Dealing with acute problems requires accepting chronic problems of monitoring, expense, and action to make practices safe (Tenner 1997). The air and water in most cities today are cleaner than they were near the beginning of industrialization because the adverse effects of local pollution were acknowledged and action taken to remedy them, sometimes at great cost. However, the problem of mobilizing action to deal with environmental and health problems is much greater when the pollution can not be perceived by the senses, like carbon dioxide, and when adverse consequences do not occur where pollution is caused but instead are distant in space or time. Today’s global risks are different in kind from early industrial risks that had only local effects where pollution affected the polluter. Now victims inhabit distant countries, or will live in the future. In many cases technical remedies cannot be found, so the only solution is prevention: abandoning the innovation (DDT, CFCs) or leaving the useful but harmful substance (asbestos) safely underground. Will this be the fate of fossil fuels, starting with coal, heavy unconventional oil, etc.? That is, however, seen as an economic “opportunity cost” and a “stranded asset”, so there is much resistance.
Grounds for Hope

Even the most deadly forces of nature can be dealt with and their consequences mitigated if scientific warnings are accepted, if future harm is not discounted, and if there is sufficient foresight to make changes in technologies, which is sometimes expensive, and/or in social practices. For example, in the past the contagious variola virus that causes smallpox killed 3 of every 10 people who contracted it and left survivors with severe scars (CDC 2016). It devastated populations since the third century BC, transmission followed trade routes, and made cities the deadliest places to live. In 1796, Dr. Edward Jenner noticed that milkmaids who contracted cowpox, a mild disease related to smallpox that can be transmitted between species, did not show symptoms of smallpox. So he took material from a cowpox sore on a milkmaid’s arm and injected it into the arm of his gardener’s son, then months later exposed the boy to smallpox multiple times. The boy never got smallpox. After several similar experiments, Jenner published a paper in 1801 entitled ‘On the Origin of the Vaccine Inoculation’, for which he is credited with being the father of vaccination. Vaccination became widely accepted in the 1800s, and in 1959 the World Health Organization initiated a campaign to globally vaccinate everyone and eradicate smallpox. New high-quality freeze-dried vaccine technologies and laboratories increased production. The last known death from smallpox occurred in 1978, and in 1980 the World Health Assembly declared that the variola smallpox virus, which was one of the most deadly in human history, had been made extinct by vaccination, except for research samples kept in the USA and Russia. Vaccination saved hundreds of millions of lives and is now seen as the greatest achievement of international public health. Nevertheless there was opposition that had to be countered. Some clergy claimed that vaccination was against religious precepts because the serum was derived from animals. Civil libertarians opposed mandatory orders. Sceptics claimed smallpox was not caused by a virus but instead by bad air. Although different in some ways, the struggle against smallpox and against fossil-fuelled climate change share similarities. Both involve a global threat from runaway dynamics of nature. In both cases, science needs to be accepted and sceptics refuted. New technologies need to be innovated.
Social practices and cultures need to be changed. Governments need to enact new laws. International cooperation is necessary, including science-based global organizations like the World Health Organization (WHO) for pandemics, and the Intergovernmental Panel on Climate Change (IPCC), World Meteorological Organization (WMO), United Nations Environmental Programme (UNEP), and the United Nations Framework Convention on Climate Change (UNFCCC) for climate change. There are social justice issues such as a doctor trying out a vaccine on his gardener’s son instead of his own. Despite demonstrable success of mitigating the threat there is ongoing opposition to measures of mitigation, such as unfounded claims that vaccines cause autism. Hopefully the struggle against fossil-fuelled climate change will be as successful as the fight against the deadly smallpox virus.

Societies have risen to meet enormous challenges in the past by being willing to make sacrifices and pay the cost. Wars are a primary example, with the sacrifices even involving dying. Another example consists of the first humans landing on the moon. NASA was given an open chequebook and told to hire the brightest people for fear the Soviets would win the race. The American population accepted to pay the huge expense for the necessary research and innovation, even though the USA was mired in the ill-conceived war in Vietnam. Far from expensive space-exploration research being a job killer, it stimulated economic growth in the long run. This could be a template for a race among countries to obtain the economic benefits and prestige of being first to develop non-carbon emitting, affordable sources of energy and storage.

Byers (2019: O3) argues that international cooperation is fostered where activities are dangerous and measures to ensure safety are expensive, hence giving an incentive for burden sharing. He points to space and the Arctic. Both are dark, cold, dangerous places where cooperation, even between enemy states, has been common. When big game hunters started using helicopters to kill polar bears and decimated their population, the USA, Soviet Union, Norway, Denmark, and Canada signed the 1973 Polar Bear Treaty banning the practice. Cooperation during the cold war led in 1979 to the creation of OSPAS-SARSAT, which pooled the capacities of satellites and ground stations of the USA, the Soviet Union, Canada, and France for search and rescue in the Arctic.
In 1987, Mikhail Gorbachev started international negotiations leading to the creation of the Arctic Council. The International Space Station is another illustration of cooperation between states, often rival ones, as is the use of Soyuz spacecraft to send American and other Western astronauts and equipment to it. These successes provide hope that inter-state cooperation and burden sharing can be scaled up to deal with the expensive global climate threat.

**Will Global-Warming Danger Elicit Solidarity?**

Research has documented that the experience of disaster fosters solidarity, mutual aid, and increased willingness to obey leaders while it is occurring. ‘The material context of grave danger augments support for leaders during a disaster or a war. In both cases, however, there is much criticism if things go wrong and much second-guessing when the threat ends and the situation returns to normal’ (Murphy 2009: 239). Clark (2011: 156) wants ‘to hold on to the idea that the disaster is an incitement to new alliances, practices, repertoires – and that the most important improvisation is community itself’. Nature’s threatening constructions such as earthquakes have repeatedly acted as prompts that promoted mutual aid and enhanced a feeling of collective belonging: ‘the rumbling of the earth is an ancient and unending imperative for human communing, not simply testing existing communities but reactivating, again and again, a primordial impulse for being together with others’ (Clark 2011: 164). Claisse and Delvenne (2015) argued that, even on a global level, the anticipation of catastrophes prompts changes in discourse and policy that will prevent catastrophes. Will dangerous fossil-fuelled global warming elicit solidarity, social cohesion, and willingness to improve social practices and technologies to win the war against man-made climate change? That danger in a modern world tightly coupled with transportation and communication technologies has the potential to inspire a transition to realizing that we are all in this together everywhere on the planet.

