“The science is **unequivocal**, and those who refuse to believe it are simply **burying their heads in the sand**. We don’t have time for a meeting anywhere of the **Flat Earth Society**. And in a sense, climate change can now be considered another weapon of mass destruction, perhaps the **world’s most fearsome weapon of mass destruction**.”*

– John Kerry
Feb 16 2014

Climate Change is a Political Agenda

THE WALL STREET JOURNAL.

OPINION

McNider and Christy: Why Kerry Is Flat Wrong on Climate Change

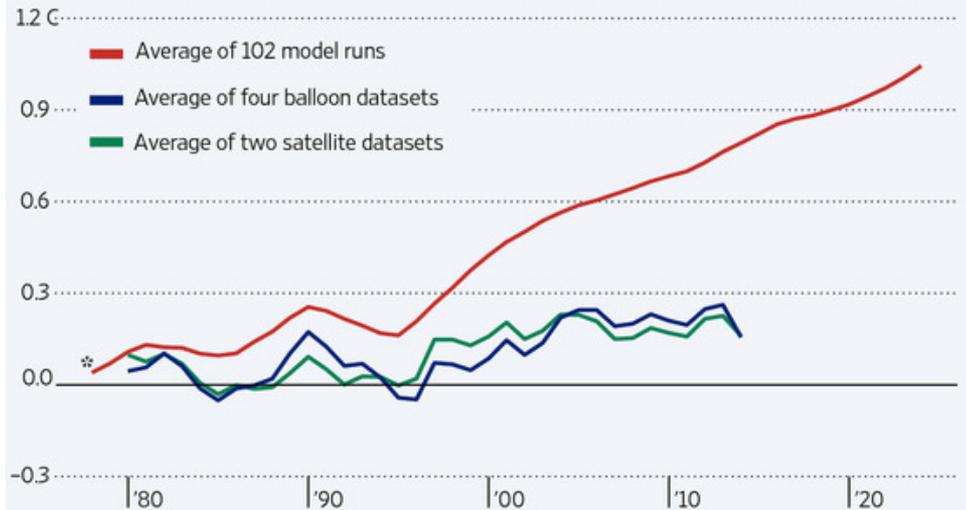
It was the scientific skeptics who bucked the 'consensus' and said the Earth was round.



U.S. Secretary of State John Kerry during a speech on climate change in Jakarta on Sunday. Agence France-Presse/Getty Images

Warming Predictions vs. the Real World

Global mid-tropospheric temperature 5-year averages, in degrees Celsius



* The linear trend of all three curves intersects at zero in 1979, with the values shown as departures from that trend line.

Sources: Various, as described in the "State of the Climate in 2012" in the Bulletin of the American Meteorological Society, August 2013



**House Committee on
Science 2 Feb 2016**



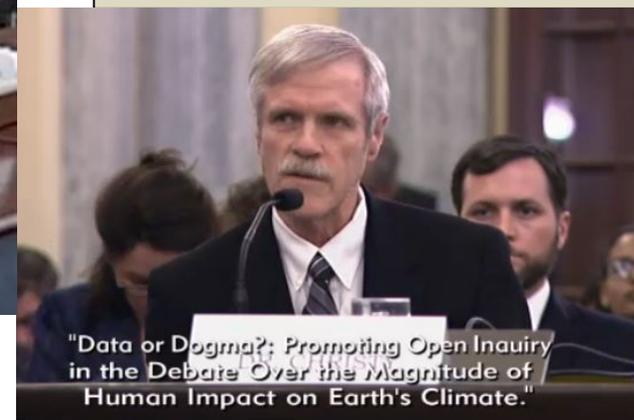
**House Science, Space
and Technology
Committee
11 Dec 2013**

**House Committee
on Natural
Resources
13 May 2015**



**House Committee on
Science 29 Mar 2017**

**Senate Commerce
Committee 8 Dec 2015**



The New York Times

Though Scorned by Colleagues, a Climate-Change Skeptic Is Unbowed

By MICHAEL WINES JULY 15, 2014



John Christy, a professor of atmospheric science at the University of Alabama, Huntsville, with the weather data he recorded daily while growing up in Fresno, Calif., in the 1960s. Rob Culpepper for The New York Times

Arizona congressman asking questions about outside funding for UAH climate expert John Christy

By Paul Gattis | pgattis@al.com
Email the author | Follow on Twitter
on February 24, 2015 at 12:52 PM, updated February 24, 2015 at 1:29 PM

A U.S. Congressman from Arizona is requesting information from the University of Alabama in Huntsville about outside funding sources of John Christy, director of the school's Earth System Science Center.

Arizona Democrat Raul Grijalva sent a letter dated Tuesday to UAH President Robert Altенkirch about Christy - an outspoken critic of climate change governmental policies.

Altенkirch's chief of staff, Ray Garner, said the school has not received the letter.

The letter to UAH outlines a **New York Times** report that said Willie Soon, a scientist at the Harvard-Smithsonian Center for Astrophysics, has received more than \$1.2 million from the fossil fuel industry. The Times article said he has frequently omitted that information.

Soon is considered a skeptic that climate change is harmful.

Grijalva, the ranking member of the House Natural Resources Committee and a proponent of President Obama's efforts to address climate change, sent letters to seven climate experts asking about outside funding that could influence their testimonies before Congress as well as their research.

All seven climate experts who received letters are considered opponents to the belief of the harmful effects of climate change, **The Washington Post** reported.

"The whole reason we sent the letter is because we don't know (about Christy's possible outside funding)," said Adam Sarvana, communications director for Natural Resources Committee's Democratic delegation.



View full size
Arizona Congressman Raul Grijalva.
Paul Gattis | pgattis@al.com



View full size
John Christy, director of the UAH Earth System Science Center.
(AL.com file photo)

"The way we chose the list of recipients is who has published widely, who has testified in Congress before, who seems to have the most impact on policy in the scientific community and he definitely fits that bill. He was **profiled in The New York Times.**"

Christy is also the state's climatologist.

Sarvana said the committee has no smoking gun on Christy.



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Paul Gattis | pgattis@al.com

Congress of the United States
Washington, DC 20515

Feb. 24, 2015

Robert A. Altенkirch
President, The University of Alabama in Huntsville
Shelbie King Hall, room 374
Huntsville, AL 35899

Dear President Altенkirch:

As Ranking Member of the House Committee on Natural Resources, I have a constitutional duty to protect the public lands, waters and resources of the United States and ensure that taxpayers are able to enjoy them. I write today because of concerns raised in a recent *New York Times* report and documents I have received that highlight potential conflicts of interest and failure to disclose corporate funding sources in academic climate research. Understanding climate change and its impacts on federal property is an important part of the Committee's oversight plan.

As you may have heard, the Koch Foundation appears to have funded climate research by Dr. Willie Soon of the Harvard-Smithsonian Center for Astrophysics, some of which formed the basis of testimony before the U.S. House Committee on Science, Space and Technology and the Kansas State Legislature's House Energy and Environment Committee - funding that was not disclosed at the time. Exxon Mobil, in response to an inquiry from the House Science Committee, may have provided false or misleading information on its funding for Dr. Soon's work. Southern Services Company funded Dr. Soon's authorship of several published climate studies; Dr. Soon did not disclose this funding to many of those journals' publishers or editors.

If true, these may not be isolated incidents. Professor John Christy at the Earth System Science Center has testified many times before the U.S. Congress on climate change. His December 2013 testimony to the House Committee on Science, Space and Technology said of the Nobel Prize-winning U.N. Intergovernmental Panel on Climate Change, "We need to put down the IPCC as soon as possible - not to protect the patient who seems to be thriving in its own little cocoon, but for the sake of the rest of us whom it is trying to infect with its disease. Fortunately much of the population seems to be immune, but some governments seem highly susceptible to the disease."

Exxon climate change dissent subpoena sweeps up more than 100 U.S. institutions



“Mr. Walker is one of 17 attorneys general who announced March 29 a coalition to pursue fraud claims against companies and others disputing the climate change consensus. Sixteen of the attorneys general are Democrats, while Mr. Walker is an independent.”

“Among those listed individually on the document are MIT professor emeritus **Richard Lindzen** and University of Alabama at Huntsville climatologist **John Christy**.”

Landmark California Bill (SB 1161) Would Allow Prosecution of Climate Change Skeptics

California Climate Science Truth and Accountability Act of 2016, [authorizes] prosecutors to sue fossil fuel companies, think tanks and others that have “deceived or misled the public on the risks of climate change.”

“... allowing legal action to be brought ... extending back indefinitely.”

