What do Policy Makers Want to Know, and How do we Communicate It?

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What do Policy Makers Want to Know?

- **How do we motivate action on climate change?**
  - **What impacts of climate change are happening right now?**
  - **What are the costs of inaction?**
  - **What will the world / U.S. / my State look like if we don't address climate change?**

- **What are the benefits of taking action on climate change?**
  - **What are the benefits of the small GHG reductions we achieve today?**
  - **What are the benefits of coordinated global action?**
  - **What happens if we do something in between?**




2013 State of the Union Address

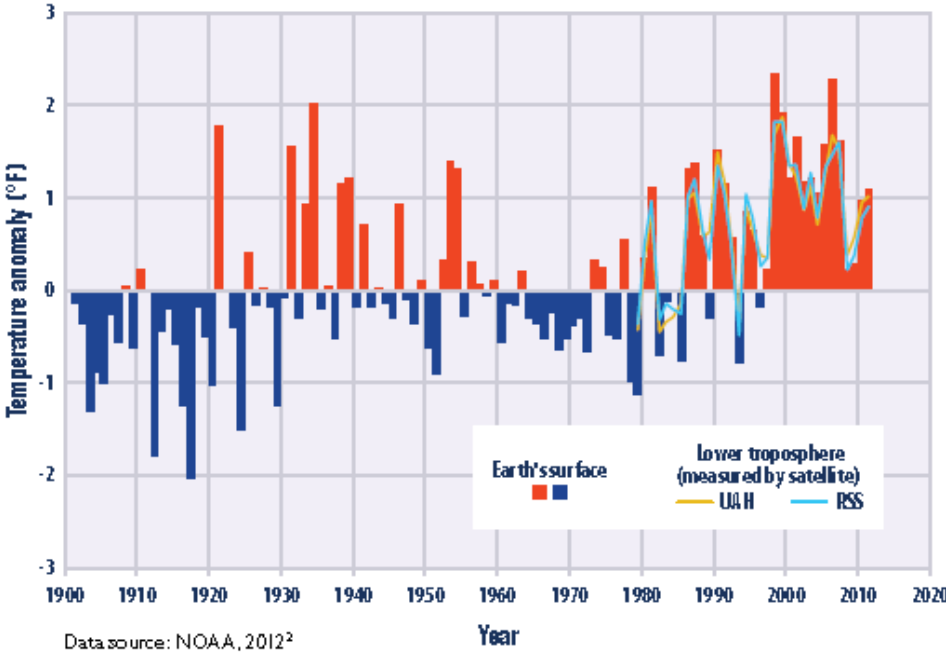
- But for the sake of our children and our future, we must do more to combat climate change. (Applause.) Now, it's true that no single event makes a trend. But the fact is the 12 hottest years on record have all come in the last 15. Heat waves, droughts, wildfires, floods -- all are now more frequent and more intense. We can choose to believe that Superstorm Sandy, and the most severe drought in decades, and the worst wildfires some states have ever seen were all just a freak coincidence. Or we can choose to believe in the overwhelming judgment of science -- and act before it's too late. (Applause.)

Climate Change Indicators in the United States, 2012, presents 26 indicators to help readers better understand observed trends related to the causes and effects of climate change. This document updates a report published by EPA in 2010.

Indicators Report
Example Figures

Figure 1. Temperatures in the Contiguous 48 States, 1901–2011

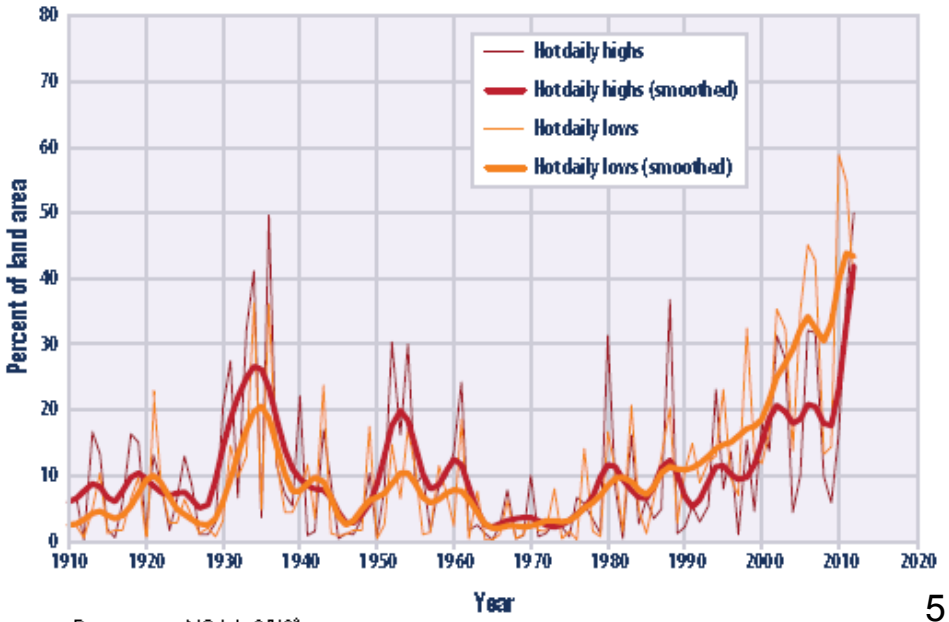
This figure shows how annual average temperatures in the contiguous 48 states have changed since 1901. Surface data come from land-based weather stations. Satellite measurements cover the lower troposphere, which is the lowest level of the Earth's atmosphere (see diagram on p. 23). "UAH" and "RSS" represent two different methods of analyzing the original satellite measurements. This graph uses the 1901 to 2000 average as a baseline for depicting change. Choosing a different baseline period would not change the shape of the data over time.



Data source: NOAA, 2012[2]

Figure 2. Area of the Contiguous 48 States With Unusually Hot Summer Temperatures, 1910–2012

This graph shows the percentage of the land area of the contiguous 48 states with unusually hot daily high and low temperatures during the months of June, July, and August. The thin lines represent individual years, while the thick lines show a nine-year weighted average. Red lines represent daily highs, while orange lines represent daily lows. The term "unusual" is based on the long-term average conditions at each location.

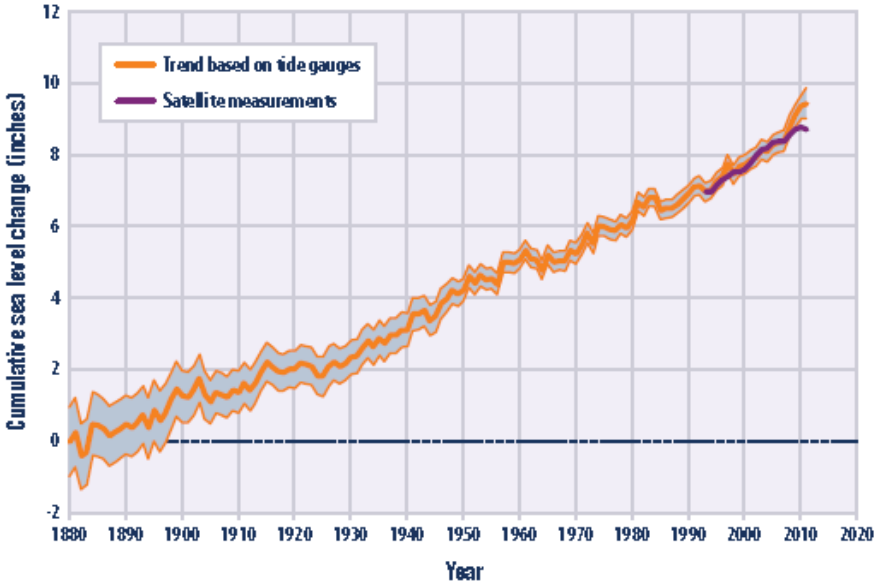


Data source: NOAA, 2012[3]