Beck (2007: 9–10) presents a theoretical formulation of this argument that the anticipation of catastrophe leads to emancipation from harmful
social practices. Material risk determines cultural perceptions of risk and actions: ‘because this constant danger [of catastrophe] shapes our expectations, lodges in our heads and guides our actions, it becomes a political force that transforms the world’. It fosters the emergence of cosmopolitan perspectives regarding the consequences of decisions for others across space and time. The dangers of fossil-fuelled climate change will impel positive changes in social practices and technologies that mitigate it: ‘it is not about the negative side effects of goods but the positive side effects of bads’. He refers to this hypothesis as ‘emancipatory catastrophism’ (Beck 2015: abstract). It is important to examine Beck’s argument in detail, and evidence for or against it, because he was the pre-eminent social scientist of risk in his generation, and because he was a public intellectual who disseminated his arguments broadly, especially in Germany. Most important, the idea that the anticipation of global climate catastrophe will incite a change in orientations is relied on in society generally to assume that all will end well. Beck’s hypothesis constitutes a window into society’s thinking about this issue. Its logic and supportive evidence need to be rigorously evaluated.

Beck’s argument can be briefly summarized as follows using his concepts. (1) The anticipation of global catastrophe violates sacred (unwritten) norms of human existence and civilization; (2) hence it causes an anthropological shock; (3) a social catharsis; (4) and a metamorphosis with new compasses for the twenty-first century and a cosmopolitan perspective. ‘The global climate risk, far from an apocalyptic catastrophe, is instead –so far! – a kind of “emancipatory catastrophe”’ (Beck 2015: 79). He (Beck 2015: 79) contends that ‘global risks – like climate change or the financial crisis – have given us new orientations, new compasses for the 21-century world. … Climate change … is a reformation of modes of thought, of lifestyles and consumer habits of law, economy, science and politics. Global climate risk could usher in a rebirth of modernity’. Beck (2015: 81) claims that ‘in this moment of catharsis the mind-walls of institutionally constructed side effects are breaking down and we can empirically study the cultural fact of how cosmopolitan horizons are emerging and being globalized’. A global risk like ‘climate change induces fundamentally changing landscapes of social class and inequality created through rising sea levels which draw new
maps of the world where the key lines are not traditional boundaries between nation-states and social classes, but rather elevation above sea — a whole different way of conceptualizing the world and the “life” chances, the chances of survival within it’ (Beck 2015: 76). It induces a sense of ethical violation which creates new norms, laws, markets, technologies, understandings, and international cooperation. Global risks also expose the limitation of ‘methodological nationalism’. Organized irresponsibility towards others is being transformed into a cosmopolitan outlook that will take into account the needs of others distant in space and time. Global cosmopolitanism consists of a moral responsibility to not engage in social practices which do harm to others and to the environment they need. Beck’s theory that the anticipation of catastrophe will lead to a cosmopolitan orientation and emancipation from global warming risk is as optimistic as it gets.

Beck’s analysis has a curious complementary-oppositional relationship with other prominent analyses of global environmental problems. The ecological modernization approach (Mol, Sonnenfeld, and Spaargaren 2009) shares the postulate that the anticipation of catastrophe is prompting adaptation, resilience, and mitigation by companies and governments. Giddens (2009: 70–71) agrees with ecological modernization authors who ‘distanced themselves from the pessimism of the “limits to development” literature, and also from those in the green movement who set themselves against modernity and, to some extent, against science and technology more generally. … [I am] in general a supporter of the ecological modernization approach’ to environmental problems. The theories of Beck, Giddens, and ecological modernization all assume that anthropogenic climate change is being mitigated. However, Giddens’ analysis is based on a premise diametrically opposed to that of Beck. Beck’s theory of catastrophism is about the motivating force of fear. Change is being brought about by dreading calamities scientifically predicted to bring harm to future generations and vulnerable populations in distant places. Giddens (2009: 12) argues, on the contrary, that ‘Martin Luther King didn’t stir people to action by proclaiming, “I have a nightmare”. Fear and anxiety are not necessarily good motivators, especially with risks perceived as abstract ones, or dangers that are seen as some way off’. He presents “Giddens paradox”.

It states that, since the dangers posed by global warming aren’t tangible, immediate or visible in the course of day-to-day life, however awesome they appear, many will sit on their hands and do nothing of a concrete nature about them. Yet waiting until they become visible and acute before being stirred to serious action will, by definition, be too late’ (Giddens 2009: 2). There is not much fear of catastrophe in that quotation. What is needed is ‘an emphasis on positives as much as on negatives, and on opportunities rather than on self-induced deprivations’ (Giddens 2009: 106). The main impetus in Europe for increased taxes on fossil fuels and development of wind, solar, and nuclear energy was the opportunity to enhance energy security after the formation of OPEC in the nineteen-seventies, with the reduction of carbon emissions and mitigation of climate change being indirect beneficial side effects. The politics of hope, according to Giddens, trump the politics of fear. Hence this chapter involves examining whether societies are motivated to respond to threats through fear or opportunities, first with a detailed assessment of Beck’s theory of fearful anticipation of global catastrophe and the remainder of the chapter consisting of hopeful examples of responses.

Nordhaus’s (2013: 180) economic modelling research arrived at the following conclusion. ‘Suppose we live in an ideal world – one where countries work together cooperatively to introduce emissions reductions, take care to ensure that all countries and sectors participate, and time their actions efficiently’. He calculated that this could slow global warming to about 2 °C at a cost of 1 to 2% of total world income annually, which is not high. This is Beck’s optimistic world, having a cosmopolitan orientation everywhere willing to sacrifice some present income to emancipate humanity present and future from catastrophic fossil-fuelled climate change. It is a noble ideal, but does it correspond to the real world? If some countries or sectors refuse to participate or receive exemptions, or if this ideal is not started promptly, then the cost, atmospheric temperature, and consequences rise precipitously. The IPCC (2018) documented that even a rise of 1.5 °C could have devastating consequences.

Where does Beck find evidence to support his hypothesis? ‘Analysing the discourses around Katrina makes apparent a paradigm shift, in fact, a social catharsis, that two formerly separate discourses came together:
ecological challenges and the history of racism in the US’ (Beck 2015: 80). He claimed that Hurricane Katrina resulted in a paradigm shift in Louisiana. ‘The traumatic experience produces a process of reflection in which things, which had not been thought of as being connected, are now connected – flooding of cities with racial inequality with questions of global justice. This is what I call “social catharsis”’ (Beck 2015: 80). Thus ‘anthropologic shocks provide a new way of being in the world, seeing the world and doing politics’ (Beck 2015: 80).

