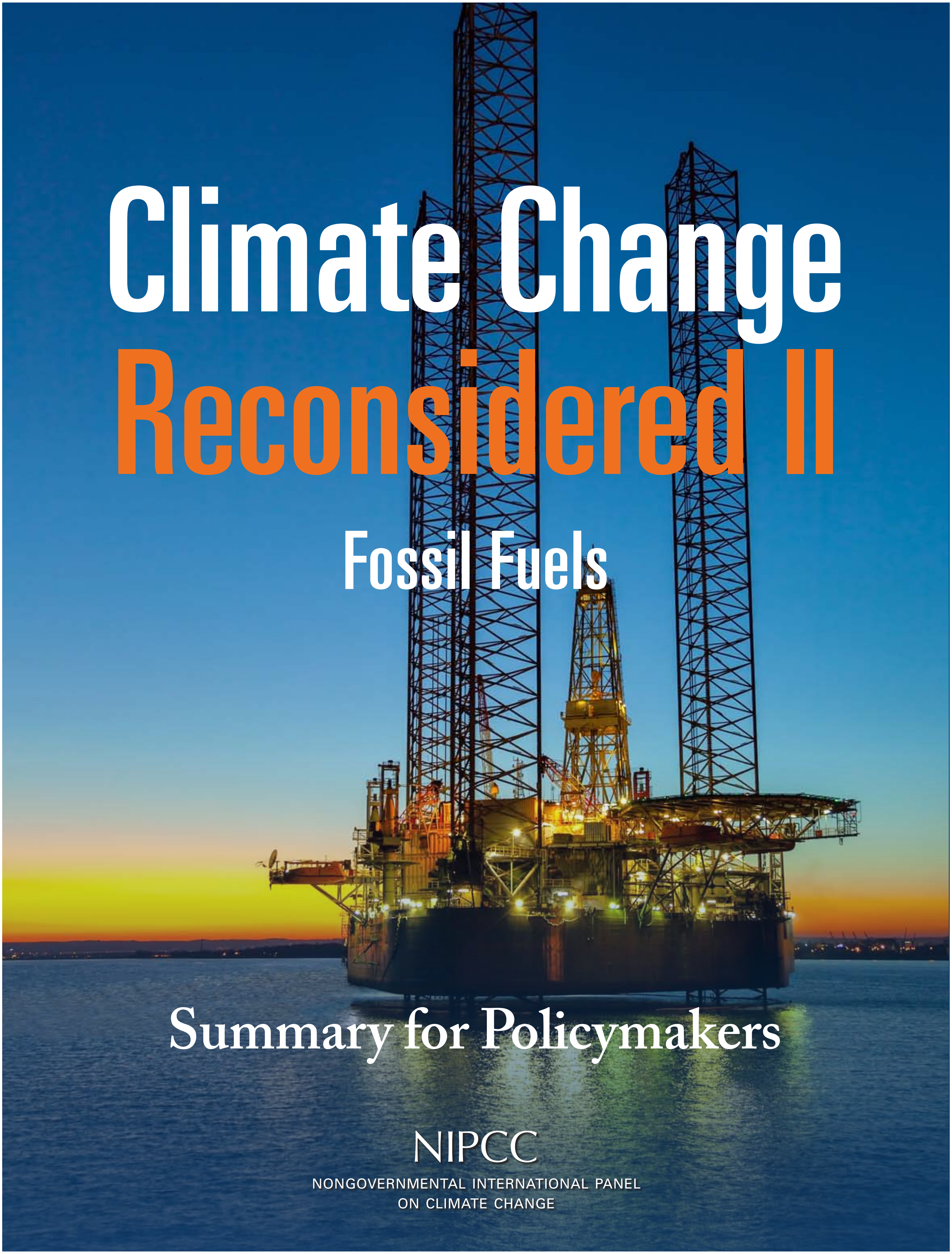

Climate Change Reconsidered II

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, as its name suggests, 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 2018, 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 and, like the preceding volumes, it focuses on research overlooked or ignored by the United Nations' Intergovernmental Panel on Climate Change (IPCC) (see Idso and Singer, 2009; Idso *et al*., 2011, 2013, 2014).

In its 2013 volume titled *Climate Change Reconsidered II: Physical Science,* NIPCC refuted the scientific basis of 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 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 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 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. Nearly 3,000 references appear in the full report.

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[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.

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.

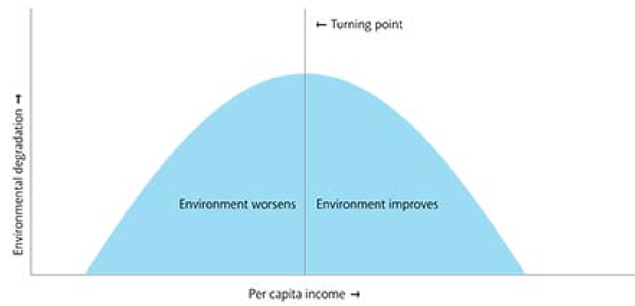
1. Environmental Economics

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 basic economic concepts that apply to climate change.

Perhaps the most useful concept economists bring to the debate is that of *opportunity cost*, the value of something that must be given up to acquire or achieve something else. By revealing the true costs and benefits of various policy options, 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 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 (Simon and Kahn, 1984; Grossman and Krueger, 1995; Simon, 1995; Yandle, *et al*., 2004; Goklany, 2007).

Figure SPM.1
A typical Environmental Kuznets Curve



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

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 (Morriss 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).

Economists have pointed out the economic, political, legal, and administrative pitfalls facing renewable and carbon-neutral energies (McKitrick, 2010; 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 (McKitrick and Essex, 2007; McKitrick, 2009; Lomborg, 2010; van Kooten, 2013; Monckton of Brenchley, 2016).

The fact that environmental issues often involve matters of social justice makes the involvement of economists even more valuable (Banzhaf, 2012). For example, economists can measure and help predict the distributional effects of public policies; e.g., whether the poor are hurt more than the wealthy by policies that seek to reduce greenhouse gas emissions by raising the price of energy (Büchs *et al*., 2011;

MISI, 2015; Kotkin, 2018). Similarly, economists can determine if poor countries are more vulnerable to climate change than wealthy countries (Mendelsohn, *et al.*, 2006).

It is sometimes raised as an objection to the involvement of economists in the climate debate that economists believe markets can solve all problems and so always recommend market-based solutions. Some economists may be guilty of tunnel vision, but most are well-schooled in the limits of markets. Don Fullerton and Robert Stavins, two distinguished environmental economists, wrote, "many economists – ourselves included – make a living out of analyzing 'market failures' such as environmental pollution. These are situations in which laissez faire policy leads not to social efficiency, but to inefficiency" (Fullerton and Stavins, 1998, p. 5). Market-based approaches to environmental protection, they wrote, "are no panacea," and "the scope of economic analysis is much broader than financial flows" (*Ibid*., pp. 5–6).

