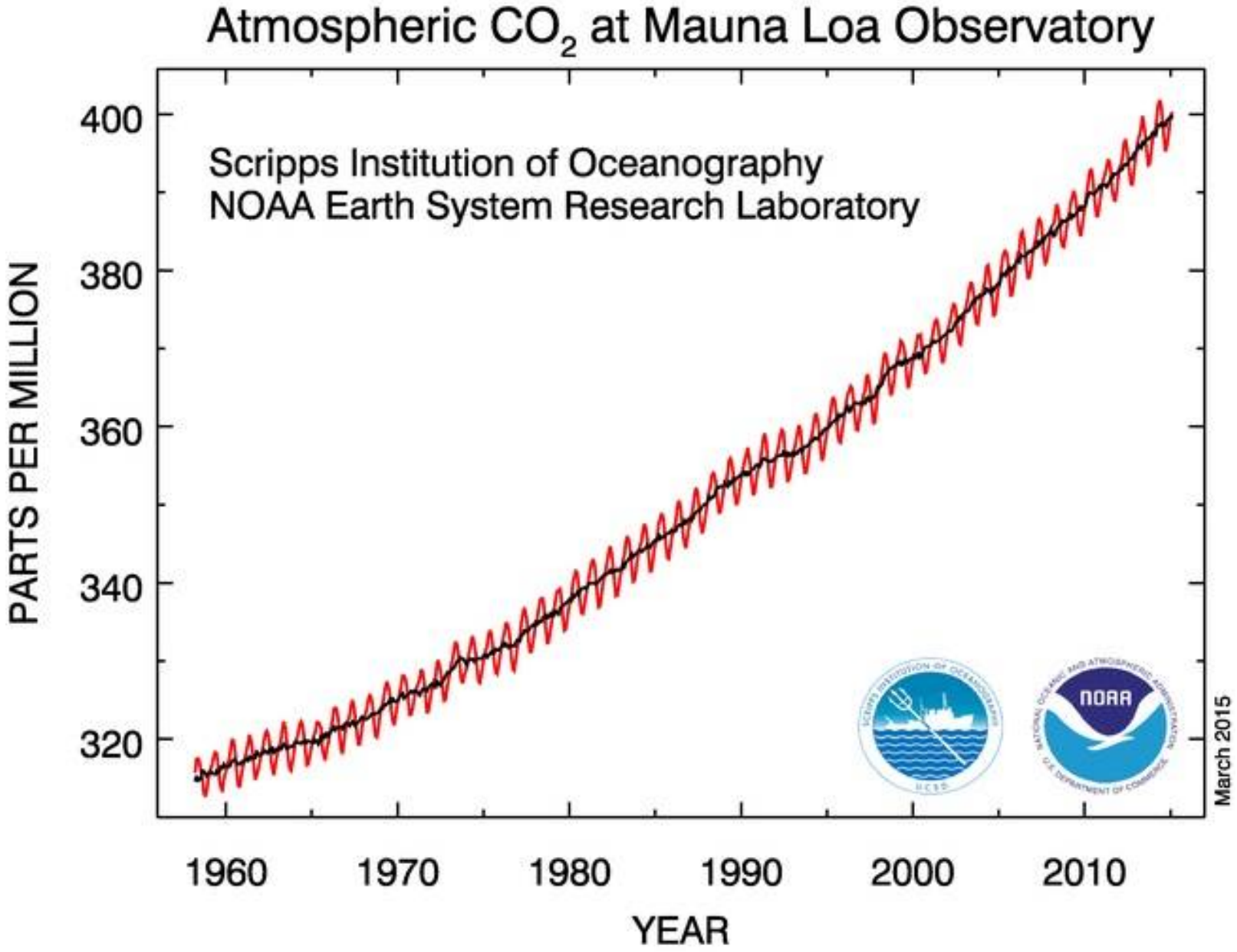
Climate Change Crisis

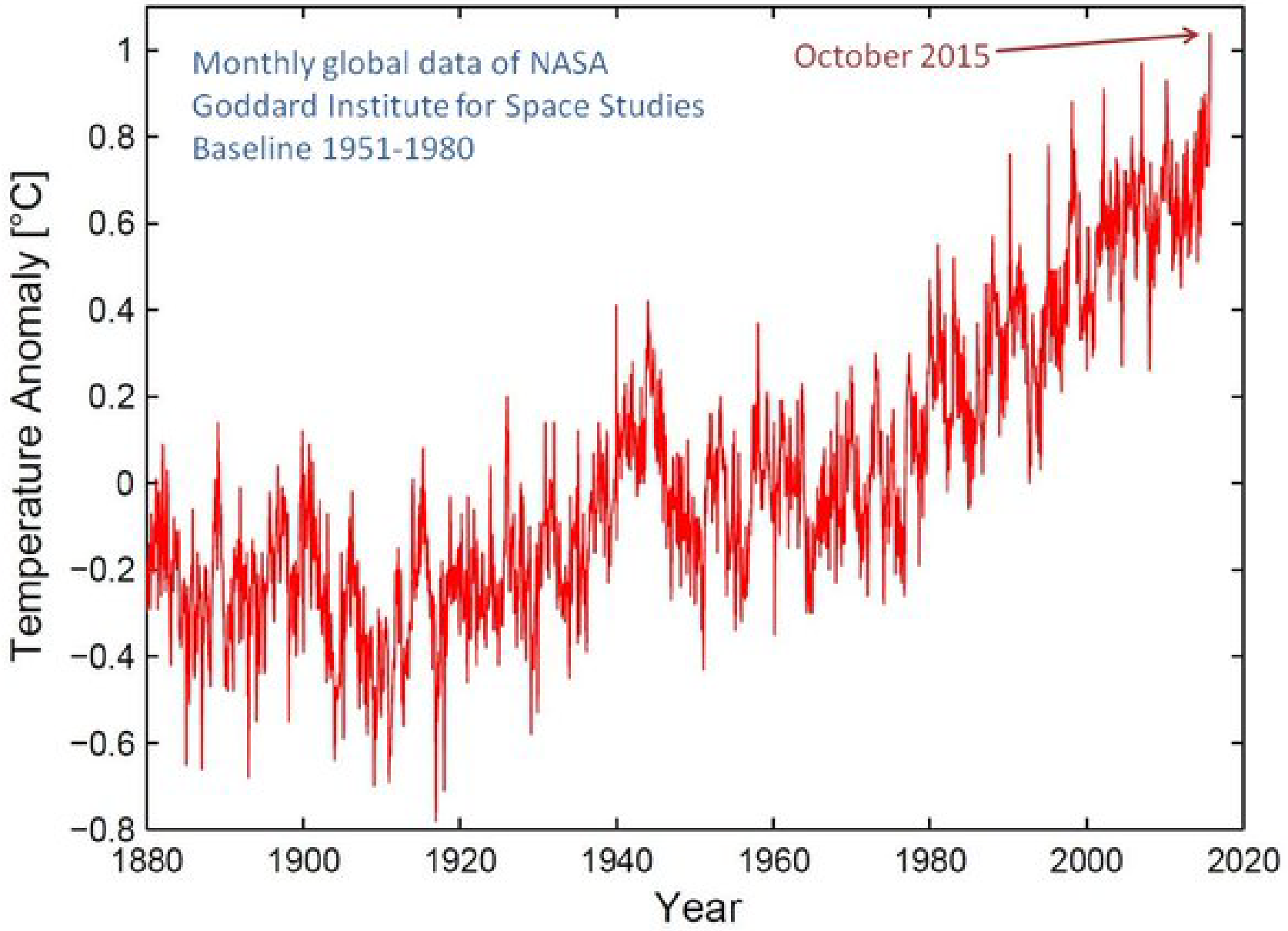
Brilliant Light Power's value in a carbon constrained world