Indicators Report
Example Figures

Figure 1. Global Average Absolute Sea Level Change, 1880–2011

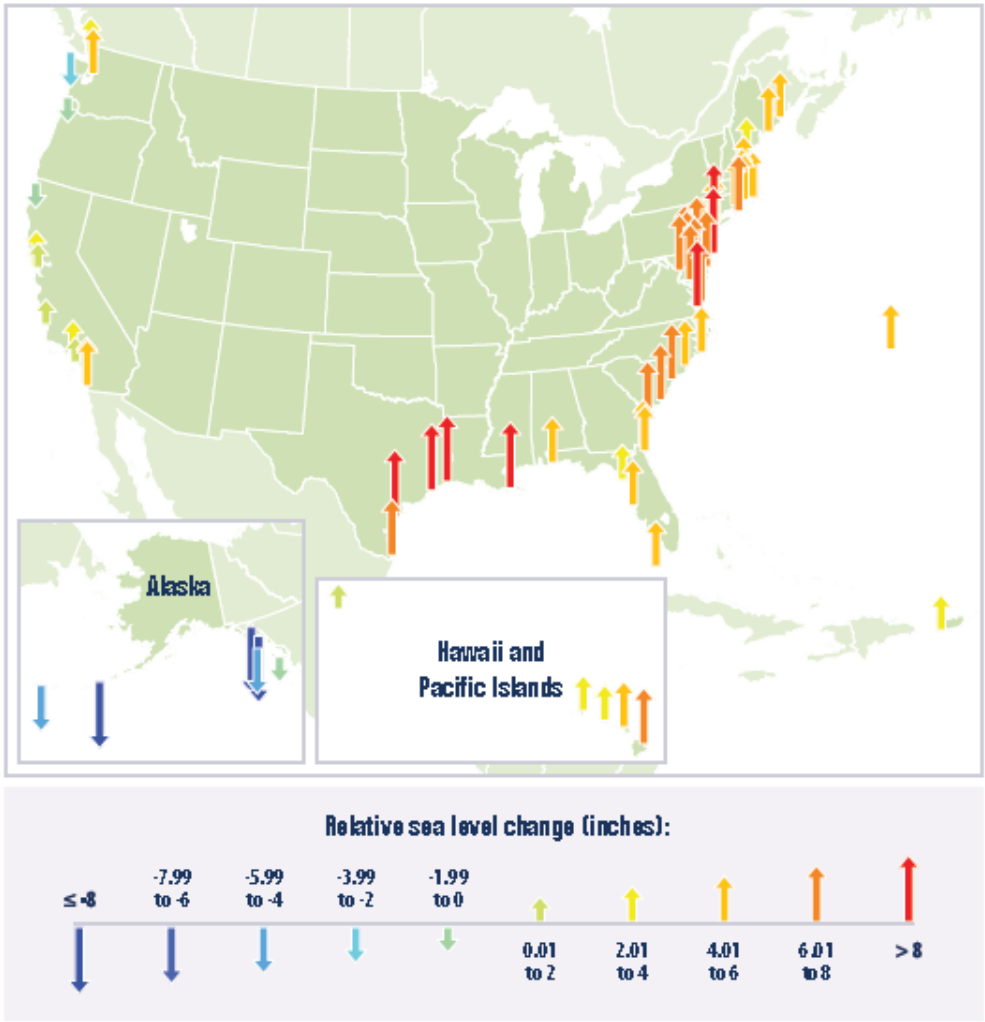
This graph shows cumulative changes in sea level for the world's oceans since 1880, based on a combination of long-term tide gauge measurements and recent satellite measurements. This figure shows average absolute sea level change, which refers to the height of the ocean surface, regardless of whether nearby land is rising or falling. Satellite data are based solely on measured sea level, while the long-term tide gauge data include a small correction factor because the size and shape of the oceans are changing slowly over time. (On average, the ocean floor has been gradually sinking since the last Ice Age peak, 20,000 years ago.) The shaded band shows the likely range of values, based on the number of measurements collected and the precision of the methods used.



Data sources: CSIRO, 2012;[12] NOAA, 2012[13]

Figure 2. Relative Sea Level Change Along U.S. Coasts, 1960–2011

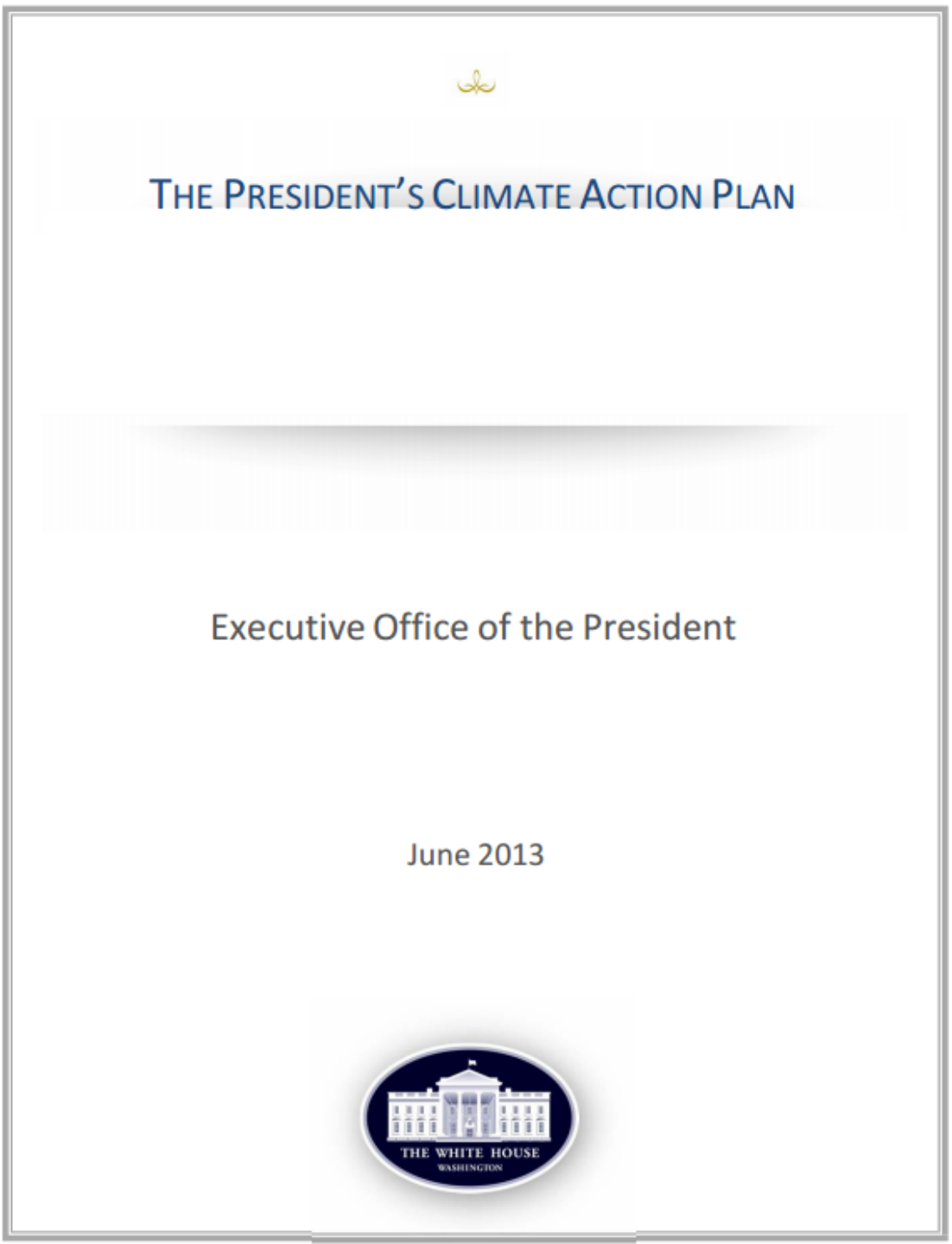
This map shows cumulative changes in relative sea level from 1960 to 2011 at tide gauge stations along U.S. coasts. Relative sea level reflects changes in sea level as well as land elevation.