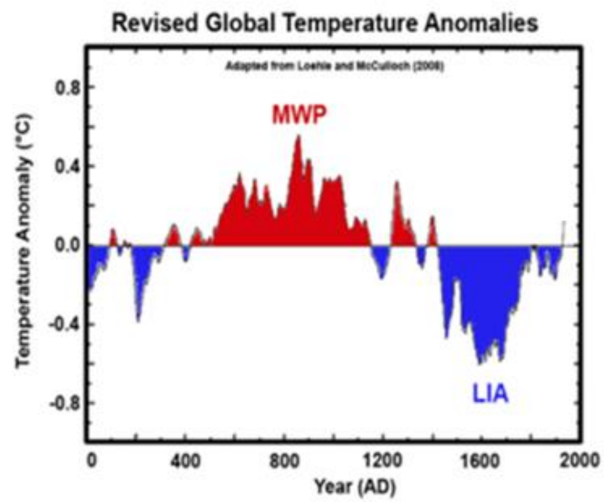
2. Climate Science

IPCC conceded in its Third Assessment Report, "In climate research and modelling, we should recognize that we are dealing with a coupled non-linear chaotic system, and therefore that long-term prediction of future climate states is not possible" (IPCC, 2001, p. 774). Fourteen years later, a team of climate scientists led by Dr. Sandrine Bony, a climate researcher at the Laboratory of Dynamic Meteorology in Paris, wrote, "fundamental puzzles of climate science remain unsolved because of our limited understanding of how clouds, circulation and climate interact. One example is our inability to provide robust assessments of future global and regional climate changes" (Bony *et al.*, 2015).

Chapter 2 begins with a climate science tutorial covering basic scientific facts and issues that must be understood in order to participate in the climate change debate. Earth's temperature is maintained by a layer of atmospheric gases that absorb heat and warm the planet's surface. The modern debate over climate change is based on IPCC's claim that human emissions of greenhouse gases (GHG)[2] are causing Earth to warm unnaturally, which is causing (or will cause) negative and potentially catastrophic effects for the environment and human well-being.

IPCC assumes, wrongly, that global temperatures would have been unchanging in the absence of man-made greenhouse gas emissions. Figure SPM.2 illustrates the variability of global temperatures during the past 2,000 years. Plainly, the modern warming is not outside the range of natural variability as revealed by the geologic record.

Figure SPM.2
Mean relative temperature history of the globe



Source: Loehle and McCulloch, 2008.

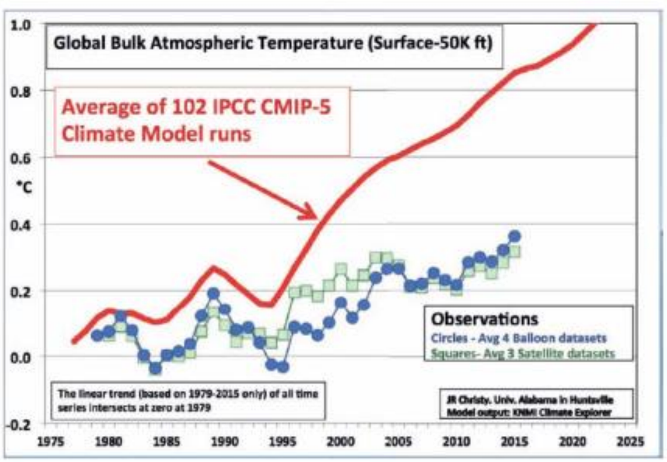
Section 2.2 critiques the claim that "97 percent of scientists agree" that climate change is mostly or entirely the result of the human presence and dangerous (AAAS, 2018; NASA, 2018). Surveys, literature reviews, and petitions demonstrate a lively debate is occurring in the scientific community over the basic science and economics of climate change (Essex and McKitrick, 2007; Schulte, 2008; Solomon, 2010; Curry, 2012; Friends of Science, 2014; Tol, 2014a; Legates *et al.*, 2015; Global Warming Petition Project, 2018).

[2] Fossil-fuel related CO_2 emissions constitute about 78% of total annual anthropogenic greenhouse gas (GHG) emissions. Other anthropogenic GHGs are methane (CH_4), nitrous oxide (N_2O), and fluorinated gases.

Section 2.3 explains why scientists disagree, finding the sources of disagreement in the interdisciplinary character of the issue, fundamental uncertainties concerning climate science (Lindzen, 2012; Curry, 2015), the failure of IPCC to be an independent and reliable source of research on the subject (IAC, 2010; Laframboise, 2011, 2013), and bias among researchers (Kabat, 2008; Berezow and Campbell, 2012).

Section 2.4 explains the scientific method and contrasts it with the methodology used by IPCC and with the "precautionary principle." Section 2.5 describes how IPCC's global climate models make flawed projections about present and future climate changes, as illustrated in Figure SPM.3.

Figure SPM.3
Failure of climate models to hindcast global temperatures, 1979–2015



Source: Christy, 2016.

Section 2.6 critiques five postulates or assumptions that underlie IPCC's work, and Section 2.7 critiques five key pieces of circumstantial evidence relied on by IPCC. The chapter's authors paid special attention to research overlooked by IPCC or containing data, discussion, or implications arguing against IPCC's claim that dangerous global warming is resulting, or will result, from human-related GHG emissions. Most notably, the authors say IPCC has exaggerated the amount of warming likely to occur if the concentration of atmospheric CO_2 were to double, and such warming as occurs is likely to be modest and cause no net harm to the global environment or to human well-being.

Part II. The Benefits of Fossil Fuels

Part II presents an accounting of the social 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. The close connection between fossil fuels and human prosperity is revealed by the history of the Industrial Revolution and analysis of more recent technological innovations. See Figure SPM.4.

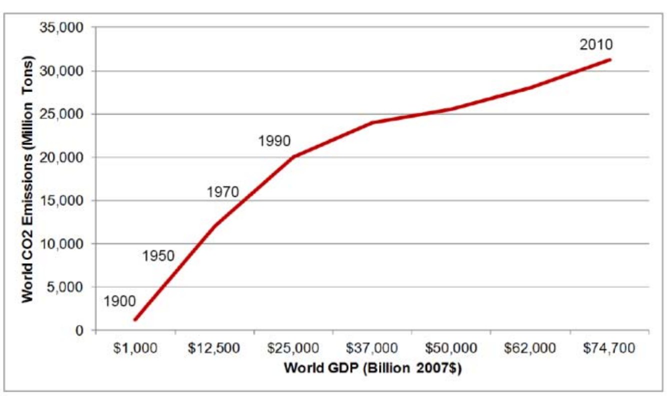
Fossil fuels are essential for fertilizer production and concrete manufacture, and responsible for such revolutionary technologies as the steam engine and cotton gin, early railroads and steamships, electric power and the U.S. electric grid, the internal combustion engine, and the computer and Internet 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; Maddison, 2010; Gordon, 2016).

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 Programme, 2010; Šlaus and Jacobs, 2011). Scholars have closely examined the connection between the cost and availability of reliable energy (from fossil fuels and other sources) and economic growth, typically measured as per-capita GDP. This research reveals a positive relationship between low energy prices and human prosperity (Clemente, 2010; Bezdek, 2014; 2015a).

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; Stacey 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 alone delivered economic benefits in the United States 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 percent from 2012 to 2030 would cost $478 billion and an average of 224,000 jobs each year (U.S. Chamber of Commerce, 2014). Reducing GHG emissions to 90 percent below 1990 levels by 2050 "would reduce world living standards in 2050 to a level they were more than two centuries prior. That is, virtually all of the economic gains of the industrial revolution and everything that followed would be nullified" (Bezdek, 2015b, p. 77).

Figure SPM.4
Relationship between world GDP and CO_2 emissions



Source: Bezdek, 2014, p. 127.