Weaknesses in Presuming That the Anticipation of Catastrophe Will Incite Safe Practices

Beck’s arguments are scholarly formulizations of presumptions in society that underpin optimism that scientific conclusions concerning global environmental problems like fossil-fuelled climate change will be heeded, social practices causing them will be changed and/or technological remedies developed, adverse consequences prevented, and sustainability enhanced. But will this happen in the real world, or will the contemporary period be seen later as the incubation of global catastrophe? Are such theories logical, valid, and well-founded empirically, or are they representative of wishful thinking? Will path-dependent social practices, perceived entitlements, and powerful economic interests override scientific conclusions of danger?

The response to threats is mixed. The COVID-19 pandemic elicited some cooperative solidarity but also inadequate reactions: belated acceptance of scientific evidence of danger and of community transmission, China blaming the USA and vice versa. Research documented that often disasters do not result in significant reductions in vulnerability when mitigation is costly or requires changed practices. Declaring an extreme-weather event a ‘hundred year storm’ or a ‘thousand year flood’ is frequent despite lack of evidence so far back. Such declarations are reassuring cultural practices so that costs of preparedness and changes
in risky social practices can be postponed, resulting in ‘man-made disasters’ (Turner and Pidgeon 1978), ‘repeat disasters’ (Platt 1999), ‘disasters by design’ (Mileti 1999), and ‘unnatural disasters’ (Abramovitz 2001). If this occurred for the experience of disasters, then it is questionable whether the mere anticipation of catastrophes will result in mitigation. Much can be learned from the flaws of Beck’s argument.

**Distinguish Aspirations for Change from Changes in Real-World Practices**

Beck’s hypothesis conflates aspirations and facts. Thus he claims that (i) ‘we have to attach central importance to the dangers that we have repressed until now’, and that (ii) ‘global climate risk could usher in a rebirth of modernity’ (Beck 2015: 79). Is what ‘has to’ or ‘could’ be done, being done? Or will consciousness of dangers be discounted and the new ecological modernity be stillborn? Funk (2014: 285) argues convincingly that ‘magical thinking is the fallacy that thoughts correspond to actions – that to think is to do, to believe is to act’. A clear distinction is required between what is and what is desired so that desires can be brought into being. Global risks like climate change are compasses indicating where to go, as Beck argues, but old orientations, habitual social practices, and economic interests predispose people not to go there.

A catastrophe does not always lead to positive change, and often ‘bads’ lead to more ‘bads’. As Diamond (2005) documented, bad societal choices can multiple into positive feedback loops and pass a tipping point resulting in societal collapse. Diamond investigated traditional societies, and moderns can hope they are more rational. But that is uncertain: interests, predispositions, and power can trump reason when science brings inconvenient conclusions. Emancipation from harm by anticipating catastrophes refers to a hoped-for future state. Beck’s concept of ‘emancipatory catastrophism’ is an aspiration and a goal, but the anticipation of catastrophe prompts a variety of responses, with a transformation of high-risk social practices being just one possibility. It can also result in doubling down on fossil-fuelled practices and discounting danger.
Beck (2015: 85) claims that global risk is a dystopian vision which ‘has a significant power of mobilization because it is about the existence of humanity’. I share Beck’s wish that this be so, but where is the evidence to confirm his assertion? The ‘existence of humanity’ is abstract and does not have as great a mobilizing power as immediate economic interests for oneself and one’s family and friends. If carbon pollution immediately harmed polluters and their families, then this would likely mobilize changes of social practices. Invisible greenhouse-gas emissions typically cause harm distant in space and time, thereby diluting mobilizing possibilities because distant harm can be discounted in favour of immediate economic gain. Ongoing socioeconomic practices causing the increasing carbonization of the atmosphere demonstrate that, so far, the threatening dystopian vision has been a less potent source of mobilization than immediate economic interests. Important social relations are those with what sociologists have long called ‘significant others’. Judging by the persistence of carbon pollution, ‘the existence of humanity’ constitutes up to now ‘an insignificant other’.

**Don’t Mistake Emancipatory Discourse for Emancipatory Social Practices**

This is a related problem. Beck (2015: 80) focusses on ‘the discourse on climate justice’ and that ‘analysing the discourses around Katrina makes apparent a paradigm shift, in fact, a social catharsis’. The book (Stewart and Ray 2007) he uses as sole documentation of change prompted by the Hurricane Katrina catastrophe includes only changes in discourse. ‘Norms and imperatives that guided decisions in the past are re-evaluated and questioned through the imagination of a threatening future. From that follow alternative ideas for capitalism, law, consumerism, science (e.g. the IPCC), etc.’ (Beck 2015: 83). But it does not follow that those ideas necessarily lead to benign alternatives to present practices of capitalism, law, consumerism, and science. New discourses can be irrelevant or more devious legitimation of pollution, inequality, racist practices, and greenwashing. Beck does not analyse fossil-fuel, racial, and class practices resulting in vulnerability and catastrophe. Talk might
change following a catastrophe, but polluting energy use, racial and class practices persist. Discourses and ideas only emancipate populations from material threats if they result in improved practices. Instead of being based on free-floating discourse and ideas, emancipation needs to be grounded in changes of social practices. Beck mistakes discourse advocating emancipation for emancipation itself. Simpson, Jaccard, and Rivers (2007) documented that many policies to mitigate global warming were ‘hot air’ and never implemented. Perverse consequences of well-intentioned discourse should not be ignored: talk about renewable energy freeing humanity from fossil fuels has sometimes led to faster rates of extraction before they are displaced by renewable energy. Failing to distinguish aspirations/discourse from changed practices results in a flawed understanding of fossil-fuelled climate change and fosters illusions of improvement even as global warming worsens.

**Don’t Assume Scientific Predictions of Danger Lead Necessarily to Anticipating Danger**

The hypothesis that scientifically documented anticipation of catastrophe leads to safety requires all links in the chain between scientific prediction, anticipation of danger by the public, and corrective action be operative, but powerful economic and political forces act to disconnect the links. Studies in the sociology of science have shown that scientific conclusions cannot be straightforwardly equated with their understanding by the public and are often socially contested (Yearley 1992, 2004). Misrepresentations by fossil-fuel supported think tanks (Jacques, Dunlap, and Freeman 2008; Dunlap and Jacques 2013; Elsasser and Dunlap 2013; Dunlap, McCright, and Yarosh 2016), diversionary tactics (Freudenburg 2006), etc., result in discounting scientific conclusions of danger. An outlier scientist can be found to reject the scientific consensus, with outlier voices being amplified by proponents of fossil fuels, thereby transforming science into a contact sport (Schneider 2009). Rigorous empirical studies (Freudenburg et al. 2009) showed there were scientific predictions of catastrophe for Louisiana before Hurricane Katrina.
struck, but they were discounted by economic and political decision-makers. These studies provide evidence against hypotheses that scientific predictions of catastrophe necessarily lead to action promoting safety.

