The Economic Case for Climate Action in the United States

FEU-US

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About FEU-US

The Universal Ecological Fund (Fundación Ecológica Universal FEU-US), a non-profit non-governmental organization, seeks to increase awareness that encourages actions through researching, analyzing, producing and disseminating information. It was incorporated in 2005 under the laws of the District of Columbia and is located in Alexandria, Virginia, United States of America.

FEU-US shares its goal, values and objectives with its partner organization, Fundación Ecológica Universal (FEU), founded in Buenos Aires, Argentina in 1990.

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About this Report

Climate change is happening now. It is already impacting our daily lives. It is also impacting the United States economy.

Action to address climate change is compatible and essential for economic growth. It also creates jobs.

However, the United States Federal Government under the Trump Administration decided to increase economic growth without climate action. In addition, against the world's commitment to fight climate change, the United States has begun the process of withdrawing from the Paris Agreement. These decisions were based on the claim that action to tackle climate change is against America's domestic interests. As a result, energy production in the United States will continue to be primarily generated by burning fossil fuels –the major driver of the observed changes in climate.

The impacts of climate change affect many sectors, including agriculture, water, human health and ecosystems, among others. Although some of these impacts are positive, most are negative and affect lives and livelihoods. Using different indicators and assumptions, numerous studies have assessed the impacts of climate change in the United States. The majority of these assessments use the end of this century as a timeframe for the analysis.

This report specifically focuses on economic losses caused by extreme and frequent weather events influenced by human-induced climate change and on health costs due to air pollution exposure caused by fossil fuel energy production. It is thus a partial assessment of the economic losses and costs of human-induced climate change and fossil fuel use on the United States economy.

Climate is the average weather –temperature, precipitation and wind– over a period of time. Changes in climate are usually measured over a 30 year period, as defined by the World Meteorological Organization. Thus, this report analyzes extreme weather events over three decades: 1980s (1980-1989), 1990s (1990-1999) and the last decade (2007-2016). Based on these past trends, a projection for the next decade is estimated. It also presents the opportunities to boost economic growth and job creation while taking climate action.

Sources used for the analysis presented in this report include the National Oceanic and Atmospheric Administration, the American Meteorological Society, the National Academy of Sciences of the United States of America, the Centers for Disease Control and Prevention, the American Lung Association, the U.S. Department of Commerce, the U.S. Department of Agriculture, the U.S. Energy Information Administration, the U.S. Department of Energy, the U.S. Department of Transportation, the U.S. Census Bureau and the Second Biennial Report of the United States of America under the United Nations Framework Convention on Climate Change. Peer-reviewed research studies published in prestigious journals were used as sources for health costs.

Economic losses, health costs and economic growth figures are presented in 2017 dollars. To harmonize and compare, all figures were adjusted using the latest Consumer Price Index.

September, 2017

Key Numbers

$240 billion. Economic losses from weather events influenced by human-induced climate change and health damages due to air pollution caused by fossil fuel energy production are currently causing an average of $240 billion a year –or about 40% of the current economic growth of the United States economy.

$360 billion a year in economic losses, damages and health costs are estimated by the next decade –or about half of the expected growth of the economy.

80% of the primary energy produced and used in the United States comes from coal, oil and natural gas –all fossil fuels. This percentage has not changed in the last two decades.

82% of the United States greenhouse gas emissions are solely from carbon dioxide (CO_2) from fossil fuel burning. CO_2 emissions are primarily driving the observed changes in the climate.

1.9 million workers in the energy industry extract and generate energy to power and fuel the residential, commercial, industrial and transportation sectors in the United States

15% of the electricity used in the residential, commercial and industrial sectors is generated from renewable sources –solar, wind, bioenergy, hydropower and geothermal.

95% of the fuel used for the transportation sector is fossil fuels –gasoline, diesel and jet fuel (92%) and natural gas (3%).

500,000 new jobs can be created by doubling the share of renewable energy, while reducing the share of electricity generation from fossil fuels by 23%.

250,000 new jobs can be created in the construction of carbon capture and storage plants which would allow the continuing burning of fossil fuels responsibly.

50,000 new jobs can be created in research, architecture and engineering to accelerate the identification, testing and deployment of innovative technologies to produce sustainable clean energy.

$200 billion in potential revenues can be generated from a tax on carbon emissions to be re-invested in reducing emissions, promoting a more efficient use of energy and encouraging the transition away from fossil fuels.

The Economic Case for Climate Action in the United States

There are risks and costs to action.
But they are far less than the long range risks of comfortable inaction.

John F. Kennedy, 35th President of the United States of America

Within one month, the United States has experienced two sides of the same coin.

Hurricane Harvey hit Texas and Louisiana. It was an unprecedented event due to the heavy rainfall. Some areas experienced more than 40 inches of rain in less than 48 hours, while other areas had more than 50 inches of rainfall– a record for a storm in the contiguous United States[1]. Harvey was also unprecedented in its exposure since it flooded almost all of Houston –the fourth largest city in the United States.

Record dry conditions and record breaking heat triggered 76 active wildfires in nine Western states: Montana, Oregon, California, Washington, Idaho, Colorado, Nevada, Utah and Wyoming[2]. Combined, these wildfires burnt 8 million acres this year –or about the combined land area of Connecticut, the District of Columbia and New Jersey[3].

After devastating the United States Virgin Islands as a catastrophic category 5 hurricane, Irma hit Florida as a category 4 hurricane. It sustained winds of 185 mph for more than 36 hours, placing it as the strongest hurricane on record globally[4]. After severely damaging and destroying Florida, Irma became a tropical storm, bringing strong winds, heavy rain, flash flooding and storm surge flooding to Georgia, North Carolina and South Carolina as well as affecting Mississippi, Alabama and Tennessee[5].