Thursday 2 June, 2016

California sidelines bill to prosecute climate change skeptics

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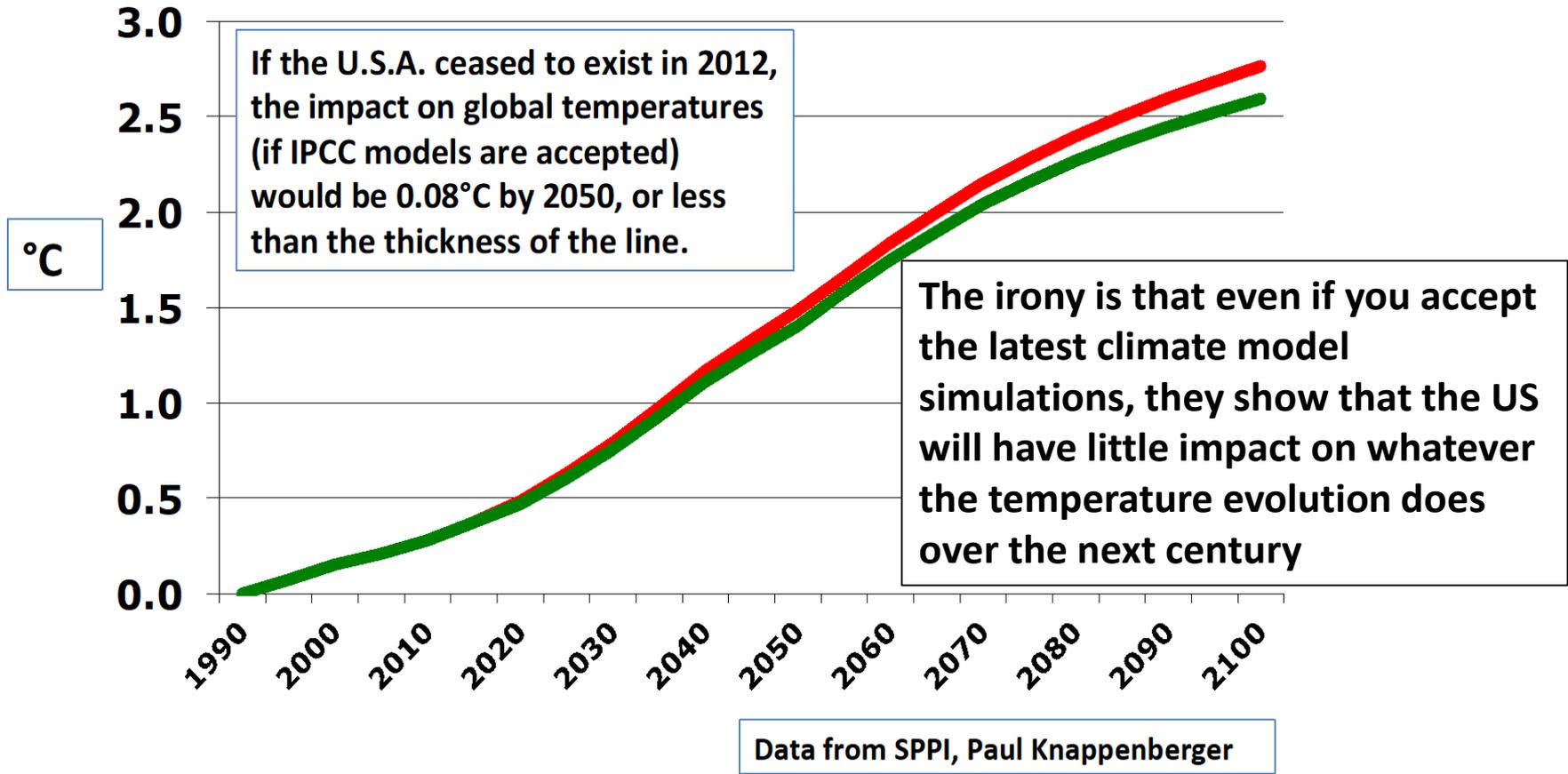
California sidelines bill to prosecute climate change skeptics

At ~ 2 a.m. after “March for Science”



**Will Politically-forced Regulations
make a difference?**

Red – Temperature IPCC A1B Emissions
Green – U.S. stops all emissions 2012



The scientific method shows:

Regulations that impose higher energy costs will do nothing perceptible or attributable to whatever the climate is going to do

**The Real World Happens -
even in the politically-correct
nations**

Law of Sustainability

**If it's not economically
sustainable,
it's not sustainable.**

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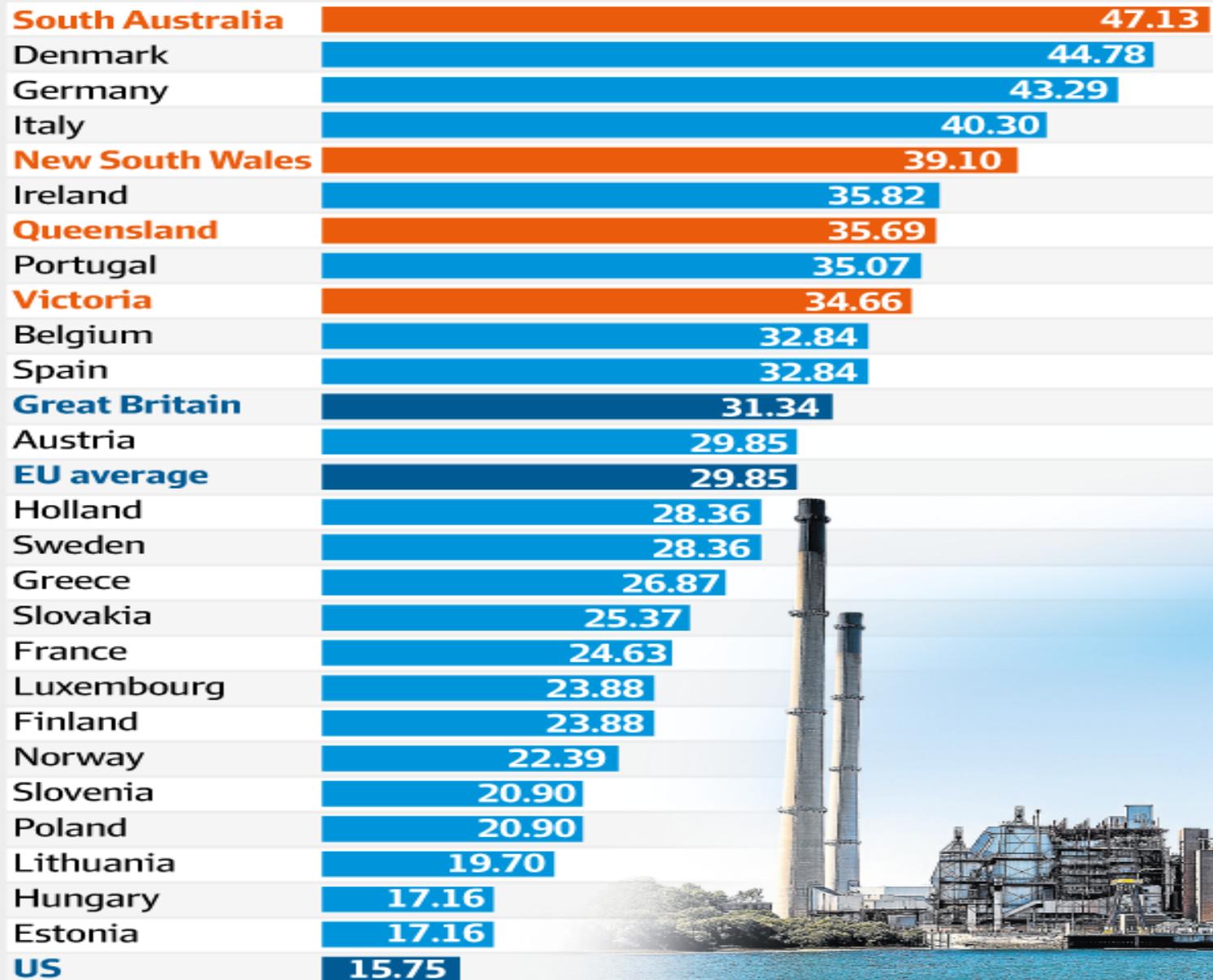
The Real World Happens – Germany and Japan

- In an environmental push these countries changed the energy mix to utilize less carbon/nuclear and more wind and solar
- Electric rates rose to \$0.43/kW-hr in Germany
- Electric rates rose to \$0.26/kW-hr in Japan
- Yet CO₂ emissions in Germany and Japan are rising

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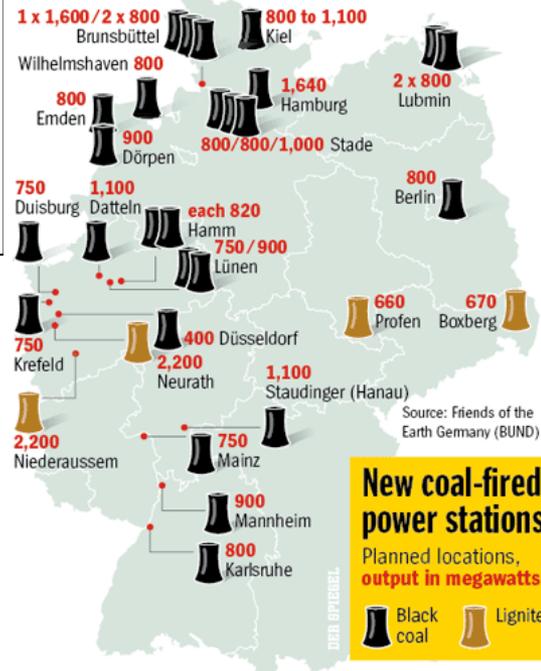
Retail electricity prices of NEM states, including taxes, compared to selected countries (¢ per kWh)