**Specify What Is Being Transformed**

Scientific measurements and modern means of communication are bringing knowledge of threatening biophysical transformations to all nations. In this sense a cosmopolitan perspective is indeed developing. But Beck is vague concerning what societies are being emancipated from through the anticipation of catastrophe. Beck’s ‘emancipatory catastrophism’, ‘metamorphosis of the world’, and ‘cosmopolitan perspective’ remain ‘highly abstract theoretical concepts’ (Han 2015: 116) that are insufficiently specified (Blok 2015: 110) and inadequately grounded in empirical research. Where is the evidence that a sociocultural transformation is occurring in which a cosmopolitan worldview taking into consideration needs of all humans, including future generations, is becoming dominant in shaping present social practices? Restricted perspectives prioritizing near-term economic interests and lifestyles seem to prevail. To mitigate the fossil-fuelled climate crisis, the ‘cosmopolitan perspective’ has to lead to greenhouse-gas reducing social practices on a global scale promptly. An ‘optimistic outlook must be qualified by the strong warning that it requires cooperative and efficient measures [such as placing a price on carbon pollution]’ (Nordhaus 2013: 194). It may well be that cosmopolitanism and carbon pollution emancipation are occurring partially in some societies but much less so in others. They should be analysed not as a universal trend but rather as variables differentiating societies.

**Nation-State and Social-Class Boundaries Remain Key**

Beck’s (2015: 76) contention that elevation above the sea is replacing social classes and nation-states as significant factors fails to recognize that there are important differences at the same elevation: between the prosperous Garden District in New Orleans and the poor Lower Ninth
Ward; between rich Switzerland and poor Nepal; between wealthy, well-protected Netherlands and underprivileged, vulnerable Bangladesh. The wealthy live in less vulnerable areas and the poor reside in more vulnerable ones. Elevation of residence above sea and other means of reducing risk are largely based on social class. Wealth gives the capacity to monopolize safety, whereas poverty excludes people from safety. This too is a dimension of social closure, which has been documented by environmental justice researchers (Bullard 2000, 2005; Bullard and Wright 2009; Roberts and Parks 2007). Risks from carbon pollution disproportionately affect more vulnerable social classes and poorer nations. It would be more accurate to argue that when new risks emerge, they are superimposed on old social class and nation-state boundaries.

**Take into Account the Preponderance of the Evidence, Not Just What Supports the Hypothesis**

Beck selected cases indicating emancipatory possibilities and ignored disconfirming evidence: ‘the agility with which the Chinese are promoting the boom in the trade in renewable energy sources’ (Beck 2015: 79). This is a strange example of emancipation involving the Communist Party dictatorship, a country whose principal agility is its increasing use of the most polluting fossil fuel (coal), contamination of the air in China’s biggest cities, etc. Since it is the excess of emissions over carbon withdrawals that causes global warming, praise for China and Louisiana should be tempered.

**The Test Case of Louisiana**

As supporting evidence, Beck cites the experience of catastrophe when Hurricane Katrina struck Louisiana. This is not a valid test of whether the scientific anticipation of global catastrophe leads to a cosmopolitan outlook taking the interests of humans distant in space and time into consideration. Nevertheless, if scientific predictions of catastrophe are to
incite action, then the actual experience of catastrophe, which confirmed scientific predictions, should result in action. If not, then serious doubt is cast on the theory that the mere prediction of catastrophe would have that effect. Louisiana is an interesting case for investigating whether the experience of environmental catastrophes, and anticipation of recurrence, prompt change of social practices causing catastrophes.

i. It suffered recurring catastrophes resulting from hurricanes (Betsy in 1965, Katrina and Rita in 2005) and from oil spills (2010 BP Deepwater Horizon two-month underwater oil gusher in 2010).

ii. New Orleans is vulnerable to extreme weather and sea level rise. It is located at sea level, with some wards below sea level, and is jammed between the Gulf of Mexico, the Mississippi River, and huge Lake Pontchartrain (1600 km²). Hence it is plausible that anticipation of recurring catastrophes is high.

iii. The importance of the oil industry and the fishery and tourism to its economy leads to conflicting interests.

The catastrophes of Hurricane Katrina and the BP blowout incited talk about the dangers of hurricanes and fossil fuels and about the problems of poverty and race relations. But did they change social practices? Blumenthal (2014) provides data after the Katrina catastrophe and after the BP blowout catastrophe to answer the fossil-fuel dependence question. ‘More than 300,000 people in the state are employed in the oil and gas sector, which provides tens of billions in tax revenue. The state hosts 19 oil refineries, second only to Texas, and just offshore in the Gulf of Mexico lie 4,000 drilling rigs’. The Hurricane Katrina catastrophe in 2005 nine years before these data were gathered, and the 2010 BP oil blowout four years prior, were not leading to emancipation from economic dependence on the fossil-fuel industry by 2014. Discourse about the 2005 catastrophe of Hurricane Katrina did not bring emancipation from danger is indicated by the 2010 BP oil catastrophe five years later, which poured oil over Louisiana’s seacoast for two months threatening its fishery (Freudenburg and Gramling 2011). This too was followed by renewed dependence on fossil fuels. This confirms the present book’s premise that the focus needs to be on socioeconomic
practices, with discourse only being important to the extent it influences those practices. Despite the experience of catastrophes, Louisiana remains heavily dependent on fossil fuels, whose combustion results in global warming, extreme weather, and sea level rise.

I visited New Orleans in 2015 to assess whether its catastrophes emancipated it from fossil fuels, inequality, and racism. I was invited to speak at Tulane University in New Orleans, which is a prestigious university that has a billion-dollar endowment fund invested in Louisiana’s fossil-fuel industry. A few students started discourse of divestment, but it was rejected by the university administration. In Louisiana, talk about global warming has been drowned out by discourse about economic growth, which is more influential for socioeconomic practices, leaving greenhouse gases to accumulate in a failure of foresight and the incubation of disasters. As a state regularly struck by hurricanes and vulnerable to rising sea level, Louisiana is trapped between the biophysical and geographical impossibility of adapting to global warming and the sociopolitical nonstarter of replacing fossil fuels with low-carbon energy because of powerful fossil-fuel interests and path-dependent, fossil-fuelled practices.