Puerto Rico suffered significant damage from Maria, a category 4 hurricane. Parts of the island received 40 inches of rain, causing widespread flooding[6].

These extreme weather events, which happened in August and September 2017, are indicators of climate change.

Weather events are the result of natural factors. For example, there are hot days in the summer and there is rainfall everywhere in the world.

Weather events, however, are also influenced by human-induced climate change. The changing climate has altered their intensity and/or frequency in a substantial and measurable manner. These include heat waves, droughts, wildfires, and severe storms (or heavy precipitation) and hurricanes (or tropical cyclones) –both of which lead to flooding[7] [8].

These weather events influenced by human-induced climate change are happening all over the United States. They are becoming more frequent and intense. They are also becoming more costly.

[1] National Weather Service: http://www.weather.gov/crp/hurricane_harvey
[2] The National Interagency Fire Center (Sept. 7, 2017): https://www.nifc.gov/fireInfo/nfn.htm
[3] U.S. Census Bureau: https://www.census.gov/geo/reference/state-area.html
[4] Since the National Aeronautics and Space Administration began using satellites to analyze hurricanes in the 1960s.
[5] National Hurricane Center: http://www.nhc.noaa.gov/archive/2017/IRMA.shtml
[6] National Hurricane Center: http://www.nhc.noaa.gov/archive/2017/MARIA.shtml
[7] Explaining Extreme Events of 2015 from a Climate Perspective, Bulletin of the American Meteorological Society (2015)
[8] Attribution of Extreme Weather Events in the Context of Climate Change, The National Academies of Sciences, Engineering, and Medicine (2016)

The facts are crystal clear. The number of extreme weather events causing at least $1 billion in economic losses have increased from 21 in the 1980s and 38 in the 1990s to 92 in the last decade (2007-2016) –a more than a two-fold increase compared to the 1990s and more than a four-fold increase compared to the 1980s[9] (Figure 1).

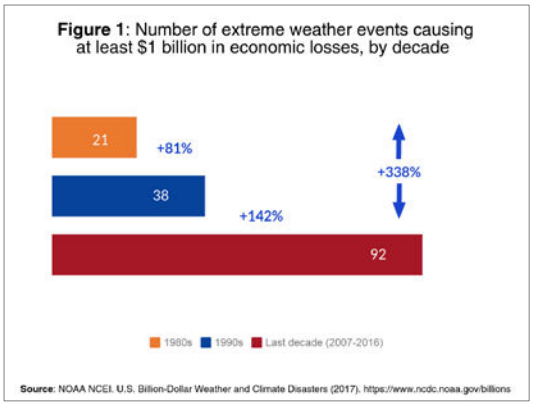
The number of severe storms experienced the most significant increase in the last decade, with more than a four-fold increase compared to the 1990s. Drought events have almost doubled in number in the last decade, compared to the 1980s and 1990s. As a result of severe storms and hurricanes, flooding events in the last decade increased by almost a two-fold compared to the 1990s (Figure 2).

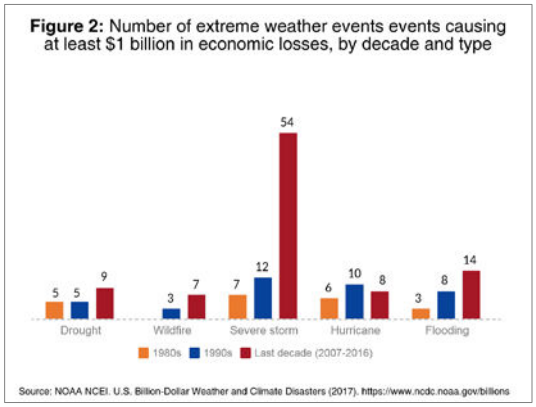
The cost from these weather events influenced by human-induced climate change, with at least $1 billion each in economic losses and damages, have significantly escalated from $145.7 billion in the 1980s and $211.3 billion in the 1990s to $418.4 billion in the last decade –a two-fold increase compared to the 1990s and an almost three-fold increase, compared to the 1980s[10] (Figure 3).

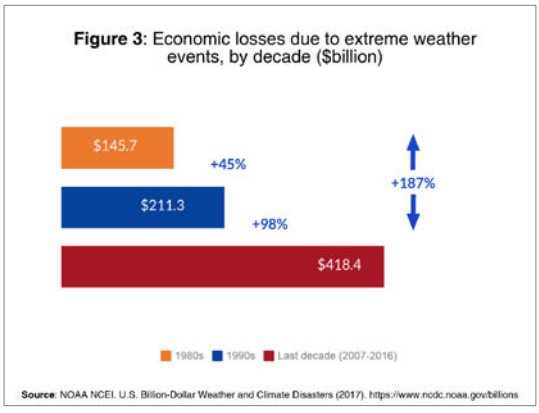
Hurricanes caused the most economic losses in the last decade, with $144.6 billion, compared to $97 billion and $36.1 billion in the 1990s and 1980s respectively. The most significant increase in economic losses and damages, however, are from severe storms, which experienced a more than a four-fold increase in the last decade compared to the 1990s (Figure 4).

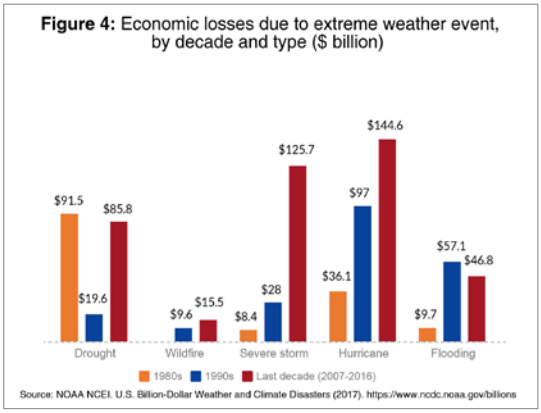
The rising trend continued in the 2000-2006 period, with $377 billion in economic losses and damages from 31 extreme weather events. The most costly event in that period was hurricane Katrina which caused $160 billion[11] in economic losses, affecting Louisiana, Mississippi, Alabama and Florida in August 2005[12].