4. Human Health Benefits

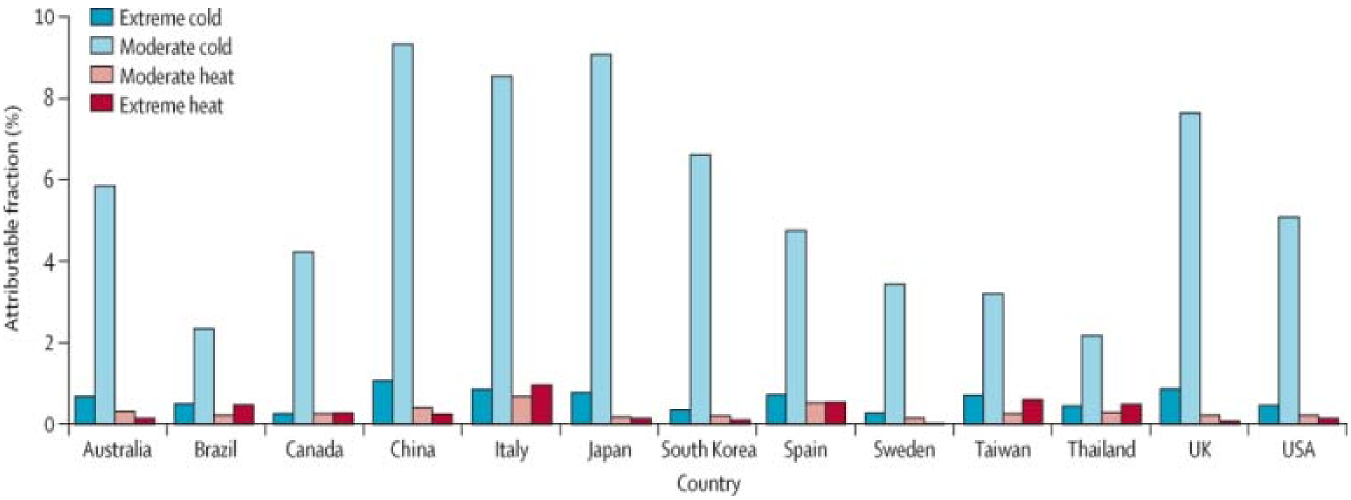
Historically, humankind was besieged by epidemics and other disasters that caused frequent widespread deaths and kept the average lifespan to less than 35 years (Omran, 1971). The average lifespan among the ancient Greeks was apparently just 18 years, and among the Romans, 22 years (Bryce, 2014, p. 59, citing Steckel and Rose, 2002).

Today, according to the U.S. Census Bureau, "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 (Institute for Health Metrics and Evaluation, 2013; Mathers *et al.*, 2015). 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 (Institute for Health Metrics and Evaluation, 2013; Figure 4-1). … [A]ll regions have had increases in mean age at death, particularly East Asia and tropical Latin America" (U.S. Census Bureau, 2016, pp. 31–3).

Fossil fuels benefit human health and longevity in four ways. First, fossil fuels have lifted billions of people out of poverty, reducing the negative effects of poverty on human health. Second, fossil fuels have improved human well-being and safety by powering labor-saving and life-protecting technologies such as air conditioning, modern medicine, cars, trucks, and airplanes. Third, fossil fuels made possible electrification of heating, lighting, manufacturing, and other processes, resulting in protection of human health and extended lives. And fourth, fossil fuels increased the quantity and improved the reliability of the food supply (Moore and Simon, 2000; Bryce, 2014; 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 global climate models for the twenty-first century and beyond. Section 4.2 documents how medical science and observational research in Asia, 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.5.

Figure SPM.5
Deaths caused by cold vs. heat



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

Sections 4.3, 4.4, and 4.5 report research showing 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). Section 4.6 finds global warming has little if any influence on mosquito- or tick-borne diseases (Murdock *et al.*, 2016).

5. Environmental Benefits

Chapter 5 reviews the scientific and economic literature on how human use of fossil fuels affects plants and wildlife. Section 5.1 begins with a tutorial on the chemistry of fossil fuels, explaining why fossil fuels are the ideal combustion fuel (Kiefer, 2013; Smil, 2016). The fact that carbon and hydrogen are ubiquitous in the natural world explains why the rest of the physical world is compatible with them and even depends on them for life itself.

Section 5.1.2 explains how the *carbon cycle* minimizes the impact of human emissions of CO_2 by reforming it into other compounds and sequestering it in the oceans, plants, and rocks. The exact size of any of these reservoirs is unknown, but they necessarily stay in balance with one another – Le Chatelier's principle – by exchanging huge amounts of carbon every year. According to 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). These percentages are so small and measurements so uncertain that it is possible there is no residual at all.

The *geological record*, reviewed in Section 5.1.3, shows (a) the concentration of CO_2 in the atmosphere today is far below levels that existed during most of the geological record, (b) CO_2 concentrations in the atmosphere typically rise several hundred years after temperatures rise, making it impossible for CO_2 to be responsible for the temperature increase, (c) in the history of the planet there has never been a "runaway warming" caused by rising CO_2 levels, and (d) the rise in CO_2 levels since the beginning of the Industrial Age has averted an ecological disaster (Moore, 2016).

Section 5.2 presents the benefits of fossil fuels for plants and wildlife. The power density of fossil fuels enables humanity to meet its ever-rising need for food and natural resources while using less surface space, rescuing precious wildlife habitat from development. In 2010, fossil fuels, thermal, and hydropower required less than 0.2 percent 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 cells, wind, and liquid biofuels), yet delivered *110 times as much power* (*Ibid.*).