Did these catastrophes result in emancipation from inequality? By 2010, half a decade after the Katrina catastrophe, Louisiana ranked as one of the states where income inequality is the highest (McNichol et al. 2012) in a country with among the highest income inequality of modern developed nations (Butler 2012; Piketty 2014). The catastrophe of Hurricane Katrina striking New Orleans resulted in an existential shock, but not one that prompted emancipation from inequality. Nor did Katrina result in reducing inequality of educational opportunity. The fees for 2014–2015 at New Orleans’ private university, Tulane, were $48,305 tuition per year per student plus $12,556 for room and board. The public universities—University of New Orleans, University of Louisiana at Lafayette and Monroe, and Louisiana State University at Baton Rouge—with tuition fees of $6000–8000 for in-state students, are struggling because taxpayers demand reduced taxes. The offspring of the wealthy enjoy small class sizes at Tulane University whereas those of the poor and middle classes face large classes at public universities, having to earn money while studying, and debt burdens upon graduation.
Hurricane Katrina demonstrated the oversimplification of Beck’s contention that the key lines are not between social classes. In New Orleans, wealthy former plantation mansions are located on safe, high ground, whereas ten years after the Hurricane Katrina catastrophe the vulnerable lower ninth ward remains populated by the poor, mainly African Americans, where city tour buses are prohibited to avoid showing the misery of the inhabitants. I found no evidence that the catastrophe was liberating the state from inequalities and divisions between races. Despite its oil riches, Louisiana remains, after Katrina as before, one of the states where poverty is highest. African Americans remain the poorest group with the lowest opportunities. This catastrophe did not result in emancipation from fossil-fuel dependence, from racism, or from inequality. There was increased talk about emancipation immediately following the catastrophe, but little sustained change in energy, racial, and class practices. It produced an existential shock, but not one that prompted transformations of practices. Far from having an emancipatory effect, reversion to pre-catastrophe fossil-fuelled practices was the outcome of this disaster. The traumatic experience resulted only in learning to have more robust defenses (improved end-of-pipe remedies like levees, pumps, blowout protectors, etc.) against nature’s forces.

Hurricane Sandy did not transform climate politics in New York either: ‘our interviews found that for the most part, people who were already concerned about climate change continued to be so, and those who were not, continued not to be even if they were persuaded that climate change played a role in the storm. … Hurricane Sandy exacerbated crises which existed before the storm and continued afterwards in heightened form, including poverty, lack of affordable housing, precarious or low employment, and unequal access to resources generally’ (Superstorm Research Lab 2014).
Do Scientific Predictions of Catastrophe Incite Prevention?

If the actual experience of catastrophe failed to prompt change, then how can the mere scientific prediction of one whose principal consequences will be distant in time and space incite a transformation? The presumption that the scientific anticipation of catastrophe will emancipate societies from social practices causing it is not an accurate portrayal of what is occurring in the real world. Economic interests and attachment to normality can override scientific warnings and lead danger to be discounted. It is necessary to be vigilant that aspirations not slide down the slippery slope into wishful thinking and false hopes, not to mention greenwashing, as fossil-fuelled climate change worsens. Furthermore, the mobilizing effect of the anticipation of catastrophe is not universal. It is contingent and differs between societies and social groups, even when the anticipation is well grounded in scientific understanding available to all cultures and societies. Groups respond to the scientific anticipation of catastrophe either by (i) emancipating themselves from social practices incubating catastrophe, or (ii) doubling down on fossil-fueled normality. The real world exhibits these two different tendencies. Theories that the anticipation of catastrophe will result in emancipation from fossil-fuelled practices extrapolates from changes that are occurring. Investigations of discounting danger shine light on tendencies unresponsive to scientific warnings, on what is not being done but is needed to prevent global warming, and how the problem is worsening. These two capture opposite important elements and have different weaknesses. The first runs the risk of failure to perceive the depth of the problem. The second risks falling into beliefs that everything must change to change anything, that fossil-fuelled global warming is too big to solve, and of fostering fatalism and inaction.

Beck’s theory of emancipatory catastrophism is pitched at a high level of abstraction and focusses on discourse. Generalities like that are of dubious value but are common. After a study of the human impact on nature, including fossil-fuelled climate change, the Chair of the Intergovernmental Panel on Biodiversity and Ecosystem Services concluded as follows. ‘The Report also tells us that it is not too late to make a
difference, but only if we start now at every level from local to global,…
Through “transformative change”, nature can still be conserved, restored
and used sustainably – this is also key to meeting most other global goals.
By transformative change, we mean a fundamental, system-wide reor-
ganization across technological, economic and social factors, including
paradigms, goals and values’ (IPBES 2019). This is also pitched at a
general level.

Identification of Needed Measures

It is necessary to examine concrete socioeconomic practices and be
inspired by specific cases of changed practices fostering safety. The most
important reason for hope is that impact natural science has provided
an understanding of the processes involved and suggested what must
be done to prevent disaster. Measures needed to mitigate the green-
house effect and global warming have already been identified. Countries
need to reduce their ‘emissions by 80 percent by 2050 through a
combination of steps: (1) energy efficiency gains, both in electricity
generation and use and in transportation, including fuel-efficient vehi-
cles; (2) renewable energy development, especially wind and solar energy
(3) other energy efficiency gains including improvements in residential
and commercial buildings; (4) shifting to low-carbon fuels; (5) geolog-
ical disposal (sequestration) of carbon dioxide; (6) reducing emissions
of greenhouse gases other than carbon dioxide; and (7) enhanced forest
and soil management practices’ (Speth 2009: 29–30). Many books and
articles have suggested multiple solutions to mitigate fossil-fuelled global
warming and slow-onset unsustainability: Barnes 2008; Jaccard 2005;
Dauncey 2009; Speth 2009, 2012; Jackson 2009; Bullard and Wright
2009; Giddens 2009; Lomborg 2010; Pielke 2010; Rand 2010, 2014;
Nordhaus 2013; Moser and Boykoff 2013; Hawken 2017; Flannery
2015; Klein 2017; Suzuki and Taylor 2009; Suzuki and Hanington
2017; Harvey and Orbis 2018; Ramish 2018; Pink 2018; Klenert et al.
2018. Some of these (Harvey and Orbis 2018); Rand 2010, 2014) have
made excellent contributions in terms of detailed and specific policy
guides for designing solutions and moving towards low-carbon energy,
typically using already available clean technologies.
However, suggesting solutions is easy. The hard part in a socioeco-
nomic context of fossil-fuelled social practices, interests, and power is
 gaining acceptance of such measures. The problem is not lack of solu-
tions nor even lack of technology, but whether proposed solutions will
be implemented or discounted and left to gather dust on library shelves.

