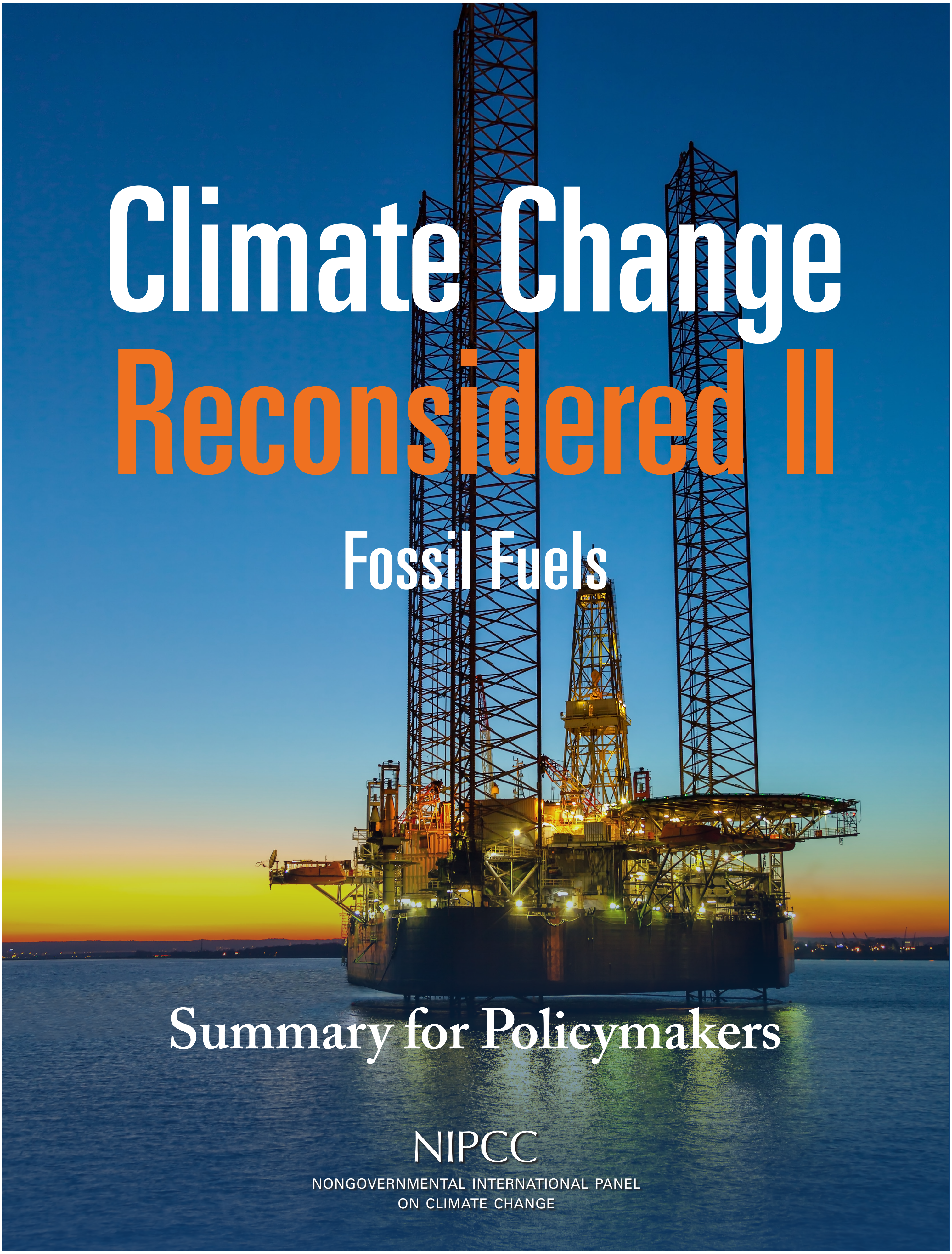

Climate Change Reconsidered II

Fossil Fuels

Summary for Policymakers

NIPCC

NONGOVERNMENTAL INTERNATIONAL PANEL
ON CLIMATE CHANGE

About NIPCC and Its Previous Reports

The Nongovernmental International Panel on Climate Change (NIPCC) is an international panel of scientists and scholars who came together to understand the causes and consequences of climate change. NIPCC has no formal attachment to or sponsorship from any government or government agency.

NIPCC seeks to objectively analyze and interpret data and facts without conforming to any specific agenda. This organizational structure and purpose stand in contrast to those of the United Nations' Intergovernmental Panel on Climate Change (IPCC), which *is* government-sponsored, politically motivated, and predisposed to believing that climate change is a problem in need of a U.N. solution.

NIPCC traces its beginnings to an informal meeting held in Milan, Italy in 2003 organized by Dr. S. Fred Singer and the Science & Environmental Policy Project (SEPP). The purpose was to produce an independent evaluation of the available scientific evidence on the subject of carbon dioxide-induced global warming in anticipation of the release of IPCC's *Fourth Assessment Report* (AR4). NIPCC scientists concluded IPCC was biased with respect to making future projections of climate change, discerning a significant human-induced influence on current and past climatic trends, and evaluating the impacts of potential carbon dioxide-induced environmental changes on Earth's biosphere.

To highlight such deficiencies in IPCC's AR4, in 2008 SEPP partnered with The Heartland Institute to produce *Nature, Not Human Activity, Rules the Climate.* In 2009, the Center for the Study of Carbon Dioxide and Global Change joined the original two sponsors to help produce *Climate Change Reconsidered: The 2009 Report of the Nongovernmental International Panel on Climate Change (NIPCC)*, the first comprehensive alternative to the reports of IPCC.

In 2010, a website (www.nipccreport.org) was created to highlight scientific studies NIPCC scientists believed likely would be downplayed or ignored by IPCC during preparation of its next assessment report. In 2011, the three sponsoring organizations produced *Climate Change Reconsidered: The 2011 Interim Report of the Nongovernmental International Panel on Climate Change (NIPCC)*.

In 2013, a division of the Chinese Academy of Sciences translated and published an abridged edition of the 2009 and 2011 NIPCC reports in a single volume. Also in 2013, NIPCC released *Climate Change Reconsidered II: Physical Science,* the first of three volumes bringing the original 2009 report up-to-date with research from the 2011 *Interim Report* plus research as current as the third quarter of 2013. A new website was created (www.ClimateChangeReconsidered.org) to feature the new report and news about its release.

In 2014, the second volume in the *Climate Change Reconsidered II* series, subtitled *Biological Impacts*, was released. The third and final volume, subtitled *Fossil Fuels,* is being released in 2019, and this is its *Summary for Policymakers*.

CO2 SCIENCE The Heartland INSTITUTE SCIENCE & ENVIRONMENTAL POLICY PROJECT

Summary for Policymakers

Introduction

Climate Change Reconsidered II: Fossil Fuels, produced by the Nongovernmental International Panel on Climate Change (NIPCC), assesses the costs and benefits of the use of fossil fuels[1] by reviewing scientific and economic literature on organic chemistry, climate science, public health, economic history, human security, and theoretical studies based on integrated assessment models (IAMs) and cost-benefit analysis (CBA). It is the fifth volume in the Climate Change Reconsidered series (NIPCC 2009, 2011, 2013, 2014) and, like the preceding volumes, it focuses on research overlooked or ignored by the United Nations' Intergovernmental Panel on Climate Change (IPCC).

In its 2013 volume titled *Climate Change Reconsidered II: Physical Science,* NIPCC refuted the scientific basis of the IPCC's claim that dangerous human interference with the climate system is occurring. In its 2014 volume titled *Climate Change Reconsidered II: Biological Impacts,* NIPCC addressed and refuted the IPCC's claim that climate change negatively affects plants, wildlife, and human health.

In this new volume, 117 scientists, economists, and other experts address and refute the IPCC's claim that the impacts of climate change on human well-being and the natural environment justify dramatic reductions in the use of fossil fuels. Specifically, the NIPCC authors critique two recent IPCC reports: *Climate Change 2014: Impacts, Adaptation, and Vulnerability,* the Working Group II contribution to the IPCC's Fifth Assessment Report (AR5), and *Climate Change 2014: Mitigation of Climate Change,* the Working Group III contribution to AR5 (IPCC, 2014a, 2014b).

The organization of this Summary for Policymakers tracks the organization of the full report. Citations to supporting research and documentation are scant for want of space but can be found at the end of the document. More than 2,000 references appear in the full report.