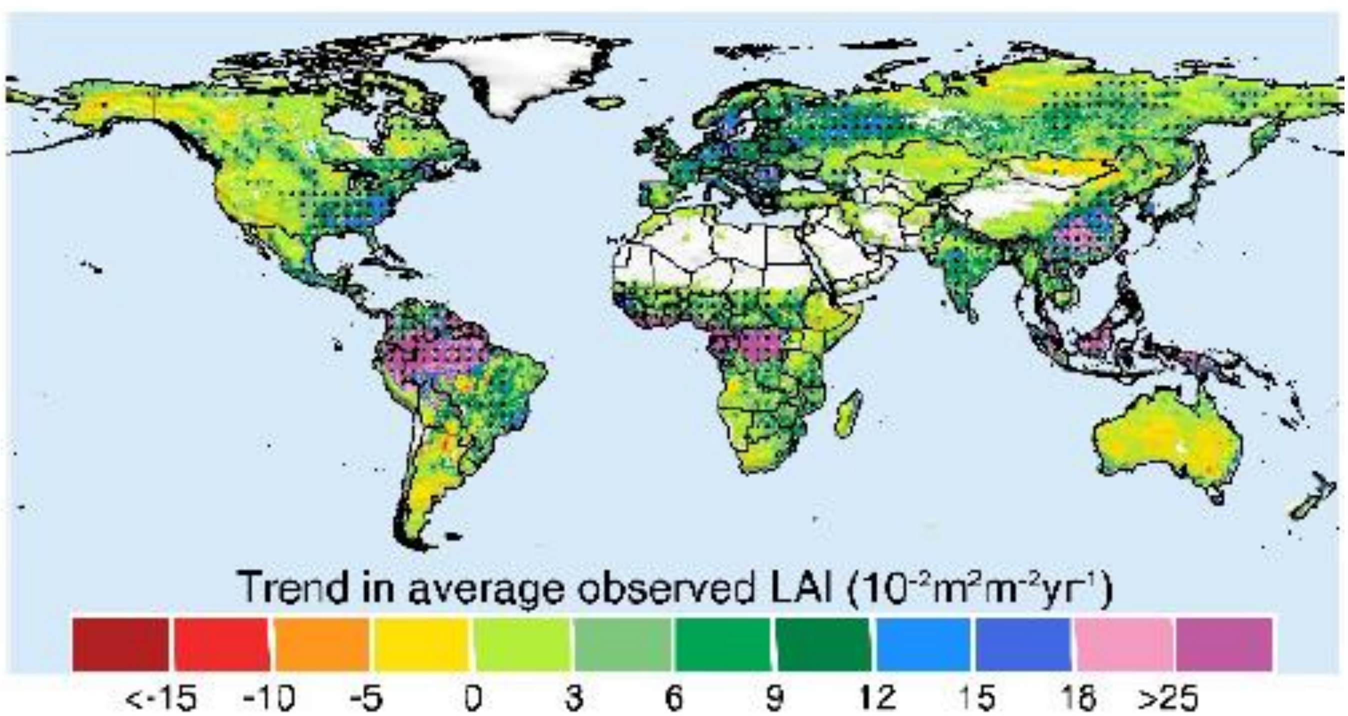
Section 5.3 reviews the scientific literature on the impacts of global warming and rising atmospheric CO_2 concentrations on plants, finding them to be overwhelmingly positive. This extends to rates of photosynthesis and biomass production and the efficiency with which plants and trees utilize water (Ainsworth and Long, 2005; Bourgault *et al.*, 2017). The result is a remarkable and beneficial Greening of the Earth (Zhu *et al.* 2016; Campbell *et al.*, 2017; Cheng *et al.*, 2017). See Figure SPM.6.

Section 5.4 reviews the impacts of global warming on terrestrial animals and once again finds the results to be positive: Real-world data indicate warmer temperatures and higher atmospheric CO_2 concentrations will be highly beneficial to wildlife, favoring a proliferation of species. Section 5.5 reviews laboratory and field studies of the impact of global warming on aquatic life and finds tolerance, adaptation, and even growth and developmental improvements in response to higher temperatures and reduced water pH levels. Section 5.6 provides a brief conclusion.

Part III. Costs of Fossil Fuels

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

Figure SPM.6
Greening of the Earth, 1982 to 2009, trend in average observed leaf area index (LAI)



Source: Zhu *et al.*, 2016.

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. Other harms attributed to the combustion of fossil fuels included 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).

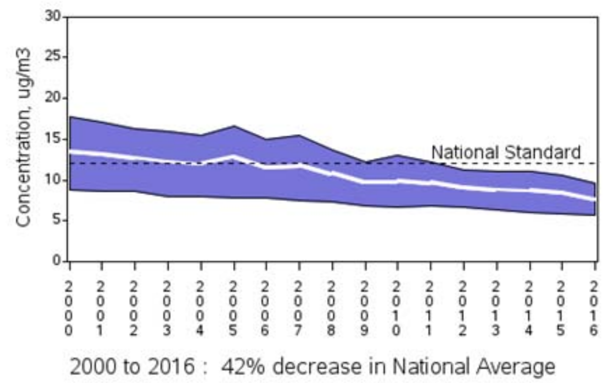
A review of the evidence shows EPA and other government agencies greatly exaggerate the public health threat posed by fossil fuels. While the combustion of fossil fuels without pollution abatement technology does release chemicals that could be harmful to humans, other animal life, and plants, the most important issue is not the quantity of emissions but *levels of exposure* (Calabrese and Baldwin, 2003; Calabrese, 2005, 2015; Belzer, 2017). By all accounts, air quality improved in the U.S. and other developed countries throughout the twentieth century (Simon, 1995, 1996) and the trend continues in the twenty-first century (Goklany 2007, 2012).

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). 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 National Ambient Air Quality Standards (NAAQS) (EPA, 2018a). (See Figure SPM.7.)

According to EPA, only 3% of children in the United States live in counties where they might be exposed to what EPA deems "unhealthy air" (EPA, 2018b). Also according to EPA, 0% of children live in counties in which they might be exposed to harmful levels of carbon monoxide in ambient 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.8.)

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).

Figure SPM.7
PM2.5 seasonally weighted average annual concentration in the United States, 2000–2016.

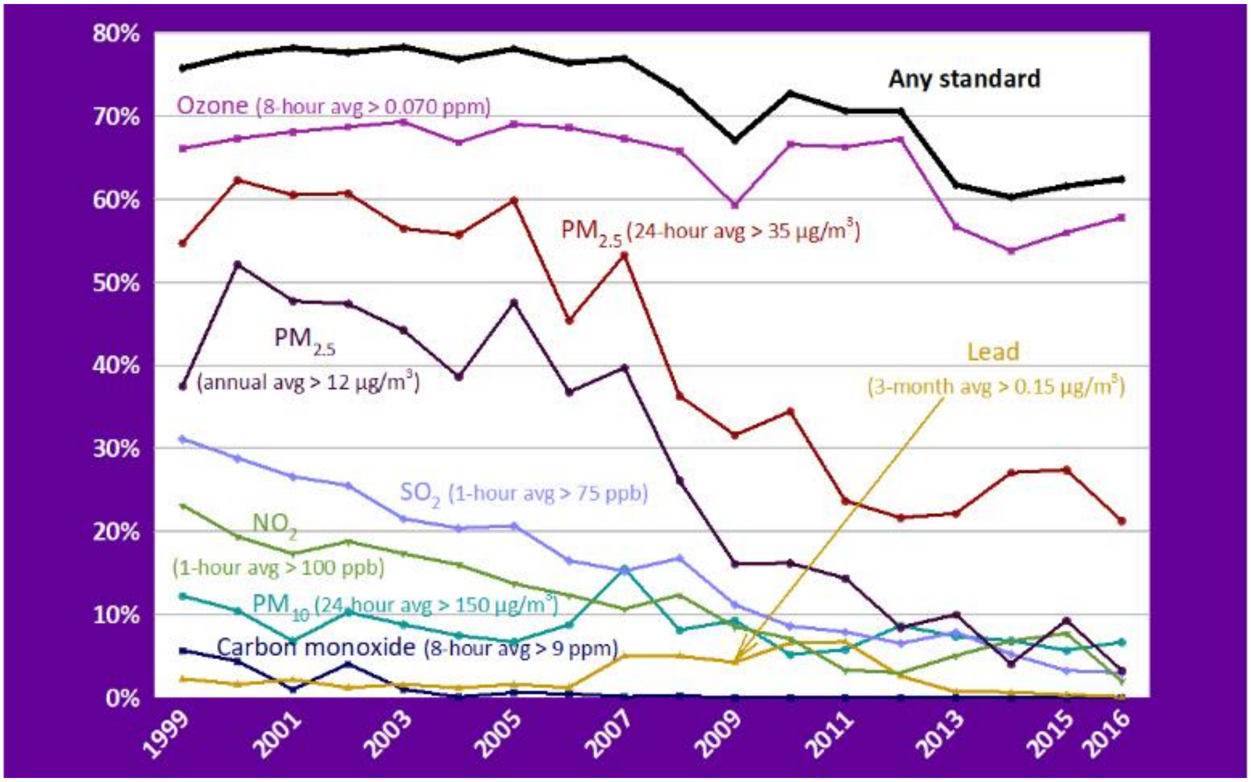


Source: EPA, 2018a.