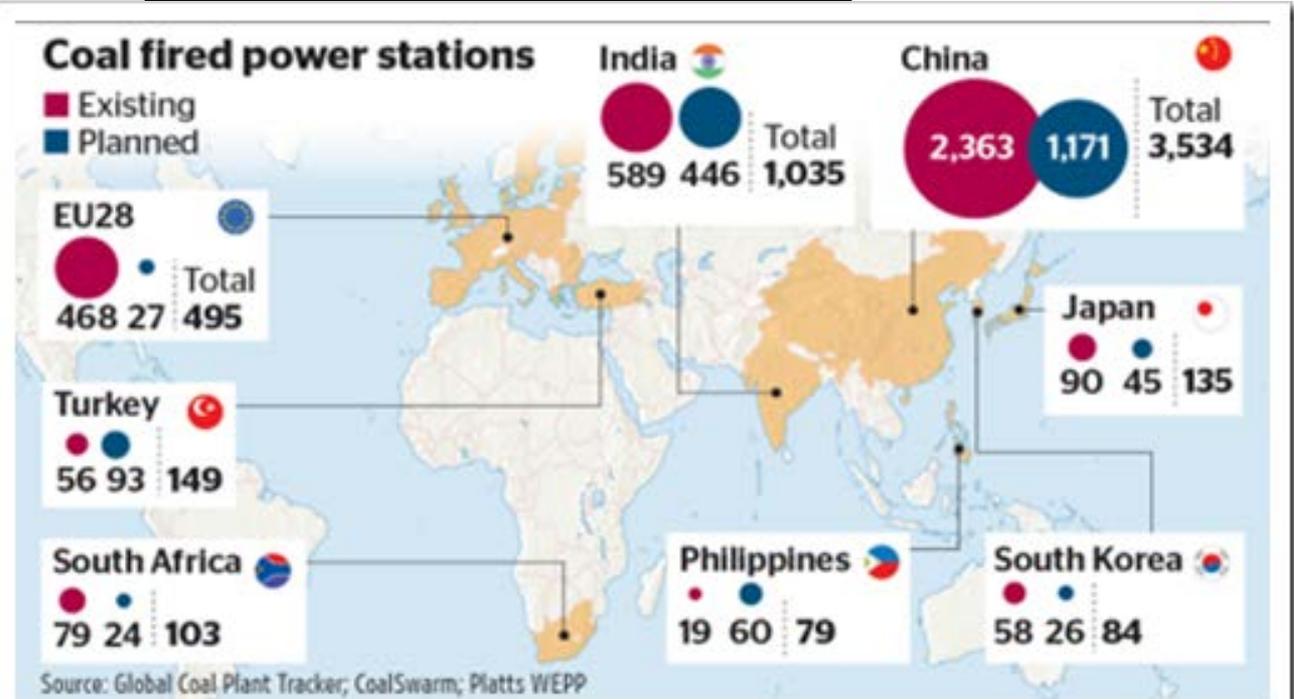
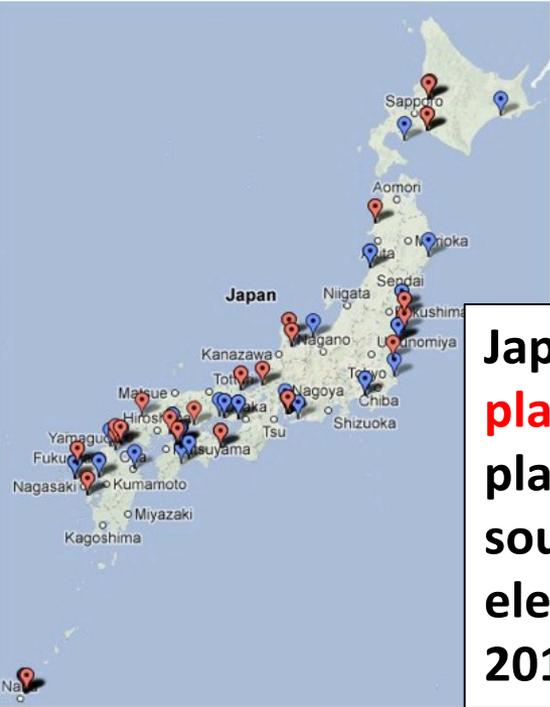
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- Electric rates rose to \$0.43/kW-hr in Germany
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- **CO2 EMISSIONS IN GERMANY AND JAPAN ARE RISING**

Germany is adding **26 coal-fired power plants**--
 Stuart Burns, Metal Miner,
 22 October 2013

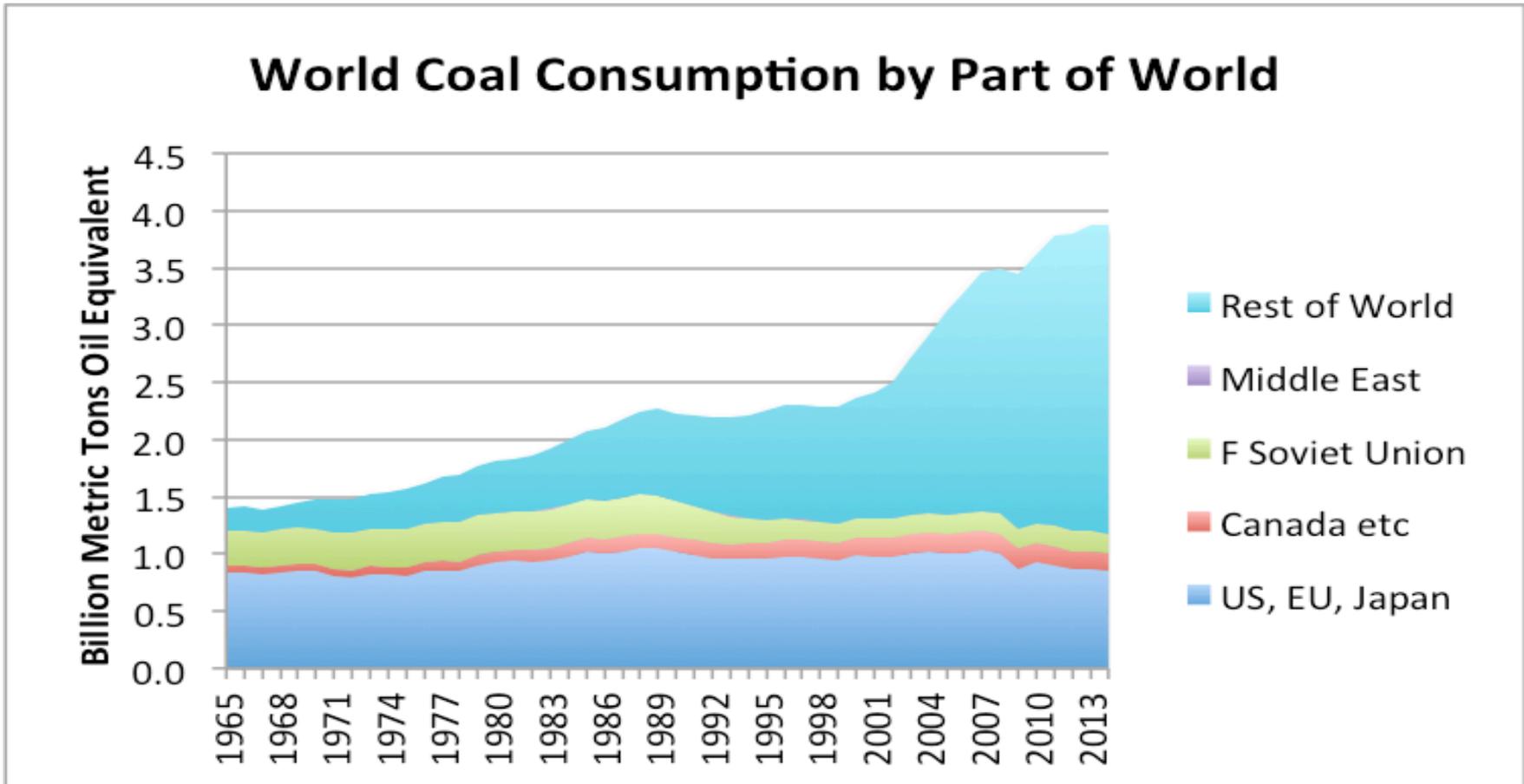


Japan has **43 coal fired power plants** under construction or planned for the dominant source of energy for electricity. *Bloomberg* 9 April 2015