Economic losses from extreme weather events are rapidly escalating. The economic losses of hurricanes Harvey, Irma and Maria and the wildfires in the nine Western states combined could be as high as the aggregate economic losses from the 92 events in the last decade[13].









[9] National Oceanic and Atmospheric Administration (NOAA) NCEI. U.S. Billion-Dollar Weather and Climate Disasters (2017). https://www.ncdc.noaa.gov/billions
[10] NOAA NCEI. U.S. Billion-Dollar Weather and Climate Disasters (2017). https://www.ncdc.noaa.gov/billions
[11] CPI-adjusted, from $125 billion in 2005 dollars
[12] NOAA NCEI. U.S. Billion-Dollar Weather and Climate Disasters (2017). https://www.ncdc.noaa.gov/billions
[13] The final accounting of the economic losses has not been completed; preliminary estimates by NOAA NCEI are nearly $300 billion for these four events combined

The economic impact of extreme weather events influenced by human-induced climate change can be severe for a region or a state. For example:

Agricultural production in the United States is highly dependent on rain. In 2012, only six percent of all farmland was irrigated[14]. Drought, thus, affects crop output impacting food availability and driving up food price for consumers. It also affects farmers' livelihoods. Since 2012, American farmers in California, Texas, Oregon, Washington, Idaho, Montana and New Mexico have lost crops on hundreds of thousands of acres, due to the persistent drought. Within the last five years, livelihoods of farmers in these states were impacted with $56 billion in economic losses[15]. If action to address climate change is not taken, the production of corn and soybean –the largest crops in the United States— could experience a 20 to 30 percent decrease within the next three decades[16]. This could potentially cost corn and soybean producers losses of $17 to $25 billion a year[17].

Louisiana is one of the states where the highest number of flooding events happened in the last decade as a result of severe storms or hurricanes. In August 2016, 30 inches of rain fell in a few days, flooding southern Louisiana –a 1 in 500 year event. More than 50,000 homes, 100,000 vehicles and 20,000 businesses were damaged or destroyed. The economic losses due to the floods in Louisiana were $10 billion[18]. Some 75 percent of those affected by this record rainfall were uninsured[19].

Many individuals, families and businesses lost everything due to extreme weather events, such as the one in Louisiana. So did those Americans affected by the severe flooding in Colorado in 2013, or by Superstorm Sandy in New York and New Jersey in 2012 or by the wildfire in California nearly each year.

Not all states are impacted in the same way by extreme weather events. Many events impact more than one state. However, each state impacted by multi-state events did not suffer at least $1 billion in economic losses (Annex 1). The states impacted by these billion dollar events in the last decade are:

- **Drought**: California (8, with no billion dollar drought events in the 1990s or 1980s), Idaho (7, with no billion dollar drought events in the 1990s), Oregon and New Mexico (6, a six-fold increase compared to the 1990s), Oklahoma (6, a two-fold increase compared to the 1990s), Kansas (6, a three-fold compared to the 1990s) and Texas (6, a three-fold increase compared to the 1990s).
- **Wildfire**: California (6, a two-fold increase compared to the 1990s), Arizona and Oregon (6, a six-fold increase compared to the 1990s), Idaho (6, with no billion dollar wildfire events in the 1990s or 1980s), Texas, Nevada, Washington and Colorado (5 each, a five-fold increase compared to the 1990s) and Montana (5, with no billion dollar wildfire events in the 1990s).
- **Severe storm:** Texas (32, a more than a four-fold increase compared to the 1990s), Kansas (24, a six-fold increase compared to the 1990s), Oklahoma and Illinois (23 each, a more than a four-fold and almost a six-fold increase compared to the 1990s,

[14] U.S. Department of Agriculture, Census of Agriculture (2012)
[15] NOAA NCEI. U.S. Billion-Dollar Weather and Climate Disasters (2017). https://www.ncdc.noaa.gov/billions
[16] Proceedings of the National Academy of Sciences of the United States of America, Nonlinear temperature effects indicate severe damages to U.S. crop yields under climate change: http://www.pnas.org/content/106/37/15594.full.pdf
[17] U.S. Department of Agriculture, Economic Research Service – Agriculture and Food Statistics
[18] NOAA NCEI. U.S. Billion-Dollar Weather and Climate Disasters (2017). https://www.ncdc.noaa.gov/billions
[19] https://www.munichre.com/site/mram-mobile/get/documents_E1333998487/mram/assetpool.mr_america/Images/5_Press_News/Press%20Releases/2016/20160103_RZ_Big-five-overview%20final.pdf

respectively) and Missouri (21, a more than a five-fold increase compared to the 1990s) and Tennessee (18, a more than a four-fold increase compared to the 1990s).

- **Hurricane:** Alabama, Louisiana and Virginia (4 each, a two-fold increase compared to the 1980s); Pennsylvania, New York, Maryland and Connecticut (3 each, a 50 percent increase compared to the 1990s); North Carolina (3); and Mississippi and New Jersey (3 each, a three-fold increase compared to the 1990s).
- **Flooding,** as a result of severe storms and hurricanes: Louisiana and Missouri (4 each, a four-fold increase compared to the 1990s); Texas (3); and Arkansas, Illinois, Indiana, Kansas and Iowa (3 each, a three-fold increase compared to the 1990s).