[1] This report follows conventional usage by using "fossil fuels" to refer to hydrocarbons, principally coal, oil, and natural gas, used by humanity to generate power. We recognize that not all hydrocarbons may be derived from animal or plant sources.

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Part I. Foundations

The most consequential issues in the climate change debate are "whether the warming since 1950 has been dominated by human causes, how much the planet will warm in the 21st century, whether warming is 'dangerous,' whether we can afford to radically reduce CO_2 emissions, and whether reduction will improve the climate" (Curry, 2015). Addressing these issues requires foundations in environmental economics and climate science. Part I of *Climate Change Reconsidered II: Fossil Fuels* provides those foundations.

1. Environmental Economics

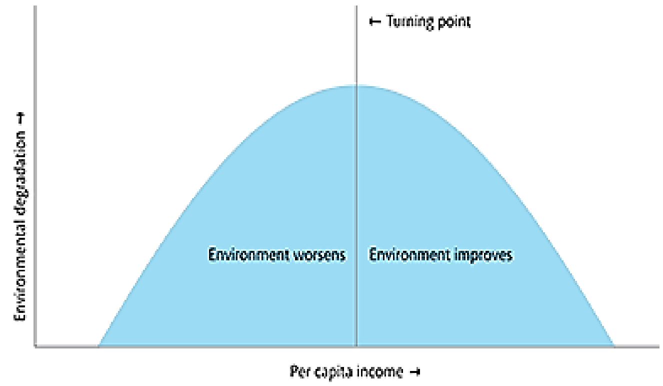
Many environmentalists and climate scientists are not familiar with economic research on environmental issues and have only vague ideas about what economics can bring to the climate change debate. Many economists make a different mistake, accepting unsubstantiated claims that the "science is settled" regarding the causes and consequences of climate change and then limiting their role in the debate to finding the most efficient way to reduce "carbon pollution." Both audiences need to be aware of what economists can bring to the climate change debate.

The most valuable concept economists bring is *opportunity cost*, the value of something that must be given up to acquire or achieve something else. Every choice has a corresponding opportunity cost. By revealing those costs, economics can help policymakers discover cost-effective responses to environmental problems, including climate change (Block, 1990; Markandya and Richardson, 1992; Libecap and Steckel, 2011).

A second key concept is the Environmental Kuznets Curve (EKC), pictured in Figure SPM.1. Fossil fuels and the technologies they power make it possible to use fewer resources and less surface space to meet human needs while also allowing environmental protection to become a positive and widely shared social value and objective. EKCs have been documented for a wide range of countries and air quality, water quality, and other measures of environmental protection (Yandle *et al*., 2004; Goklany, 2012; Bertinelli *et al.*, 2012).

Economists can help compassionate people reconcile the real-world trade-offs of protecting the environment while using natural resources to produce the goods and services needed by humankind (McKitrick, 2010; Morris and Butler, 2013; Anderson and Leal, 2015). They have demonstrated how committed environmentalists can better achieve their goals by recognizing fundamental economic principles such as discount rates and marginal costs (Anderson and Huggins, 2008). They have shown how entrepreneurs can use private property, price signals, and markets to discover new ways to protect the environment (Anderson and Leal, 1997; Huggins, 2013).

Figure SPM.1
A typical Environmental Kuznets Curve



Source: Ho and Wang, 2015, p. 42.

Economists have pointed out the economic and political pitfalls facing renewable and carbon-neutral energies (Morriss *et al.*, 2011; Yonk *et al.*, 2012). Economists have explained how proposals to force a transition away from fossil fuels advanced without an understanding of the true costs and implications of alternative fuels can lead to unnecessary expenses and minimal or even no net reduction in greenhouse gas emissions (Lomborg, 2010; van Kooten, 2013; Heal, 2017; Lemoine and Rudik, 2017).

Economists describe how common resources can be degraded by overuse by "free riders," but also how they can be effectively managed by individuals and nongovernment organizations using their knowledge of local opportunities and costs, the kind of knowledge national and international organizations typically lack (Coase, 1994). These market-based solutions exhibit the sort of spontaneous order that Hayek (1988) often wrote about, a coordination that is not dictated or controlled by a central planner. Ostrom (2010) identified eight design principles shared by entities most successful at managing common-pool resources.

The prosperity made possible by the use of fossil fuels has made environmental protection a social value in countries around the world (Hartwell and Coursey, 2015). The value-creating power of private property rights, prices, profits and losses, and voluntary trade can turn climate change from a possible *tragedy* of the commons into an *opportunity* of the commons (Boettke, 2009). Energy freedom, not government intervention, can balance the interests and needs of today with those of tomorrow. It alone can access the local knowledge needed to find efficient win-win responses to climate change.

2. Climate Science

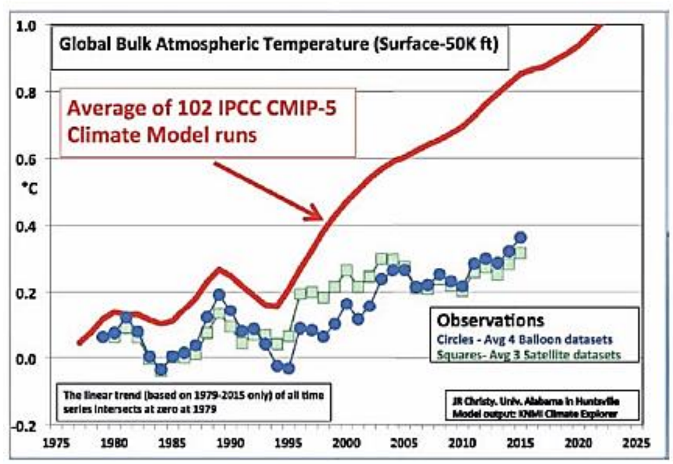
Chapter 2 provides an overview of the current state of climate science beginning with an explanation of the Scientific Method, which imposes restrictions and duties on scientists intended to ensure the quality, objectivity, utility, and integrity of their work. Key elements of the Scientific Method include experimentation, the testing of competing hypotheses, objective and careful peer review, discerning correlation from causation, and controlling for natural variability. In each of these areas, the IPCC and many scientists whose work is prominent in climate science have been shown to fall short (Essex and McKitrick, 2007; Darwall, 2013; Lewin, 2017; Armstrong and Green, 2018).

Two other topics concerning methodology are the role of consensus in science and ways to manage and communicate uncertainty. Consensus may have a place in science when it is achieved over an extended period of time by independent scientists following the conventions of the Scientific Method. This is not the context in which it is invoked in climate science, and consequently it has been the cause of controversy and polarization of views (Curry, 2012; Lindzen, 2017). Uncertainty is unavoidable in science, but it can be reduced using techniques such as Bayesian inference and honestly communicated to other researchers and the public. Instead of following best practices, the IPCC and its followers make many unmerited declarative statements and issue seemingly confident predictions without error bars (Essex and McKitrick, 2007; Frank, 2015).

The unique chemistry of carbon explains why fossil fuels, composed mainly of carbon and hydrogen, are so widely used as fuel. Kiefer (2013) writes, "Carbon transforms hydrogen from a diffuse and explosive gas that will only become liquid at -423° F [-253° C] into an easily handled, room-temperature liquid with 63% more hydrogen atoms per gallon than pure liquid hydrogen, 3.5 times the volumetric energy density (joules per gallon), and the ideal characteristics of a combustion fuel. … A perfect combustion fuel possesses the desirable characteristics of easy storage and transport, inertness and low toxicity for safe handling, measured and adjustable volatility for easy mixing with air, stability across a broad range of environmental temperatures and pressures, and high energy density. Because of sweeping advantages across all these parameters, liquid hydrocarbons have risen to dominate the global economy" (p. 117).

Climate models are a subject of controversy in climate science. General circulation models (GCMs) "run hot," meaning they predict more warming than actually occurred or is likely to occur in the future (Monckton *et al*., 2015). They hindcast twice as much warming from 1979 to 2017 as actually occurred (Christy, 2018). See Figure SPM.2. Climate models are unable to reproduce many important climate phenomena (Legates, 2014) and are "tuned" to produce results that fall into an "acceptable range" of outputs (Hourdin *et al.*, 2017).

Figure SPM.2
Failure of climate models to hindcast global temperatures, 1979–2015



Source: Christy, 2016.