**Foresight Prevails: Reconciling the Economy with the Environment**

There are cases where leaders had the foresight to tackle the threat of fossil-fuelled climate change. On the international level, the best known case is the 2015 Paris Agreement, where all nations committed to reduce emissions and limit global warming to below 2 °C, to increase adaptation, build resilience, reduce vulnerability, and developed nations agreed in principle to help developing countries finance these goals. A less known case consists of the Kigali Amendment to the Montreal Protocol, which is especially significant because enforcement practices were accepted. That amendment dealt with refrigeration, which includes both keeping foods from spoiling and air conditioning. Science developed an understanding of the chemical processes of refrigeration and production science applied this knowledge and innovated the early chemical refrigerants, namely CFCs and HCFCs. However, impact science discovered they were depleting the ozone layer which shields the Earth from harmful ultraviolet radiation. Despite a campaign of disinfection by companies like Dupont, which produced these chemicals, a counter-campaign resulted in political leaders agreeing to the 1987 Montreal Protocol to phase them out. This resulted in the innovation of replacement chemicals HFCs, which do not deplete the ozone layer. Hence, air conditioning and refrigeration could be maintained and expanded. Unfortunately, it was then found that HFCs are a thousand times more powerful causes of a greenhouse effect than carbon dioxide. This is extremely threatening because air conditioning, which previously was seen as a luxury, is now viewed as a necessity in hot climates. As global warming intensifies, there will be even more demand for air conditioning. In 2016 in Kigali, 170 countries negotiated an amendment to
the Montreal Protocol. They agreed that high-income countries would start phasing out HFCs in 2019, low-income ones would do so between 2024 and 2028, rich countries would finance the transition even in poor ones, and trade sanctions would be used to enforce compliance. This Kigali amendment has been hailed, notably by then US Secretary of State John Kerry, as ‘the biggest thing we can do [on climate] in one giant swoop’ (Hawken 2017: 164). Replacement chemicals have already been developed, and no deleterious consequences of their use have been found, so far. Hawken (2017) rates this sociotechnical innovation in refrigeration as the most beneficial and cost-effective remedy for the avoidance of carbon in the atmosphere and the greenhouse effect for the years between 2020 and 2050.

It should be noted that refrigeration, such as air conditioning, constitutes a double jeopardy global warming social practice. The chemicals used, such as HFCs, cause a greenhouse effect when released into the atmosphere, usually at disposal. But also refrigeration is powered by electricity, which in most cases uses fossil fuels as its primary energy source, which when combusted cause carbon to combine with oxygen to produce the greenhouse gas of carbon dioxide. Air conditioning in vehicles, planes, and ships is powered directly by fossil fuels. The Kigali agreement, valuable as it is, only solves the HFC part of refrigeration’s contribution to global warming, but not the fossil-fuel combustion part. Nevertheless, it is a hopeful template for other international agreements to deal with the fossil-fuelled climate crisis. The Paris Agreement and the Kigali Amendment are examples of the interaction of sociopolitical practices with nature’s properties and dynamics as actants, of the positive relationship natural science can have with political leadership, and of a global threat being mitigated by cooperation among nations.

In 1991, Sweden implemented a carbon tax of US$133 a metric ton. By 2008, emissions there had fallen 40% compared to 1990 levels, and its economy had grown 44%. Since carbon pollution continued increasing globally, Sweden did not merely point to other polluting countries as an excuse for climate inaction, but instead raised its carbon tax in 2014 to $168 (Suzuki and Hanington 2017: 232). Sweden illustrates the fact that countries which do the most to mitigate fossil-fuelled climate change through high gasoline prices are not thereby prevented
from being prosperous. Similarly, Switzerland has high gasoline prices, the best environmental performance of 180 countries, and the second best climate and energy performance (Yale University 2018), yet this has not prevented it from being one of the world’s most affluent countries without having the windfall of oil deposits. Environmental performance and near-term economic performance can be complementary.

Norway is as good as it gets for exploiting fossil fuels. First, its North Sea oil has the lowest life cycle emissions of any type of oil (see Table 2.1 Chapter 2). Second, it extracts maximum royalties and benefits for the Norwegian people from private oil companies by having a state-owned oil company to leverage royalties from competing private-sector companies. Third, it implements a high-carbon tax throughout its economy to reduce carbon-polluting activities and stimulate low-carbon innovation. Fourth, it saves a large proportion of the oil benefits in a sovereignty fund for future generations and economic downturns. Parenthetically, it borrowed this idea from Alberta, but whereas Norway saved massive amounts in it, Alberta didn’t because its right-wing leaders refused to form its own state oil company and government involvement. Norway’s economic practices result in taking maximum benefits for its citizens so that the least amount of oil need be extracted and combusted. This contrasts with other crude oil exporting states whose prosperity depends on volume: extracting as much crude oil as possible. They then suffer the boom-and-bust cycles of the market. Fifth, Norway built efficient systems of low-carbon rapid public transportation and heating. Sixth, it spends part of its oil revenue to offset emissions, principally by financing reforestation in Indonesia, Brazil, and other countries. Some environmentalists complain that Norway’s measures do not go far enough, contending Norway should abandon North Sea oil entirely as the perfect solution to climate change. If the only goal is eliminating Norway’s contribution to climate change, they are right. However, such an environmental utopia has been rejected by Norwegians as threatening to provoke an economic dystopia. Norway’s approach is the best practices template for exploiting fossil fuels in an imperfect world.

Germany has huge reserves of lignite coal, which has been the source of its energy but is a particularly polluting type of coal. The population voted strong support for its Green Party, which gave it significant
influence in an electoral system of proportional representation. Germany then promoted a green energy transition, called *Energiewende*, away from fossil fuels towards low-carbon energy. It developed feed-in tariffs whereby consumers accept higher electricity costs to transform generation from fossil fuels to low-carbon energy, with the latter increasing from 5% to 40% of electricity production (Turner 2019). The low-carbon facilities are 40% owned by farmers and citizens and 340,000 Germans now work in the renewable energy industry, five times more than in the coal industry. The transition was opposed by the coal industry and the powerful automotive industry. After the nuclear disaster at Fukushima, Germany decided to phase out its nuclear reactors, which resulted in pressure to return to coal. Nevertheless, the energy transition marches on with the support of the population and without damaging Germany’s performance as an economic powerhouse. The country is on track to shutter its remaining coal-fired power plants and leave its valuable but polluting coal reserves underground.