Other weather events that can be influenced by human-induced climate change have impacts on health. Heat waves –more than two consecutive days of extreme heat —have become more intense[20]. Extreme heat impacts human health, including heat strokes, heat exhaustion, heat cramps and heat rashes[21]. Heat waves are linked to an increase in emergency room visits, hospitalizations, and premature mortality. In July 2006, California had a 14-day heat wave. About 36 million people were affected, leading to more than 16,000 emergency room visits, 152,000 outpatient visits and 1,620 hospitalizations. These aggregate health costs were estimated at $207 million[22]. In addition, this 2-week heat wave caused 655 premature deaths, estimated at $6 billion[23] in health costs[24]. The number of deaths as a result of this heat wave exceeded the current annual average of 618 deaths by extreme heat in the United States[25].

The 2006 heat wave also impacted other states, when half of the United States experienced maximum temperatures much above normal. This percentage was exceeded in 2012 and in 2016 with 88 percent and 70 percent, respectively. These are the three years with the highest percentage of the United States experiencing maximum temperatures above normal since 1910[26]. Heat waves are increasing[27], which will aggravate health impacts and further escalate health costs.

Frequent weather events add to the economic losses. Their frequency and intensity are also on the rise. Their cost is increasing too. In the latest decade, economic losses from frequent weather events causing less than $1 billion in damages are estimated at $100 billion for 800 events, compared to $50 billion for 600 events in the 1990s.

The increase in the number of weather events influenced by human-induced climate change is the result of the already observed 1.1ºC increase in global temperature above pre-industrial times[28].

Despite the escalating economic losses and costs on lives, health, homes, businesses and livelihoods, the United States continues to primarily rely on fossil fuels to produce energy, the root cause of climate change.

Coal, oil and natural gas –all fossil fuels— account for about 80 percent of the primary energy produced and used in the United States[29]. This percentage has decreased slightly during the last two decades, but still remains above 80 percent. As a result, 82 percent of the United States

[20] Explaining Extreme Events of 2015 from a Climate Perspective, in the Bulletin of the American Meteorological Society (2015)
[21] Centers for Disease Control and Prevention (CDC), Warning Signs and Symptoms of Heat-Related Illness: https://www.cdc.gov/disasters/extremeheat/warning.html
[22] CPI-adjusted from $179 million in 2008 dollars
[23] CPI-adjusted from $5.1 billion in 2008 dollars
[24] Six Climate Change-Related Events In The United States Accounted For About $14 Billion In Lost Lives And Health Costs: Knowlton, et al. (2011)
[25] Centers for Disease Control and Prevention (CDC), Natural Disasters and Severe Weather - Extreme Heat: https://www.cdc.gov/disasters/extremeheat/index.html
[26] NOAA, National Centers for Environmental Information: https://www.ncdc.noaa.gov/extremes/cei/graph/us/1c/01-12
[27] Bulletin of the American Meteorological Society*:* Monitoring and Understanding Changes in Heat Waves, Cold Waves, Floods and Droughts in the United States: State of Knowledge (2013)
[28] World Meteorological Organization, State of the Global Climate (2016)
[29] U.S. Energy Information Administration, Primary Energy Overview (2016)

greenhouse gas emissions are currently from carbon dioxide (CO_2) from fossil fuel burning[30]. CO_2 emissions are primarily driving the observed changes in the climate.

Burning fossil fuels to generate energy (electricity, fuel and natural gas) comes at the price of the impacts of climate change. It also brings about air pollution which, in turn, has consequences on health.

More than 43 million people in the United States live in areas with unhealthy air pollution[31]. The costs of health damages due to air pollution exposure caused by energy production in the United States were estimated at $188 billion[32] in 2011. However, effective emission regulations on the energy sector have successfully reduced air pollution and thus decreased health costs from $255 billion[33] in 2002 –a 35 percent reduction. Indiana, Ohio and Pennsylvania are the states with the highest annual damages from electric power generation, oil and gas extraction, coal mining and oil refineries[34]. The Appalachian region also has a significant public health burden. Alabama, Kentucky, Maryland, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia produce 25 percent of the coal in the United States[35]. The health costs associated with coal mining of communities in Appalachia was estimated at $86 billion[36] a year[37].

These three trends –more frequent and intense weather events influenced by human-induced climate change, increased economic losses and health costs, coupled with continued use of fossil fuels– will continue to negatively impact Americans and the American economy.

Impacts on the United States economy growth

The United States economy has been adding $610 billion a year on average in the last decade, except for 2009 –a recession year [38].

The impacts of weather events influenced by human-induced climate change and direct human health consequences of pollution from fossil fuel use are currently causing, on average, $240 billion a year in economic losses, damages and health costs –or about 40 percent of the current growth of the United States economy (Table 1). This amount equals 1.2 percent of the GDP. This is a conservative estimate because the sum does not include economic losses due to additional consequences of extreme weather events, such as decreased agricultural yields or health costs for premature deaths due to heat waves. This total is more than three times the amount spent for the Department of Education ($67 billion) or five times the amount for the Department of Homeland Security ($48 billion) for this year[39].

These massive costs are being borne mainly by individuals, not the Government or the private sector.

[30] Second Biennial Report of the United States of America under the United Nations Framework Convention on Climate Change, 2016
[31] State of the Air 2017, American Lung Association: http://www.lung.org/our-initiatives/healthy-air/sota/key-findings/people-at-risk.html
[32] CPI-adjusted from $131 billion in 2000 dollars
[33] CPI-adjusted from $175 billion in 2000 dollars
[34] Energy Policy: The International Journal of the Political, Economic, Planning, Environmental and Social Aspects of Energy, Vol. 90 (2016) Air pollution emissions and damages from energy production in the U.S.: 2002–2011, Paulina Jaramillo (Department of Engineering and Public Policy, Carnegie Mellon University) and Nicholas Z. Muller (Department of Economics, Middlebury College)
[35] U.S. Energy Information Agency
[36] CPI-adjusted from $74 billion in 2008 dollars
[37] Annals of the New York Academy of Sciences: Full cost accounting for the life cycle of coal, Paul R. Epstein et al (2011)
[38] U.S. Department of Commerce, Bureau of Economic Analysis
[39] U.S Congress, Appropriations for Fiscal Year 2017

	Annual Average for the Last Decade
Economic losses from extreme weather events	$42
Economic losses from frequent weather events	$10
Health costs due to air pollution caused by fossil fuel energy production	$188
Total	**$240**

Table 1: Summary of economic losses from weather events influenced by human-induced climate change and health costs caused by fossil fuel use in the United States (in $billion)

These economic losses and health costs are projected to continue to escalate due to the increasing number of weather events influenced by human-induced climate change and fossil fuel use.