EPA claims PM and ozone remain as public health problems, 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 EPA's misconduct and flagrant violation of sound methodology are most apparent. EPA violated the scientific method, resisted transparency and accountability for its actions, and even repeatedly violated the law as it set NAAQS for PM and ozone (Schwartz, 2003; U.S. Senate Committee on Environment and Public Works, 2014; Milloy, 2016).

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.

Figure SPM.8
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.

7. Human Security

Similar to how EPA exaggerates the harmful effects of air pollution, IPCC exaggerates the harmful effects of global warming 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 long and superficially impressive reports relying on assumptions and tenuous associations that fall far short of science (Lindzen, 2013; Gleditsch and Nordås, 2014; Tol, 2014b).

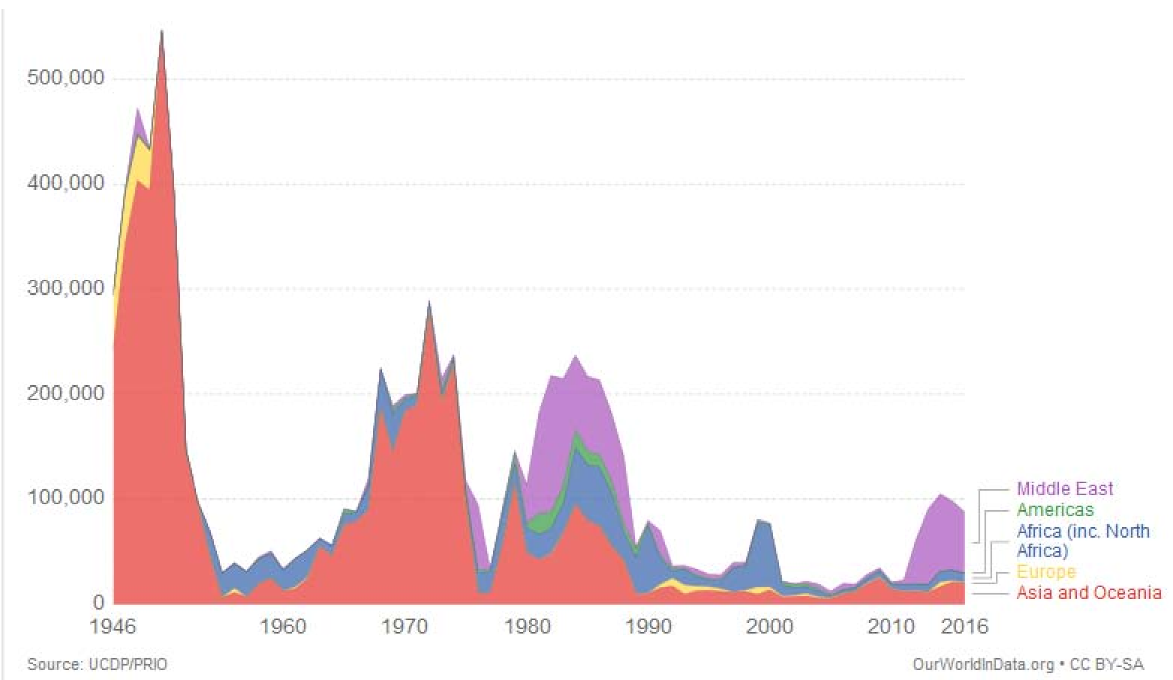
Fossil fuels make human prosperity possible (see Chapter 3 and Goklany, 2012). Prosperity in turn, as Benjamin Friedman writes, "more often than not fosters greater opportunity, tolerance of diversity, social mobility, commitment to fairness, and dedication to democracy" (Friedman, 2006, p. 15). All of this serves to protect, not threaten, human security. Prosperity 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 (Ginor and Remez, 2007; 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 global warming, the Middle East could become more, not less, violent (Pipes, 2018, p. 21).

Empirical research shows no direct association between climate change and armed 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.9.) 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 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. President Donald Trump was right to remove it from the Pentagon's list of threats to national security (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).

Figure SPM.9
Battle-related deaths in state-based conflicts since 1946, by world region



Source: Our World in Data (website). Retrieved on July 6, 2018.

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. Fossil fuels make it possible to *protect humanity from the climate*, producing a net positive effect on human security (Goklany, 2012; Epstein, 2014).

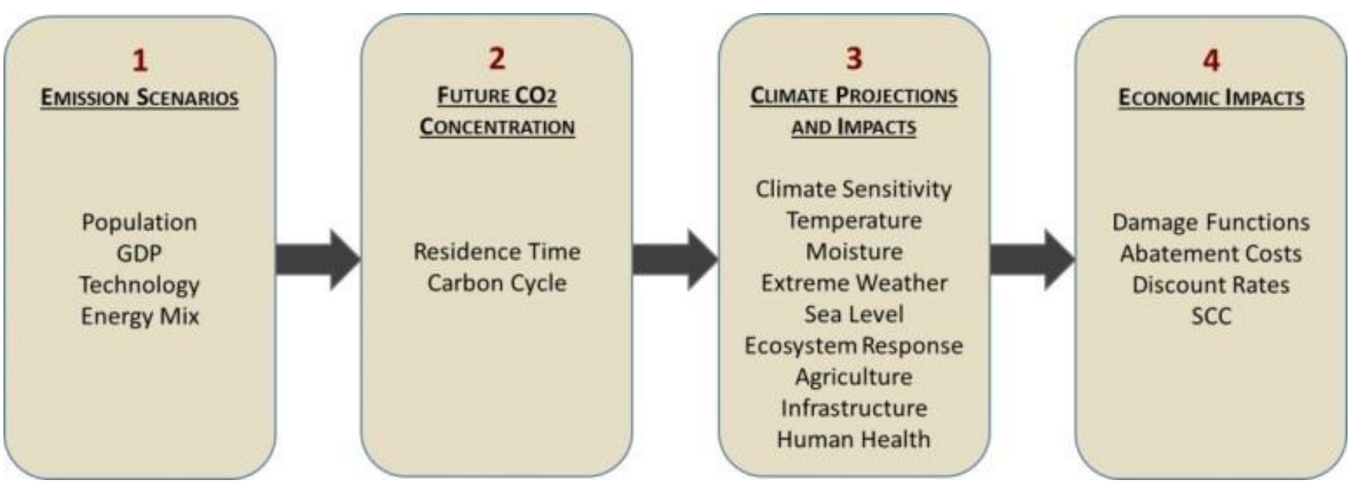
8. Cost-Benefit Analysis

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 for national regulations in the United States by presidential executive order. In the climate change debate, cost-benefit analysis is used to estimate the net social 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 resolve the "mitigate versus adapt" question.

Section 8.1 contains 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.10). 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). This "cascading uncertainty" makes IAMs "close to useless" for policymakers (Pindyck, 2013a). In such cases, the most reliable method of forecasting is to project a simple linear continuation of past trends (Armstrong, 2001), but that is not the approach taken by IPCC or the authors of the models on which it relies.

Two prominent efforts to conduct CBAs of climate change, the U.S. Interagency Working Group on the Social Cost of Carbon (disbanded in 2017) and the British Stern Review (IWG, 2015; Stern, 2007), were severely handicapped by unacknowledged uncertainties, unjustified selection of low discount rates, and reliance on IPCC's flawed climate science (IER, 2014; Byatt *et al.*, 2006; Mendelsohn, 2006).

