



The Turning Point: New Hope for the Climate

It's time to accelerate the shift toward a low-carbon future

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In the struggle to solve the climate crisis, a powerful, largely unnoticed shift is taking place. The forward journey for human civilization will be difficult and dangerous, but it is now clear that we will ultimately prevail. The only question is how quickly we can accelerate and complete the transition to a low-carbon civilization. There will be many times in the decades ahead when we will have to take care to guard against despair, lest it become another form of denial, paralyzing action. It is true that we have waited too long to avoid some serious damage to the planetary ecosystem – some of it, unfortunately, irreversible. Yet the truly catastrophic damages that have the potential for ending civilization as we know it can still – almost certainly – be avoided. Moreover, the pace of the changes already set in motion can still be moderated significantly.

Global Warming's Terrifying New Math

There is surprising – even shocking – good news: Our ability to convert sunshine into usable energy has become much cheaper far more rapidly than anyone had predicted. The cost of electricity from photovoltaic, or PV, solar cells is now equal to or less than the cost of electricity from other sources powering electric grids in at least 79 countries. By 2020 – as the scale of deployments grows and the costs continue to decline – more than 80 percent of the world's people will live in regions where solar will be competitive with electricity from other sources.

No matter what the large carbon polluters and their ideological allies say or do, in markets there is a huge difference between "more expensive than" and "cheaper than." Not unlike the difference between 32 degrees and 33 degrees Fahrenheit. It's not just a difference of a degree, it's the difference between a market that's frozen up and one that's liquid. As a result, all over the world, the executives of companies selling electricity generated from the burning of carbon-based fuels (primarily from coal) are openly discussing their growing fears of a "utility death spiral."

Germany, Europe's industrial powerhouse, where renewable subsidies have been especially high, now generates 37 percent of its daily electricity from wind and solar; and analysts predict that number will rise to 50 percent by 2020. (Indeed, one day this year, renewables created 74 percent of the nation's electricity!)

Scorched Earth: How Climate Change Is Spreading Drought Throughout the Globe

What's more, Germany's two largest coal-burning utilities have lost 56 percent of their value over the past four years, and the losses have continued into the first half of 2014. And it's not just Germany. Last year, the top 20 utilities throughout Europe reported losing half of their value since 2008. According to the Swiss bank UBS, nine out of 10 European coal and gas plants are now losing money.

In the United States, where up to 49 percent of the new generating capacity came from renewables in 2012, 166 coal-fired electricity-generating plants have either closed or have announced they are closing in the past four and a half years. An additional 183 proposed new coal plants have been canceled since 2005.

To be sure, some of these closings have been due to the substitution of gas for coal, but the transition under way in both the American and global energy markets is far more significant than one fossil fuel replacing another. We are witnessing the beginning of a massive shift to a new energy-distribution model – from the "central station" utility-grid model that goes back to the 1880s to a "widely distributed" model with rooftop solar cells, on-site and grid battery storage, and microgrids.

The principal trade group representing U.S. electric utilities, the Edison Electric Institute, has identified distributed generation as the "largest near-term threat to the utility model." Last May, Barclays downgraded the entirety of the U.S. electric sector, warning that "a confluence of declining cost trends in distributed solarphotovoltaic-power generation and residentialscale power storage is likely to disrupt the status quo" and make utility investments less attractive.

See the 10 Dumbest Things Said About Global Warming

This year, Citigroup reported that the widespread belief that natural gas – the supply of which has ballooned in the U.S. with the fracking of shale gas – will continue to be the chosen alternative to coal is mistaken, because it too will fall victim to the continuing decline in the cost of solar and wind electricity. Significantly, the cost of battery storage, long considered a barrier to the new electricity system, has also been declining steadily – even before the introduction of disruptive new battery technologies that are now in advanced development. Along with the impressive gains of clean-energy programs in the past decade, there have been similar improvements in our ability to do more with less. Since 1980, the U.S. has reduced total energy intensity by 49 percent.

It is worth remembering this key fact about the supply of the basic "fuel": Enough raw energy reaches the Earth from the sun in one hour to equal all of the energy used by the entire world in a full year.

In poorer countries, where most of the world's people live and most of the growth in energy use is occurring, photovoltaic electricity is not so much displacing carbon-based energy as leapfrogging it altogether. In his first days in office, the government of the newly elected prime minister of India, Narendra Modi (who has authored an e-book on global warming), announced a stunning plan to rely principally upon photovoltaic energy in providing electricity to 400 million Indians who currently do not have it. One of Modi's supporters, S.L. Rao, the former utility regulator of India, added that the industry he once oversaw "has reached a stage where either we change the whole system quickly, or it will collapse."

Nor is India an outlier. Neighboring Bangladesh is installing nearly two new rooftop PV systems every minute — making it the most rapidly growing market for PVs in the world. In West and East Africa, solar-electric cells are beginning what is widely predicted to be a period of explosive growth.