Data source: NOAA, 2012[14]

2013 State of the Union Address

- Now, the good news is we can make meaningful progress on this issue while driving strong economic growth. I urge this Congress to get together, pursue a bipartisan, market-based solution to climate change, like the one John McCain and Joe Lieberman worked on together a few years ago. But if Congress won't act soon to protect future generations, I will. (Applause.) I will direct my Cabinet to come up with executive actions we can take, now and in the future, to reduce pollution, prepare our communities for the consequences of climate change, and speed the transition to more sustainable sources of energy.



In my State of the Union address, I urged Congress to come up with a bipartisan, market-based solution to climate change, like the one that Republican and Democratic senators worked on together a few years ago. And I still want to see that happen. I'm willing to work with anyone to make that happen.

But this is a challenge that does not pause for partisan gridlock. It demands our attention now. And this is my plan to meet it -- a plan to cut carbon pollution; a plan to protect our country from the impacts of climate change; and a plan to lead the world in a coordinated assault on a changing climate.

- President Obama
June 25, 2013

DUE TO CLIMATE CHANGE,

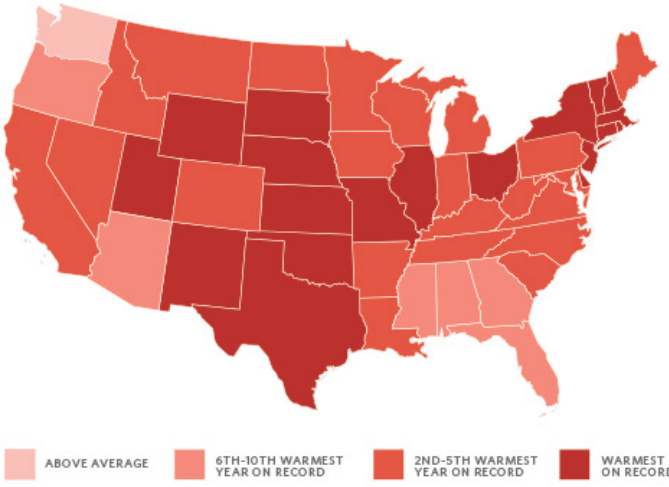
THE WEATHER IS GETTING MORE EXTREME

2012 WAS THE SECOND MOST EXTREME YEAR ON RECORD FOR THE NATION

SOURCE: NOAA, U.S. CLIMATE EXTREMES INDEX

RECORD HEAT ACROSS THE U.S.

STATE-BY-STATE TEMPERATURES IN 2012



SOURCE: NATIONAL CLIMATIC DATA CENTER/NESDIS/NOAAV

Doesn't include Alaska, Hawaii or U.S. territories.

ALSO IN 2012:

WARMEST YEAR ON RECORD FOR THE U.S.

Doesn't include Alaska, Hawaii, or U.S. territories.

SOURCE: NOAA

356 **RECORD HIGH TEMPERATURES TIED OR BROKEN**

IN THE UNITED STATES.

SOURCE: NOAA, STATE OF THE CLIMATE REPORT

APPROXIMATELY

ONE-THIRD OF THE U.S. POPULATION EXPERIENCED 100° TEMPERATURES

FOR TEN OR MORE DAYS.

SOURCE: NOAA

DROUGHTS, WILDFIRES, AND FLOODS ARE ALL MORE FREQUENT AND INTENSE

PRECIPITATION WAS 2.57 INCHES BELOW THE 20TH CENTURY AVERAGE.

SOURCE: NOAA

15TH DRIEST YEAR ON RECORD

SOURCE: NOAA

WILDFIRES BURNED MORE THAN 9.3 MILLION U.S. ACRES

SOURCE: NATIONAL INTERAGENCY COORDINATION CENTER

EXTREME WEATHER COMES AT A COST

CLIMATE AND WEATHER DISASTERS IN 2012 COST THE AMERICAN ECONOMY MORE THAN $100 BILLION

$30 BILLION
U.S. DROUGHT/HEATWAVE
ESTIMATED ACROSS THE U.S.

$1 BILLION
WESTERN WILDFIRES
ESTIMATED

$65 BILLION
SUPERSTORM SANDY
ESTIMATED

$2.3 BILLION
HURRICANE ISAAC
ESTIMATED

$11.1 BILLION
COMBINED SEVERE WEATHER
ESTIMATED FOR INCIDENTS ACROSS THE U.S.

THERE ARE ALSO PUBLIC HEALTH THREATS ASSOCIATED WITH EXTREME WEATHER

Children, the elderly, and the poor are most vulnerable to a range of climate-related health effects, including those related to heat stress, air pollution, extreme weather events, and diseases carried by food, water, and insects.

WE CAN CHOOSE TO BELIEVE THAT SUPERSTORM SANDY, AND THE MOST SEVERE DROUGHT IN DECADES, AND THE WORST WILDFIRES SOME STATES HAVE EVER SEEN WERE ALL JUST A FREAK COINCIDENCE. OR WE CAN CHOOSE TO BELIEVE IN THE OVERWHELMING JUDGMENT OF SCIENCE — AND ACT BEFORE IT'S TOO LATE." - PRESIDENT OBAMA

WE'RE STILL CONTRIBUTING TO THE PROBLEM

CARBON POLLUTION IS THE BIGGEST DRIVER OF CLIMATE CHANGE

U.S. GREENHOUSE GAS POLLUTION INCLUDES:

CARBON DIOXIDE (CO2) — 84%

Enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g., manufacture of cement).

FLUORINATED GASES — 2%

Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes.

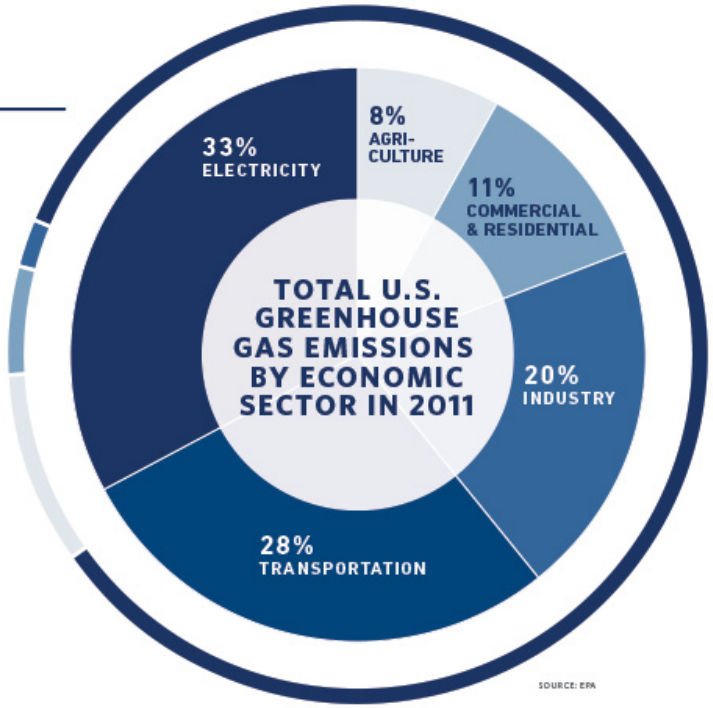
NITROUS OXIDE (N2O) — 5%

Emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

METHANE (CH4) — 9%

Emitted during the production and transport of coal, natural gas, and oil as well as from landfills.

SOURCE: EPA



WE'VE MADE PROGRESS THANKS TO:

STRONGER FUEL ECONOMY STANDARDS

We set the highest fuel economy standards in American history that will double the efficiency of our cars and trucks by 2025.

DOUBLED RENEWABLE ENERGY

We doubled renewable energy generation from from wind and solar resources.

DECREASED CARBON POLLUTION

In 2012, U.S. Energy Sector carbon pollution fell to the lowest level in nearly 20 years.

BUT WE HAVE MORE WORK TO DO.

THE PRESIDENT'S PLAN TO CUT CARBON POLLUTION IN AMERICA

REDUCING CARBON POLLUTION FROM POWER PLANTS

Power plants are the largest major source of emissions in the U.S., together accounting for roughly 40 percent of all domestic greenhouse gas pollution.