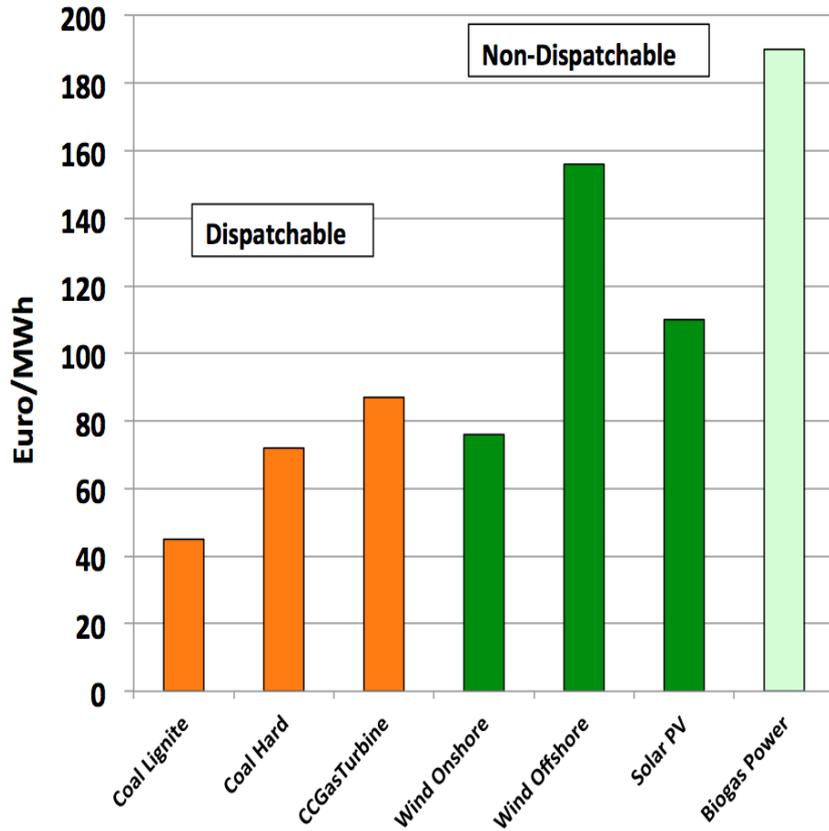


Coal – no one is following the old “official” U.S. view

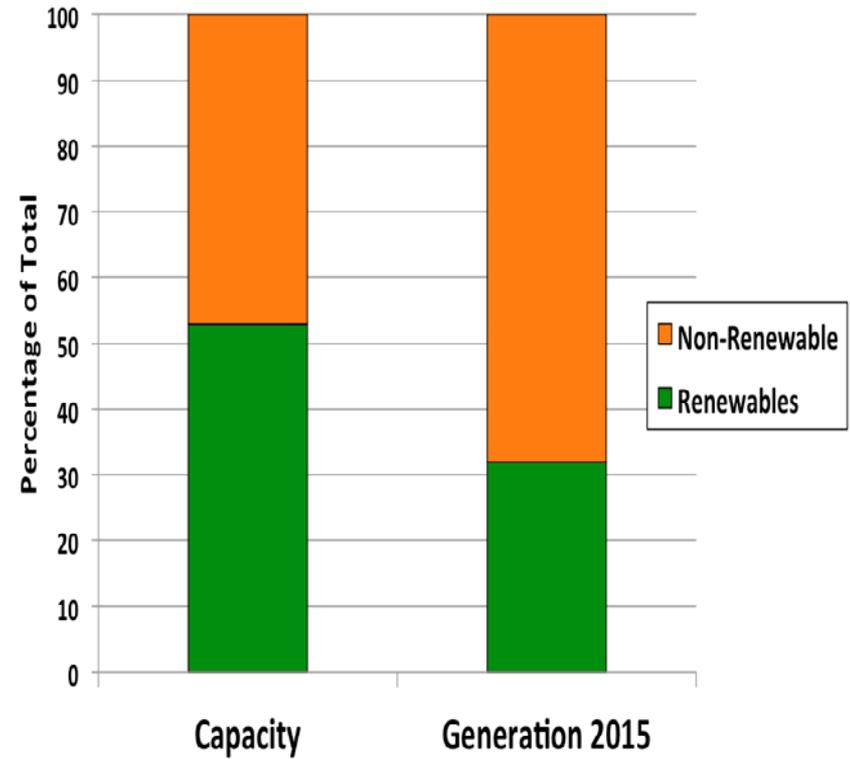
This is all horrifying to the climate-change lobby, but they might note that U.S. coal exports are rising to countries that claim climate-change virtue. **Exports to France increased 214%** during the first quarter of this year amid a nuclear power plant outage. Other European countries like Germany and the U.K. are utilizing U.S. coal **to stabilize unreliable renewable sources** and make up for electric capacity lost from the shutdown of nuclear plants. First-quarter coal exports were **up 94% to Germany** and **282% to the U.K.**
WSJ 16 August 2017



Germany: Levelized Cost of Power Source
(Fraunhofer ISE)



Germany "Renewable" vs. "Non-renewable"





**“Only two things are infinite; the Universe and human stupidity”
Albert Einstein**

Workers Required to Produce the Same Amount of Electric Power (2016)

COAL



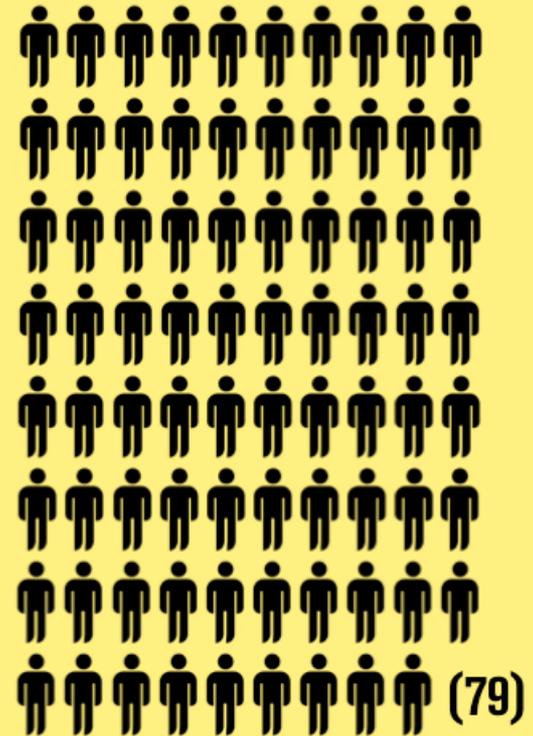
160,119 coal workers produced 1.24 billion megawatt hours (7,745 per worker)

NATURAL GAS



362,118 natural gas workers produced 1.38 billion megawatt hours (3,812 per worker)

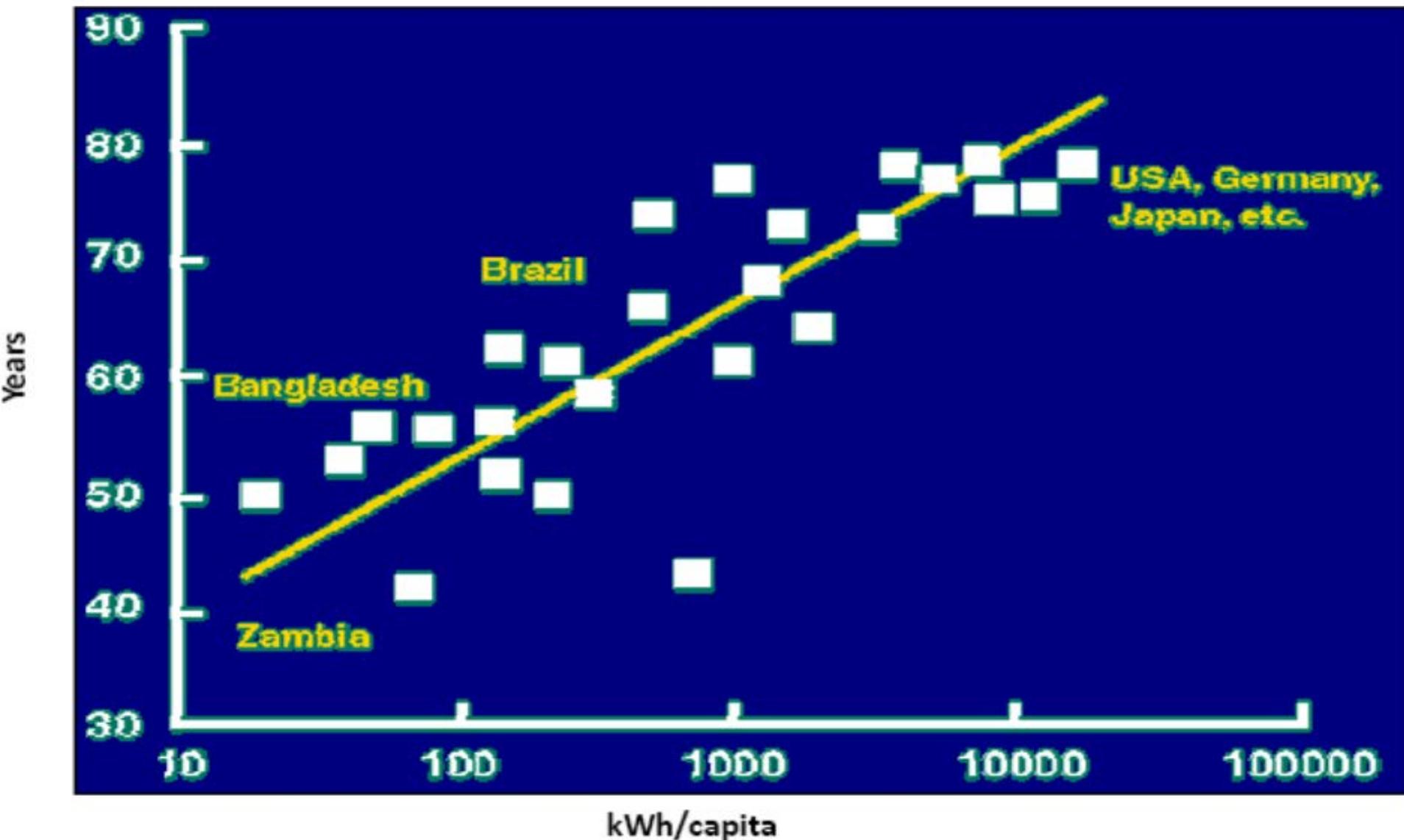
SOLAR



373,807 solar workers produced 36.75 million megawatt hours (98 per worker)