Figure SPM.10
Simplified linear causal chain of an IAM illustrating the basic steps required to obtain social cost of carbon (SCC) estimates



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

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).

Tracking and drawing on research presented in previous chapters, Section 8.2 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.

Section 8.3 reveals how correcting the shortcomings of two 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 probably indistinguishable from zero and likely to be negative, meaning the social benefits of each additional unit of CO_2 emitted exceed its costs.

Section 8.4 summarizes evidence presented in previous chapters for all the costs and benefits of fossil fuels in figures reproduced as Figures SPM.11 and SPM.12 below. While not exhaustive, the list of impacts includes most of the topics addressed by IPCC's WGII and can be compared to Assessment Box SPM.2 Table 1 in its Summary for Policymakers (IPCC, 2014a, pp. 21-25). 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.

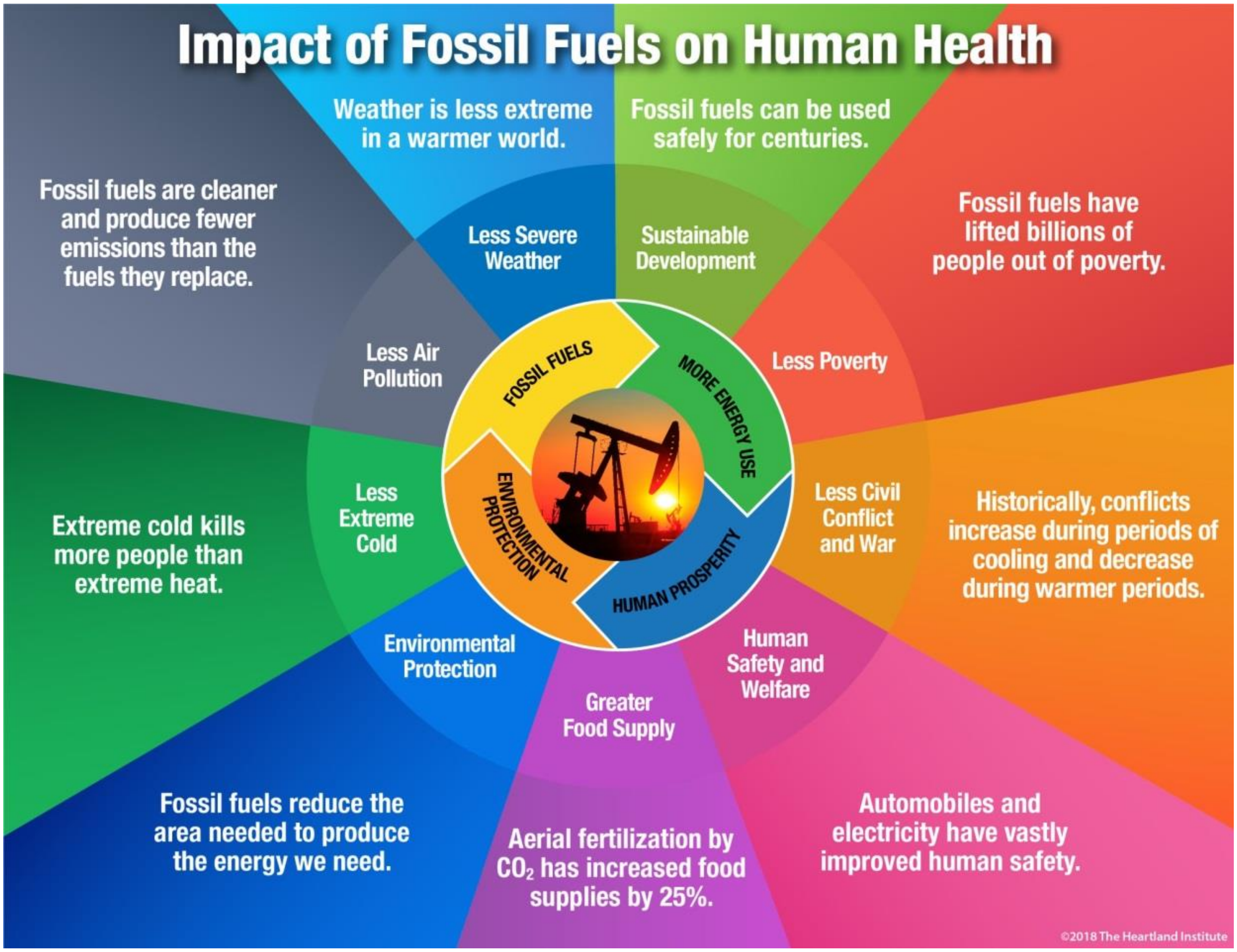
Figure SPM.11
Impact of fossil fuels on human well-being

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 benefits of nitrogen deposition more than offset 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 are responsible for 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 at least 15 percent	3.4, 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.	8.1
Conflict	Benefit	The occurrence of armed conflicts around the world has fallen dramatically thanks to prosperity and the spread of democracy	7.1, 7.3, 8.2

Impact	Benefit or Cost	Observations	Chapter References
		made possibly by affordable and reliable energy and a secure food supply.	
Democracy	Benefit	The prosperity made possible by fossil fuels is closely correlated with the values and institutions that sustain democratic governments. Tyranny is often promoted by poverty and slow growth. Without fossil fuels, there would be fewer democracies.	7.1
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.	2.7, 5.3
Economic growth (consumption)	Benefit	Affordable and reliable energy is positively correlated with economic growth rates everywhere in the world. Fossil fuels produced the three Industrial Revolutions that made possible the unprecedented global rise in human prosperity.	Chapter 3, 4.1, 5.2, 7.1, 7.2, 8.1, 8.2
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.	2.7, 8.2
Forestry	Benefit	Fossil fuels made it possible for automobiles, trucks, and trains to replace horses as the primary means of transportation, allowing millions of acres of pastures to return to 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 nearly all the trees that have been evaluated experimentally.	5.3
Heat-related mortality	Benefit	Extreme cold kills more people than extreme heat, so a warmer world would see a net decrease in temperature-related mortality in virtually all parts of the world, even those with tropical climates.	4.2
Human development	Benefit	Affordable energy and electrification are closely correlated with the United Nations' Index of Human Development and advance what IPCC labels "human capital."	3.1, 4.1, 7.2
Human health	Benefit	Fossil fuels are responsible for 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.")	3.1, Chapter 4, 5.2
Human settlements /migration	Unknown	Forced migration due to sea-level rise or hydrological changes attributable to man-made climate change have yet to be documented and is unlikely since the global average rate of sea-level rise has not accelerated. Global warming is as likely to decrease as increase the number of people forced to migrate due to changes in temperature or precipitation.	7.3, 8.2
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	5.5

Impact	Benefit or Cost	Observations	Chapter References
		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.	
Oil spills	Cost	Because fossil fuels are carbon-based, accidental releases or spills simply return the fuels' component parts to carbon reservoirs in different chemical forms. This often has the effect of minimizing the harm they could cause by coming into contact with plants or animals, including humans. 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 businesses taking advantage of new opportunities to meet consumer wants. Institutional adaptation, including of markets, to a small and slow global warming is likely.	1.2, 7.2
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.	2.7
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.	2.7, 8.2
Sustainability	Benefit	Fossil fuels are a sustainable source of energy for future generations. The technology they support makes sustainable development possible. Rising prosperity and market forces also are working to ensure an endless supply of fossil fuels.	1.5, 5.2
Transportation	Benefit	Fossil fuels revolutionized society by making transportation faster, less expensive, and safer for everyone. The increase in human 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	Global 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 will 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 percent over the past 35 years. Aerial CO_2 fertilization improves plant water use efficiency, reducing the demand for irrigation.	5.2, 5.3

Figure SPM.12
Impact of fossil fuels on human health



Since economic growth is closely related to the cost of electricity and energy generally, the opportunity cost of reducing greenhouse gas (GHG) emissions includes the lost economic prosperity that otherwise would have occurred. Moreover, wind and solar face physical limits on scale that prevent them from generating enough dispatchable energy (available 24/7) to 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.