PROGRESS:
Renewable energy accounts for about half of all new generation capacity installed in 2012.

PROGRESS:
35 states have renewable energy targets in place, and more than 25 have set energy efficiency targets.

CONTINUING THE MOMENTUM FOR THE FUTURE:

There are currently no federal standards in place to reduce carbon pollution from power plants.

2013–2016

President Obama is directing the EPA to work closely with states, industry and other stakeholders to establish carbon pollution standards for both new and existing power plants.

ACCELERATING CLEAN ENERGY LEADERSHIP

During the President's first term, the United States more than doubled generation of electricity from wind and solar energy.

PROGRESS:
Since 2009, the Administration has approved 25 utility-scale solar facilities on public lands, which will provide enough electricity to power 4.4 million homes and support an estimated 17,000 jobs.

PROGRESS:
In 2012, the President set a goal to issue permits for 10 gigawatts of renewables on public lands by the end of the year, and the Department of Interior achieved this goal ahead of schedule.

CONTINUING THE MOMENTUM FOR THE FUTURE:

To ensure America's continued leadership position in clean energy, President Obama has set new goals...

2014

President Obama's Fiscal Year 2014 Budget commits to increasing funding for clean energy technology across all agencies by 30 percent. This includes investment in a range of energy technologies, from advanced biofuels and emerging nuclear technologies to clean coal.

2020

To ensure America's continued leadership position in clean energy, President Obama has set a goal to double wind and solar electricity generation **once again** by 2020.

2020

President Obama has also directed the Department of Interior to permit enough renewable electricity generation to power more than 6 million homes. Federal agencies are setting a new goal of reaching 100MW of installed renewable capacity across federally-subsidized housing stock by 2020.

2025

The Department of Defense — the single largest consumer of energy in the United States — is committed to deploying three gigawatts of renewable energy on military installations by 2025.

BUILDING A 21ST CENTURY TRANSPORTATION SECTOR

Heavy-duty vehicles (commercial trucks, vans, and buses) are currently the second largest source of greenhouse gas pollution within the transportation sector.

PROGRESS:
In 2011, the Administration finalized fuel economy standards for Model Year 2014-2018 for heavy-duty trucks, buses, and vans. This will reduce green-house gas emissions by about 270 million metric tons and save 530 million barrels of oil.

PROGRESS:
The Administration has already established the toughest fuel economy standards for passenger vehicles in U.S. history. These standards require an average performance equivalent of 54.5 miles per gallon by 2025.

CONTINUING THE MOMENTUM FOR THE FUTURE:

During the President's second term, the Administration will once again partner with industry leaders and other key stakeholders.

POST-2018

In partnership with industry leaders and other key stakeholders, the Administration will develop post-2018 fuel economy standards for heavy-duty vehicles to further reduce fuel consumption through the application of advanced cost-effective technologies.

The Administration will also support the Renewable Fuels Standard and invest in research and development to help bring next-generation biofuels on line.

CUTTING ENERGY WASTE IN HOMES, BUSINESSES, AND FACTORIES

Energy efficiency is one of the clearest and most cost-effective opportunities to save families money, make our businesses more competitive, and reduce greenhouse gas pollution.

PROGRESS:
In President Obama's first term, DOE and HUD completed efficiency upgrades in more than one million homes, saving many families more than $400 on their heating and cooling bills in the first year alone.

PROGRESS:
In 2011, President Obama announced the Better Buildings Initiative to help commercial and industrial buildings become at least 20 percent more energy efficient by 2020. So far, more than 120 organizations are on track.

CONTINUING THE MOMENTUM FOR THE FUTURE:

The Administration will take a range of new steps geared towards achieving President Obama's goal of doubling energy productivity by 2030, relative to 2010 levels.

AS SOON AS FALL 2013:

The Department of Agriculture's (USDA) Rural Utilities Service (RUS) will update its Energy Efficiency and Conservation Loan Program to provide up to $250 million for rural utilities to finance efficiency investments.

2020

To continue the success of the Better Buildings Challenge, the Administration will expand the Challenge to multifamily housing to cut energy waste.

In addition, the Administration is launching the Better Buildings Accelerators, to support and encourage adoption of state and local policies to cut energy waste.

2030

The Administration will build on this momentum by establishing new standards that — when combined with the progress already underway from the first term — will reduce carbon pollution by at least 3 billion metric tons by 2030, equivalent to more than a year's carbon pollution from our entire electricity system.

REDUCING OTHER GREENHOUSE GAS EMISSIONS

Emissions of hydrofluorocarbons (HFCs) — which are potent greenhouse gases — are expected to double by 2020 and nearly triple by 2030 in the U.S.

PROGRESS:
Since 1990, methane emissions have decreased by eight percent in part through partnerships with industry. We have demonstrated that we have the technology to deliver emissions reductions that benefit our economy and environment.

PROGRESS:
The Administration has included an incentive in the fuel economy and carbon pollution standards for cars and trucks to encourage automakers to reduce HFC leakage and transition away from the most potent HFCs in vehicle A.C. systems.

CONTINUING THE MOMENTUM FOR THE FUTURE:

The United States must lead through international diplomacy and domestic actions to reduce emissions and transition to safer and more sustainable options.

2020

The Environmental Protection Agency and the Departments of Agriculture, Energy, Interior, Labor, and Transportation will develop and implement a comprehensive, interagency methane strategy.

The EPA will also use its authority under the Clean Air Act to encourage private sector investment in low-emissions technology by identifying and approving climate-friendly chemicals while prohibiting certain uses of more harmful HFCs.

MOVING FORWARD

When it comes to the oil and gas sector, investments to build and upgrade gas pipelines will not only put more Americans to work, but also reduce emissions and enhance economic productivity.

The Obama Administration will work collaboratively with state governments, as well as the private sector, to reduce emissions across multiple sectors, improve air quality, and achieve public health and economic benefits.

FEDERAL LEADERSHIP

Since 2008, federal agencies have reduced greenhouse gas pollution by more than 15 percent — the equivalent of permanently taking 1.5 million cars off the road.

PROGRESS:
In December 2011, President Obama signed a memorandum challenging Federal agencies to enter into $2 billion worth of performance contracts for building energy efficiency within two-years; they have committed to about $2.2B billion so far.

PROGRESS:
The federal government has been pursuinggreater energy efficiency that reduces greenhouse gas emissions and saves taxpayer dollars.

CONTINUING THE MOMENTUM FOR THE FUTURE:

President Obama believes that the federal government must be a leader in clean energy and energy efficiency.

2020

The federal government will consume 20 percent of its electricity from renewable sources by 2020 — more than double the current goal of 7.5 percent.

EVEN AS WE TAKE NEW STEPS TO REDUCE U.S. GREENHOUSE GAS EMISSIONS, WE MUST ALSO PREPARE FOR THE IMPACTS OF A CHANGING CLIMATE THAT ARE ALREADY BEING FELT ACROSS THE COUNTRY.

THE PRESIDENT'S PLAN WILL

PREPARE THE U.S. FOR THE IMPACTS OF CLIMATE CHANGE

WE'VE MADE GREAT PROGRESS

The Administration and partners developed national strategies to help decision makers address the impacts of climate change on freshwater resources — fish, wildlife, and plants — and oceans.

PROGRESS:
In 2013, federal agencies released Climate Change Adaptation plans for the first time, outlining strategies to protect their operations, missions, and programs from the effects of climate change.

PROGRESS:
The US Global Change Research Program, NOAA, USACE, and FEMA developed and released interactive sea-level rise maps and a calculator to aid rebuilding efforts in NY and NJ after Superstorm Sandy.

THERE'S MORE WORK TO DO

Moving forward, the Obama Administration will help states, cities, and towns build stronger communities and infrastructure, protect critical sectors of our economy as well as our natural resources, and use sound science to better understand and manage climate impacts.

SUPPORT CLIMATE-RESILIENT INVESTMENTS

at the community level by removing policy barriers, modernizing programs, and establishing a short-term task force of state, local, and tribal officials to advise on key actions the federal government can take to support local and state efforts to prepare for climate change.