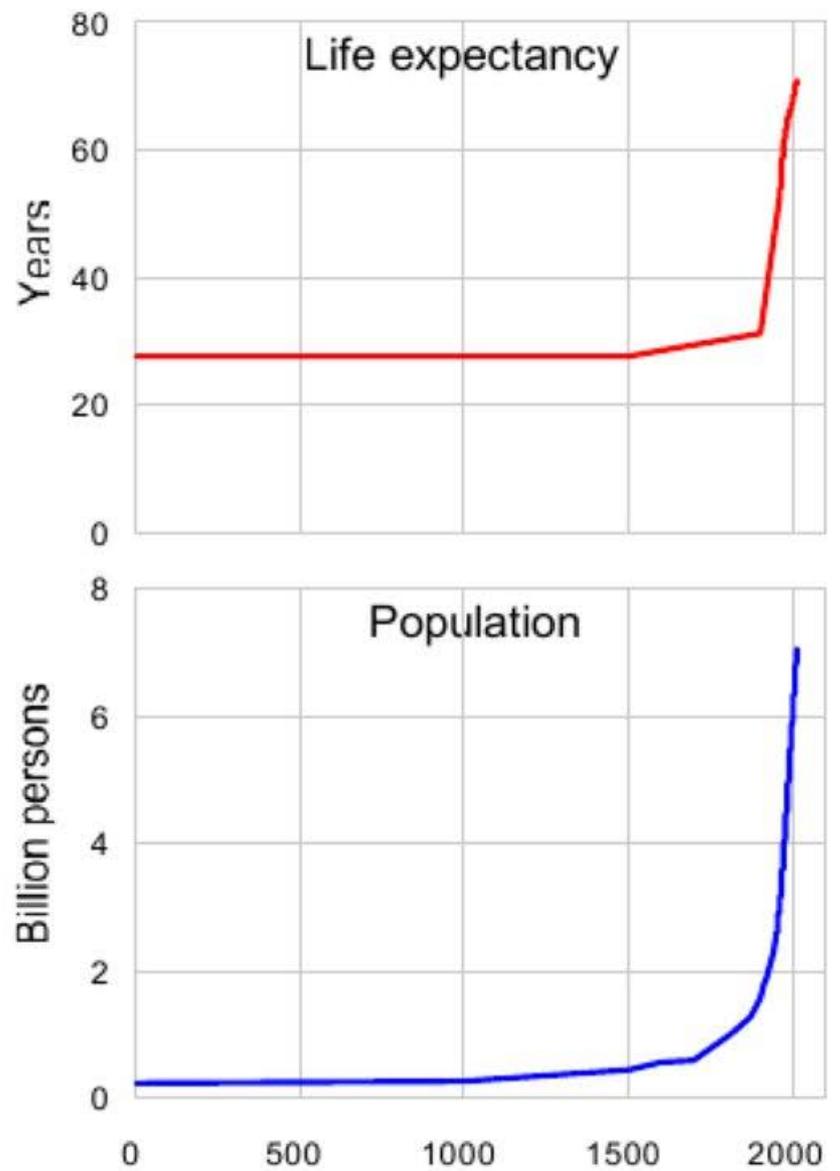
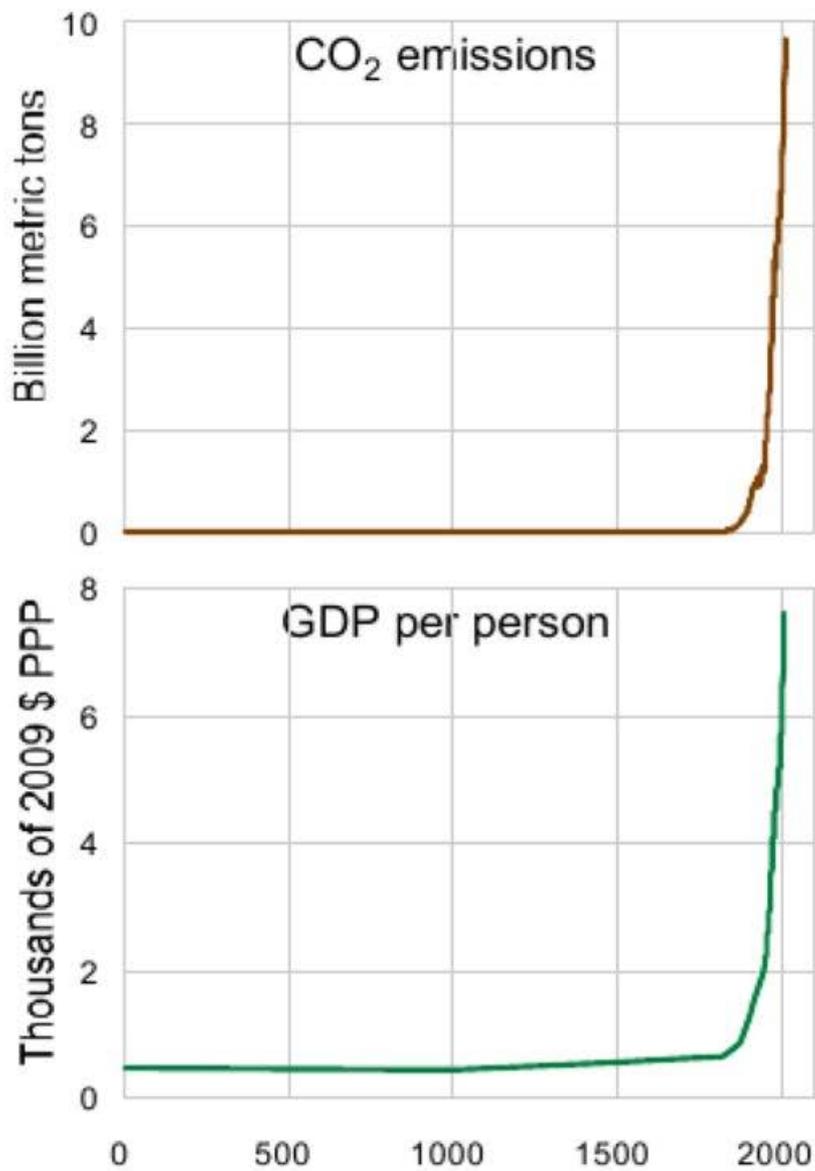
Climate Change is a Moral Issue

What is the value of human life?



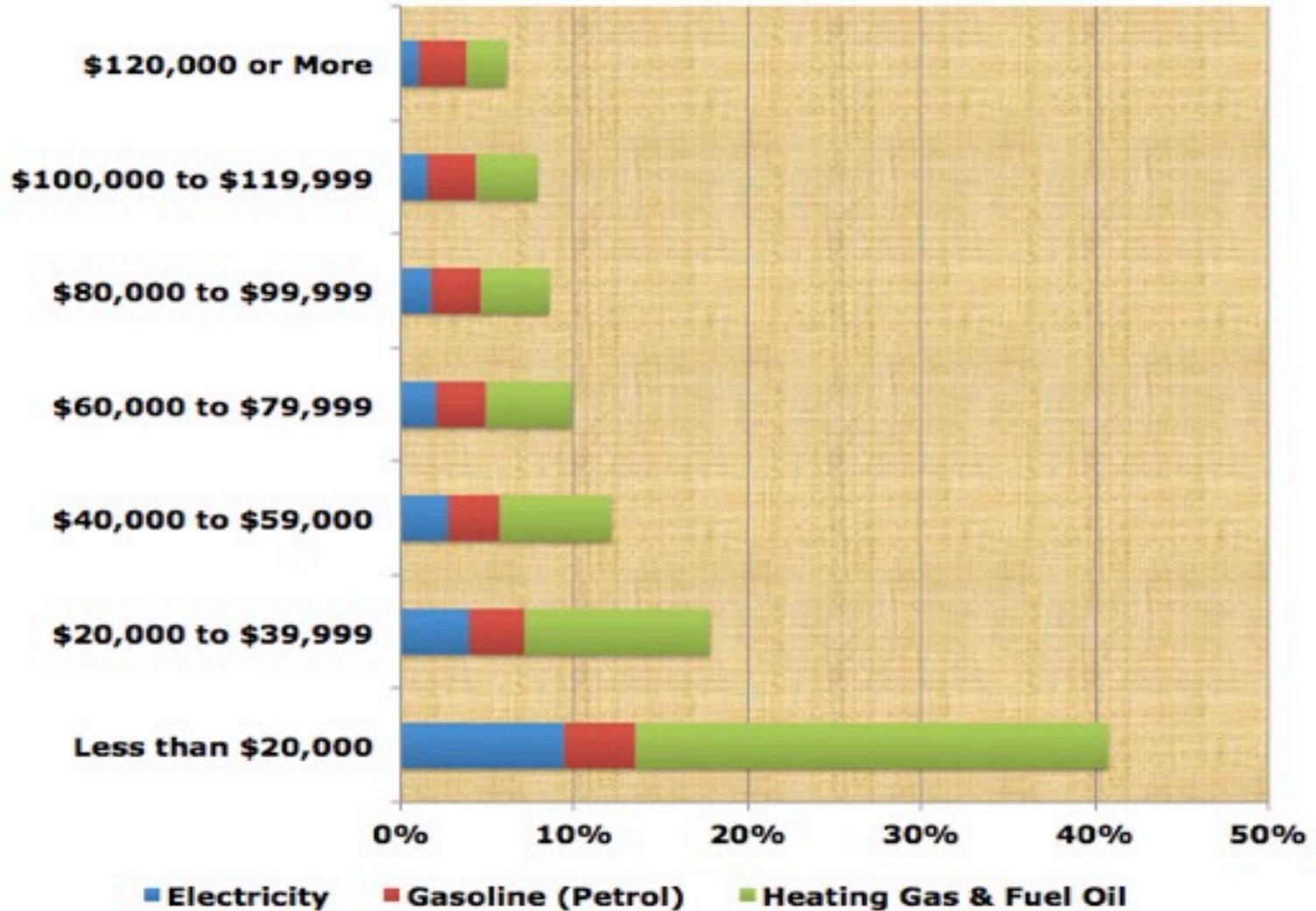
A high value on Human Life means moving people up on on the energy curve