When these factors are accounted for, reducing GHGs to 90 percent below 1990 levels by 2050 would require that world GDP in 2050 be reduced 96%, to only 4% of what it is projected to be in that year. That is, world GDP would be only about $12 trillion instead of the $292 trillion now forecast by the U.S. Energy Information Administration, and per-capita world GDP would be about $1,200 instead of $30,600. Per-capita income would be at about the level it was in the United States and Western Europe in about 1820 or 1830, before the Industrial

Revolution. Virtually all of the economic gains of the modern era would be nullified (Bezdek, 2015b).

Since IPCC estimates the cost of unabated climate change to be approximately 3% of global GDP in 2100, that is the expected *benefit* of reducing and eventually banning the use of fossil fuels for power generation. The cost-benefit ratio is therefore 96:3, or 32. In other words, reducing anthropogenic GHG emissions enough to avoid a 2°C warming by 2100 would cost 32 times as much as the benefits. Even this estimate is almost certainly too low since it grants all of IPCC's false and exaggerated claims regarding climate sensitivity and the negative impacts of climate change. An alternative methodology that corrects some of IPCC's most glaring mistakes places the cost-benefit ratio at 300:1.

Cost-benefit analysis also can 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 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. In short, even accepting IPCC's flawed science and scenarios, there is no justification for adopting GHG emission reduction 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 powered the technologies that reduced the environmental impact of a growing human population, saving space for wildlife.

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. Nearly all the impacts of fossil fuel use on human well-being are net positive (benefits minus costs) or are simply unknown. The alleged negative human health impacts due to air pollution are greatly exaggerated by researchers who violate the scientific method 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.

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, nor are they likely to do so given their political agendas. The CBAs conducted for this volume find the social benefits of fossil fuels exceed the costs by a wide margin. A forced reduction of GHG emissions to 90 percent below 1990 levels by 2050 would require that world GDP in 2050 be reduced to only 4% of what it is projected to be in that year. Most regulations aimed at reducing GHG emissions have costs that are hundreds and even thousands of times greater than their benefits.

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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Authors, Contributors, and Reviewers of *CCR-II: Fossil Fuels*

Lead Authors/Editors

Roger Bezdek, Ph.D.
Management Information Services, Inc.
USA

Craig D. Idso, Ph.D.
Center for the Study of Carbon Dioxide and Global Change
USA

David Legates, Ph.D.
University of Delaware
USA

S. Fred Singer, Ph.D.
Science and Environmental Policy Project
USA

Patrick Moore, Ph.D.
GreenSpirit
CANADA

Ross McKitrick, Ph.D.
University of Guelph
CANADA

S. Fred Singer, Ph.D.
Science and Environmental Policy Project
USA

Charles N. Steele, Ph.D.
Hillsdale College
USA

Richard Stroup, Ph.D.
North Carolina State University
USA

Chapter Lead Authors

Dennis Avery
The Heartland Institute
USA

Roger Bezdek, Ph.D.
Management Information Services, Inc.
USA

John Dale Dunn, M.D., J.D.
Emergency Physician
USA

James Enstrom, Ph.D.
Scientific Integrity Institute
USA

Craig D. Idso, Ph.D.
Center for the Study of Carbon Dioxide and Global Change
USA

David Legates, Ph.D.
University of Delaware
USA

Contributing Authors

Jerome Arnett, Jr., M.D.
American Council on Science and Health
USA

Dennis Avery
The Heartland Institute
USA

Charles Battig, M.S.E.E., M.D.
Private Practice Medicine
USA

Edward Briggs
Commander, Naval Surface Force, U.S. Atlantic Fleet (retired)
USA

Barry Brill, OPM
Associate Minister of Energy & Science (retired)
NEW ZEALAND

John Dale Dunn, M.D., J.D.
Emergency Physician
USA

James Enstrom, Ph.D.
Scientific Integrity Institute
USA

Donald K. Forbes
Commandant of Midshipmen, U.S. Naval Academy (retired)
USA

Kenneth Haapala
Science and Environmental Policy Project
USA

Thomas B. Hayward
Commander-in-Chief, U.S. Pacific Fleet (retired)
USA

Jay Lehr, Ph.D.
The Heartland Institute
USA

Bryan Leyland
LCL Ltd.
NEW ZEALAND

Steve Milloy, J.D.
JunkScience
USA

Christopher Monckton
Third Viscount Monckton of Brenchley
UNITED KINGDOM

Patrick Moore, Ph.D.
GreenSpirit
CANADA

Robert Murphy, Ph.D.
Institute for Energy Research
USA

Willie Soon, Ph.D.
Astrophysicist
USA

Aaron Stover
The Heartland Institute
USA

Richard J. Trzupek
Chemist and Author
USA

S. Stanley Young, Ph.D.
National Institute of Statistical Sciences (retired)
USA

Chapter Reviewers

D. Weston Allen, Dip.Phys.Med.
Kingscliff Family Medical Services
AUSTRALIA

Mark Alliegro, Ph.D.
Brown University
USA

Charles Anderson, Ph.D.
Anderson Materials Evaluation, Inc.
USA

David Archibald
Backreef Oil Pty Ltd
AUSTRALIA

Dennis Avery
The Heartland Institute
USA

John Baden, Ph.D.
Foundation for Research on Economics and the Environment
USA

Timothy Ball, Ph.D.
University of Winnipeg (retired)
CANADA

Joe Bastardi
WeatherBELL Analytics
USA

David Bowen, Ph.D.
Cardiff University (emeritus)
UNITED KINGDOM

Barry Brill, OPM
Associate Minister of Energy &
Science (retired)
NEW ZEALAND

H. Sterling Burnett, Ph.D.
The Heartland Institute
USA

David Burton
SeaLevelInfo
USA

William Butos, Ph.D.
Trinity College
USA

Mark Campbell, Ph.D.
United States Naval Academy
USA

Jorge David Chapas
Red de Amigos de la Naturaleza / Universidad Francisco Marroquín
GUATEMALA

Ian D. Clark, Ph.D.
University of Ottawa
CANADA

Donald Crowe
Absaroke Corporation
USA

Weihong Cui
Institute of Remote Sensing and Digital Earth
Chinese Academy of Sciences
CHINA