REBUILD AND LEARN FROM SUPERSTORM SANDY

by piloting innovative strategies in the Superstorm Sandy-affected region to strengthen communities against future extreme weather and other climate impacts and building on a new, consistent flood risk reduction standard established for the Sandy-affected region, agencies will update their flood-risk reduction standards for all federally-funded projects.

LAUNCH AN EFFORT TO CREATE SUSTAINABLE AND RESILIENT HOSPITALS

in the face of climate change through a public-private partnership with the healthcare industry.

MAINTAIN AGRICULTURAL PRODUCTIVITY

by delivering tailored, science-based knowledge to farmers, ranchers, and forest landowners to help them understand and prepare for the impacts of climate change.

PROVIDE TOOLS FOR CLIMATE RESILIENCE

including existing and newly developed climate preparedness tools and information that state, local, and private-sector leaders need to make smart decisions.

BECAUSE CLIMATE CHANGE SPANS INTERNATIONAL BORDERS, THE PRESIDENT'S PLAN WILL ALSO

LEAD INTERNATIONAL EFFORTS TO ADDRESS GLOBAL CLIMATE CHANGE

America will continue to take on a leadership role in engaging the world's major economies to advance key climate priorities and in galvanizing global action through international climate negotiations. The plan will:

WORK WITH OTHER COUNTRIES TO TAKE ACTION TO ADDRESS CLIMATE CHANGE

- ENHANCE MULTILATERAL ENGAGEMENT WITH MAJOR ECONOMIES
- COMBAT SHORT-LIVED CLIMATE POLLUTANTS
- EXPAND CLEAN ENERGY USE AND CUT ENERGY WASTE
- PHASE OUT SUBSIDIES THAT ENCOURAGE WASTEFUL CONSUMPTION OF FOSSIL FUELS
- STRENGTHEN GLOBAL RESILIENCE TO CLIMATE CHANGE
- EXPAND BILATERAL COOPERATION WITH MAJOR EMERGING ECONOMIES
- REDUCE EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION
- NEGOTIATE GLOBAL FREE TRADE IN ENVIRONMENTAL GOODS AND SERVICES
- LEAD GLOBAL PUBLIC SECTOR FINANCING TOWARD CLEANER ENERGY
- MOBILIZE CLIMATE FINANCE

LEAD EFFORTS TO ADDRESS CLIMATE CHANGE THROUGH INTERNATIONAL NEGOTIATIONS

The United States has made historic progress in the international climate negotiations during the past four years.

PROGRESS:
In 2009, the U.S. and China launched the $150 Million Clean Energy Research Center for joint research and development of clean energy technology funded equally by the U.S. and China.

PROGRESS:
Negotiations at the Copenhagen Accord helped to move the world toward a more sustainable emissions trajectory through 2020 by limiting greenhouse pollution.

MOVING FORWARD

The U.S. has committed to expand major new and existing international initiatives, including bilateral initiatives with China, India, and other major emitting countries.

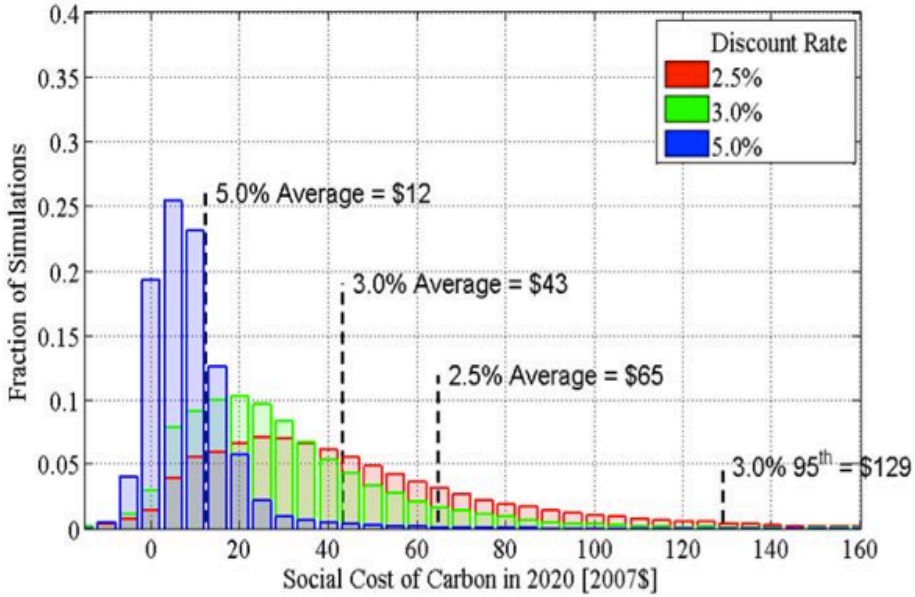
We will lead global public sector financing toward cleaner energy by ending U.S. government financial support for new coal-fired powers plants overseas, with limited exceptions.

Social Cost of Carbon

Federal agencies use the social cost of carbon (SCC) to estimate the climate benefits of rulemakings. The SCC is an estimate of the economic damages associated with a small increase in carbon dioxide (CO_2) emissions, conventionally one metric ton, in a given year. This dollar figure also represents the value of damages avoided for a small emission reduction (i.e. the benefit of a CO_2 reduction).

Social Cost of Carbon
2013 Update

Interagency SCC Estimates [2011$/tonne CO_2]				
	Discount Rate			
Year	5.0% Avg.	3.0% Avg.	2.5% Avg.	3.0% 95th
2015	$12	$40	$62	$117
2020	$13	$46	$69	$137
2025	$15	$51	$75	$154
2030	$17	$56	$81	$170
2035	$20	$61	$87	$187
2040	$23	$66	$93	$205
2045	$25	$71	$99	$220
2050	$28	$76	$105	$236



Interagency SCC Estimates 2020 Emissions, 2011$/tonne CO2				
	Discount Rate			
Source	5.0% Avg.	3.0% Avg.	2.5% Avg.	3.0% 95th
Original Interagency Estimates	$7	$28	$44	$86
Updated Interagency Estimates	$13	$46	$69	$137
% change	*81%*	*64%*	*55%*	*60%*

Federal Rules using SCC

Interagency SCC Estimates: 2010-2013 Rulemakings

Federal Register Date	Rule	Status
3/9/2010	DOE ECS for Small Electric Motors (75 FR 10874)	Final
4/16/2010	DOE ECS for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters	Final
5/1/2010	DOE Equipage Mandate for Air Traffic Control	Final
5/7/2010	EPA/DOT Light Duty Vehicle GHG Standards (2012-2016)	Final
9/9/2010	EPA Cement NESHAP/NSPS (CO2 disbenefits) (under reconsideration)	Final
3/14/2011	EPA (supp) NESHAP: Mercury Cell Chlor-Alkali Plants -Amendments	Proposal
3/21/2011	EPA Sewage Sludge Incinerators NSPS/Emissions Guidelines (CO2 disbenefits)	Final
3/21/2011	EPA Boiler MACT (CO2 disbenefits)	Final
4/21/2011	DOE ECS for Residential Clothes Dryers and Room Air Conditioners	Direct Final
6/27/2011	DOE ECS CAC-HP Furnace HVAC DFR	Direct Final
8/8/2011	EPA Cross-State Air Pollution Rule (CSAPR) (vacated by courts, in review)	Final
9/15/2011	EPA/DOT Medium-Heavy Duty Vehicles GHG Standards	Final
9/15/2011	DOE ECS for Residential Refrigerators and Freezers	Final
11/14/2011	DOE ECS for Fluorescent Lamp Ballasts	Final
1/12/2012	DOE ASHRAE Standard 90.1	Proposal
2/10/2012	DOE ECS for Distribution Transformers	Proposal
2/16/2012	EPA MATS Rule	Final
3/27/2012	DOE ECS for Battery Chargers and External Power Supplies	Proposal
4/13/2012	EPA GHG Standards for New Stationary Source EGUs	Proposal
5/30/2012	DOE ECS for Residential Dishwashers	Direct Final
5/31/2012	DOE ECS for Residential Clothes Washers	Direct Final
10/15/2012	EPA/DOT Light Duty Vehicle GHG Standards (2017-2025)	Final
4/18/2013	DOE ECS for Distribution Transformers	Final