Source: World Resources Institute, IEEE Spectrum



Sources: *Boden, Marland, Andres (2010)*; *Bolt and van Zanden (2013)*; *World Bank, World Development Indicators (WDI) Online Data, April 2014*

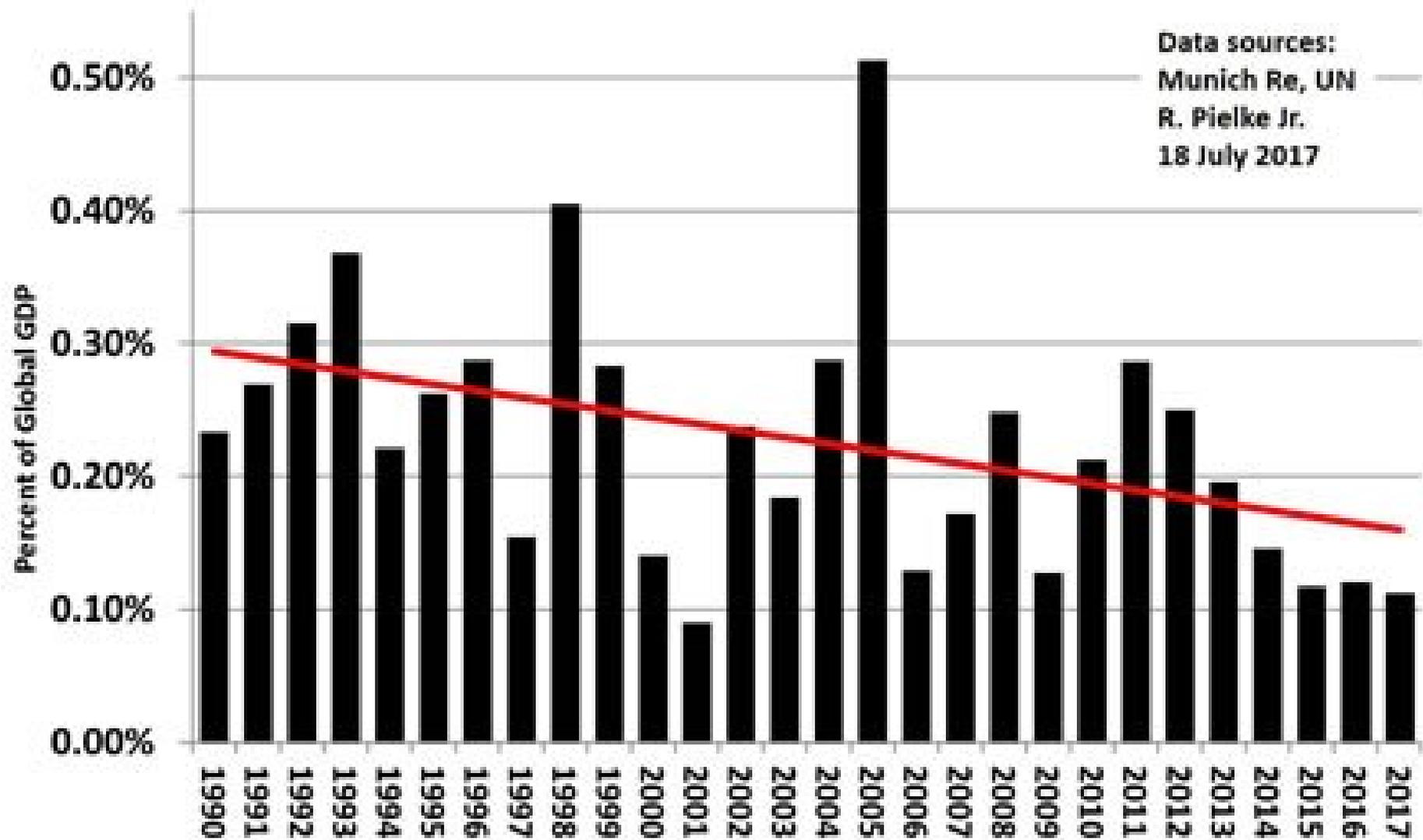
Percentage of Household Income Spent On Energy by Household Income Amount



Helping the poor means lowering energy costs
Hurting the poor means increasing energy costs

Global Weather-Related Disaster Losses as a Proportion of Global GDP: 1990-2017

(note: 2017 thru June)



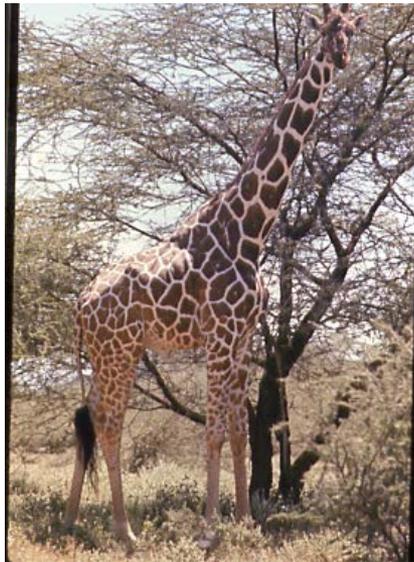
The Real World Happens – Developing World

- **Affordable energy vastly improves the quality and length of human life**
- The most affordable path to energy today is carbon combustion
- U.S. share of world CO₂ emissions has fallen from 28 percent in 1990s to 16 percent today to 13 percent by 2040.

The Real World Happens – Developing World

- Affordable energy vastly improves the quality and length of human life
- The most affordable path to energy today is carbon combustion
- U.S. share of world CO₂ emissions has fallen from 28 percent in 1990s to 16 percent today to 13 percent by 2040.