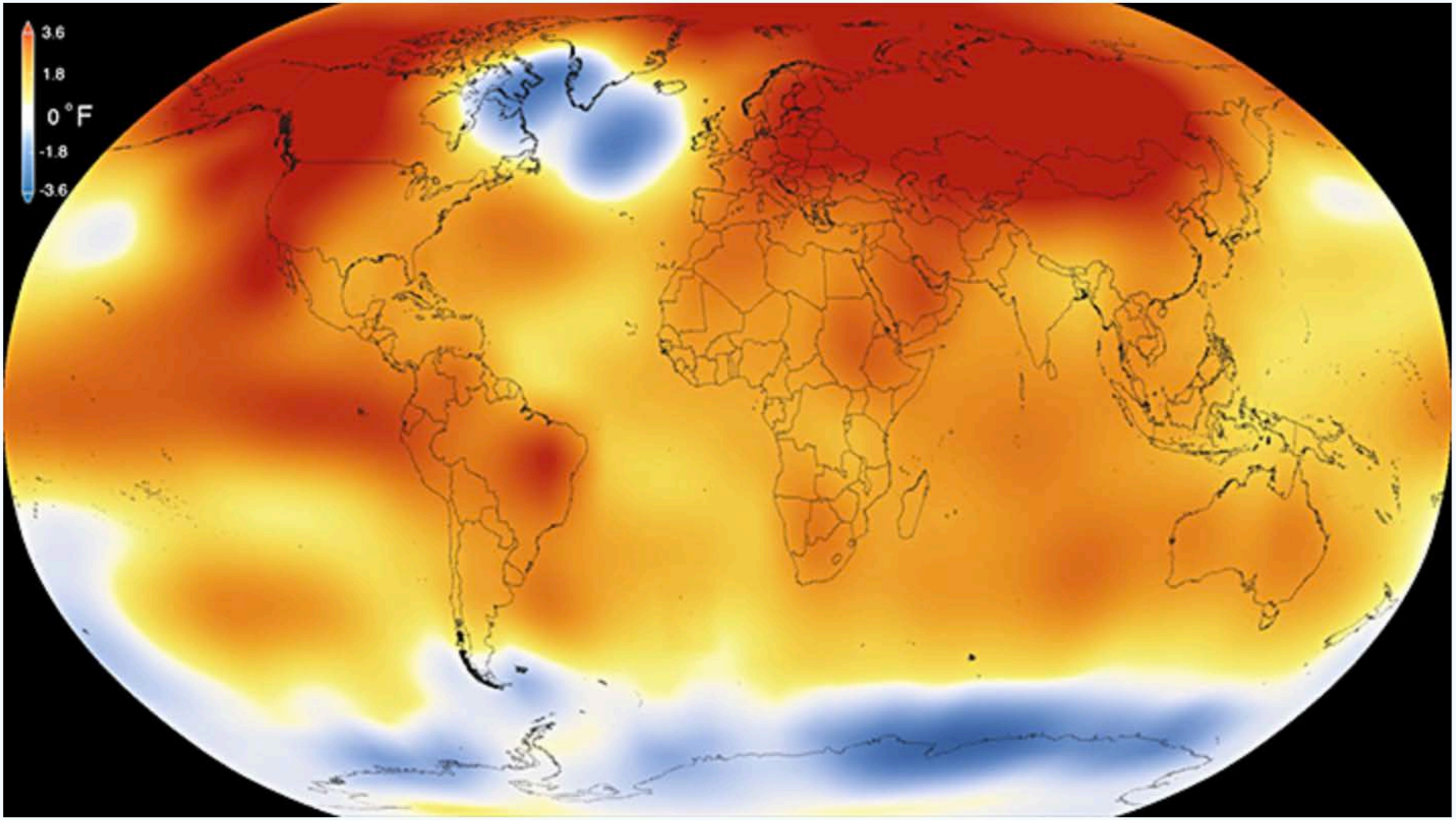
Kert Davies, Director – Climate Investigations Center

Climate Change

- The largest environmental, ecological, social challenge we face
- Issue is broad and complex
- Science and policy arenas interwoven
- Society and governments slow to react
- Big changes in energy sector needed to avert worse impacts than we are already seeing


Atmospheric CO_2 at Mauna Loa Observatory
Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
PARTS PER MILLION
400
380
360
340
320
1960
1970
1980
1990
2000
2010
YEAR
NOAA
March 2015


Monthly global data of NASA
Goddard Institute for Space Studies
Baseline 1951-1980
October 2015
Temperature Anomaly [°C]
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
1880
1900
1920
1940
1960
1980
2000
2020
Year



2015 was the warmest year since modern record-keeping began in 1880, according to a new analysis by NASA's Goddard Institute for Space Studies. The record-breaking year continues a long-term warming trend — 15 of the 16 warmest years on record have now occurred since 2001. (Credit: NSA/GSFC/Scientific Visualization Studio)

Climate Change Impacts

- Extreme weather
- 1000-year events now common
- Sea level rise threatens coasts worldwide
- Species extinction
- Agricultural disruption
- Destabilized governments - refugees

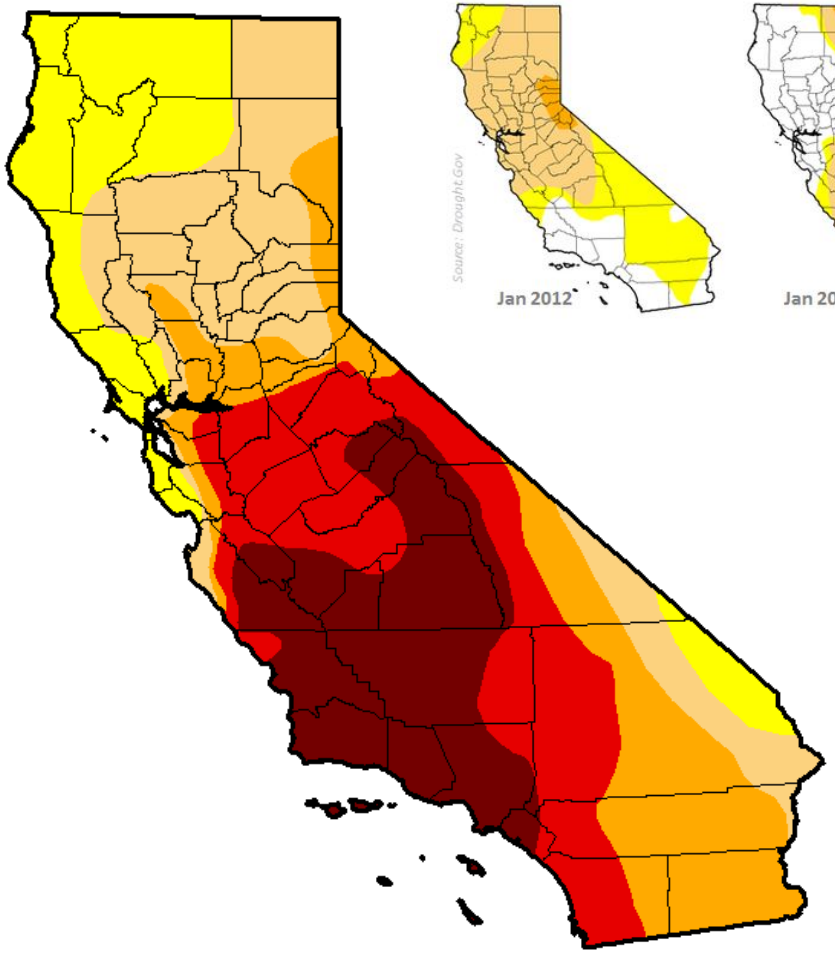
U.S. Drought Monitor

California

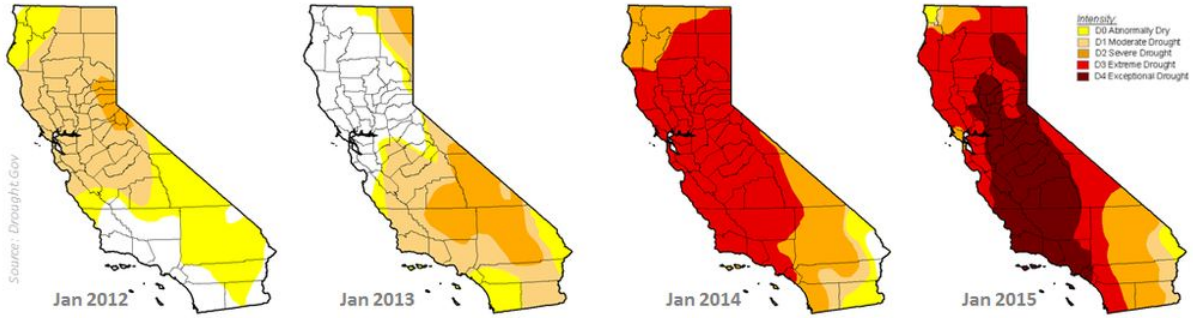
October 4, 2016

(Released Thursday, Oct. 6, 2016)

Valid 8 a.m. EDT



Drought Conditions (Percent Area)



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Water Year 9/27/2016	0.00	100.00	83.59	62.27	42.80	21.04
One Year Ago 10/6/2015	0.14	99.86	97.33	92.36	71.08	46.00