Interagency Updated SCC Estimates: 2013 Rulemakings

6/17/2013	DOE ECS for Microwaves	Final

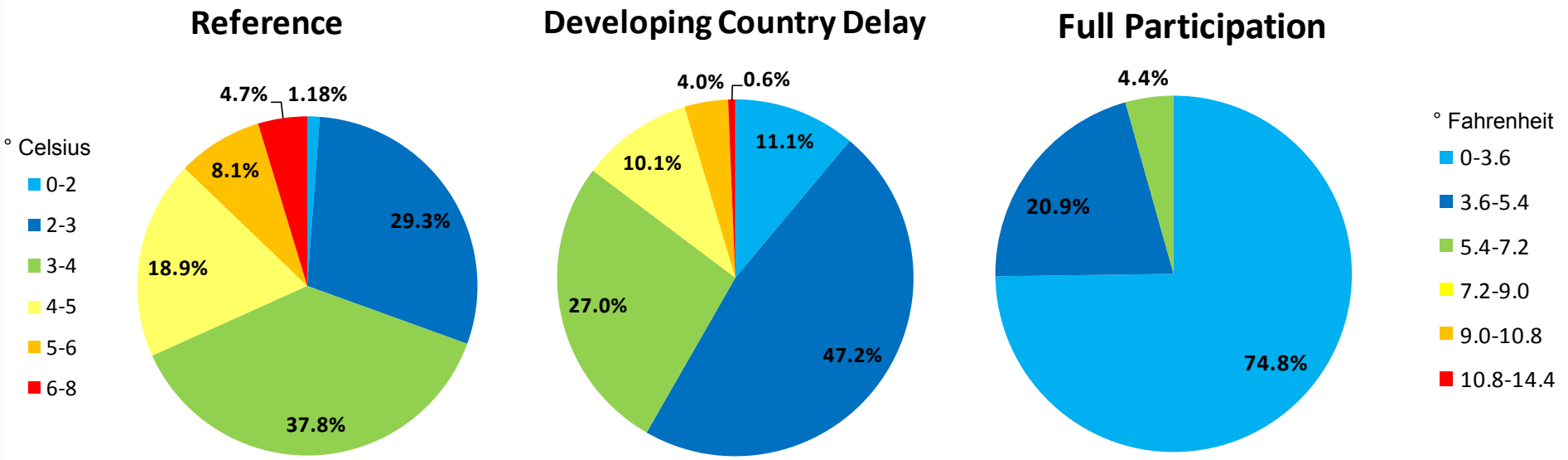
17

What are the Benefits of Global Action?

What will it achieve?

Probability of Observed Temperature Changes in 2100

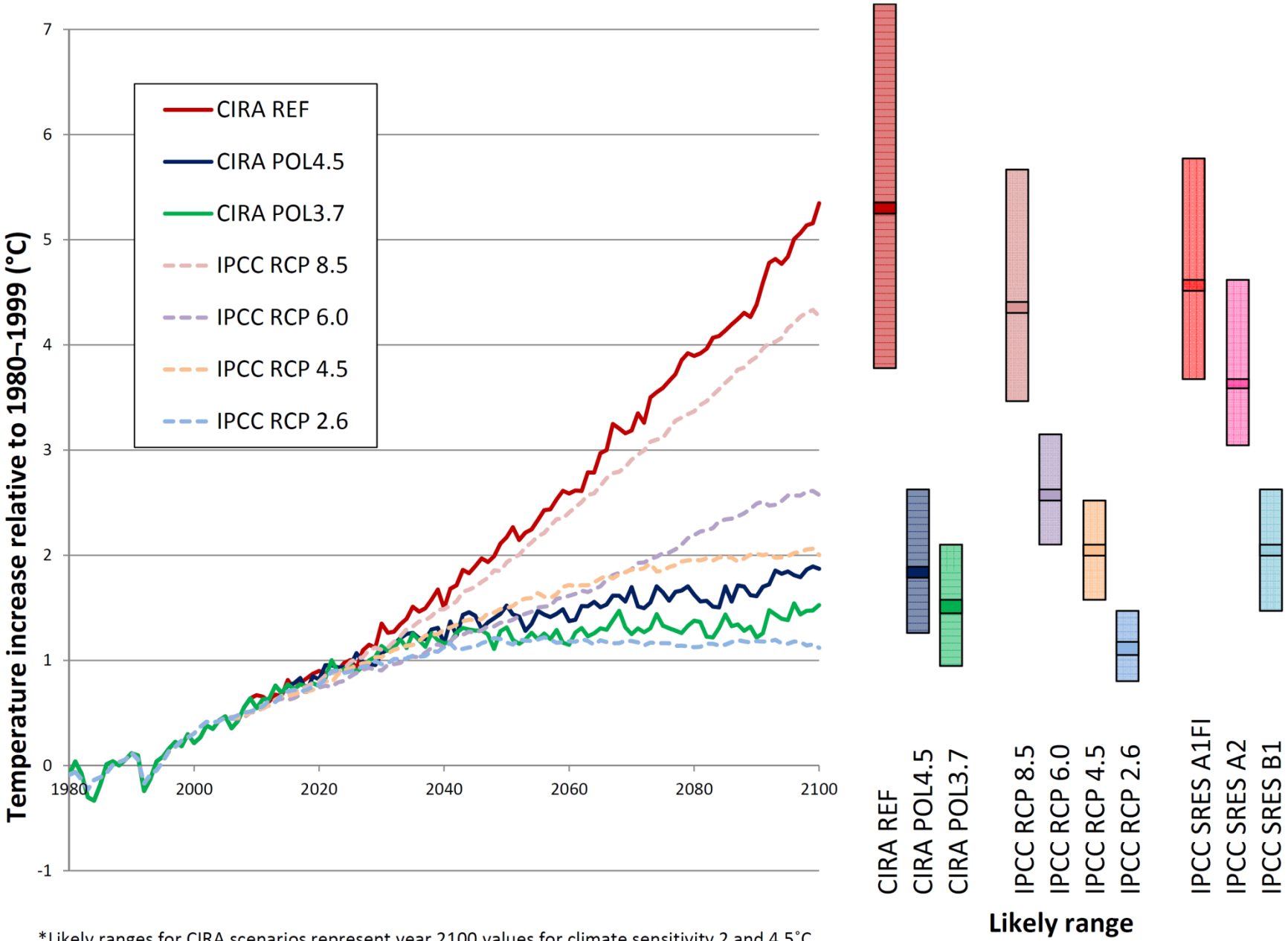
Reference, Delayed Participation, and Full Participation Scenarios



- The pie charts show the approximate probability of **observed** global mean temperature changes in 2100, relative to pre-industrial, falling within specific temperature ranges under reference, developing country action delayed until 2050, and G8 international action scenarios.
- Observed temperature change does not equal the change in equilibrium temperature because
  - **CO_2e concentrations rise after 2100**: Equilibrium temperature change is not achieved until after CO_2e concentrations are stabilized. In this analysis, CO_2e concentrations will continue to rise after 2100. Therefore, changes in equilibrium temperature will differ from the observed temperature changes.
  - **Ocean temperature inertia**: This inertia causes the equilibrium global mean surface temperature change to lag behind the observed global mean surface temperature change by as much as 500 years. Even if CO_2e concentrations in 2100 were stabilized, observed temperatures would continue to rise for centuries before the equilibrium was reached.
- Under the Reference scenario (1st chart), the probability of the observed temperature change in 2100 being below 2 degrees C is approximately 1%, while there is a nearly 75% probability associated with this under the Full Participation scenario (3rd chart).
- The probability of being above 4 degrees C is about 32% in the Reference case, while it is just under 15% in the Delayed Participation scenario (2nd chart) and zero under Full Participation (3rd chart).