The accuracy of temperature records since pre-industrial times is a second area of controversy. Records from surface stations are known to contain systematic errors due to instrument and recording errors, physical changes in the instrumentation, and database mismanagement, making them too unreliable to form the basis of scientific research, yet they are seldom questioned (Frank, 2015; McLean, 2018). More accurate satellite-based temperature records, which reach back only to 1979, reveal a range of near-global warming of approximately 0.07°C to 0.13°C per decade from 1979 to 2016 (Christy *et al*., 2018).

Equilibrium climate sensitivity (ECS), a measure of expected warming when CO_2 concentrations in the atmosphere double, is yet another source of controversy in climate science. The IPCC's estimate of ECS is one-third higher than most recent estimates in the scientific literature (Michaels, 2017). There is so much uncertainty in climate models and so many new discoveries being made that a single "true" estimate of ECS is probably impossible to calculate.

Scientists also disagree about whether climate change is negatively affecting human well-being or the natural world. Despite headlines and documentary films claiming the opposite, there is little or no evidence of trends that lie outside natural variability in severe weather events, melting ice, sea-level rise, precipitation patterns, and adverse effects on plant life. In some cases, the historical record reveals just the opposite: more mild weather and fewer droughts, for example, than in the pre-industrial past. Most plants are known to flourish in a warmer environment with higher levels of CO_2 (Idso and Idso, 2015).

Why do scientists disagree? Partly because *skepticism*, not consensus, is the heart of science. Sources of disagreement can be found in the interdisciplinary character of the issue, fundamental uncertainties concerning climate science (Curry, 2015; Lindzen, 2017), the failure of the IPCC to be an independent and reliable source of research on the subject (IAC, 2010; Laframboise, 2011, 2013), and tunnel vision (bias) among researchers (Kabat, 2008; Berezow and Campbell, 2012).

The final section of Chapter 2 critiques the claim that "97% of scientists agree" that climate change is mostly or entirely the result of the human presence and is dangerous. Surveys, literature reviews, and petitions demonstrate a lively debate is occurring in the scientific community over the basic science and economics of climate change (Solomon, 2010; Curry, 2012; Friends of Science, 2014; Tol, 2014a; Legates *et al.*, 2015; Global Warming Petition Project, n.d.).

In conclusion, fundamental uncertainties arising from insufficient observational evidence and disagreements over how to interpret data and set the parameters of models prevent science from determining whether human greenhouse gas emissions are having effects on Earth's atmosphere that could endanger life on the planet. There is no compelling scientific evidence of long-term trends in global mean temperatures or climate impacts that exceed the bounds of natural variability.

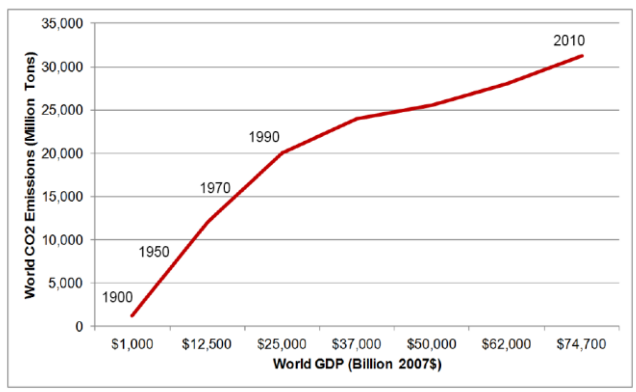
Part II. The Benefits of Fossil Fuels

Part II presents an accounting of the benefits created by the use of fossil fuels. Chapters 3, 4, and 5 address human prosperity, human health benefits, and environmental benefits, respectively.

3. Human Prosperity

The primary reason humans burn fossil fuels is to produce the goods and services that make human prosperity possible. Put another way, humans burn fossil fuels to live more comfortable, safer, and higher-quality lives. Chapter 3 documents the many ways in which fossil fuels contribute to human prosperity.

Figure SPM.3
Relationship between world GDP and CO_2 emissions



Source: Bezdek, 2014, p. 127.

The role played by fossil fuels in the dramatic rise in human prosperity is revealed by the close correlation between carbon dioxide (CO_2) emissions and world gross domestic product (GDP) shown in Figure SPM.3. Fossil fuels were responsible for such revolutionary technologies as the steam engine and cotton gin, early railroads and steamships, electrification and the electric grid, the internal combustion engine, and the computer and Internet revolution. In particular, the spread of electrification made possible by fossil fuels has transformed the modern world, making possible many of the devices, services, comforts, and freedoms we take for granted (Smil, 2005, 2010; Goklany, 2012; Gordon, 2016).

Today, fossil fuels supply 81% of global primary energy and 78% of U.S. primary energy. They are required to power the revolving turbine electric generators that supply dispatchable energy to electric grids, making electricity available on demand in the quantities needed, not only when the sun shines and the wind blows. Fossil fuels are also essential for fertilizer production and the manufacture of concrete and steel. Access to affordable, plentiful, and reliable energy is closely associated with key measures of global human development, including per-capita GDP, consumption expenditure, urbanization rate, life expectancy at birth, and the adult literacy rate (United Nations Development Program, 2010; Šlaus and Jacobs, 2011). Research reveals a positive relationship between low energy prices and human prosperity (Clemente, 2010; Bezdek, 2014; 2015).

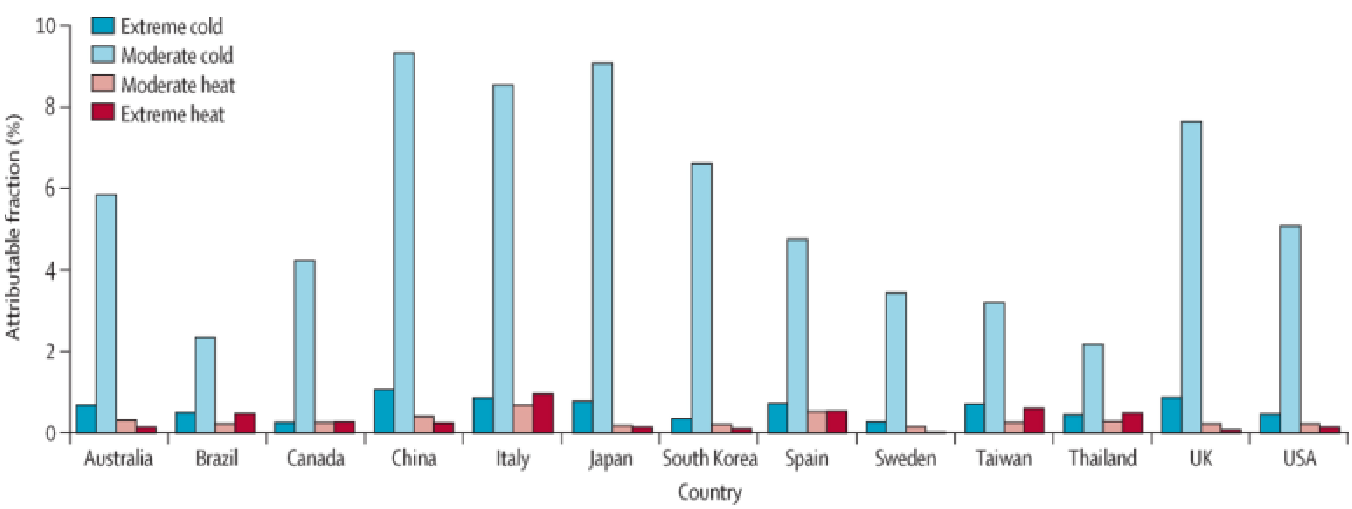
A similar level of human prosperity is not possible by relying on alternative fuels such as solar and wind power. Wind and solar power are intermittent and unreliable, much more expensive than fossil fuels, cannot be deployed without the use of fossil fuels to build them and to provide back-up power, cannot power most modes of transportation, and cannot increase dispatchable capacity sufficiently to meet more than a small part of the rising demand for electricity (Rasmussen, 2010; Bryce, 2010; Smil, 2010, 2016; Stacy and Taylor, 2016).

The contribution of fossil fuels to human prosperity can be estimated in numerous ways, making agreement on a single cost estimate difficult. However, estimates converge on very high amounts: Coal delivered economic benefits in the United States alone worth between $1.275 trillion and $1.76 trillion in 2015 and supported approximately 6.8 million jobs (Rose and Wei, 2006). Reducing reliance on fossil fuels in the United States by 40% from 2012 to 2030 would cost $478 billion and an average of 224,000 jobs each year (U.S. Chamber of Commerce, 2014).