At the turn of the 21st century, some scoffed at projections that the world would be installing one gigawatt of new solar electricity per year by 2010. That goal was exceeded 17 times over; last year it was exceeded 39 times over; and this year the world is on pace to exceed that benchmark as much as 55 times over. In May, China announced that by 2017, it would have the capacity to generate 70 gigawatts of photovoltaic electricity. The state with by far the biggest amount of wind energy is Texas, not historically known for its progressive energy policies.

The cost of wind energy is also plummeting, having dropped 43 percent in the United States since 2009 – making it now cheaper than coal for new generating capacity. Though the downward cost curve is not quite as steep as that for solar, the projections in 2000 for annual worldwide wind deployments by the end of that decade were exceeded seven times over, and are now more than 10 times that figure. In the United States alone, nearly one-third of all new electricity-generating capacity in the past five years has come from wind, and installed wind capacity in the U.S. has increased more than fivefold since 2006.

For consumers, this good news may soon get even better. While the cost of carbonbased energy continues to increase, the cost of solar electricity has dropped by an average of 20 percent per year since 2010. Some energy economists, including those who produced an authoritative report this past spring for Bernstein Research, are now predicting energy-price deflation as soon as the next decade.

For those (including me) who are surprised at the speed with which this impending transition has been

accelerating, there are precedents that help explain it. Remember the first mobile-telephone handsets? I do; as an inveterate "early adopter" of new technologies, I thought those first huge, clunky cellphones were fun to use and looked cool (they look silly now, of course). In 1980, a few years before I bought one of the early models, AT&T conducted a global market study and came to the conclusion that by the year 2000 there would be a market for 900,000 subscribers. They were not only wrong, they were way wrong: 109 million contracts were active in 2000. Barely a decade and a half later, there are 6.8 billion globally. These parallels have certainly caught the attention of the fossil-fuel industry and its investors: Eighteen months ago, the Edison Electric Institute described the floundering state of the once-proud landline-telephone companies as a grim predictor of what may soon be their fate.

The utilities are fighting back, of course, by using their wealth and the entrenched political power they have built up over the past century. In the United States, brothers Charles and David Koch, who run Koch Industries, the second-largest privately owned corporation in the U.S., have secretly donated at least \$70 million to a number of opaque political organizations tasked with spreading disinformation about the climate crisis and intimidating political candidates who dare to support renewable energy or the pricing of carbon pollution.

A Call to Arms: An invitation to Demand Action on Climate Change

They regularly repeat shopworn complaints about the inadequate, intermittent and inconsistent subsidies that some governments have used in an effort to speed up the deployment of renewables, while ignoring the fact that global subsidies for carbon-based energy are 25 times larger than global subsidies for renewables.

One of the most effective of the groups financed by the Koch brothers and other carbon polluters is the American Legislative Exchange Council, or ALEC, which grooms conservative state legislators throughout the country to act as their agents in introducing legislation written by utilities and carbon-fuel lobbyists in a desperate effort to slow, if not stop, the transition to renewable energy.

The Kochs claim to act on principles of low taxation and minimal regulation, but in their attempts to choke the development of alternative energy, they have induced the recipients of their generous campaign contributions to contradict these supposedly bedrock values, pushing legislative and regulatory measures in 34 states to discourage solar, or encourage carbon energy, or both. The most controversial of their initiatives is focused on persuading state legislatures and public-utility commissions to tax homeowners who install a PV solar cell on their roofs, and to manipulate the byzantine utility laws and regulations to penalize renewable energy in a variety of novel schemes.

The chief battleground in this war between the energy systems of the past and future is our electrical grid. For more than a century, the grid – along with the regulatory and legal framework governing it – has been dominated by electric utilities and their centralized, fossil-fuel-powered electricity-generation plants. But the rise of distributed alternate energy sources allows consumers to participate in the production of electricity through a policy called net metering. In 43 states, homeowners who install solar PV to systems on their rooftops are permitted to sell electricity back into the grid when they generate more than they need.

These policies have been crucial to the growth of solar power. But net metering represents an existential threat to the future of electric utilities, the so-called utility death spiral: As more consumers install solar panels on their roofs, utilities will have to raise prices on their remaining customers to recover the lost revenues. Those higher rates will, in turn, drive more consumers to leave the utility system, and so on.

But here is more good news: The Koch brothers are losing rather badly. In Kansas, their home state, a poll by North Star Opinion Research reported that 91 percent of registered voters support solar and wind. Three-quarters supported stronger policy encouragement of renewable energy, even if such policies raised their electricity bills.

In Georgia, the Atlanta Tea Party joined forces with the Sierra Club to form a new organization called – wait for it – the Green Tea Coalition, which promptly defeated a Koch-funded scheme to tax rooftop solar panels.