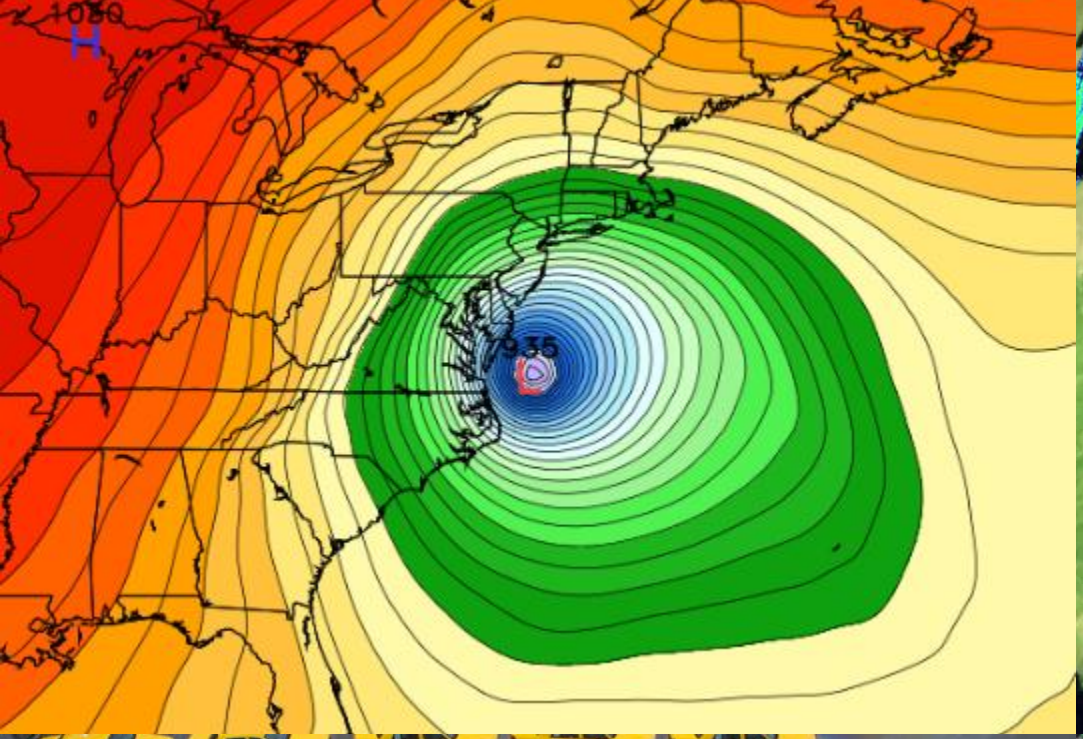
Intensity:

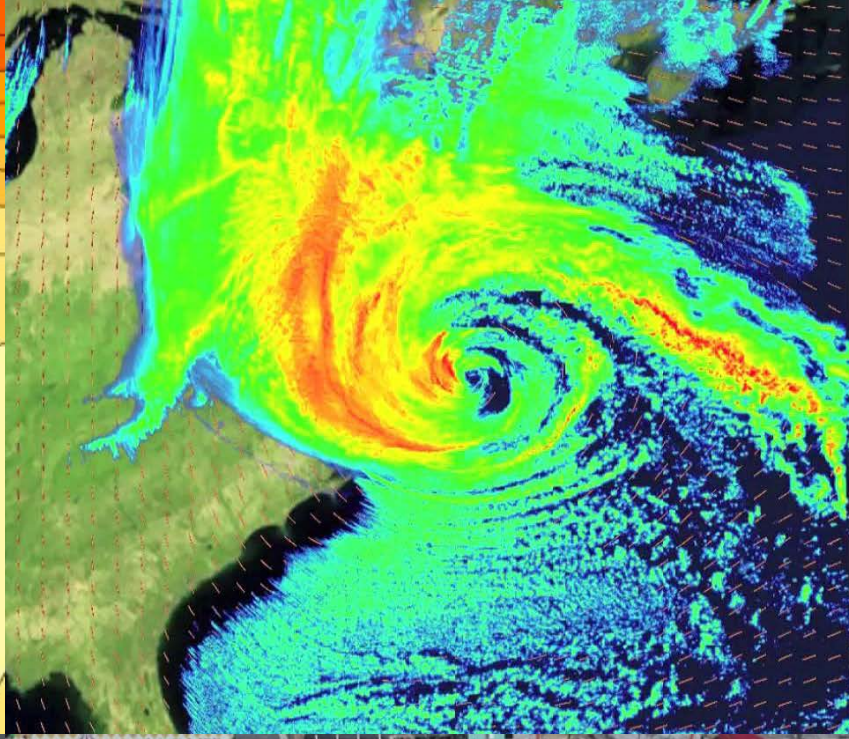
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

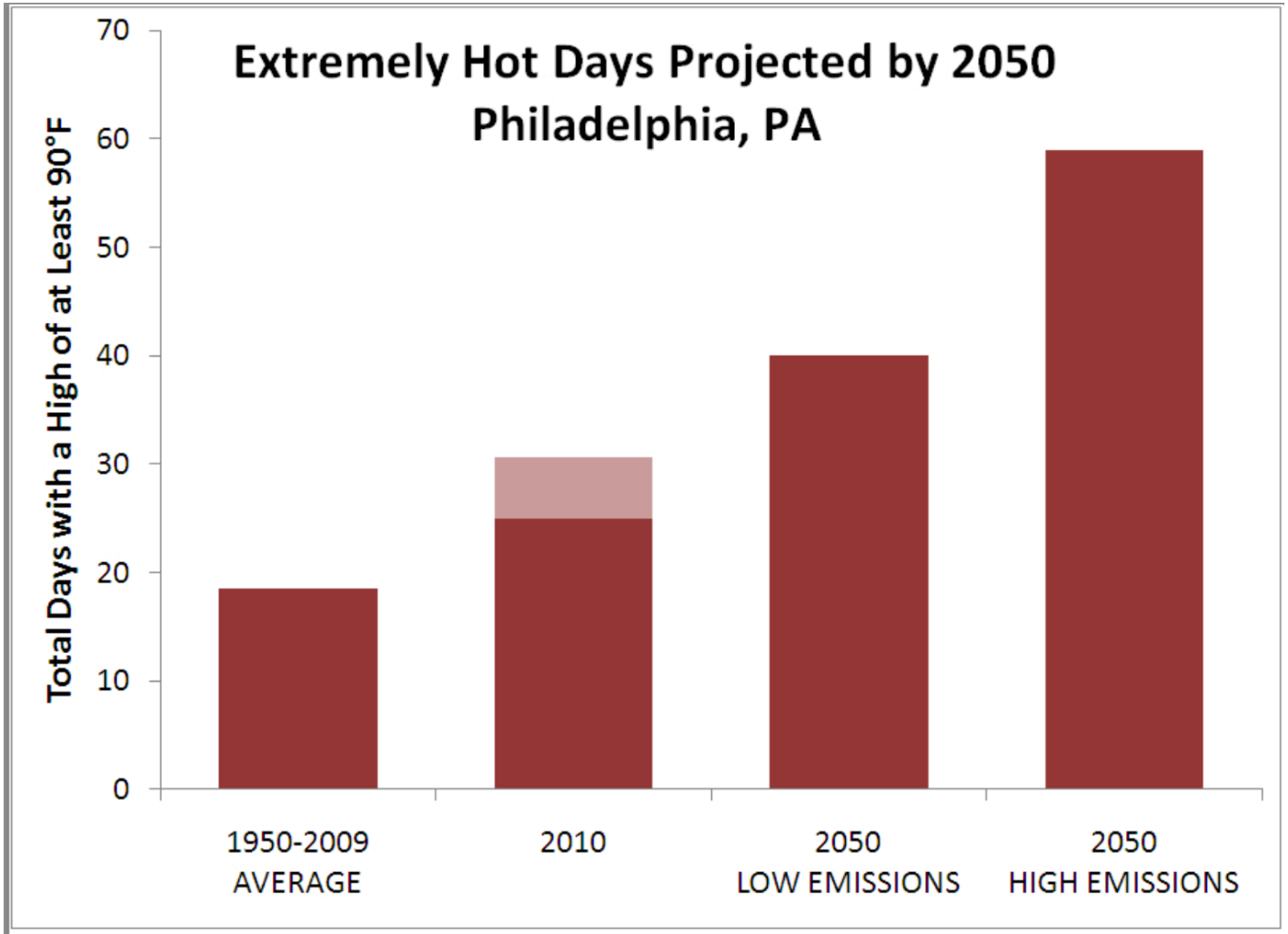
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Brian Fuchs
National Drought Mitigation Center

http://droughtmonitor.unl.edu/


1050
H
1035





Number of days when maximum temperature is 90°F or higher for the 1950-2009 average, 2010 observed through the end of July (in dark red) and expected for the year if August and September follow the past average (in pink), climate projections for 2040-2069 using a lower emissions scenario, and climate projections for 2040-2069 using a higher emissions scenario.