Kevin Dayaratna, Ph.D.
The Heritage Foundation
USA

Donn Dears
GE Company (retired)
USA

David Deming, Ph.D.
University of Oklahoma
USA

Terry W. Donze
Missouri University of Science & Technology
USA

Paul Driessen, J.D.
Committee for a Constructive Tomorrow
USA

John Droz, Jr.
Independent Scientist
USA

John Dale Dunn, J.D., M.D.
Physician
USA

Willis Eschenbach
Independent Climate Researcher
USA

Rex J. Fleming, Ph.D.
Global Aerospace, LLC (retired)
USA

Vivian Richard Forbes
Carbon Sense Coalition
AUSTRALIA

Patrick Frank, Ph.D.
SLAC National Accelerator Center
Stanford University
USA

Lee C. Gerhard, Ph.D.
Kansas Geological Survey, University of Kansas (retired)
USA

François Gervais, Ph.D.
University of Tours (emeritus)
FRANCE

Albrecht Glatzle, Dr.Sc.Agr.
Iniciativa para la Investigación y Transferencia de Technología Agraria Sostenible (INTTAS)
PARAGUAY

Steve Goreham
Climate Science Coalition of America
USA

Pierre Gosselin
NoTricksZone
GERMANY

Laurence Gould, Ph.D.
University of Hartford
USA

Kesten Green, Ph.D.
University of South Australia
AUSTRALIA

Hermann Harde, Ph.D.
Helmut-Schmidt-University Hamburg (retired)
GERMANY

Tom Harris
International Climate Science Coalition
CANADA

Howard Hayden, Ph.D.
University of Connecticut (emeritus)
USA

Tom Hennigan
Truett McConnell University
USA

Donald Ian Hertzmark, Ph.D.
DMP Resources
USA

Ole Humlum, Ph.D.
University of Oslo (emeritus)
NORWAY

Mary Hutzler
Institute for Energy Research
USA

Hans Konrad Johnsen, Ph.D.
Det Norske Oljeselskap ASA (retired)
NORWAY

Brian Joondeph, M.D., M.P.S.
Colorado Retina Associates, PC
USA

Richard A. Keen, Ph.D.
University of Colorado, Boulder (emeritus)
USA

William Kininmonth
National Climate Centre (retired)
AUSTRALIA

Joseph Leimkuhler
LLOG Exploration L.L.C.
USA

Marlo Lewis, Jr., Ph.D.
Competitive Enterprise Institute
USA

Bryan Leyland
LCL Ltd.
NEW ZEALAND

Sebastian Lüning
Geologist and Author
GERMANY

Anthony Lupo, Ph.D.
University of Missouri
USA

Paul McFadyen, Ph.D.
Deputy Parliamentary Counsel (retired)
AUSTRALIA

John Merrifield, Ph.D.
University of Texas at San Antonio
USA

Patrick Michaels, Ph.D.
Cato Institute
USA

Christopher Monckton
Third Viscount Monckton of Brenchley
UNITED KINGDOM

Alan Moran, Ph.D.
Regulation Economics
AUSTRALIA

Robert Murphy, Ph.D.
USA

Daniel W. Nebert, M.D.
University of Cincinnati Medical Center (emeritus)
USA

Norman J. Page, Ph.D.
ClimateSense
USA

Fred Palmer, J.D.
The Heartland Institute
USA

Garth Paltridge, Ph.D., D.Sc., FAA
Australian National University
AUSTRALIA

Jim Petch
University of Manchester Trican
Manchester Metropolitan University (retired)
UNITED KINGDOM

Charles T. Rombough, Ph.D.
CTR Technical Services, Inc.
USA

Ronald Rychlak, J.D.
University of Mississippi, School of Law
USA

Tom V. Segalstad
University of Oslo
NORWAY

Gary Sharp
Center for Climate/Ocean Resources Study (retired)
USA

Jan-Erik Solheim
Arctic University of Norway
NORWAY

Willie Soon, Ph.D.
Astrophysicist
USA

David T. Stevenson
Caesar Rodney Institute
USA

Peter Stilbs, Ph.D.
Royal Institute of Technology (KTH)
SWEDEN

Daniel Sutter, Ph.D.
Troy University
USA

Roger Tattersol
Tallbloke's Talkshop
UNITED KINGDOM

Frank Tipler, Ph.D.
Tulane University
USA

Richard J. Trzupek
Chemist and Author
USA

Fritz Vahrenholt, Ph.D.
Deutsche Wildtier Stiftung
GERMANY

Art Viterito, Ph.D.
College of Southern Maryland (retired)
USA

Gösta Walin, Ph.D.
University of Gothenburg (emeritus)
SWEDEN

Lance Wallace, Ph.D.
U.S. Environmental Protection Agency (retired)
USA

James Wanliss, Ph.D.
Presbyterian College
USA

Bernard L. Weinstein, Ph.D.
Maguire Energy Institute, Southern Methodist University
USA

Steve Welcenbach
Alchemical Ventures, Inc.
USA

Several additional reviewers wish to remain anonymous.

Affiliations are for identification purposes only and do not imply institutional endorsement of this work.

Editors

Joseph L. Bast
The Heartland Institute
USA

Diane Carol Bast
The Heartland Institute
USA

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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.

CCR II: FOSSIL FUELS

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 June, 2018. This volume tracks and critiques the 2014 report of the IPCC's Working Group III on "Mitigation of Climate Change."

ABOUT THE COAUTHORS

Dr. Roger Bezdek is an internationally recognized energy analyst, president of MISI, a Washington, DC-based economic, energy, and environmental research firm, co-founder of energy technology firm Cavendish Energy, and Washington editor of *World Oil* magazine. He is the author or coauthor of 13 books and his writing has appeared more than 300 times in scientific and technical journals, including *Science, Nature, Energy Policy, Natural Resources Journal, and Public Finance.* He earned a Ph.D. in Economics from the University of Illinois at Urbana-Champaign, where he served as a faculty member from 1971-74.

Dr. Craig D. Idso is founder and chairman of the Center for the Study of Carbon Dioxide and Global Change. Since 1998, he has been the editor and chief contributor to the online magazine CO2 Science. He is the author of several books, including *The Many Benefits of Atmospheric CO2 Enrichment* (2011) and *CO2 , Global Warming and Coral Reefs* (2009). He earned a Ph.D. in geography from Arizona State University (ASU), where he lectured in meteorology and was a faculty researcher in the Office of Climatology.

Dr. David R. Legates is Associate Professor and Director of the Center for Climate Research at the University of Delaware, He has taught at Louisiana State University, the University of Oklahoma, and the University of Virginia. He has been Research Scientist at the Southern Regional Climate Center, Chief Research Scientist at the Center for Computational Geosciences, and Visiting Research Scientist at the National Climate Data Center. He received his Ph.D. in climatology from the University of Delaware.

Dr. S. Fred Singer is one of the most distinguished atmospheric physicists in the U.S. He established and served as the first director of the U.S. Weather Satellite Service, now part of the National Oceanic and Atmospheric Administration (NOAA), and earned a U.S. Department of Commerce Gold Medal Award for his technical leadership. He is coauthor, with Dennis T. Avery, of *Unstoppable Global Warming Every 1,500 Years* (2007, second ed. 2008) and many other books. Dr. Singer served as professor of environmental sciences at the University of Virginia, Charlottesville, VA (1971-94), and is founder of the nonprofit Science and Environmental Policy Project. He earned a Ph.D. in physics from Princeton University.

THE HEARTLAND INSTITUTE

3939 NORTH WILKE ROAD
ARLINGTON HEIGHTS, IL 60004
WWW.HEARTLAND.ORG