California, which is the most populous American state and one of the most prosperous but which has been devastated by drought, wildfires, and floods, is implementing its own strict fuel-efficiency standards to cut emissions and other pollutants in cars, pickup trucks, and SUVs, which will also reduce air pollution and smog, and save money for drivers in fuel costs. Governor Newsom argued that ‘we’re not a small, isolated state. California moves markets’ (McCarthy and Lewis 2019: B2). Thirteen American states and the government of Canada indicated they will follow California’s lead. Nevertheless, not only the Trump Administration but also some automakers are opposed, arguing it will add US$1800 to the price of vehicles, will split the market, and disrupt highly integrated supply chains. States like California are willing to pay that cost and solve the split-market problem by promoting a single, ambitious standard to diminish the danger. Many automakers complied with California’s fuel-efficiency standards. But it would have been better to have a federal administration apply rigorous fuel-efficiency standards to all states rather than the Trump Administration fighting to suppress California’s right to implement fuel-efficiency standards.

Some other social practices are changing and technologies are being innovated with the climate challenge in mind. Cities are attempting
to densify and develop dedicated bicycle lanes for the home-to-work commute. Deforestation has decelerated and afforestation has begun, which withdraws carbon from the atmosphere. The practice of draining wetlands has largely stopped, and some are being expanded because they are effective protecting against floods and in withdrawing atmospheric carbon. The birth rate is dropping everywhere and the education of girls is rising. The environmental movement is strong in many countries. Young people are becoming more involved in politics because they realize it is they who will be most affected by slow-onset problems like global warming.

Private-Sector Solutions

There are private-sector solutions for mitigating the fossil-fuelled climate crisis, unsurprisingly often found in Nordic countries with a history of social democracy. One case occurred in Denmark (see Reguly 2019). Before 1974, energy in Denmark was almost entirely based on oil imported largely from Saudi Arabia. The OPEC oil embargo of 1974 sent prices soaring, resulting in Denmark having to pay almost 400% more, immediately, for Saudi oil. This would make Denmark’s energy bill ruinous, so the country converted its oil-burning electricity generating plants to coal, which was less expensive and less vulnerable to foreign volatility. A state-owned company called DONG, an acronym for Danish Oil and Natural Gas, was founded with the mission of discovering and extracting oil and natural gas in the Danish part of the North Sea. Over the following decades, DONG expanded its oil and gas portfolio in the North Sea, and merged with other companies and expanded into coal. It built an enormous coal-fired power station in northeast Germany and became one of the most coal-intensive companies in Europe.

By 2006, however, scientific findings concerning the danger of global warming became accepted by the Danish population. Al Gore’s Inconvenient Truth had a major impact. The European Union introduced its carbon dioxide reduction goals for 2020. Sustained anti-coal protests erupted in Denmark. Debates within DONG’s leadership began to
occur. One group argued that Denmark had high carbon dioxide emissions, that more investing in fossil fuels would result in being locked into carbon emissions, that offshore wind is the energy of the future, and that the company should replace fossil fuels and especially coal with wind energy. An opposing leadership group claimed that the company’s core competence was in fossil fuels, that there was almost no wind energy being produced in Denmark, and that changing from one of Europe’s most coal-intensive companies to wind energy would be risky and unprofitable, hence fossil fuels should remain the priority. The social change to wind leadership group won this internal struggle over the risk averse, path-dependent coal group. Despite major expenses to decommission coal plants and construct offshore wind farms, the decision was made to dismantle the fossil-fuel infrastructure and replace it with wind energy. High-carbon taxes in Denmark provided the push, and the pull came from the conviction that remaining a carbon polluter was morally wrong. There was nevertheless nervousness in the company and the country concerning whether the transformation would involve a substantial financial sacrifice. External factors also came into play. In 2012, European natural gas companies, such as DONG, were clobbered by the plummeting prices because of fracking in the USA. Vast amounts of low-price American coal were dumped onto Europe. DONG’s huge fossil-fuel business lost money that year, which prompted it to sell those assets and focus on offshore wind, which was growing in profitability. Furthermore, the technology and installation costs of offshore wind were decreasing dramatically. In 2017, DONG sold its North Sea oil and gas business, and changed its name to Orsted. By 2018, Orsted’s wind energy output was 75% of its total energy on the way to 99% by 2025. Its carbon dioxide emissions fell 98% by 2015 compared to the level in 2009. It now markets itself as the greenest energy company in Europe. The transition from fossil fuels to wind energy was made far more rapidly than expected. Not only did it result in a major reduction in Denmark’s carbon dioxide emissions, it also meant cleaner air in Copenhagen and heat for homes and businesses as a by-product of electricity generation. The transformation has also been exceptionally profitable, making Orsted one of Europe’s most valuable energy companies. ‘In 2009, Orsted was largely a domestic Danish company. Today, it
is the leader in offshore wind power, with control of 30% of the global market. Orsted has more than two dozen offshore farms in Denmark, Britain, Germany, Netherlands and Taiwan, and has several in development off the U.S. east coast’ (Reguly 2019: 40). This demonstrates how the economy can be reconciled with the environment if leaders do not discount future harm in favour of short-term benefits and if they have the foresight to innovate out of carbon-polluting fossil fuels towards clean renewable energy.

There are many other examples of market-driven technological innovations reducing emissions. ‘New LEDs [light emitting diodes] use about one-eight as much energy as the incandescent bulbs they replace and last about 20 times longer. As a result, more than 80 million LED bulbs have been installed in the United States today, which have avoided millions of tons of CO₂ emissions and saved billions of dollars’ (Harvey and Orbis 2018: 11). This despite the fact that upfront costs are greater for LEDs than for incandescent bulbs. Hawken’s (2017: 222) research team estimates that over the thirty year period from 2010 to 2050 replacing incandescent lighting globally with LEDs would cost $324 billion but would save $1730 billion and would avoid emitting 7.8 gigatonnes (= 7.8 trillion kilograms) of carbon dioxide equivalent into the atmosphere. Resistance to this simple remedy results from aesthetic claims that incandescent bulbs give a psychological feeling of warmth, which is because they waste energy as heat.