Data source for observed temperatures:
National Oceanic and Atmospheric Administration Global Historical Climatology Network

CO_2 Emissions

- Fossil fuels responsible for the majority of existing problem
- Deforestation, agriculture and land use related emissions are the rest of the problem
- Emissions growing in ‘developing’ countries – China, India
- Carbon bubble- We simply cannot burn the fossil fuels we know exist
- 2° degree target – Paris agreement/ US Clean Power Plan

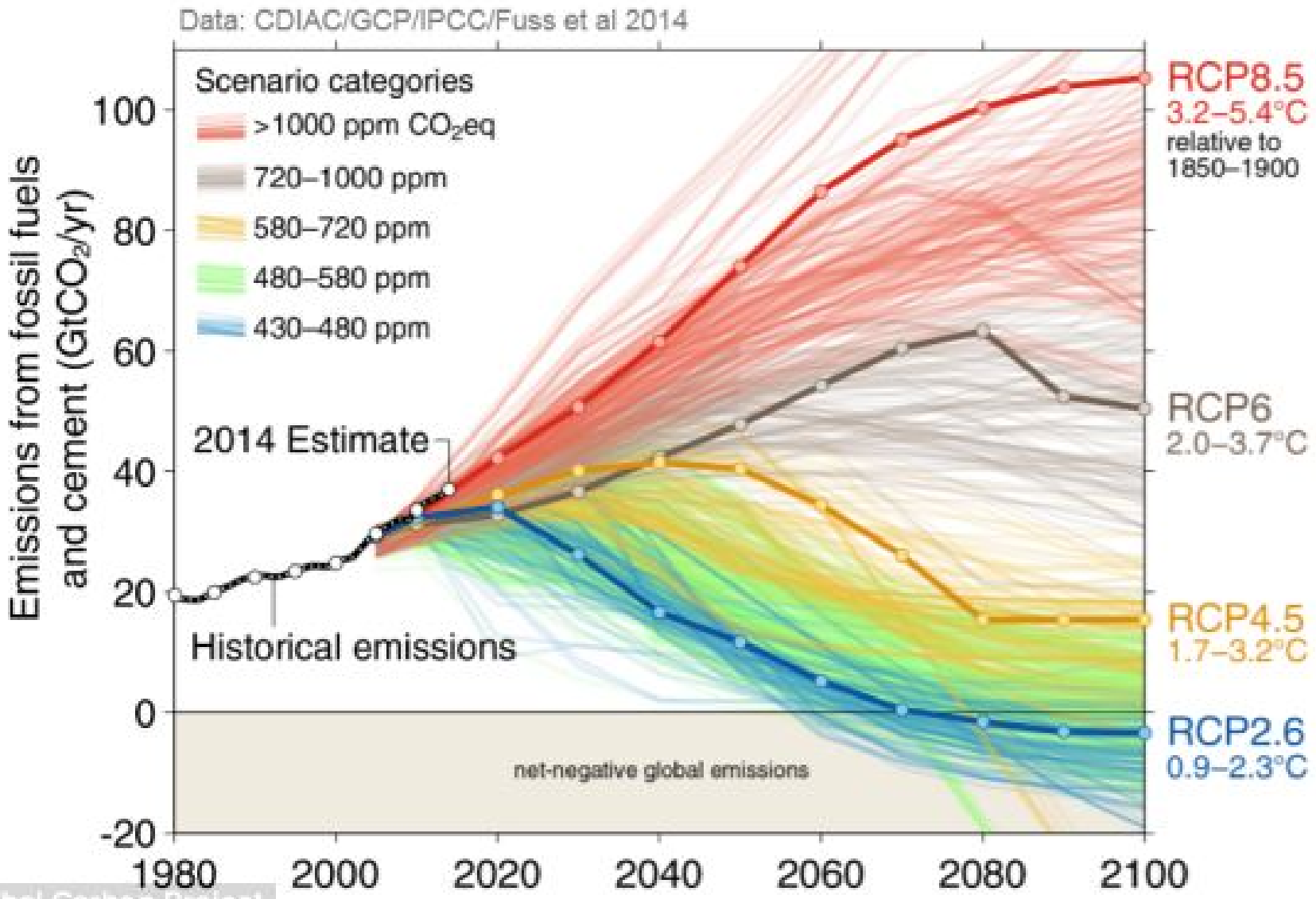
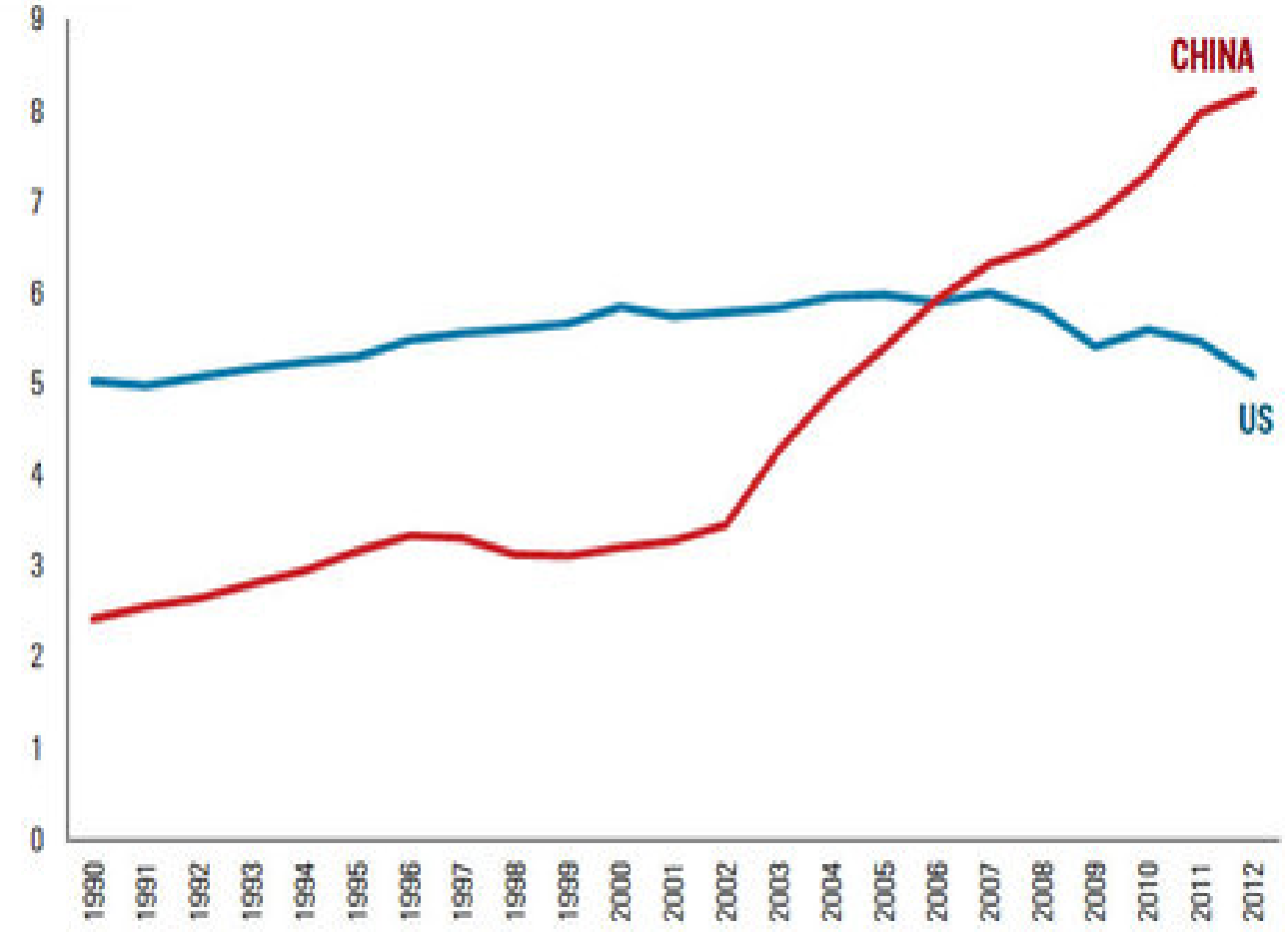
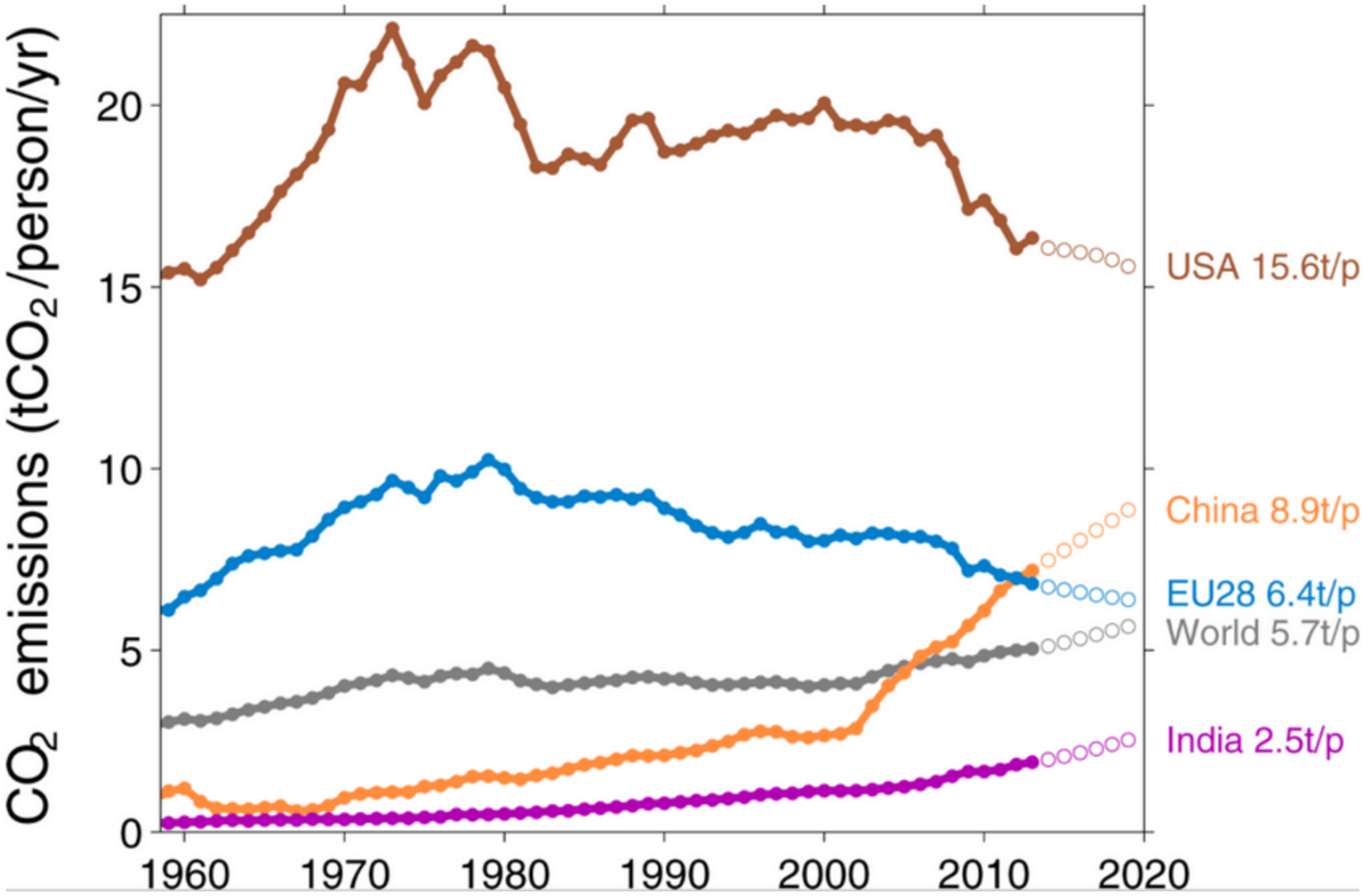