Kenya, East Africa



Energy System

Energy Source



Energy Transmission

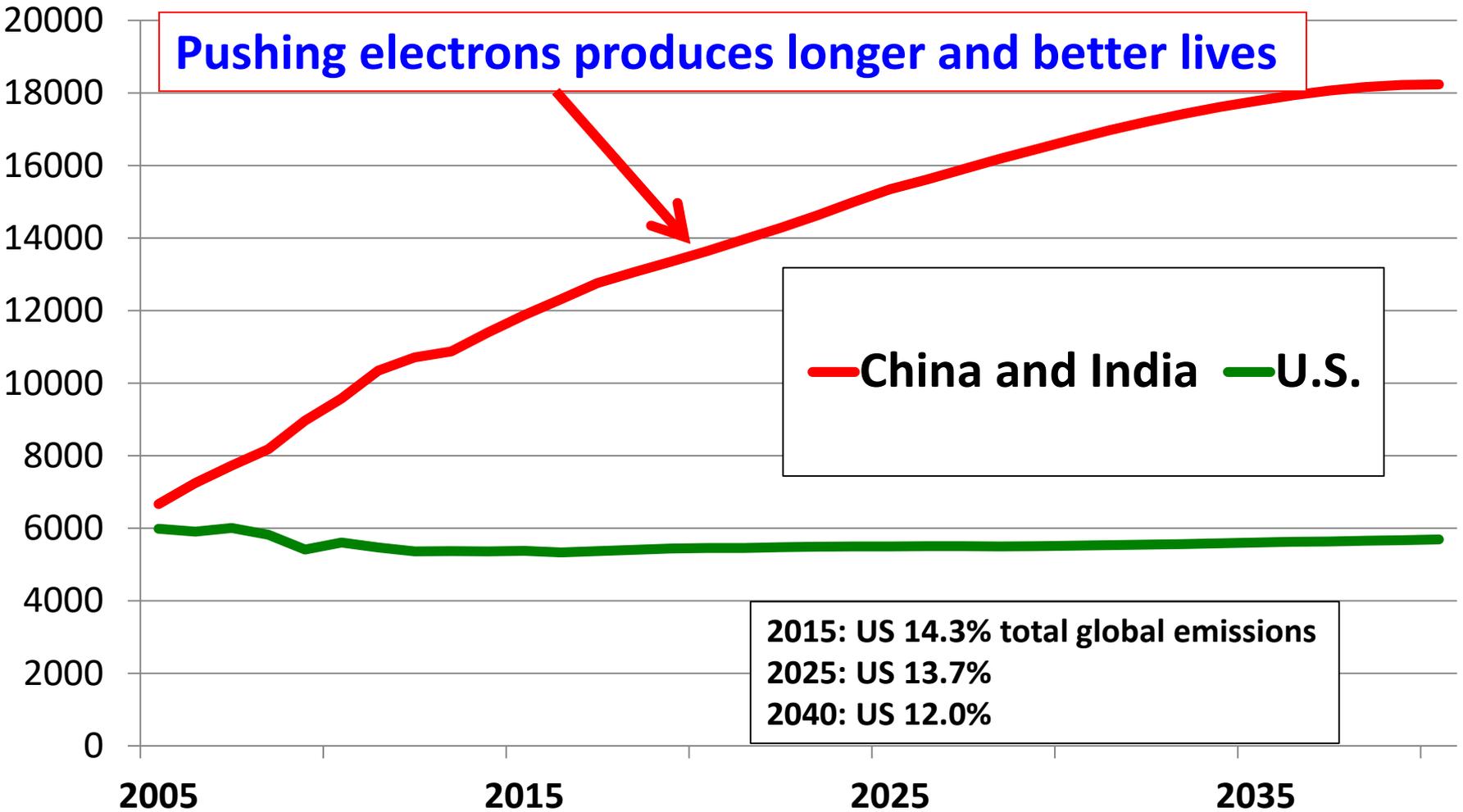


Energy Use



To value human life means
avoiding this energy system

CO2 Emissions EIA 2013 Outlook (million metric tons CO2)



China broke ground on 66 coal plants in 2015
India 148 new coal plants under construction in Dec 2015

The Real World Happens – Developing World

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Affordable Energy

**Electrification
Transportation
Industry**

Carbon 91%
(coal, natural gas, oil)

Nuclear 5%
Hydroelectric power 3%

CO2: Non-toxic
Invigorates Biosphere
Increases food production
Basis for Human Progress
Climate?????

We are addicted to:

Long life
Good health/Medical advances
Technological Progress
Affordable Services
Freedom of mobility
Abundant and affordable food
Natural landscapes
Clean Water/Air

Without energy, life is brutal and short

Law of Sustainability

What [CO2] cuts? That's for more developed countries. The moral principle of historic responsibility cannot be washed away. India's first task is eradication of poverty. Twenty percent of our population doesn't have access to electricity, and that's our top priority. We will grow faster, and our CO2 emissions will rise.

--Indian Environment Minister Prakash Javadekar, [The New York Times](#) 24 September 2014

Law of Sustainability

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What does my experience say?

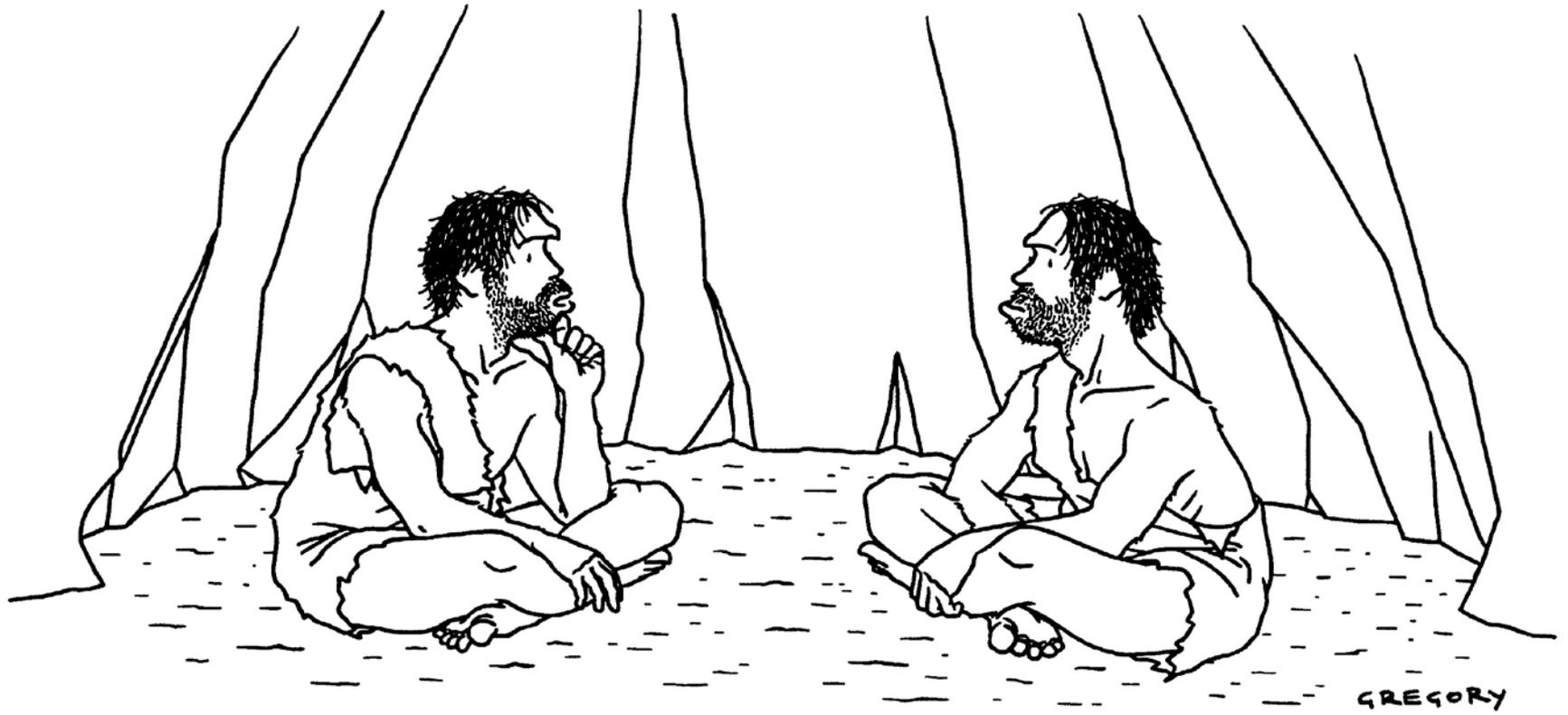
Climate Change is a political issue and there is a cost for those of us who are not politically correct

If there is value in enhancing the quality and length of human life, the moral imperative is to expand access to that which is available today: low-cost, carbon-based energy. This is happening anyway.