Based on the rising trend in the last decade, and considering the current path, economic losses from weather events influenced by human-induced climate change could at least double in the next decade. Health costs caused by fossil fuel use could increase by at least 33 percent due to the current revocation of regulations, rules and policies to energy production[40].

Thus, economic losses from weather events influenced by human-induced climate change and health costs caused by fossil fuel use could escalate to at least $360 billion a year or 50 percent of the economic growth in the next 10 years.

Some argue that rebuilding efforts after an extreme weather event boost economic growth. However, by continuing to rely on fossil fuels to generate energy and grow the economy, job creation in the United States will otherwise be focused on rebuilding and reconstructing what the increasing number of weather events will continue to damage and destroy.

The benefits of taking climate action outweigh the escalating economic losses and health damages.

Economic growth, job creation and climate action

Many Americans still have doubts, conflicting views and opinions about climate change that are inconsistent with the overwhelming scientific evidence. Many believe that addressing climate change and transitioning to a low-carbon economy is incompatible with economic growth. Others, influenced by those with vested interests in the fossil fuel industry and climate deniers, continue to question the knowledge of reducing risks by taking action to avoid the worst impacts of climate change. For those whose highest priority is finding a job or a better job the impacts of climate change may be perceived as distant and intangible.

Contrary to these views, opinions and misperceptions, action to tackle climate change is, in fact, compatible with and essential for economic growth.

Economic growth and job creation –a priority for the current Administration for the next four years in America– require energy. Sustainable economic growth just requires generating energy

[40] Executive Order on Promoting Energy Independence and Economic Growth, March, 2017 (https://www.whitehouse.gov/the-press-office/2017/03/28/presidential-executive-order-promoting-energy-independence-and-economi-1)

differently. It also requires a more efficient use of energy in all sectors –residential, commercial, industrial and transportation.

Relying on fossil fuels for economic growth was how many economies grew in the 19th and 20th centuries. The key difference with today is that the consequences of burning fossil fuels were not known and understood more than a century ago; they were not appreciable then either. Today, however, they are. The evidence is undeniable: the more fossil fuels we burn, the faster the climate continues to change.

Clean and sustainable energy just requires smart decisions and smarter investments.

The United States can boost economic growth and create jobs, while taking climate action by:

1. Changing the energy equation

Carbon-free and sustainable energy can provide the additional energy needed to continue to grow the United States economy. It can also create jobs. Employment in the energy sector, currently employing 1.9 million workers[41], can significantly increase through:

Renewable Energy. Currently, about 10 percent of the energy (or 15 percent of electricity generation)[42] used in the United States comes from renewables –solar, wind, bioenergy, hydropower and geothermal.

Half of the electricity generated by renewables is solely from solar and wind, or about 7 percent of the electricity used in the United States[43]. These technologies provide almost 500,000 jobs, including manufacturing, construction, project development, and operation and maintenance[44]. In particular, jobs in the solar industry grew 17 times faster than the overall job creation in the American economy[45]. In 2016, the solar workforce increased by 25 percent, accounting for 374,000 jobs or more than 40 percent of the employment in the generation of electricity in the United States [46.]

A major transition to renewable energy is required. Doubling the solar and wind generation capacity –an important first step— will create 500,000 new jobs. It will also provide sustainable clean electricity, only requiring an initial investment in installation but significant savings in the long-term due to low operating costs.

Most importantly, doubling the solar and wind generation capacity will reduce the share of electricity generation from fossil fuels (natural gas and coal) by 23 percent –from the current 65[47] to 50 percent –a step in the right direction.

The expansion of these renewable technologies will, in turn, make their costs much more competitive and accessible, especially given that storage systems are now much more efficient.

Workers in the extraction of natural gas and coal in Illinois, Kentucky, Louisiana, Oklahoma, Pennsylvania, Texas, West Virginia and Wyoming can greatly benefit from these new jobs in renewable energy, with training and investments.

[41] U.S. Department of Energy: U.S. Energy and Employment Report (2017)
[42] U.S. Energy Information Administration
[43] U.S. Energy Information Administration
[44] U.S. Department of Energy: U.S. Energy and Employment Report (2017)
[45] IRENA (2017), Renewable Energy and Jobs - Annual Review 2017, International Renewable Energy Agency, Abu Dhabi
[46] U.S. Department of Energy: U.S. Energy and Employment Report (2017)
[47] U.S. Energy Information Administration

Nuclear. Electricity produced with nuclear power accounts for 9 percent of America's energy (or 20 percent of electricity generation)[48]. Nuclear power provides carbon-free energy and is now safer.

There are 60 nuclear power plants in the United States, employing about 70,000[49]. Two new nuclear reactors are planned for Georgia and an additional four are planned to be built in Florida, North Carolina, Virginia and Texas. These new plants could provide, at least, 10,000 new jobs in the generation of electricity.

Using fossil fuels responsibly. Fossil fuel power plants can be consistent with job creation and a low-carbon economy.

Currently, fossil fuel power plants generate about 65 percent of the electricity used in the United States[50], contributing 39 percent of the United States CO_2 emissions[51]. Natural gas and coal are the main sources of electricity generation, accounting for 34 and 30 percent respectively[52].