Data: CDIAC/GCP/IPCC/Fuss et al 2014
Scenario categories
>1000 ppm CO_2eq
720–1000 ppm
580–720 ppm
480–580 ppm
430–480 ppm
2014 Estimate
Historical emissions
net-negative global emissions
Emissions from fossil fuels and cement ($GtCO_2$/yr)
100
80
60
40
20
0
-20
1980
2000
2020
2040
2060
2080
2100
RCP8.5
3.2–5.4°C
relative to 1850–1900
RCP6
2.0–3.7°C
RCP4.5
1.7–3.2°C
RCP2.6
0.9–2.3°C
© Global Carbon Project

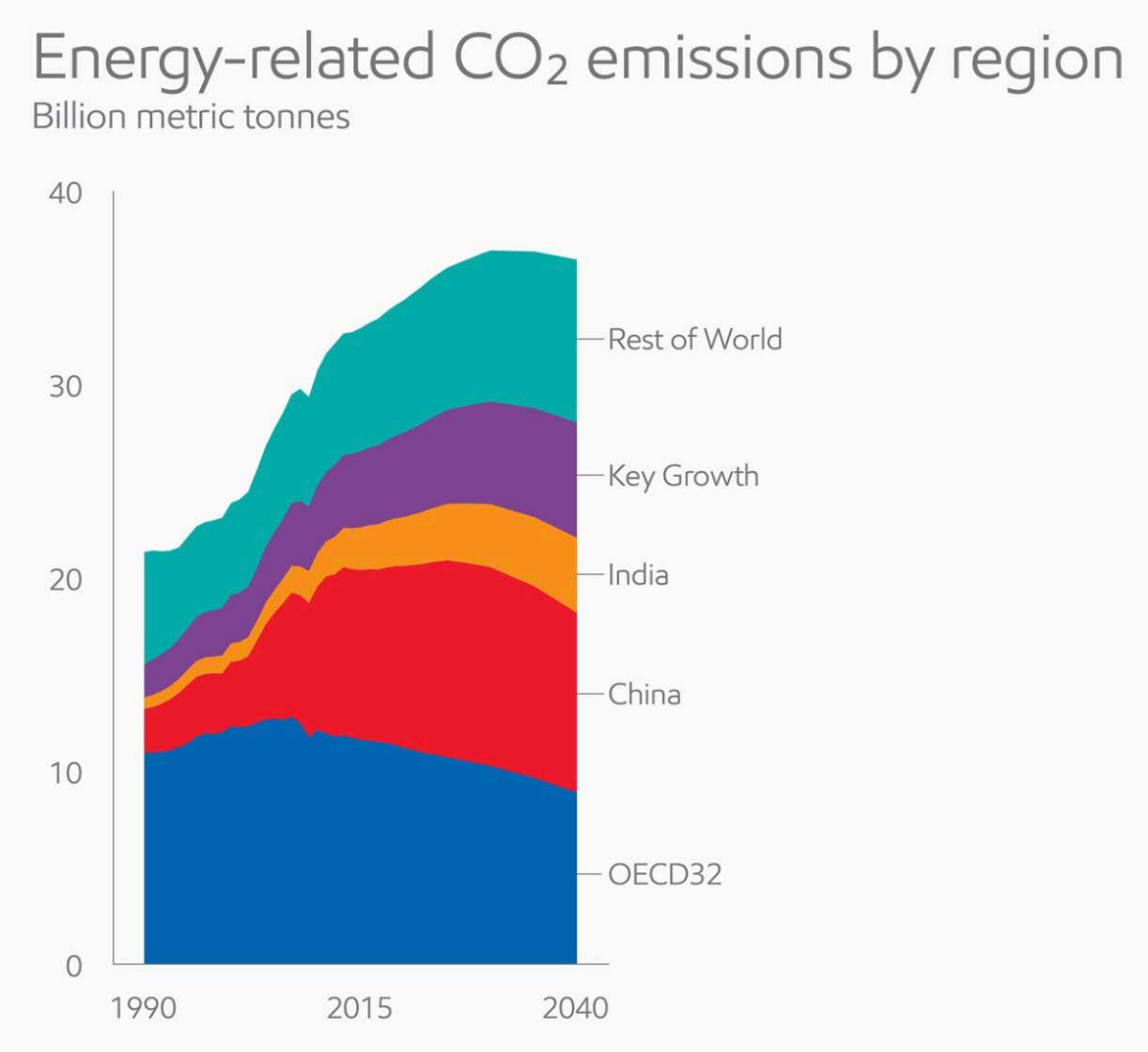
Figure II: Energy-Related CO2 Emissions

Billion tons

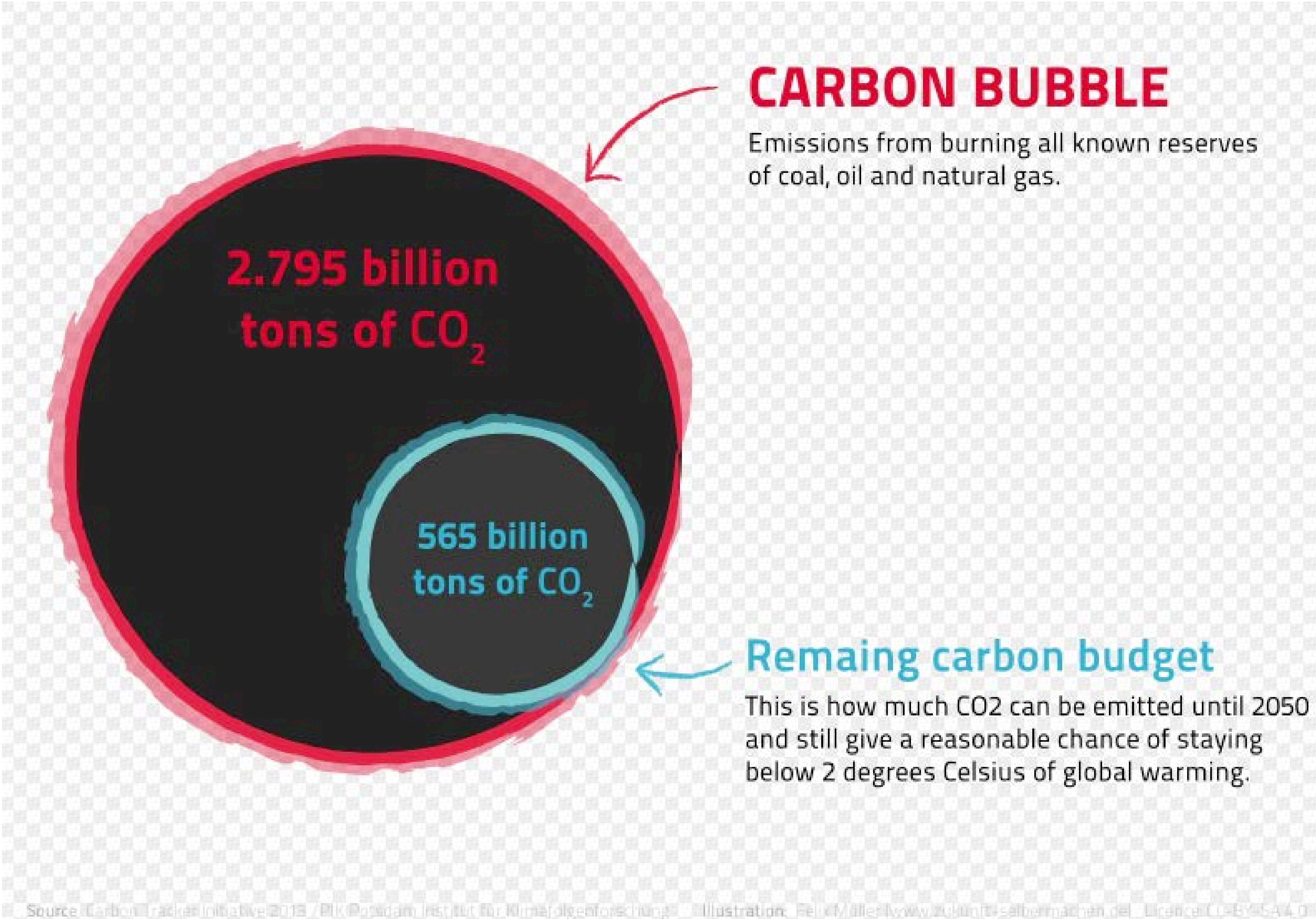


Source: UNFCCC, CDIAC, EIA, USGS, CEIC and RHG estimates


CO_2 emissions (tCO_2/person/yr)
0
5
10
15
20
1960
1970
1980
1990
2000
2010
2020
USA 15.6t/p
China 8.9t/p
EU28 6.4t/p
World 5.7t/p
India 2.5t/p



Exxon – The Outlook for Energy: A View to 2040



CARBON BUBBLE
Emissions from burning all known reserves of coal, oil and natural gas.