4. Human Health Benefits

Chapter 4 presents the human health benefits of fossil fuels. Historically, humankind was besieged by epidemics and other disasters that caused frequent widespread deaths and kept the average lifespan to less than 35 years (Omran, 1971). The average lifespan among the ancient Greeks was apparently just 18 years, and among the Romans, 22 years (Bryce, 2014, p. 59, citing Steckel and Rose, 2002). Today, according to the U.S. Census Bureau (2016), "The world average age of death has increased by 35 years since 1970, with declines in death rates in all age groups, including those aged 60 and older. From 1970 to 2010, the average age of death increased by 30 years in East Asia and 32 years in tropical Latin America, and in contrast, by less than 10 years in western, southern, and central Sub-Saharan Africa. … [A]ll regions have had increases in mean age at death, particularly East Asia and tropical Latin America" (pp. 31–3).

Figure SPM.4
Deaths caused by cold vs. heat



Source: Gasparrini *et al.*, 2015, p. 369.

Fossil fuels have lifted billions of people out of poverty, reducing the negative effects of poverty on human health (Moore and Simon, 2000). They improve human well-being and safety by powering labor-saving and life-protecting technologies such as air conditioning, modern medicine, cars, trucks, and airplanes (Goklany, 2007). Fossil fuels made possible electrification of heating, lighting, manufacturing, and other processes, resulting in protection of human health and extended lives (Bryce, 2014). Fossil fuels also increased the quantity and improved the reliability and safety of the food supply (Moore and White, 2016).

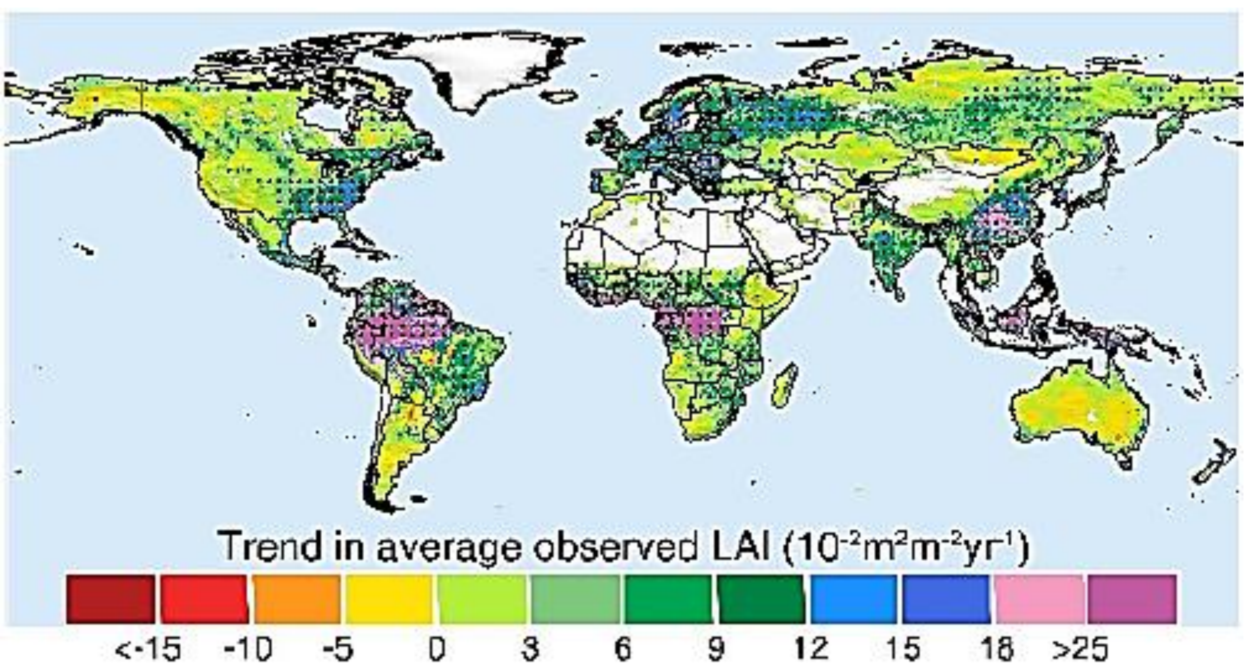
Fossil fuels may also affect human health by contributing to some part of the global warming experienced during the twentieth century or forecast by GCMs for the twenty-first century and beyond. Medical science and observational research in Asia, Australia, Europe, and North America confirm that warming is associated with lower, not higher, temperature-related mortality rates (Keatinge and Donaldson, 2004; Gasparrini *et al.*, 2015; White, 2017). See Figure SPM.4. Research shows warmer temperatures lead to decreases in premature deaths due to cardiovascular and respiratory disease and stroke occurrences (Nafstad *et al.*, 2001; Gill *et al.*, 2012; Song *et al.*, 2018), while warmer temperatures have little if any influence on mosquito- or tick-borne diseases (Murdock *et al.*, 2016).

5. Environmental Benefits

Chapter 5 reviews evidence showing how human use of fossil fuels benefits the environment. The scientific literature on the impacts of warmer temperatures and rising atmospheric CO_2 concentrations on plants finds them to be overwhelmingly positive. This extends to rates of photosynthesis and biomass production and the efficiency with which plants and trees utilize water (Ainsworth and Long, 2005; Bourgault *et al*., 2017). The result is a remarkable and beneficial Greening of the Earth shown in Figure SPM.5 (Zhu *et al.* 2016; Campbell *et al.*, 2017; Cheng *et al.*, 2017).

Similarly, the impacts of global warming on terrestrial animals is likely to be net positive. Wildlife benefit from expanding habitats, and real-world data

Figure SPM.5
Greening of the Earth, 1982 to 2009, trend in average observed leaf area index (LAI)



Source: Zhu *et al.*, 2016.

indicate warmer temperatures have not been harmful to wildlife (Willis *et al.*, 2010). Laboratory and field studies of the impact of warmer temperatures and reduced water pH levels (so-called "acidification") on aquatic life find tolerance and adaptation and even examples of benefits (Pandolfi *et al.*, 2011; Baker, 2014).

The fact that carbon and hydrogen are ubiquitous in the natural world helps to explain why the rest of the physical world is compatible with them and even depends on them for life itself (Smil, 2016). The *carbon cycle* minimizes the environmental impact of human emissions of CO_2 by reforming it into other compounds and sequestering it in the oceans, plants, and rocks. According to the IPCC, the residual of the human contribution of CO_2 that remains in the atmosphere after natural processes move the rest to other reservoirs is as little as 0.53% of the carbon entering the air each year and 0.195% of the total amount of carbon thought to be in the atmosphere (IPCC, 2013, p. 471).

The high power density of fossil fuels enable humanity to meet its ever-rising need for food and natural resources while using less surface space, thereby rescuing precious wildlife habitat from development. In 2010, fossil fuels, thermal, and hydropower required less than 0.2% of the Earth's ice-free land, and nearly half that amount was surface covered by water for reservoirs (Smil, 2016, pp. 211–212). Fossil fuels required roughly the same surface area as devoted to renewable energy sources (solar photovoltaic, wind, and liquid biofuels), yet delivered *110 times as much power* (*Ibid.*).

Acid rain, once thought to be a serious environmental threat, is no longer considered one (NAPAP, 1998). Human contributions of oil to the oceans via leakage and spills are trivial in relation to natural sources and quickly disperse and biodegrade (NRC, 2003). The damage caused by oil spills is a net cost of using oil, but not a major environmental problem.

In conclusion, fossil fuels directly benefit the environment by making possible huge (orders of magnitude) advances in efficiency, making it possible to meet human needs while using fewer natural resources. Fossil fuels make it possible for humanity to flourish while still preserving much of the land needed by wildlife to survive. And the prosperity made possible by fossil fuels has made environmental protection both highly valued and financially possible, producing a world that is cleaner and safer than it would have been in their absence.

Part III. Costs of Fossil Fuels

Part III presents an accounting of the costs of using fossil fuels. Chapters 6 and 7 address impacts on air quality and human security. Chapter 8 reviews the literature on cost-benefit analysis (CBA), integrated assessment models (IAMs), and the "social cost of carbon" (SCC), providing new CBAs for global warming, fossil fuels, and emission mitigation programs.