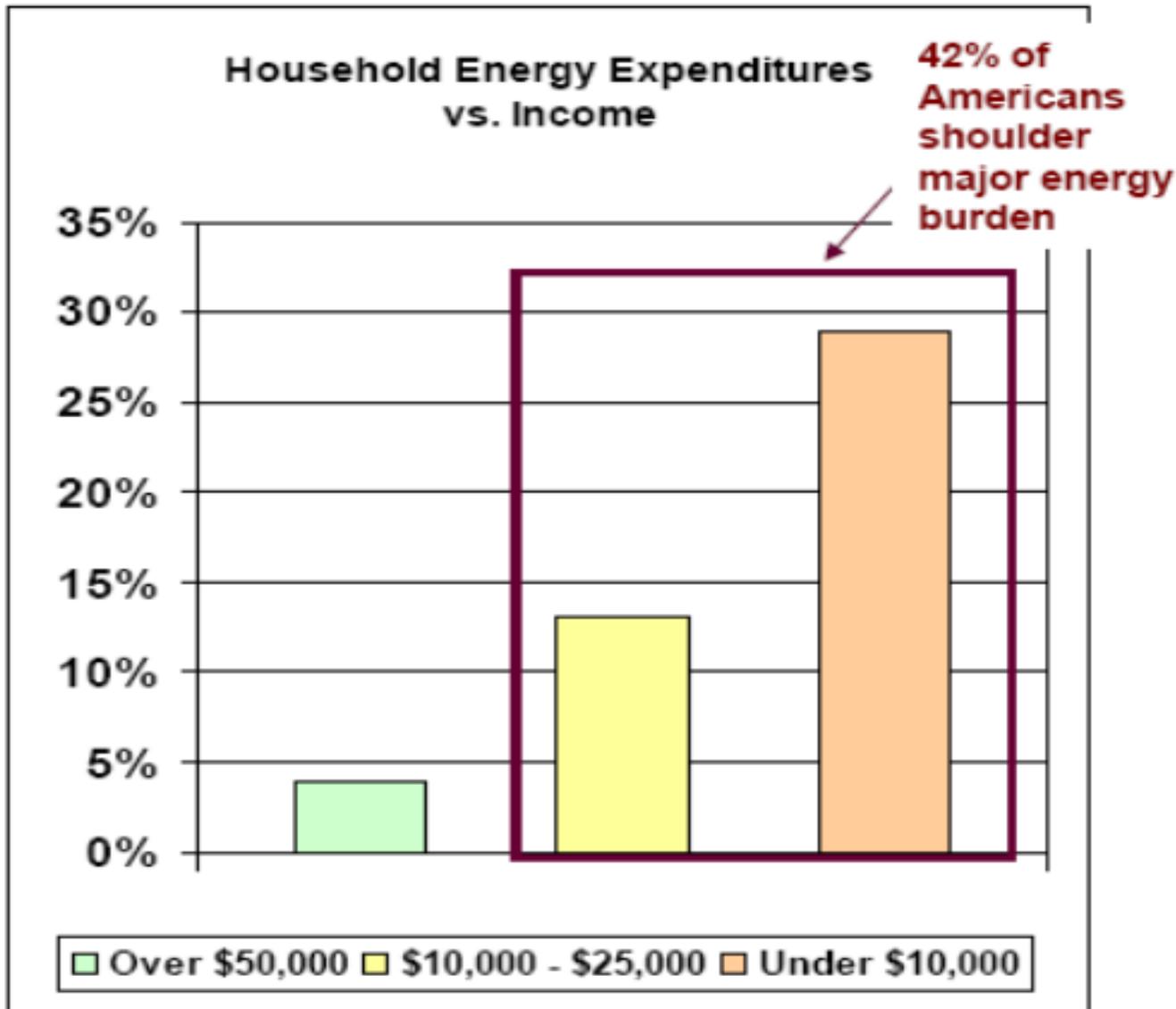
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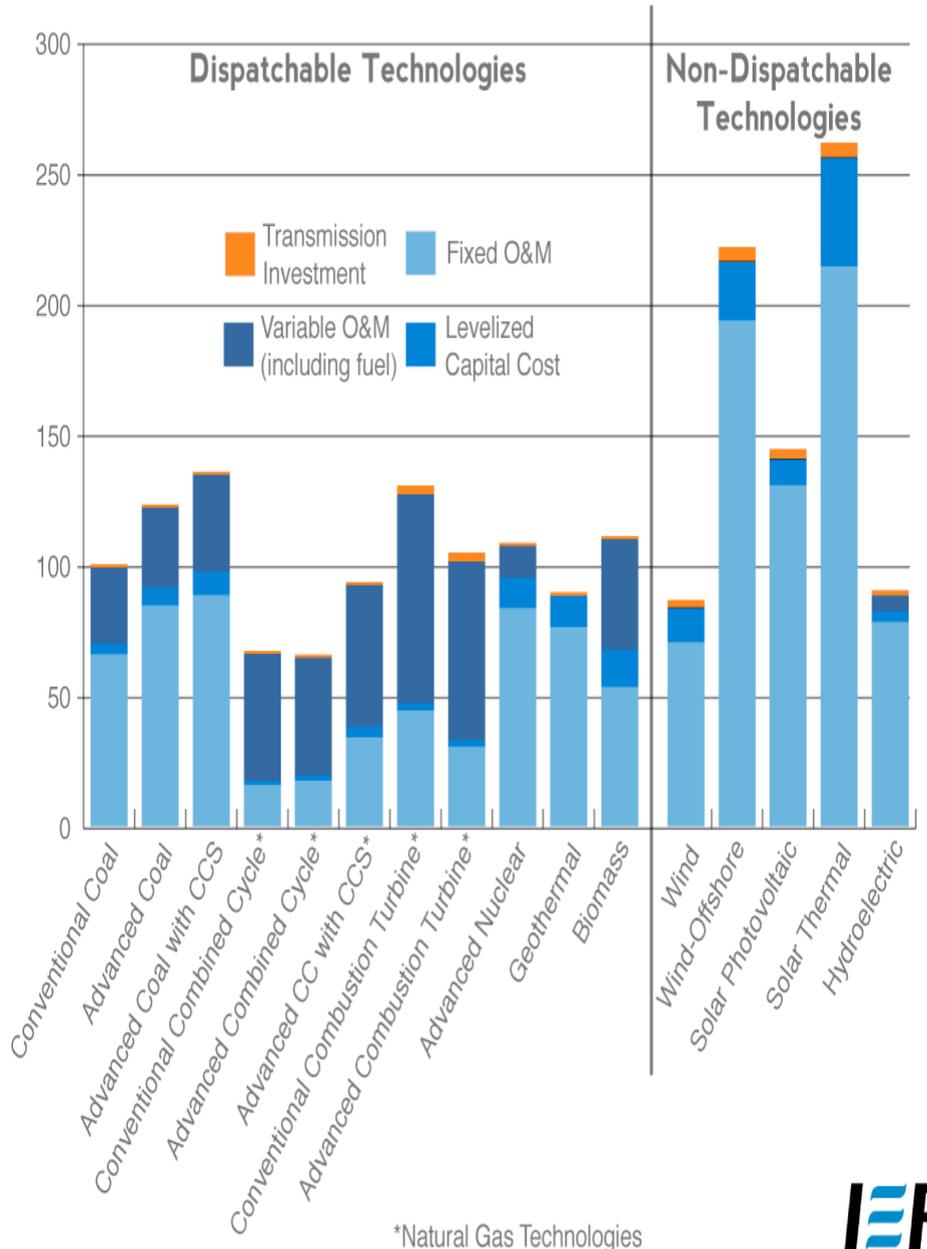
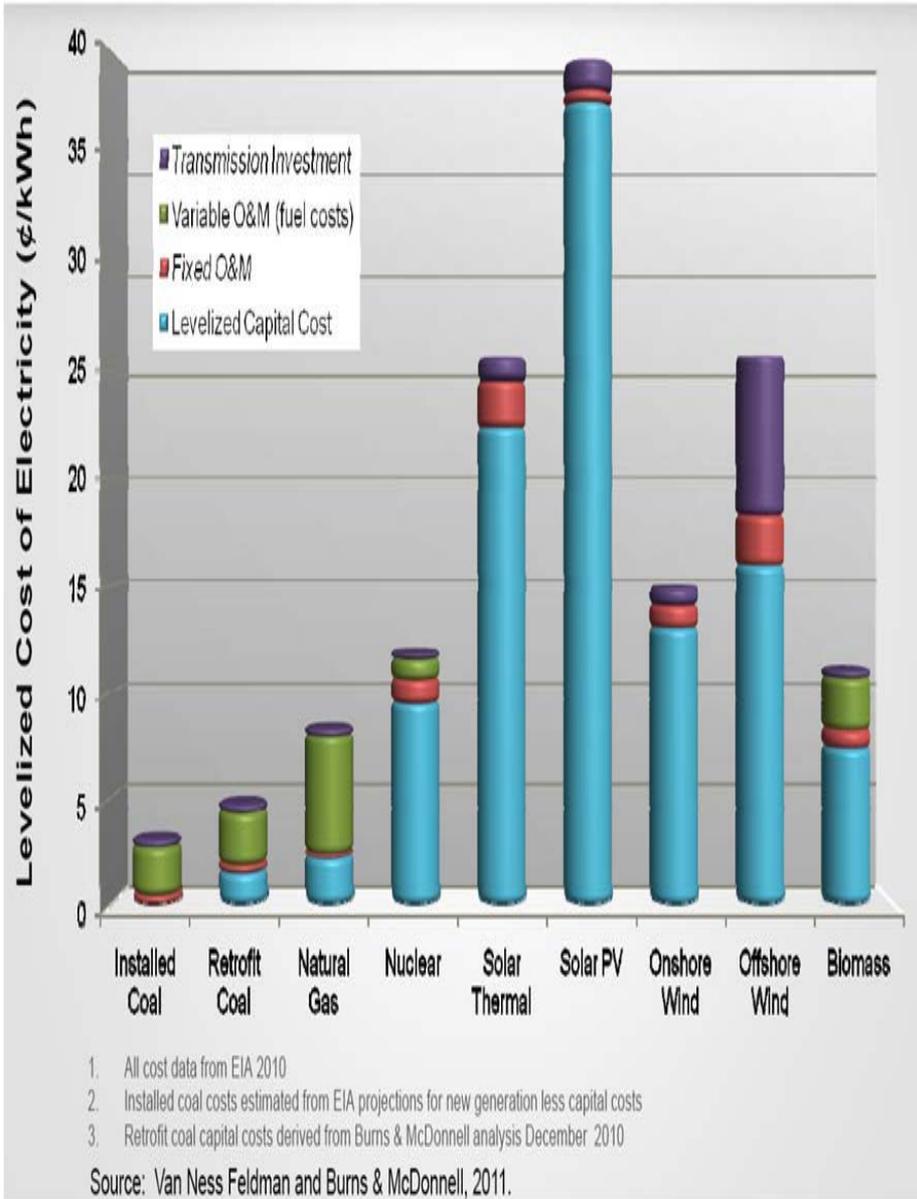


“Something’s just not right—our air is clean, our water is pure, we all get plenty of exercise, everything we eat is organic and free-range, and yet nobody lives past thirty.”



Helping the poor means lowering energy costs
Hurting the poor means increasing energy costs

<http://www.americaspower.org/sites/default> **Estimated Levelized Cost of New Electric Generating Technologies in 2018 (2011 \$/megawatthour)**



In the U.S., there are 210,000 employees in the solar energy sector and 190,000 in the coal industry.

The annual energy produced per coal industry employee is 23,800 MWh.

The annual energy produced per solar industry employee is 395 MWh.

The coal industry employee provides a return that is over 60 times that of a solar industry employee.

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