Solar, wind, and energy storage, particularly in batteries and electric vehicles, are becoming more efficient and cheaper as they scale up, pushed especially by China seeking to leap-frog Western countries into clean energy of the future (Rand 2018: B4). A variety of electric vehicles are being developed and their prices are diminishing. Electric vehicles ‘are the perfect storage system for renewables, and the synergy created with their widespread deployment may well provide the momentum for a decisive end to the fossil-fuel era’ (Flannery 2015: 131). Fossil fuels are becoming less attractive to investors pursuing long-term profits, especially carbon-laden ones like coal and heavy oil. One energy consultancy forecasts ‘that global demand for oil will peak in 2022 owing to a surge in electric-vehicle adoption and a bearish outlook on petrochemicals. The demand for natural gas could surpass global oil demand by
2026’ (quoted in Quinlan 2019: B4). The investment firm BNP Paribas calculated that to be competitive over the next 25 years with renewable energy, oil will have to be priced between US$9 and US$20 a barrel (Lewis 2019). Many oil reserves cannot meet those requirements, hence will be left underground. Lewis (2019: 3) states that ‘economic and environmental benefits [are] set to make renewables in tandem with EVs [electric vehicles] irresistible. …We conclude that the economics of oil for gasoline and diesel versus wind- and solar-powered EVs are now in relentless and irreversible decline’. Divestment from fossil fuels is increasing. Renewable energy, especially wind, solar, and hydro, is coming on stream and their costs are decreasing as they begin to be mass produced. Flannery (2015: 120) points out that ‘renewables are now successfully competing with fossil fuels. For two years running more renewable energy, including wind and solar, has been installed globally than fossil fuel-based generation’. After an exhaustive study, Hawken (2017: 1) concludes that humanity is ‘squarely in the middle of the greatest energy transition in history. The era of fossil fuels is over, and the only question now is when the new era will be fully upon us. Economics make its arrival inevitable. Clean energy is less expensive’.

The Anglo-Australian mining company BHP is the world’s biggest exporter of coking coal used for steelmaking, the third largest iron-ore miner, and a major producer of liquefied natural gas, oil, and copper. It announced in 2019 it will invest US$400 million over five years to reduce emissions and, more significantly, will take into consideration scope 3 emissions (Russell 2019). Whereas scope 1 and 2 include an organization’s direct and indirect emissions from its own activities, scope 3 refers to emissions generated by the use of its products, and is always excluded from consideration by resource extractors. Scope 3 emissions of BHP would cover emissions from burning its coal, oil, and natural gas in whatever country they are combusted, as well as fossil fuels combusted by ships and trains bringing them to their destination. Most of BHP’s fossil fuels are extracted in Australia, the world’s largest extractor of coal, iron ore, and liquefied natural gas, so taking scope 3 into consideration would mean more emissions included in Australia’s already high total. Taking scope 3 into account could potentially attract ethical investors and pressure downstream users of fossil fuels to increase efficiency and
reduce emissions. Whether these grounds for hope are fulfilled depends on whether it is more than a public relations coup, on how it is implemented, on whether investors reward or punish the company’s foresight in mitigating the fossil-fuelled climate crisis, and on whether its initiative inspires other resource companies to follow suit.

The insurance industry will be most affected by global warming, hence tends to be in the vanguard of transforming its practices to heed warnings of scientists. Swiss-based Zurich Insurance Group Ltd, with US$190 billion investments worldwide, committed to using only renewable power by 2023, eliminated coal used for electricity production from its investment portfolio in 2017, is creating standards to set targets and measure the carbon footprint of companies’ underwriting and investment portfolios, and will divest from Alberta’s bituminous sands extractors, their pipeline facilities and their crude-by-rail companies within two years unless they produce business plans to reduce emissions (McCarthy 2019).

Green bonds are being issued by banks to raise capital to mitigate environmental problems like climate change (Flannery 2015: 111) by financing wind and solar power, energy efficient buildings, and clean transportation. They are being driven by demand from institutional investors. The Green Bond market taking into account environmental impacts has grown from US$10 billion in 2013 to US$170 billion in 2018 (Le Hanerou and Lamontagne 2019). This growth followed the construction of the Green Bond Principles organization in 2014, which assesses and monitors green bonds to ensure they finance climate-friendly projects and are not greenwashing. That organization also promotes disclosure. This is significant for reconciling the economy and the environment rather than obsessing about only the financial bottom line.

Some other examples of private-sector innovation towards lower carbon energy are the following. The USA reduced its greenhouse-gas emissions, not intentionally by government mandate to switch away from fossil fuels, but rather by fossil-fuel companies innovating new cost-effective technology to extract natural gas from shale by hydraulic fracturing, which made natural gas as inexpensive as coal and resulted in transitioning from high-emissions coal to lower emissions natural gas. A flat-roofed shopping mall took the initiative of installing solar
panels, which provide electricity to run air conditioning especially in the hottest, sunniest days of summer when demand is highest (Immen 2019). This reduces the need for fossil-fuelled electricity, saves the mall money, and could be a template for all malls, big-box stores, and other large flat-roofed buildings. Patents for innovation in renewable energy have recently become far greater than patents for innovation in fossil fuels, whereas they were roughly equal before 2000 (Flannery 2015: 125).

However, the pursuit of profit in the market leading to innovations is a double-edged sword, with one side having been sharper than the other to date. It invented fracking, deepwater drilling, Arctic drilling, etc., which increased fossil-fuel extraction and resulted in more emissions worsening global warming. And hydraulic fracturing deflects investment away from clean, renewable energy. Profit-seeking entrepreneurs vastly expanded fossil-fuelled cruises and jet-fuelled intercontinental tourism. They developed air conditioning and computer servers which enable social media and data storage to function, but these worsen global warming by requiring huge amounts of electricity frequently provided by fossil-fuel combustion. These innovations are all desired, but have harmful effects of increasing emissions and worsening global warming. The market’s innovation of low-carbon energy, carbon capture and storage (CCS), and other means of bringing emissions into line with carbon withdrawals trails way behind its success in developing technologies to extract and use more fossil fuels. Dependence on the market by itself to solve the climate change crisis is contradicted by its overall failure to bring cost-effective innovations to decrease emissions without government regulations. Reliance on profit-seeking companies to implement solutions is exceedingly risky. It constitutes dangerous brinkmanship by making global warming worse before hoped-for solutions are implemented.

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