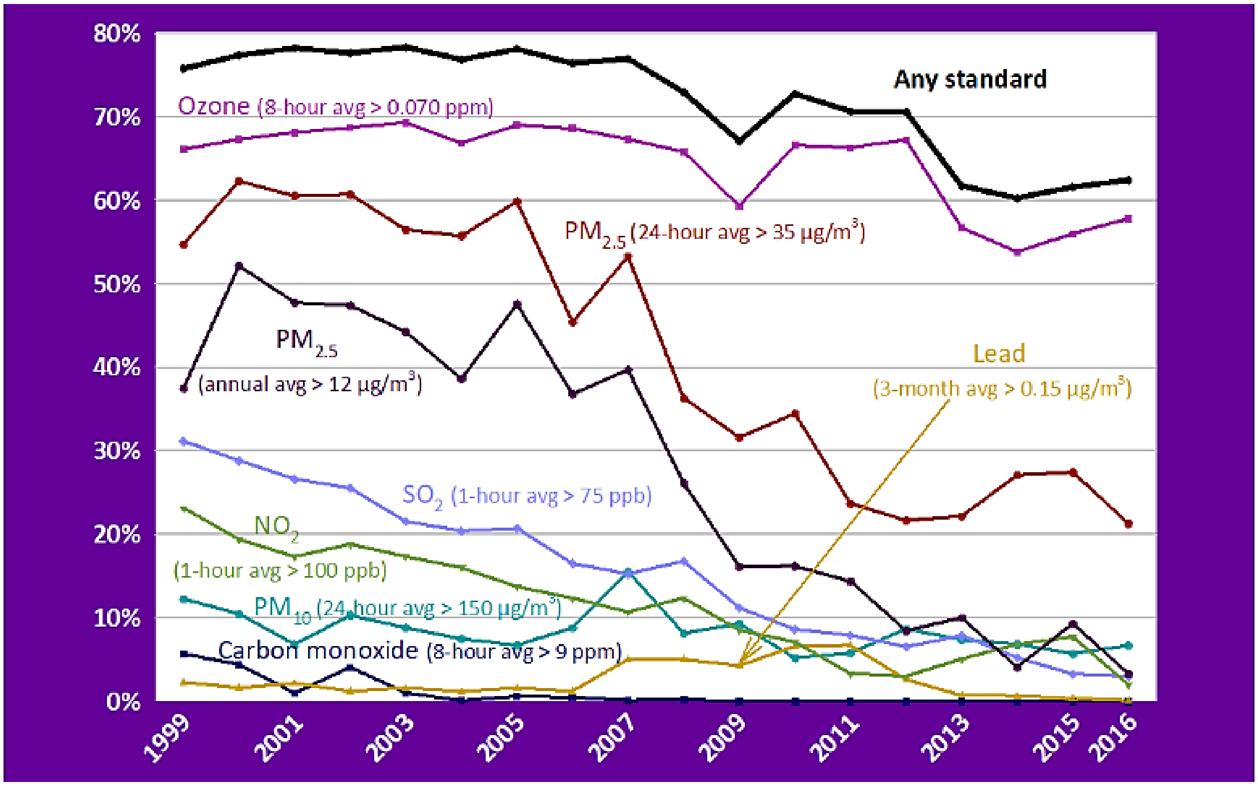
6. Air Quality

The U.S. Environmental Protection Agency (EPA) claims public health is endangered by exposure to particulate matter (PM), ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), methylmercury, and hydrogen chloride attributed to the combustion of fossil fuels. Other harms include visibility impairment (haze), corrosion of building materials, negative effects on vegetation due to ozone, acid rain, and nitrogen deposition, and negative effects on ecosystems from methylmercury (EPA, 2013).

A review of the evidence shows the EPA and other government agencies exaggerate the public health threat posed by fossil fuels. While the combustion of fossil fuels without pollution abatement technology does release chemicals that could be harmful to humans, other animal life, and plants, the most important issue is not the quantity of emissions but *levels of exposure* (Calabrese and Baldwin, 2003; Calabrese, 2005, 2015). By all accounts, air quality improved in the United States and other developed countries throughout the twentieth century and the trend continues in the twenty-first century (Goklany 2012; EPA, 2018a).

By the EPA's own measures, only 3% of children in the United States live in counties where they might be exposed to what the agency deems "unhealthy air" (EPA, 2018b). Also according to the EPA, 0% of children live in counties in which they might be exposed to harmful levels of carbon monoxide in outdoor air, only 0.1% live in counties where lead exposure might be a threat, 2% live where nitrogen dioxide is a problem, and 3% live where sulfur dioxide is a problem (*Ibid.*). (See Figure SPM.6.)

Figure SPM.6
Percentage of children ages 0 to 17 years living in counties with pollutant concentrations above the levels of the current air quality standards, 1999–2016



Source: EPA, 2018b, p. 11.

Even these estimates inflate the real public health risk by assuming all children are continuously exposed to the worst air quality measured in the county in which they reside, and by relying on air quality standards that are orders of magnitude lower than medically needed to be protective of human health (Arnett, 2006; Schwartz and Hayward, 2007; Avery, 2010; Belzer, 2017).

The EPA claims PM and ozone remain public health problems in the United States, saying 7% (for PM_{10}) to 21% (for $PM_{2.5}$) of children live in counties where they might be exposed to unhealthy levels of PM and 58% are threatened by ozone. But it is precisely with respect to these two alleged health threats that the EPA's misconduct and violation of sound methodology are most apparent. The agency violated the Bradford Hill Criteria, resisted transparency and accountability for its actions, and even violated the law as it set National Ambient Air Quality Standards (NAAQS) for PM and ozone (Schwartz, 2003; U.S. Senate Committee on Environment and Public Works, 2014; Milloy, 2016).

The EPA's claim that PM kills hundreds of thousands of Americans annually (EPA, 2010, p. G7) is classic scaremongering based on unreliable research (Enstrom, 2005; Milloy and Dunn, 2012; Wolff and Heuss, 2012). The EPA's own measurements show average exposure in the United States to both PM_{10} and $PM_{2.5}$ has fallen steeply since the 1990s and is now below its NAAQS (EPA, 2018a).

The authors of Chapter 6 conclude that air pollution caused by fossil fuels is unlikely to kill *anyone* in the United States in the twenty-first century, though it may be a legitimate health concern in rapidly growing developing countries that rely on biofuels and burning coal without modern emission control technologies.

7. Human Security

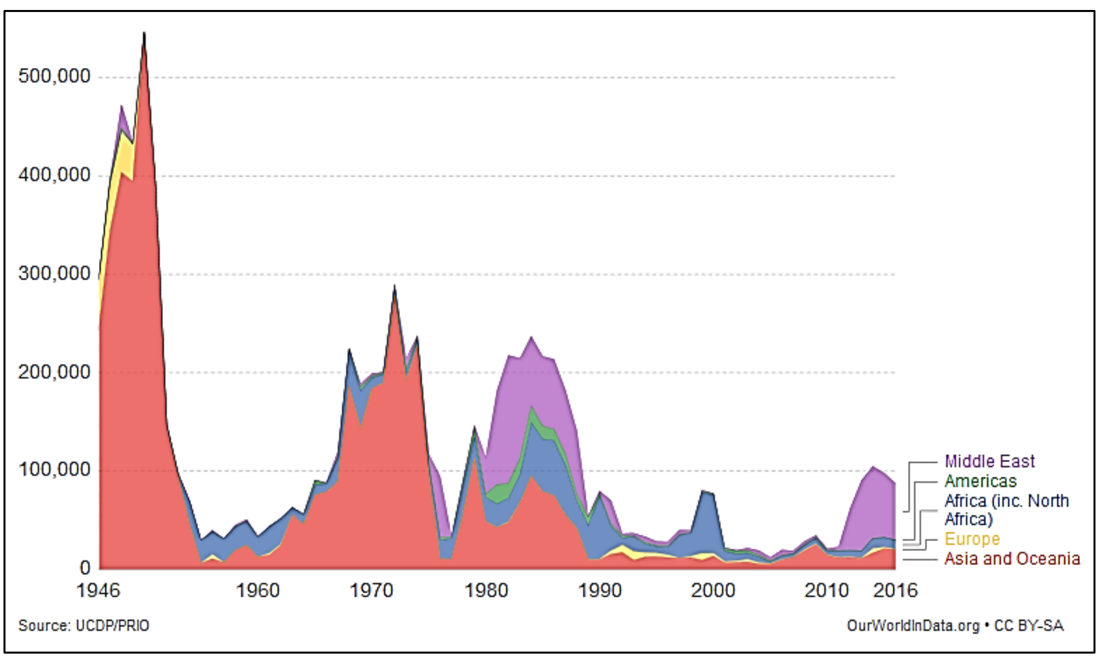
Similar to how the EPA exaggerates the harmful effects of air pollution, the IPCC exaggerates the harmful effects of climate change on "human security," which it defines as "a condition that exists when the vital core of human lives is protected, and when people have the freedom and the capacity to live with dignity" (IPCC, 2014a, p. 759). It collects circumstantial evidence to build a case linking climate change to an almost endless list of maladies, but it never actually tests the null hypothesis that these maladies are due to natural causes. The result is a long and superficially impressive report relying on assumptions and tenuous associations that fall far short of science (Lindzen, 2013; Gleditsch and Nordås, 2014; Tol, 2014b).