The 220,000 workers[53] employed by these fossil fuel power plants may feel threatened by the need to switch the generation of energy. However, carbon capture and storage (CCS) technologies would allow the continuing burning of fossil fuels to responsibly meet America's energy needs.

Of the 16 large-scale CCS plants in operation in the world, eight are in the United States. An additional CCS plant will be operational this year[54], placing the United States at the top of technological innovation in using fossil fuels responsibly.

Power generation with CCS still requires more research and development for its large-scale deployment. More pilot programs will need to be implemented, since there are more than 1,000 electric power plants that burn fossil fuels in the United States (256 use coal and 816 use natural gas)[55].

The research, construction and maintenance of CCS plants could double the current number of workers in energy construction, creating 250,000 additional jobs[56], while securing jobs of those currently employed by fossil fuel power plants.

The responsible use of fossil fuels also means that the social and environmental costs of burning coal, natural gas and oil should be incorporated into their price. For example, the price of electricity from coal without CCS would double to triple if the environmental and health costs would be accounted for[57]. This would, in turn, make the costs of renewables and non-carbon energy even more economically competitive, accelerating the transition away from fossil fuels.

Innovation and new technologies. New technologies to produce carbon-free energy will also have to be tested and deployed, such as locally produced advanced biofuels from forest and crop residues or municipal and construction waste, and biofuels derived from algae, with subsequent

[48] U.S. Energy Information Administration
[49] U.S. Department of Energy: U.S. Energy and Employment Report (2017)
[50] U.S. Energy Information Administration
[51] Second Biennial Report of the United States of America under the United Nations Framework Convention on Climate Change (2016)
[52] U.S. Energy Information Administration
[53] U.S. Department of Energy: U.S. Energy and Employment Report (2017)
[54] Global Carbon Capture and Storage (CCS) Institute: https://www.globalccsinstitute.com/projects/large-scale-ccs-projects
[55] U.S. Energy Information Administration: Electric Power Industry Power Plants: http://www.eia.gov/electricity/annual/html/epa_04_01.html
[56] U.S. Department of Energy: U.S. Energy and Employment Report (2017)
[57] Annals of the New York Academy of Sciences: Full cost accounting for the life cycle of coal, Paul R. Epstein et al, Center for Health and the Global Environment, Harvard Medical School (2011)

sequestration of CO_2. In addition, strategic and forward-looking investments are already being made to identify and test reliable and affordable innovative sources of energy.

Currently, about 300,000 jobs are focused on research, architecture, and engineering to support energy generation technologies[58]. An additional 50,000 jobs will accelerate the identification, testing and deployment of innovative technologies to produce sustainable clean energy.

Research continues to be developed and tested for the large-scale deployment of carbon-free energy. For example, fusion uses hydrogen to replicate the processes which power the sun. The technology has been researched for many decades and is still a long way from being commercially viable. If successful, it could provide a sustainable solution to electricity generation.

2. Using energy more efficiently

Reducing fossil fuel use will be easier and faster in some sectors of the economy than others. Thus, promoting energy efficiency is another key element of ensuring economic growth while taking climate action.

For example, a critical sector of the economy is transportation, which contributes 33 percent of the United States CO_2 emissions[59]. Gasoline, diesel and jet fuel –all petroleum-based fuels— comprise 92 percent of the energy used in the transportation sector, and natural gas for another three percent[60].

These fuels are used in 263 million cars, trucks, motorcycles; 6,676 aircrafts (passenger and cargo), 132,500 transit and commuter buses and rail cars; 397,500 freight trains and locomotives; 11.8 million recreational boats and 465 vessels (tankers, passenger and cargo ships) to transport individuals, passengers and goods throughout the United States[61].

Using transportation more efficiently will ensure that travelling and trade meets needs and demands, while using less energy.

Electric cars powered by renewable energy sources (solar or wind) provide carbon-free transportation. Programs to provide consumers with financial incentives will make the transition faster and more accessible.

Other sectors that can greatly benefit from energy efficiency include:

- 136 million homes and buildings where 324 million people in the United States live[62].
- Offices, hospitals, schools, police stations, places of worship, warehouses, hotels, shopping malls and industries (manufacturing, agriculture, and construction) where 160 million people in the United States work[63].

[58] U.S. Department of Energy: U.S. Energy and Employment Report (2017)
[59] Second Biennial Report of the United States of America under the United Nations Framework Convention on Climate Change, 2016
[60] U.S. Energy Information Administration
[61] U.S. Department of Transportation
[62] U.S. Census Bureau
[63] U.S. Census Bureau, U.S. Department of Labor, U.S. Energy Information Administration

3. Generating strategic investments

Transitioning to a low-carbon economy and increasing the efficient use of energy in all sector will require strategic investments. Much of the revenue for these investments could come from a carbon tax.

The aim of a carbon tax is to reduce emissions, promote a more efficient use of energy and encourage the transition away from fossil fuels.

The potential revenues from a tax on carbon emissions could be up to $200 billion in the United States within the next decade, according to models analyzed by the Intergovernmental Panel on Climate Change[64].

A carbon tax will affect the cost of electricity from fossil fuel power plants as well as the price of gasoline. However, a carbon tax will promote a much more efficient use of energy and stimulate the transition to renewable energy technologies.

The opportunities ahead

The long-term economic benefits of ensuring economic growth and creating jobs while taking climate action outweigh the short-term costs and economic losses of delaying action to address climate change.

Doubling or tripling the share of carbon-free energy, increasing the efficient use of energy in all sectors, and expanding fossil fuel power generation with CCS, along with a carbon tax, among other measures and policies to take climate action, will protect Americans from the escalating economic losses and costs due to the impacts of climate change.