2.795 billion tons of CO2
565 billion tons of CO2
Remaing carbon budget
This is how much CO2 can be emitted until 2050 and still give a reasonable chance of staying below 2 degrees Celsius of global warming.
Source: Carbon Tracker Initiative 2013 / PIK Potsdam Institut für Klimafolgenforschung
Illustration: Felix Müller | www.zukunft-selbermachen.de | Licence CC-BY-SA 4.0

Fossil Fuels “externalities”

- Fossil fuel use causes many other environmental problems
  - Air pollution, smog, acid rain,
  - oil spills, pipeline breaks, oil trains
  - Ocean acidification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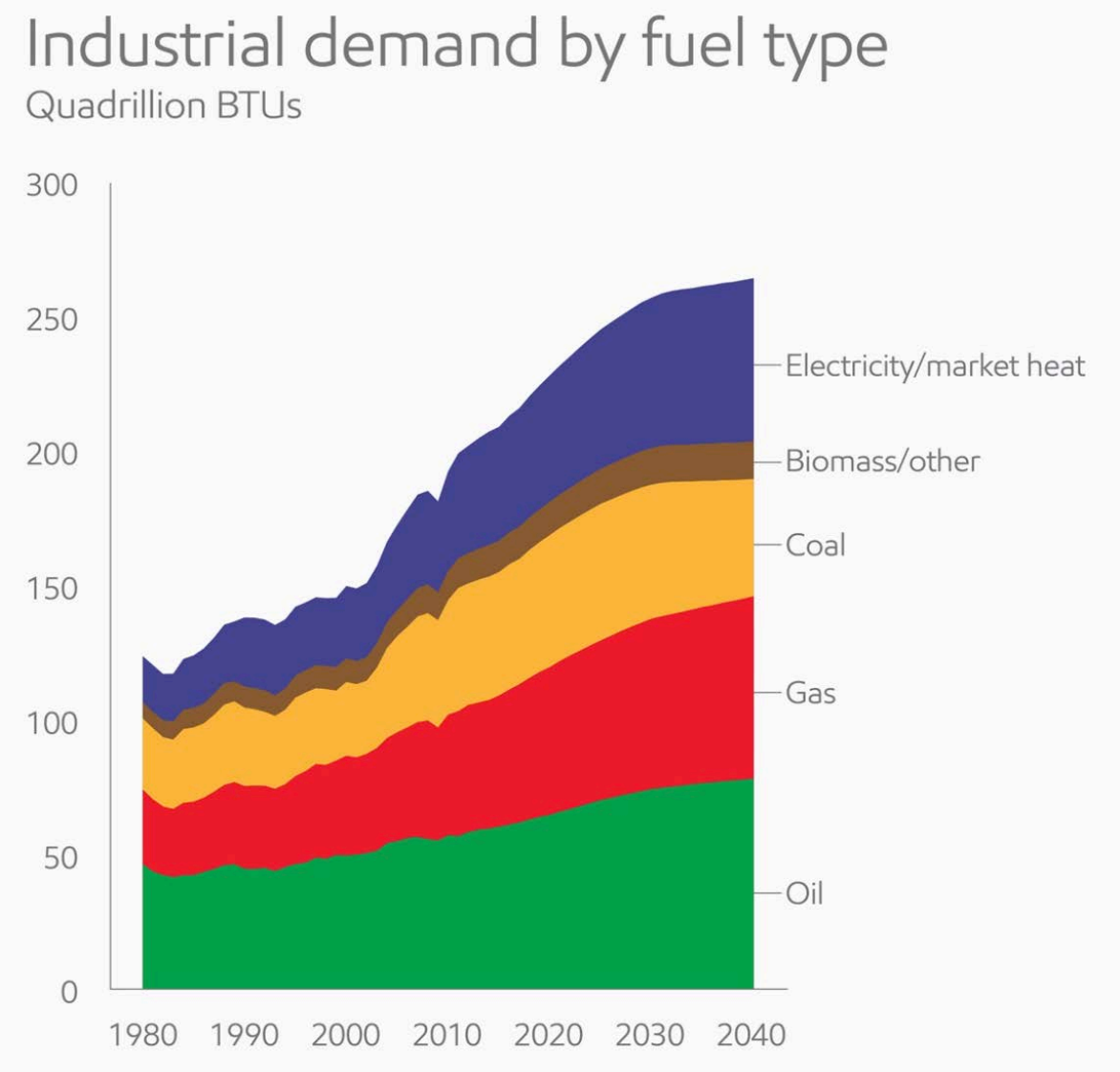
Global Energy Demand

- The hill we have to climb
- “Energy Poverty”
- What is Brilliant Light Power’s true value in a carbon constrained world?



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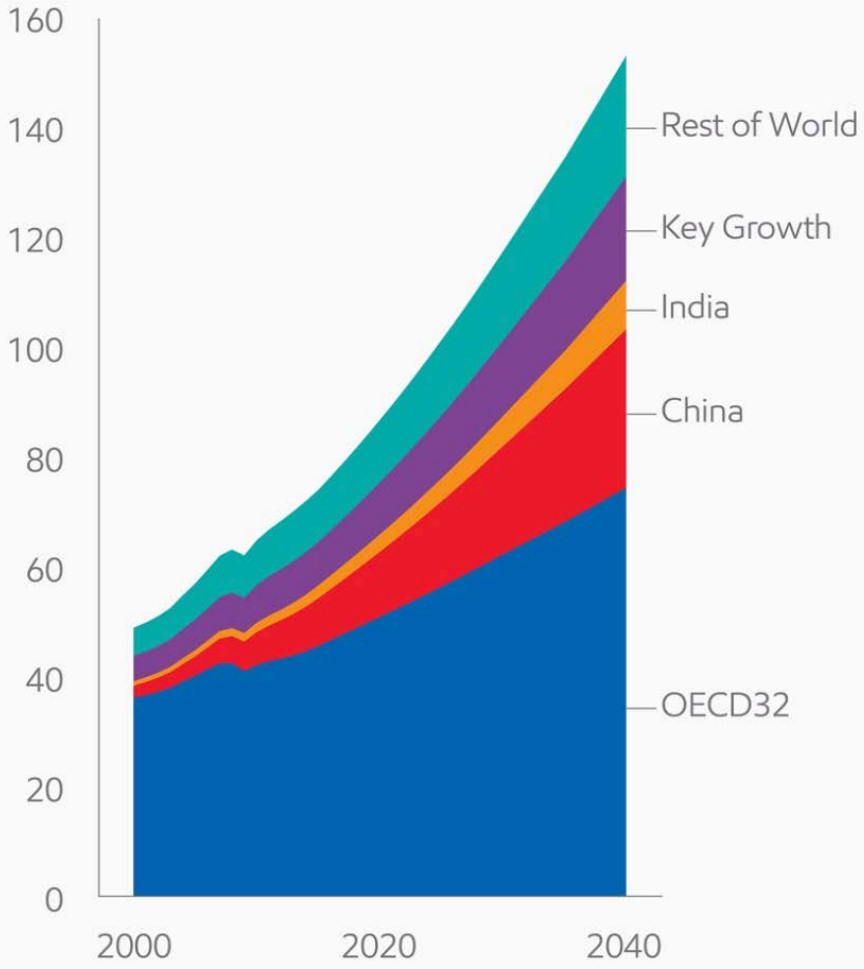