Fossil fuels make human prosperity possible (see Chapter 3 and Goklany, 2012). Prosperity in turn, as Benjamin Friedman writes, "more often than not fosters greater opportunity, tolerance of diversity, social mobility, commitment to fairness, and dedication to democracy" (Friedman, 2006, p. 15). All of this serves to protect, not threaten, human security. Prosperity also promotes democracy, and democracies have lower rates of violence and go to war less frequently than any other form of government (Halperin *et al.*, 2004, p. 12).

The cost of wars fought in the Middle East is sometimes attributed to the industrial nations' "addiction to oil." But many of those conflicts have origins and justifications unrelated to oil (Bacevich, 2017; Glaser and Kelanic, 2016; Glaser, 2017). On the verge of becoming a net energy exporter, the United States could withdraw from the region, but it is likely to remain for other geopolitical reasons. If global consumption of oil were to fall as a result of concerns over climate change, the Middle East could become more, not less, violent (Pipes, 2018, p. 21).

Empirical research shows no direct association between climate change and violent conflicts (Salehyan, 2014; Gleditsch and Nordås, 2014). The warming of the second half of the twentieth and early twenty-first centuries coincided with a dramatic decline in the number of fatalities due to warfare. (See Figure SPM.7.) In fact, extensive historical research in China and elsewhere reveals close and positive relationships between a warmer climate and peace and prosperity, and between a cooler climate

Figure SPM.7
Battle-related deaths in state-based conflicts since 1946, by world region



Source: Our World in Data, n.d.

and war and poverty (Yin *et al*., 2016; Lee *et al.*, 2017). A warmer world is likely to be more prosperous and peaceful than is the world today. Climate change does not pose a military threat to the United States (Kueter, 2012; Hayward *et al*., 2014). Forcing America's military leaders to utilize costly biofuels, prepare for climate-related humanitarian disasters, and harden military bases for possible changes in weather or sea level attributed to climate change wastes scarce resources and reduces military preparedness (Kiefer, 2013; Smith, 2015).

The authors of Chapter 7 conclude it is probably impossible to attribute to the human impact on climate *any* negative impacts on human security. Deaths and loss of income due to storms, flooding, and other weather-related phenomena are and always have been part of the human condition. Real-world evidence demonstrates warmer weather is closely associated with peace and prosperity, and cooler weather with war and poverty. A warmer world, should it occur, is therefore more likely to bring about peace and prosperity than war and poverty.

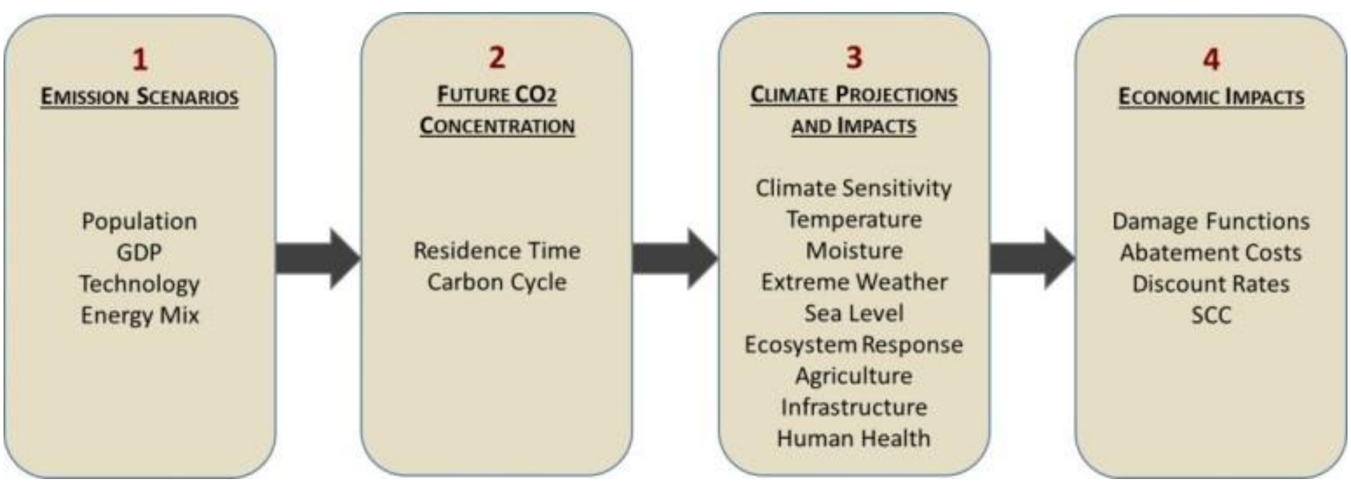
8. Cost-Benefit Analysis

Cost-benefit analysis (CBA), sometimes and more accurately called benefit-cost ratio analysis, is an economic tool that can help determine if the financial benefits over the lifetime of a project exceed its costs. Its use is mandated by executive order for regulations in the United States. In the climate change debate, cost-benefit analysis is used to estimate the net benefits or costs that could result from unabated global warming, from replacing fossil fuels with alternative energy sources, and of particular programs aimed at reducing greenhouse gas emissions or sequestering CO_2. CBA is also employed to estimate the "social cost of carbon."

Chapter 8 starts with a brief tutorial on cost-benefit analysis including its history and use in public policy and the order of "blocks" or "modules" in integrated assessment models (IAMs) (shown in Figure SPM.8). The biggest problem facing the use of IAMs in the climate change debate is the problem of propagation of error, the mounting uncertainty with each step in a complex formula where variables and processes are not known with certainty (Curry, 2011; Frank, 2015, 2016; Heal, 2017). This "cascading uncertainty" makes IAMs "close to useless" for policymakers (Pindyck, 2013). In such cases, the most reliable method of forecasting is not to rely on expert opinion, but to project a simple linear continuation of past trends (Armstrong, 2001).

Two prominent efforts to conduct CBAs of climate change, the U.S. Interagency Working Group on the Social Cost of Carbon (IWG, 2015; since disbanded) and the British Stern Review (Stern, 2007), were severely handicapped by un-

Figure SPM.8
Simplified linear causal chain of an IAM illustrating the basic steps required to obtain SCC estimates



Source: Modified from Parson *et al.*, 2007, Figure ES-1, p. 1.

acknowledged uncertainties, low discount rates, and reliance on the IPCC's flawed climate science (IER, 2014; Byatt, 2006; Mendelsohn, 2006; Tapia Granados and Carpintero, 2013). The complexity of climate science and economics makes conducting any of these CBAs a difficult and perhaps even impossible challenge (Ceronsky *et al.,* 2011). Harvard University Professor of Economics Martin Weitzman remarked, "the economics of climate change is a problem from hell," adding that "trying to do a benefit-cost analysis (BCA) of climate change policies bends and stretches the capability of our standard economist's toolkit up to, and perhaps beyond, the breaking point" (Weitzman, 2015).

Research presented in previous chapters shows how errors or uncertainties in choosing emission scenarios, estimating the amount of carbon dioxide that stays in the atmosphere, the likelihood of increases in flooding and extreme weather, and other inputs render IAMs unreliable guides for policymakers. Correcting the shortcomings of two of the leading IAMs – the DICE and FUND models – results in a superior analysis that, unsurprisingly, arrives at a very different conclusion, a "social cost of carbon" that is either zero or negative, meaning the social benefits of each additional unit of CO_2 emitted exceed its social costs (Dayaratna *et al*., 2017).

Figure SPM.9 summarizes evidence presented in previous chapters for all the costs and benefits of fossil fuels. While not exhaustive, the list of impacts in Figure SPM.9 includes most of the topics addressed by the IPCC's Working Group II and can be compared to Assessment Box SPM.2 Table 1 in its Summary for Policymakers (IPCC, 2014a, pp. 21–5). The new review finds 16 of 25 impacts are net benefits, only one is a net cost, and the rest are either unknown or likely to have no net impact.