Climate Impacts & Risk Analysis Project

Comparison of CIRA Scenarios to RCPs and SRES

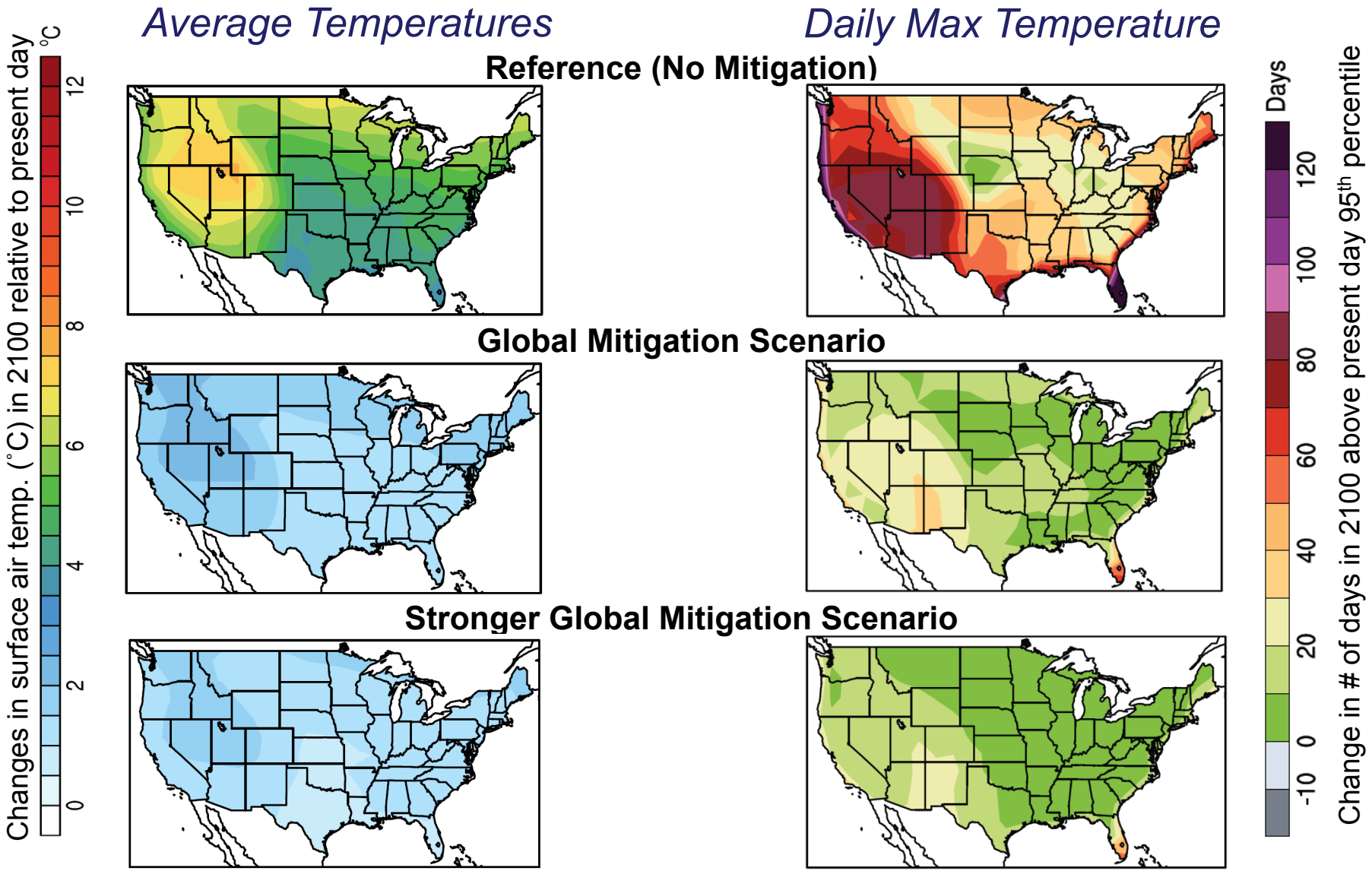


*Likely ranges for CIRA scenarios represent year 2100 values for climate sensitivity 2 and 4.5˚C

[IPCC ranges adapted from Rogelj et al. 2012]

Changes in Temperature in 2100

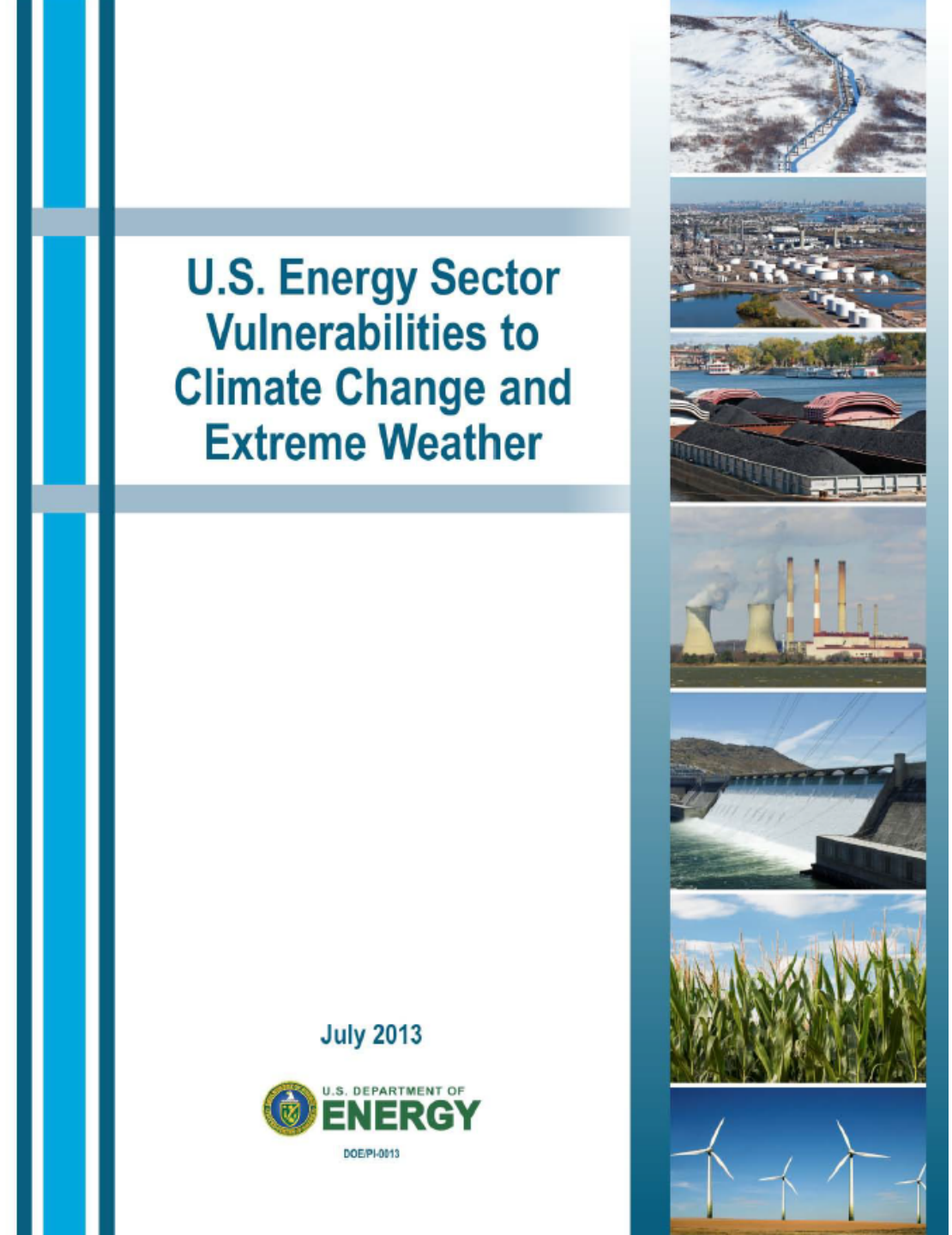
- With no mitigation, avg. temps increase substantially & hottest days become more frequent.
- These changes are substantially reduced under both mitigation scenarios.