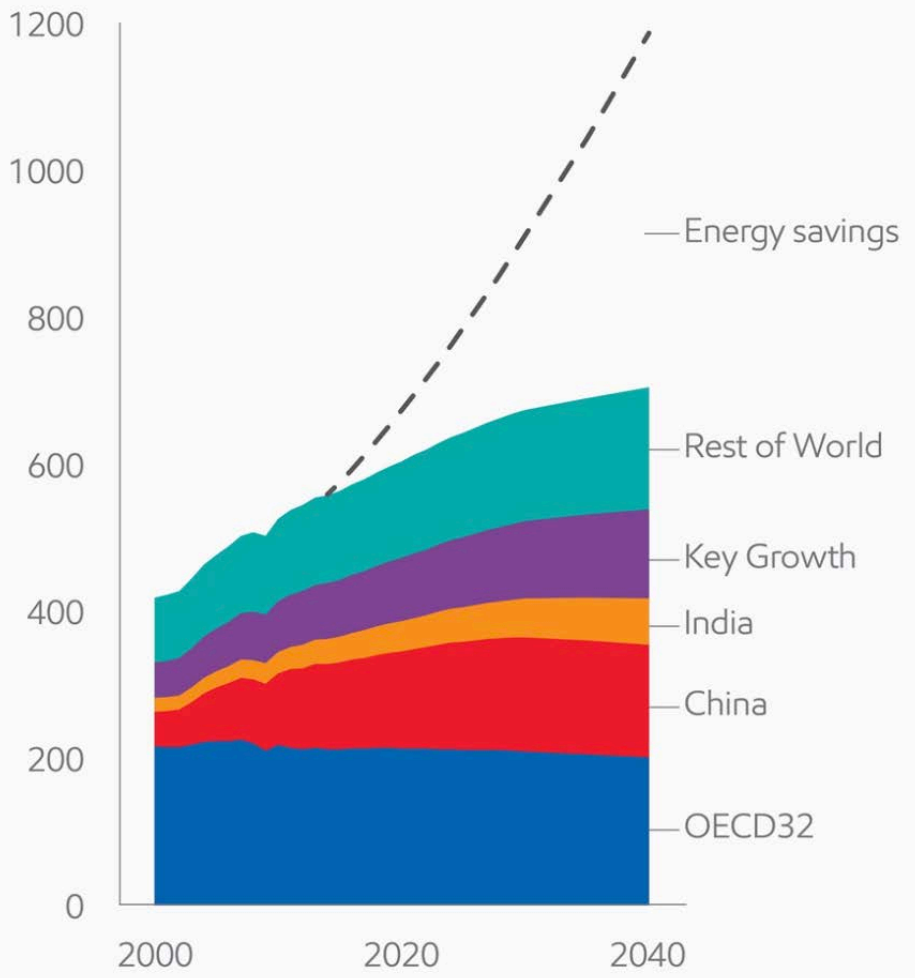

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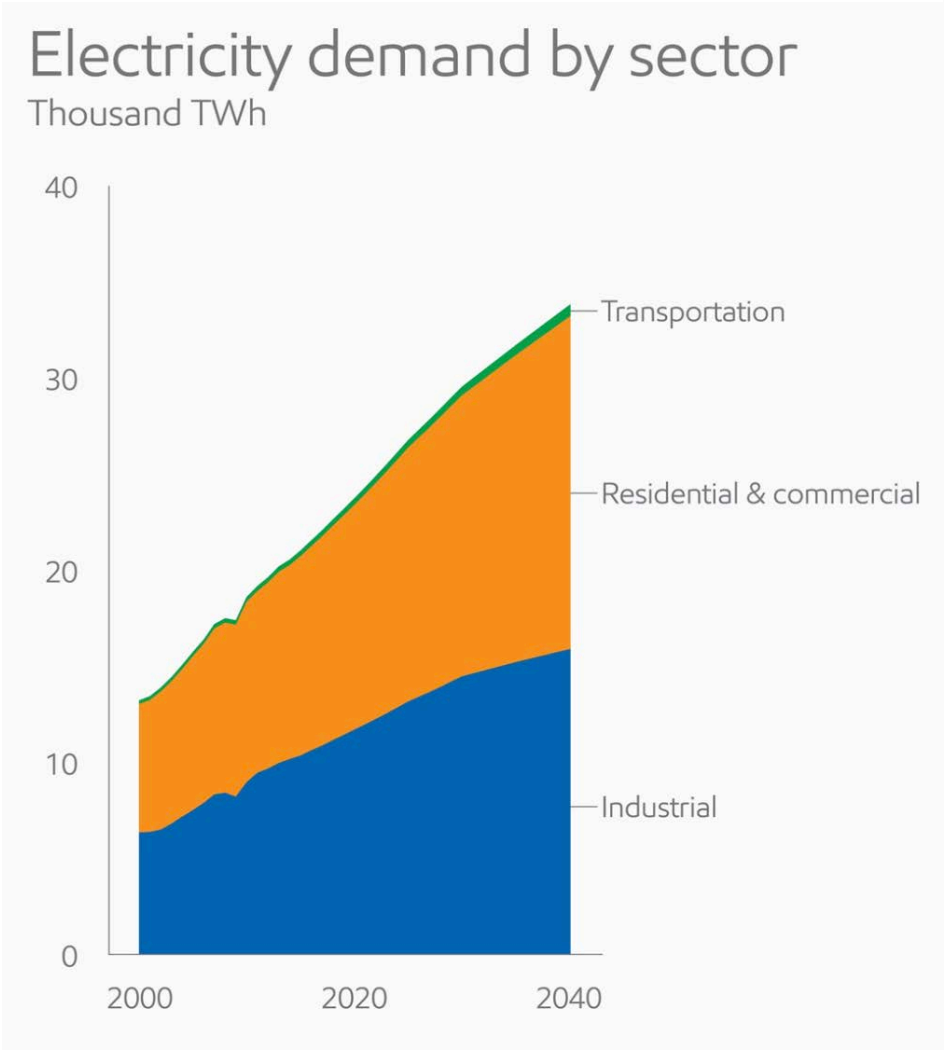
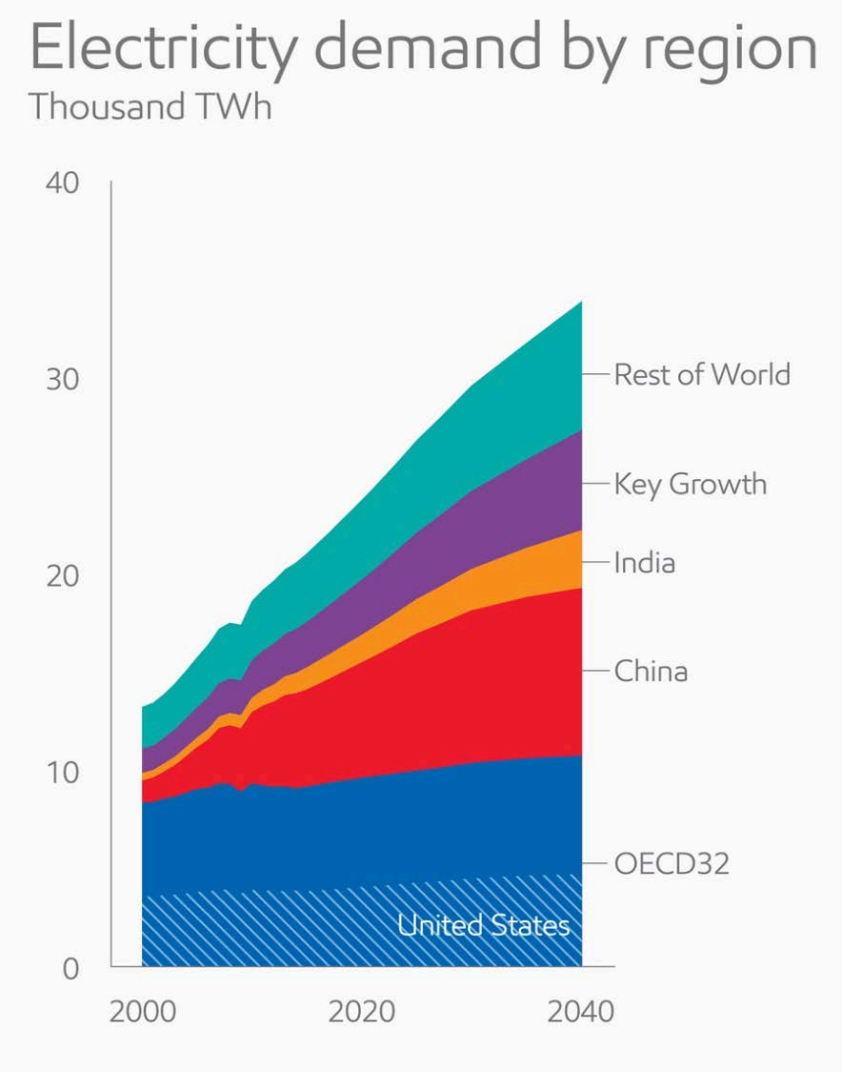