Figure SPM.9
Impact of fossil fuels on human well-being

Impact	Benefit or Cost	Observations	Chapter References
Acid rain	No net impact	Once feared to be a major environmental threat, the deposition of sulfuric and nitric acid due to smokestack emissions, so-called "acid rain," was later found not to be a threat to forest health and to affect only a few bodies of water, where remediation with lime is an inexpensive solution. The fertilizing effect of nitrogen deposition more than offsets its harms to vegetation. Dramatic reductions in SO_2 and NO_2 emissions since the 1980s mean "acid rain" has no net impact on human well-being today.	5.1, 6.1
Agriculture	Benefit	Fossil fuels have contributed to the enormous improvement in crop yields by making artificial fertilizers, mechanization, and modern food processing techniques possible. Higher atmospheric CO_2 levels are causing plants to grow better and require less water. Numerous studies show the aerial fertilization effect of CO_2 is improving global agricultural productivity, on average by 15%.	3.3, 4.1, 5.2, 5.3, 7.2, 8.2
Air quality	Benefit	Exposure to potentially harmful chemicals in the air has fallen dramatically during the modern era thanks to the prosperity, technologies, and values made possible by fossil fuels. Safe and clean fossil fuels made it possible to rapidly increase energy consumption while improving air quality.	5.2, Chapter 6
Catastrophes	Unknown	No scientific forecasts of possible catastrophes triggered by global warming have been made. CO_2 is not a "trigger" for abrupt climate change. Inexpensive fossil fuel energy greatly facilitates recovery.	7.2, 8.2
Conflict	Benefit	The occurrence of violent conflicts around the world has fallen dramatically thanks to prosperity and the spread of democracy made possible by affordable and reliable energy and a secure food supply.	7.1, 7.3, 8.2
Democracy	Benefit	Prosperity is closely correlated with the values and institutions that sustain democratic governments. Tyranny promoted by zero-sum	7.1

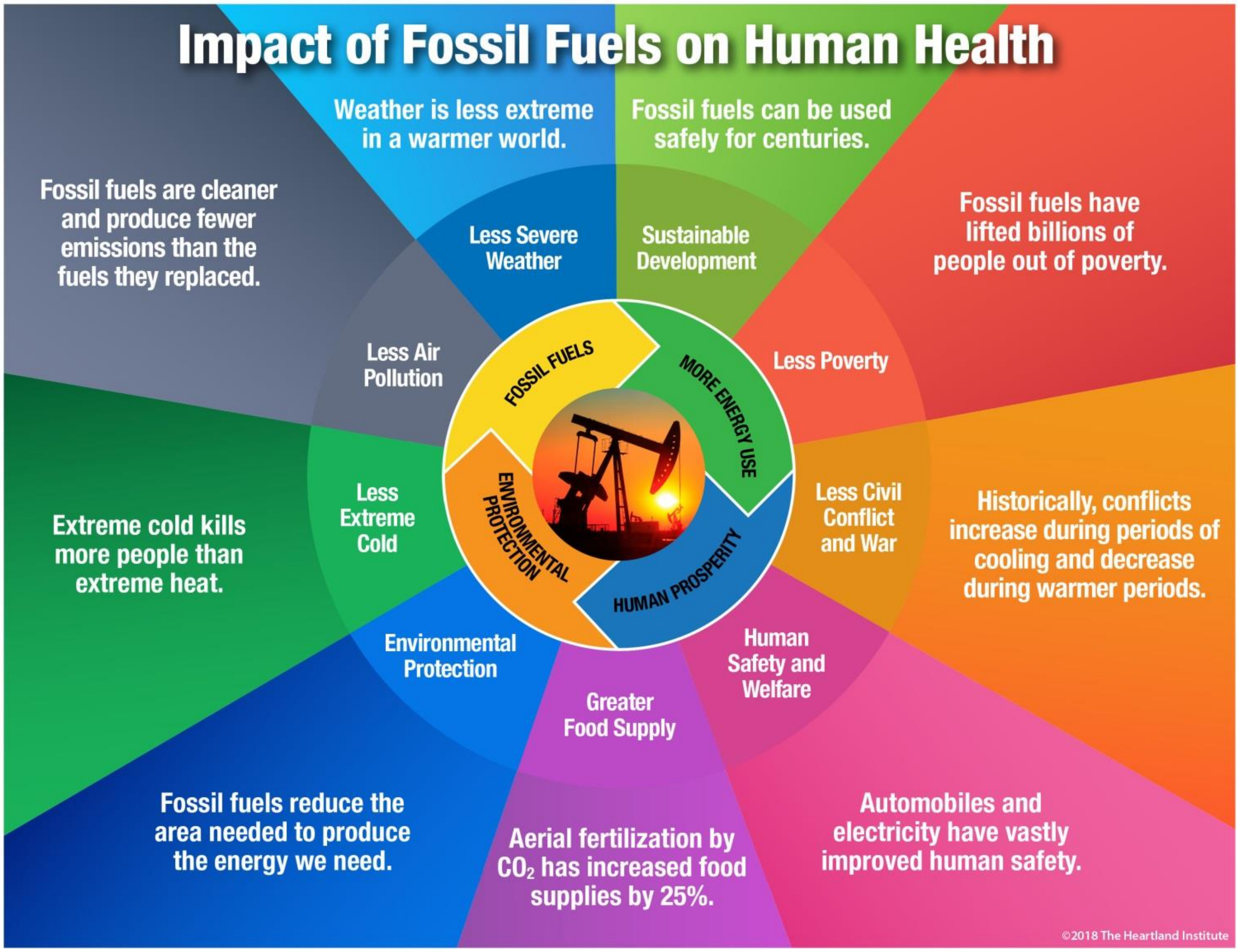
Impact	Benefit or Cost	Observations	Chapter References
		wealth is eliminated. Without fossil fuels, there would be fewer democracies in the world.	
Drought	No net impact	There has been no increase in the frequency or intensity of drought in the modern era. Rising CO_2 lets plants use water more efficiently, helping them overcome stressful conditions imposed by drought.	2.3, 5.3
Economic growth (consumption)	Benefit	Affordable and reliable energy is positively correlated with economic growth rates everywhere in the world. Fossil fuels were indispensable to the three Industrial Revolutions that produced the unprecedented global rise in human prosperity.	Chapter 3, 4.1, 5.2, 7.1, 7.2
Electrification	Benefit	Transmitted electricity, one of the greatest inventions in human history, protects human health in many ways. Fossil fuels directly produce some 80% of electric power in the world. Without fossil fuels, alternative energies could not be built or relied on for continuous power.	Chapter 3, 4.1
Environmental protection	Benefit	Fossil fuels power the technologies that make it possible to meet human needs while using fewer natural resources and less surface space. The aerial CO_2 fertilization effect has produced a substantial net greening of the planet, especially in arid areas, that has been measured using satellites.	1.3, Chapter 5
Extreme weather	No net impact	There has been no increase in the frequency or intensity of extreme weather in the modern era, and therefore no reason to expect any economic damages to result from CO_2 emissions.	2.3, 8.2
Forestry	Benefit	Fossil fuels made it possible to replace horses as the primary means of transportation, saving millions of acres of land for forests. Elevated CO_2 concentrations have positive effects on forest growth and health, including efficiency of water use. Rising CO_2 has reduced and overridden the negative effects of ozone pollution on the photosynthesis, growth, and yield of nearly all the trees that have been evaluated experimentally.	5.3
Human development	Benefit	Affordable energy and electrification, better derived from fossil fuels than from renewable energies, are closely correlated with the United Nations' Human Development Index and advance what the IPCC labels "human capital."	3.2, 4.1, 7.2
Human health	Benefit	Fossil fuels contribute strongly to the dramatic lengthening of average lifespans in all parts of the world by improving nutrition, health care, and human safety and welfare. (See also "Air quality.")	3.2, Chapter 4, 5.2
Human settlements/ migration	Unknown	Forced migrations due to sea-level rise or hydrological changes attributable to man-made climate change have yet to be documented and are unlikely since the global average rate of sea-level rise has not accelerated. Climate change is as likely to decrease as increase the number of people forced to migrate.	7.3
Ocean acidification	Unknown	Many laboratory and field studies demonstrate growth and developmental improvements in aquatic life in response to higher temperatures and reduced water pH levels. Other research illustrates the capability of both marine and freshwater species to tolerate and adapt to the rising temperature and pH decline of the planet's water bodies.	5.5
Oil spills	Cost	Oil spills can harm fish and other aquatic life and contaminate drinking water. The harm is minimized because petroleum is typically reformed by dispersion, evaporation, sinking, dissolution, emulsification, photo-oxidation, resurfacing, tar-ball formation, and biodegradation.	5.1
Other market sectors	No net impact	The losses incurred by some businesses due to climate change, whether man-made or natural, will be offset by profits made by other	1.2, 7.2