Thank You

Appendix

Interagency Climate Change Adaptation Task Force



This report—part of the Administration's efforts to support national climate change adaptation planning through the Interagency Climate Change Adaptation Task Force and Strategic Sustainability Planning process established under Executive Order 13514 and to advance the U.S. Department of Energy's goal of promoting energy security—examines current and potential future impacts of these climate trends on the U.S. energy sector. It identifies activities underway to address these challenges and discusses potential opportunities to enhance energy technologies that are more climate resilient, as well as information, stakeholder engagement, and policies and strategies to further enable their deployment.

Key Messages

- The nation's ability to produce, deliver, and store energy is affected by climate change.
- Climate change impacts are expected to vary regionally, but vulnerabilities in one region may have broader implications due to the interconnected nature of energy systems.
- Vulnerabilities of interdependent sectors, such as oil and gas production and electricity generation sectors, may compound one another and lead to cascading impacts.
- Optimal public and private responses to climate change will depend on many factors, including the availability of climate-resilient energy technologies and the cost of various adaptation strategies.

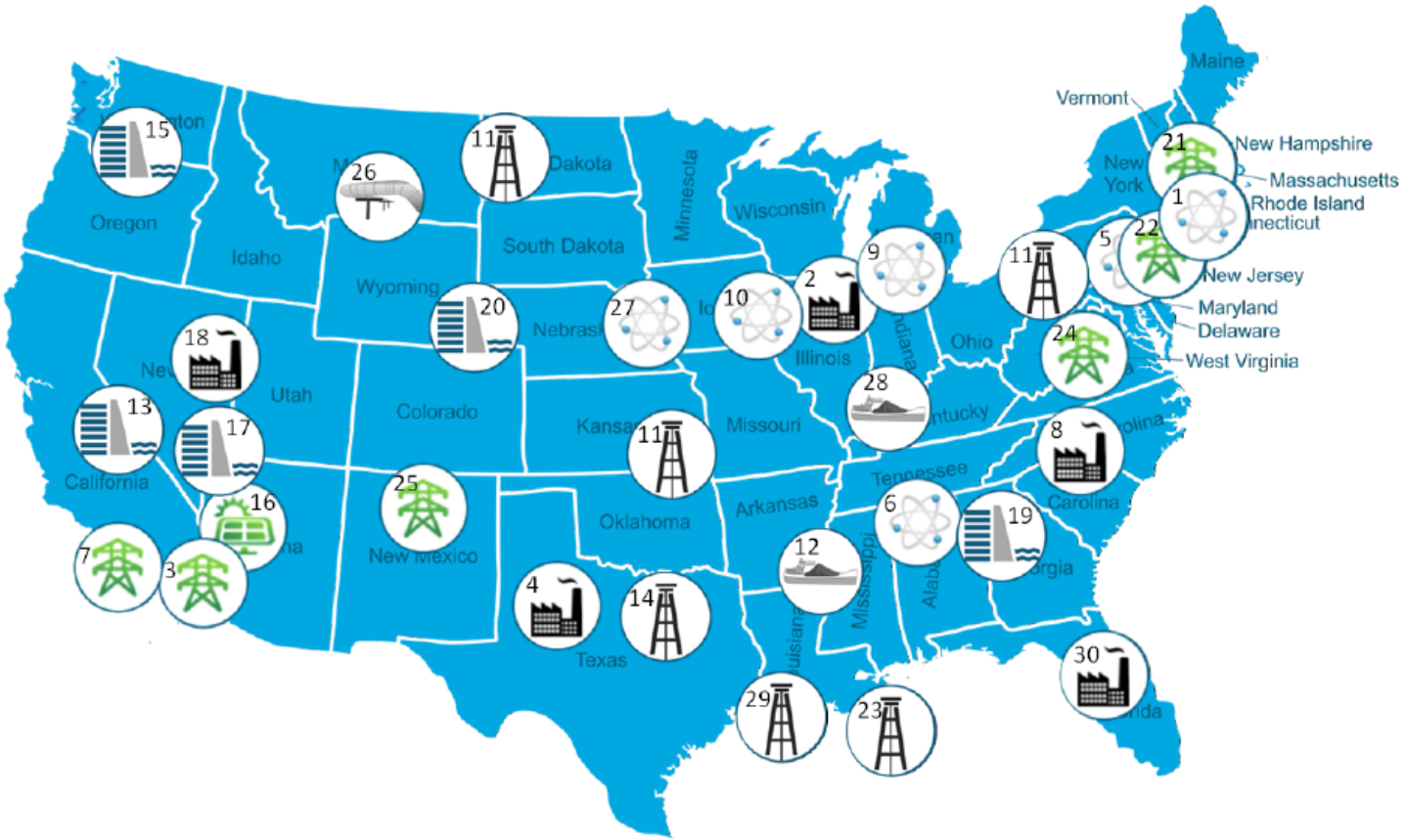


Figure 1. Selected events over the last decade illustrate the U.S. energy sector's vulnerabilities to climatic conditions

Table ES-1. Relationship between climate change projections and implications for the energy sector*

Energy sector	Climate projection	Potential implication
Oil and gas exploration and production	▪ Thawing permafrost in Arctic Alaska	▪ Damaged infrastructure and changes to existing operations
	▪ Longer sea ice-free season in Arctic Alaska	▪ Limited use of ice-based infrastructure; longer drilling season; new shipping routes
	▪ Decreasing water availability	▪ Impacts on drilling, production, and refining
	▪ Increasing intensity of storm events, sea level rise, and storm surge	▪ Increased risk of physical damage and disruption to offshore and coastal facilities
Fuel transport	▪ Reduction in river levels	▪ Disruption of barge transport of crude oil, petroleum products, and coal
	▪ Increasing intensity and frequency of flooding	▪ Disruption of rail and barge transport of crude oil, petroleum products, and coal
Thermoelectric power generation (Coal, natural gas, nuclear, geothermal and solar CSP)	▪ Increasing air temperatures	▪ Reduction in plant efficiencies and available generation capacity
	▪ Increasing water temperatures	▪ Reduction in plant efficiencies and available generation capacity; increased risk of exceeding thermal discharge limits
	▪ Decreasing water availability	▪ Reduction in available generation capacity; impacts on coal, natural gas, and nuclear fuel supply chains
	▪ Increasing intensity of storm events, sea level rise, and storm surge	▪ Increased risk of physical damage and disruption to coastal facilities
	▪ Increasing intensity and frequency of flooding	▪ Increased risk of physical damage and disruption to inland facilities
Hydropower	▪ Increasing temperatures and evaporative losses	▪ Reduction in available generation capacity and changes in operations
	▪ Changes in precipitation and decreasing snowpack	▪ Reduction in available generation capacity and changes in operations
	▪ Increasing intensity and frequency of flooding	▪ Increased risk of physical damage and changes in operations
Bioenergy and biofuel production	▪ Increasing air temperatures	▪ Increased irrigation demand and risk of crop damage from extreme heat events
	▪ Extended growing season	▪ Increased production
	▪ Decreasing water availability	▪ Decreased production
	▪ Sea level rise and increasing intensity and frequency of flooding	▪ Increased risk of crop damage
Wind energy	▪ Variation in wind patterns	▪ Uncertain impact on resource potential
Solar energy	▪ Increasing air temperatures	▪ Reduction in potential generation capacity
	▪ Decreasing water availability	▪ Reduction in CSP potential generation capacity
Electric grid	▪ Increasing air temperatures	▪ Reduction in transmission efficiency and available transmission capacity
	▪ More frequent and severe wildfires	▪ Increased risk of physical damage and decreased transmission capacity
	▪ Increasing intensity of storm events	▪ Increased risk of physical damage
Energy demand	▪ Increasing air temperatures	▪ Increased electricity demand for cooling; decreased fuel oil and natural gas demand for heating
	▪ Increasing magnitude and frequency of extreme heat events	▪ Increased peak electricity demand