The United States Federal Government should have embraced the opportunities to ensure economic growth and create jobs while taking climate action. Instead, it has made some decisions[65], solely focused a short-term vision for economic growth and job creation, relying on an increased dependence on fossil fuels. Regulations, rules and policies that burden the development or use of domestically produced energy resources to the energy industry are being reviewed, revoked, suspended, revised or rescinded.

These regulations, rules and policies were intended to protect American lives, homes, businesses and livelihoods from the increasing impacts of climate change, by reducing emissions and pollution from fossil fuel power plants.

As the most influential country in the world, the United States should be leading the way in the 21st century global economy, by taking the path towards clean energy, sustained economic growth and job creation.

But as a result of these unfortunate and misinformed decisions by the Federal Government, the United States has become isolated from the rest of the rest of the world in the efforts to address climate change.

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[64] Intergovernmental Panel on Climate Change, Fifth Assessment Report, Working Group III (Chapter 16)

[65] Executive Order on Promoting Energy Independence and Economic Growth, March, 2017 (https://www.whitehouse.gov/the-press-office/2017/03/28/presidential-executive-order-promoting-energy-independence-and-economi-1) and U.S. withdrawal from Paris Agreement, June 2017 (https://www.whitehouse.gov/the-press-office/2017/06/01/statement-president-trump-paris-climate-accord)

The consequences of these decisions may have left many Americans concerned. A simple risk analysis proves that it is in Americans best interest to take climate action.

There are, though, reasons for hope.

States, cities, businesses, universities and other organizations in the United States have joined forces to take climate action[66]. They recognize the economic opportunity that ensuring economic growth, creating jobs and promoting innovation represents through the transition to clean energy. Together, they represent about one-third of the population in America –more than 100 million people.

They understood the urgency of climate change and committed to taking climate action.

Each and every one of us can multiply and accelerate action to tackle climate change.

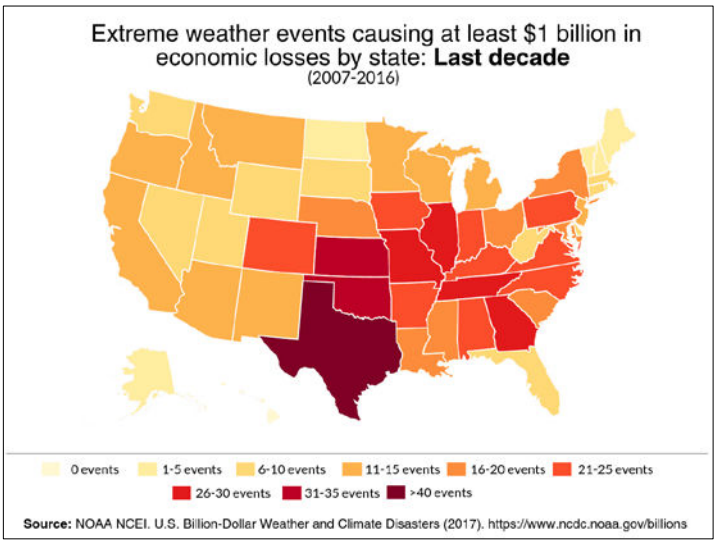
Actions we take every day where we live, where we work, where we study, how we travel, what we buy, how we build, even what we eat can contribute to climate action and make a difference.

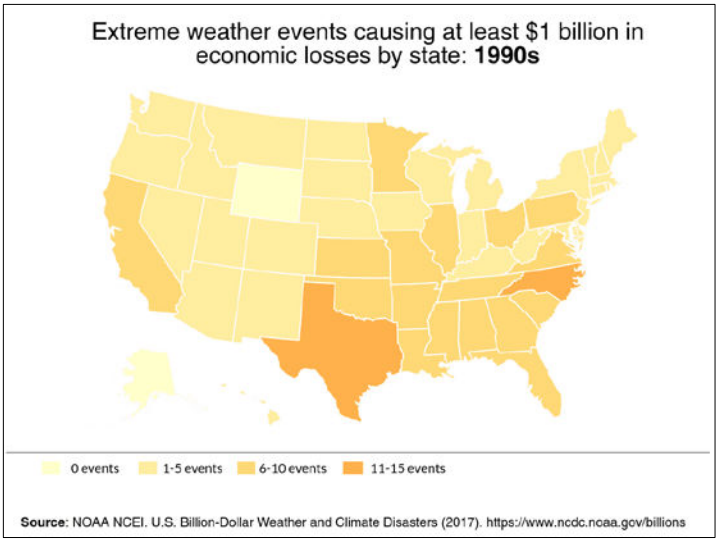
Each and every one us is part of the problem. Each and every one of us is part of the solution. ■

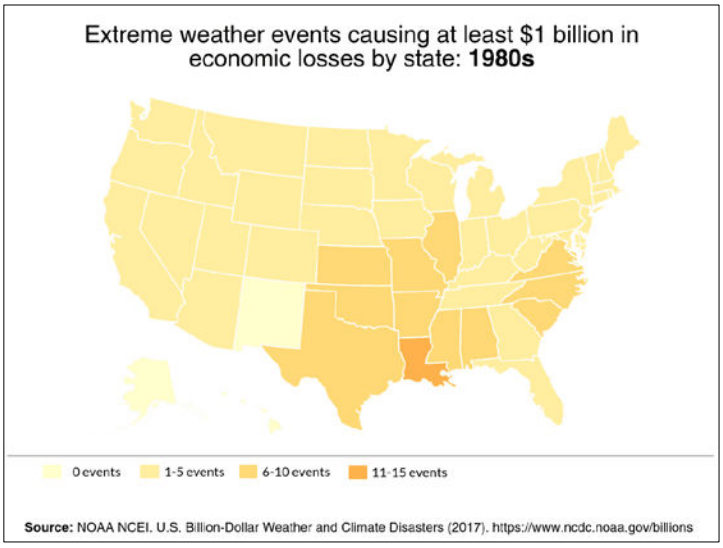
[66] Governors of 13 states in the U.S. Climate Alliance (with 10 additional governors pledging support), 19 State Attorneys Generals, 279 Mayors, more than 1,600 businesses and investors, and more than 300 universities: wearestillin.com