Impact	Benefit or Cost	Observations	Chapter References
		businesses taking advantage of new opportunities to meet consumer wants. Institutional adaptation, including of markets, to a small and slow warming is likely.	
Polar ice melting	Unknown	What melting is occurring in mountain glaciers, Arctic sea ice, and polar icecaps is not occurring at “unnatural” rates and does not constitute evidence of a human impact on the climate. Global sea-ice cover remains similar in area to that at the start of satellite observations in 1979, with ice shrinkage in the Arctic Ocean offset by growth around Antarctica.	2.3
Sea-level rise	No net impact	There has been no increase in the rate of increase in global average sea level in the modern era, and therefore no reason to expect any economic damages to result from it. Local sea levels change in response to factors other than climate.	2.3, 8.2
Sustainability	Benefit	Fossil fuels are a sustainable source of energy today and for the foreseeable future. Their impacts do not endanger human health or the environment. A market-based transition to alternative fuels will occur when supply and demand require it.	1.5, 5.2
Temperature-related mortality	Benefit	Cold weather kills more people than warm weather, and fossil fuels enable people to protect themselves from temperature extremes. A world made warmer and more prosperous by fossil fuels would see a net decrease in temperature-related mortality.	4.2
Transportation	Benefit	Fossil fuels revolutionized society by making transportation faster, less expensive, and safer for everyone. The increase in human, raw material, and product mobility was a huge boon for humanity, with implications for agriculture, education, health care, and economic development.	4.1
Vector-borne diseases	No net impact	Warming will have no impact on insect-borne diseases because temperature plays only a small role in the spread of these diseases. The technologies and prosperity made possible by fossil fuels eliminated the threat of malaria in developed countries and could do the same in developing countries regardless of climate change.	4.6
Water resources	Benefit	While access to water is limited by climate and other factors in many locations around the world, there is little evidence warming would have a net negative effect on the situation. Fossil fuels made it possible for water quality in the United States and other industrial countries to improve substantially while improving water use efficiency by about 30% over the past 35 years. Aerial CO_2 fertilization improves plant water use efficiency, reducing the demand for irrigation.	5.2, 5.3

The IPCC’s Working Group II says CO_2 emissions must be cut by between 40% and 70% from 2010 levels by 2050 in order to prevent the ~2°C of warming (since pre-industrial times) that would otherwise occur by that year (IPCC, 2014b, pp. 10, 12). Since economic growth is closely related to CO_2 emissions (a proxy for the use of fossil fuels to generate primary energy), the opportunity cost of reducing greenhouse gas (GHG) emissions includes the lost economic prosperity that otherwise would have occurred. Original analysis for this book shows that when this factor is accounted for, reducing GHGs to 70% below 2010 levels by 2050 would lower world GDP in 2050 by 21% from baseline forecasts. World GDP would be about $231 trillion instead of the $292 trillion now forecast by the World Bank, a loss of $61 trillion.

The IPCC also overlooked the physical limits wind and solar energy face preventing them from generating enough dispatchable energy (available on demand 24/7) to entirely replace fossil fuels, so energy consumption must fall in order for emissions to fall. If global population continues to grow, then per-capita energy consumption must decline even faster. One estimate that takes this factor into account finds reducing GHG emissions by 80% by 2050

Figure SPM.10
Impact of fossil fuels on human health



would reduce GDP by 81%, plunging the world into permanent economic recession and undoing all the progress made since 1905 (Tverberg, 2012).

The IPCC estimates the cost of unabated climate change to be between 0.2% and 2% of GDP in 2050 (IPCC, 2014a, p. 663) while the models it relies on produce an average estimate of 0.5%. That is the expected *benefit* of avoiding ~ 2°C of warming by 2050. Since the cost of reducing CO_2 emissions by 70% is approximately 21% of projected GDP that year, the cost-benefit ratio is 42:1 (21 / 0.5). In other words, reducing anthropogenic GHG emissions enough to avoid a 2°C warming by 2050 would cost 42 times as much as the benefits. The estimate by Tverberg (2012) taking into account the physical limits that prevent alternative energy sources from completely replacing fossil fuels produces an alarming cost-benefit ratio of 162:1 (81 / 0.5).

Cost-benefit analysis can also be applied to greenhouse gas mitigation programs to produce like-to-like comparisons of their cost-effectiveness. The cap-and-trade bill considered by the U.S. Congress in 2009, for example, would have cost 7.4 times more than its benefits, even assuming all of the IPCC's assumptions and claims about climate science were correct. Other bills and programs already in effect have costs exceeding benefits by factors up to 7,000 (Monckton, 2016). In short, even accepting the

IPCC's flawed science and scenarios, there is no justification for adopting GHG emission mitigation programs.

Conclusion

Fossil fuels have benefited humanity by making possible the prosperity that occurred since the first Industrial Revolution, which made possible investments in goods and services that are essential to protecting human health and prolonging human life. Fossil fuels also power the technologies that reduce the environmental impact of a growing human population, saving space for wildlife.

The IPCC and national governments around the world claim the negative impacts of global warming on human health and security, occurring now or likely to occur in the future, more than offset the benefits that come from the use of fossil fuels. This claim lacks any scientific or economic basis. The benefits of fossil fuels are nowhere reported in the IPCC's assessment reports. The analysis conducted here for the first time finds nearly all the impacts of fossil fuel use on human well-being are net positive (benefits minus costs), near zero (no net benefit or cost), or are simply unknown.

The alleged negative human health impacts due to air pollution are exaggerated by researchers who violate the Bradford Hill Criteria and rely too heavily on epidemiological studies finding weak relative risks. The alleged negative impacts on human security due to climate change depend on tenuous chains of causality that find little support in the peer-reviewed literature.

In conclusion, the IPCC and its national counterparts have not conducted proper cost-benefit analyses of fossil fuels, global warming, or regulations designed to force a transition away from fossil fuels. The global war on fossil fuels, which commenced in earnest in the 1980s and reached a fever pitch in the second decade of the twenty-first century, was never founded on sound science or economics. The authors of and contributors to *Climate Change Reconsidered II: Fossil Fuels* urge the world's policymakers to acknowledge this truth and end that war.

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THE NONGOVERNMENTAL INTERNATIONAL PANEL ON CLIMATE CHANGE

The Nongovernmental International Panel on Climate Change (NIPCC) is an international network of scientists first convened in 2003 to critically examine the reports of the United Nations-sponsored Intergovernmental Panel on Climate Change (IPCC). Unlike the IPCC, the NIPCC is not a government agency and does not receive government funding. Whereas the mission of the IPCC is to justify control of greenhouse gas emissions, NIPCC has no agenda other than discovering the truth about climate change.

CLIMATE CHANGE RECONSIDERED

Climate Change Reconsidered is a publication series produced by NIPCC and published by The Heartland Institute. The coauthors and editors have assembled and oversee an international team of scholars devoted to producing thorough and unbiased reviews of the extensive research on climate change. Five volumes were published prior to the present publication: *Nature, Not Human Activity, Rules the Climate* (2008), *Climate Change Reconsidered: The 2009 Report of the Nongovernmental International Panel on Climate Change (NIPCC)* (2009), *Climate Change Reconsidered: The 2011 Interim Report of the Nongovernmental International Panel on Climate Change (NIPCC)* (2011), *Climate Change Reconsidered II: Physical Science* (2013), and *Climate Change Reconsidered II: Biological Impacts* (2014). All are available for purchase from The Heartland Institute and for free online at www.climatechangereconsidered.org and www.nipccreport.org.

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The current report, *Climate Change Reconsidered II: Fossil Fuels,* is a comprehensive and authoritative review of environmental economics, climate science, and policy analysis regarding the social benefits and costs resulting from the use of fossil fuels. This report summarizes scientific research presented in previous volumes in the series and adds new research published as recently as December 2018. This volume tracks and critiques the IPCC's Fifth Assessment Report.

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