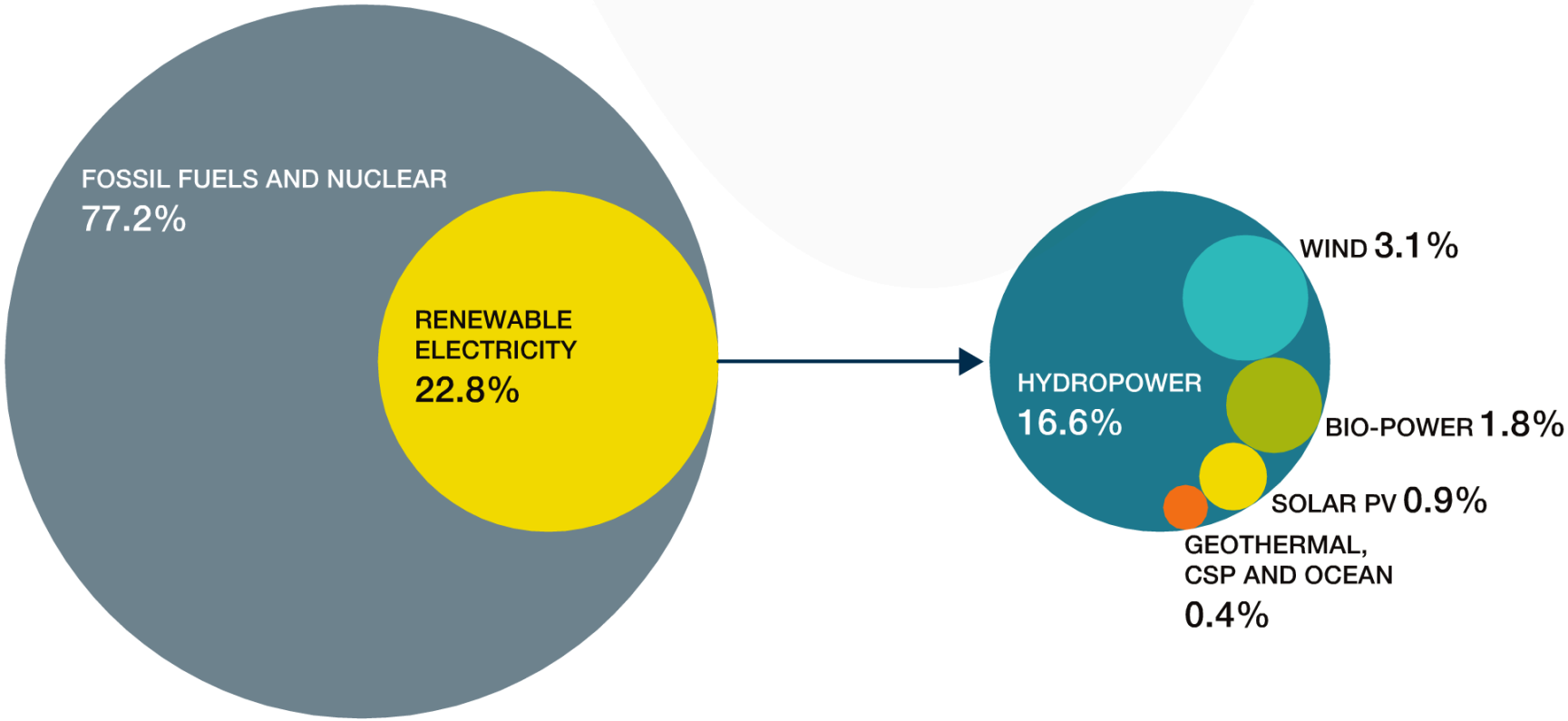


Exxon – The Outlook for Energy: A View to 2040

Climate Solutions

- Massive de-carbonization of the economy urgently needed
- Nuclear – too expensive
- “Clean coal” mythology
- Natural gas – better than coal, but not clean
- Solar & Wind – growing faster than expected but not fast enough
- Batteries
- Efficiency and Conservation

FIGURE 8.7 | ESTIMATED RENEWABLE ENERGY SHARE OF GLOBAL ELECTRICITY PRODUCTION, END-2014

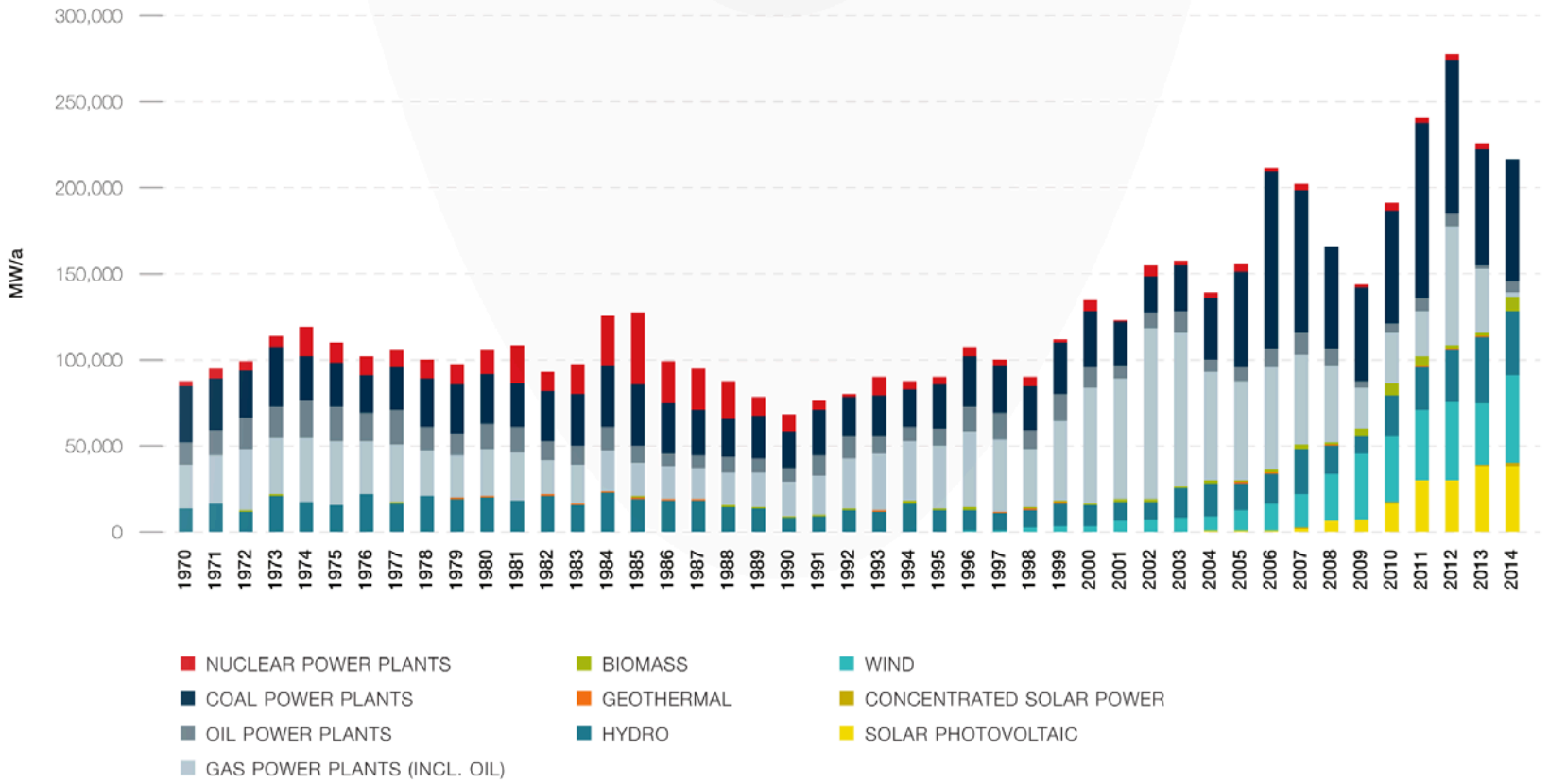


source REN21.

The Energy Revolution

- Business as Usual path of energy use unacceptable
- Renewable energy
- Energy efficiency
- Conservation
- Smart policies
- http://www.greenpeace.org/international/en/campaigns/climate-change/energyrevolution/#tab=4

FIGURE 8.1 | GLOBAL ANNUAL POWER PLANT MARKET 1970 - 2014



source Platts, REN21, EWEA, GWEC, EPIA, National Statistics, IEA, Breyer.
data compilation Dr. Sven Teske/Greenpeace.

Greenpeace- Energy Revolution 2015

Batteries

EVs