Annex 1: Number of extreme weather events causing more than $1 billion in economic losses

The maps and the table show the increasing frequency of billion dollar events (it does not indicate that each state impacted by multi-state extreme weather events has suffered $1 billion in losses for each event)







State	Drought			Wildfire			Severe Storm			Hurricane			Flooding		
	1980s	1990s	Last decade	1980s	1990s	Last decade	1980s	1990s	Last decade	1980s	1990s	Last decade	1980s	1990s	Last decade
Alaska	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Alabama	**4**	**3**	5	0	0	1	2	3	12	**2**	3	**4**	**1**	0	1
Arkansas	**4**	2	4	0	0	0	2	3	14	0	0	2	**2**	1	**3**
Arizona	0	0	5	0	**1**	**6**	0	0	1	0	0	0	**1**	0	0
California	0	0	**8**	0	**3**	**6**	1	1	0	0	0	0	**1**	**2**	0
Colorado	1	1	4	0	**1**	**5**	**3**	2	11	0	0	0	0	0	2
Connecticut	0	0	1	0	0	0	2	1	4	1	2	**3**	0	0	1
Delaware	0	0	3	0	0	0	0	0	3	1	1	1	0	0	0
Florida	0	**3**	1	0	0	3	1	3	4	**2**	**4**	2	**1**	0	0
Georgia	**3**	**3**	5	0	0	2	2	4	16	0	2	2	0	0	2
Hawaii	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Iowa	3	1	3	0	0	0	2	2	15	0	0	0	0	1	**3**
Idaho	1	0	**7**	0	0	**6**	0	0	0	0	0	0	**1**	**2**	0
Illinois	**3**	1	3	0	0	0	**3**	4	**23**	0	0	1	0	1	**3**
Indiana	1	1	4	0	0	0	2	3	15	0	0	1	0	1	**3**
Kansas	**3**	2	**6**	0	0	0	**3**	4	**24**	0	0	0	0	1	**3**
Kentucky	**3**	1	4	0	0	0	2	4	16	0	0	1	0	0	1
Louisiana	**4**	2	2	0	0	0	**3**	4	6	**3**	2	**4**	**2**	1	**4**
Massachusetts	0	0	1	0	0	0	2	2	2	1	2	2	0	0	1
Maryland	1	2	4	0	0	0	1	1	10	1	2	**3**	0	0	2
Maine	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0
Michigan	1	0	3	0	0	0	1	2	7	0	0	0	0	0	2
Minnesota	2	1	4	0	0	1	1	3	6	0	0	0	0	**2**	1
Missouri	**4**	1	3	0	0	0	**3**	4	**21**	0	0	1	0	1	**4**
Mississippi	**4**	2	5	0	0	0	2	4	11	**2**	1	**3**	**2**	1	1
Montana	2	0	3	0	0	**5**	0	0	2	0	0	0	**1**	**2**	1
North Carolina	**3**	**3**	5	0	0	2	2	**5**	12	**2**	**5**	**3**	0	0	1
North Dakota	**3**	0	3	0	0	1	0	0	0	0	0	0	0	2	1
Nebraska	**3**	0	2	0	0	1	1	2	11	0	0	0	0	1	2
New Hampshire	0	0	1	0	0	0	0	2	1	1	1	2	0	0	0
New Jersey	0	1	3	0	0	0	1	2	7	1	1	**3**	0	0	2
New Mexico	0	1	**6**	0	**1**	4	0	0	2	0	0	1	0	0	0
Nevada	1	0	5	0	**1**	**5**	1	0	0	0	0	0	0	1	0
New York	0	0	3	0	0	0	1	3	11	1	2	**3**	0	0	2
Ohio	1	2	3	0	0	0	2	4	11	0	1	2	0	0	2
Oklahoma	2	**3**	**6**	0	0	4	**4**	**5**	**23**	0	0	0	0	1	2
Oregon	0	1	**6**	0	**1**	**6**	1	0	0	0	0	0	**1**	**2**	0
Pennsylvania	0	2	3	0	0	0	2	3	16	1	2	**3**	0	0	1
Puerto Rico	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
Rhode Island	0	0	1	0	0	0	1	1	1	1	2	2	0	0	1

South Carolina	**3**	**3**	3	0	0	0	**3**	3	12	1	**4**	1	0	0	2
South Dakota	**3**	0	2	0	0	1	1	2	4	0	0	0	0	**2**	1
Tennessee	**4**	**3**	4	0	0	1	1	4	**18**	0	1	1	0	0	2
Texas	3	2	**6**	0	**1**	**5**	**4**	**7**	**32**	**2**	0	2	0	**3**	**3**
Utah	1	0	4	0	**1**	3	0	0	0	0	0	0	**1**	0	0
Virginia	**3**	**3**	4	0	0	0	2	1	12	**2**	3	**4**	0	0	2
Vermont	0	0	1	0	0	0	0	2	1	1	1	1	0	0	0
Washington	0	1	5	0	**1**	**5**	0	0	0	0	0	0	**1**	**2**	0
Wisconsin	1	0	4	0	0	0	1	1	8	0	0	0	0	1	1
West Virginia	1	2	2	0	0	0	1	2	3	0	1	1	0	0	1
Wyoming	1	0	3	0	0	3	1	0	4	0	0	0	0	0	0

Source: National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI). U.S. Billion-Dollar Weather and Climate Disasters (2017). https://www.ncdc.noaa.gov/billions