Meanwhile, in Arizona, after the state's largest utility, an ALEC member, asked the public-utility

commission for a tax of up to \$150 per month for solar households, the opposition was fierce and well-organized. A compromise was worked out – those households would be charged just \$5 per month – but Barry Goldwater Jr., the leader of a newly formed organization called TUSK (Tell Utilities Solar won't be Killed), is fighting a new attempt to discourage rooftop solar in Arizona. Characteristically, the Koch brothers and their allies have been using secretive and deceptive funding in Arizona to run television advertisements attacking "greedy" owners of rooftop solar panels – but their effort has thus far backfired, as local journalists have exposed the funding scam.

Even though the Koch-funded forces recently scored a partial (and almost certainly temporary) victory in Ohio, where the legislature voted to put a hold on the state's renewable-portfolio standard and study the issue for two years, it's clear that the attack on solar energy is too little, too late. Last year, the Edison Electric Institute warned the utility industry that it had waited too long to respond to the sharp cost declines and growing popularity of solar: "At the point when utility investors become focused on these new risks and start to witness significant customer- and earnings-erosion trends, they will respond to these challenges. But, by then, it may be too late to repair the utility business model."

The most seductive argument deployed by the Koch brothers and their allies is that those who use rooftop solar electricity and benefit from the net-metering policies are "free riders" – that is, they are allegedly not paying their share of the maintenance costs for the infrastructure of the old utility model, including the grid itself. This deceptive message, especially when coupled with campaign contributions, has persuaded some legislators to support the proposed new taxes on solar panels.

But the argument ignores two important realities facing the electric utilities: First, most of the excess solar electricity is supplied by owners of solar cells during peak-load hours of the day, when the grid's capacity is most stressed – thereby alleviating the pressure to add expensive new coal- or gas-fired generating capacity. But here's the rub: What saves money for their customers cuts into the growth of their profits and depresses their stock prices. As is often the case, the real conflict is between the public interest and the special interest.

The second reality ignored by the Koch brothers is the one they least like to discuss, the one they spend so much money trying to obfuscate with their **hired "merchants of doubt."** You want to talk about the uncompensated use of infrastructure? What about *sewage infrastructure* for 98 million tons per day of gaseous, heat-trapping waste that is daily released into our skies, threatening the future of human civilization? Is it acceptable to use the thin shell of atmosphere surrounding our planet as an open sewer? Free of charge? Really?

This, after all, is the reason the climate crisis has become an existential threat to the future of human civilization. Last April, the average CO₂ concentrations in the Earth's atmosphere exceeded 400 parts-per-million on a sustained basis for the first time in at least 800,000 years and probably for the first time in at least 4.5 million years (a period that was considerably warmer than at present).

According to a cautious analysis by the influential climate scientist James Hansen, the accumulated man-made global-warming pollution already built up in the Earth's atmosphere now traps as much extra heat energy every day as would be released by the explosion of 400,000 Hiroshima-class nuclear bombs. It's a big planet, but that's a lot of energy.

And it is that heat energy that is giving the Earth a fever. Denialists hate the "fever" metaphor, but as the American Association for the Advancement of Science (AAAS) **pointed out this year**, "Just as a 1.4-degree-fever change would be seen as significant in a child's body, a similar change in our Earth's temperature is also a concern for human society."

Thirteen of the 14 hottest years ever measured with instruments have occurred in this century. This is the 37th year in a row that has been hotter than the 20th-century average. April was the 350th month in a row hotter than the average in the preceding century. The past decade was by far the warmest decade ever measured.

Many scientists expect the coming year could break all of these records by a fair margin because of the extra boost from the anticipated El Niño now gathering in the waters of the eastern Pacific. (The effects of periodic El Niño events are likely to become stronger because of global warming, and this one is projected by many scientists to be stronger than average, perhaps on the scale of the epic El Niño of

1997 to 1998.)

The fast-growing number of extreme-weather events, connected to the climate crisis, has already had a powerful impact on public attitudes toward global warming. A clear majority of Americans now acknowledge that **man-made pollution is responsible**. As the storms, floods, mudslides, droughts, fires and other catastrophes **become ever more destructive**, the arcane discussions over how much of their extra-destructive force should be attributed to global warming have become largely irrelevant. The public at large feels it viscerally now. As Bob Dylan sang, "You don't need a weatherman to know which way the wind blows."

Besides, there is a simple difference between linear cause and effect and systemic cause and effect. As one of the world's most-respected atmospheric scientists, Kevin Trenberth, has said, "The environment in which all storms form has changed owing to human activities."

For example, when Supertyphoon Haiyan crossed the Pacific toward the Philippines last fall, the storm gained strength across seas that were 5.4 degrees Fahrenheit warmer than they used to be because of greenhousegas pollution. As a result, Haiyan went from being merely strong to being the most powerful and destructive ocean-based storm on record to make landfall. Four million people were displaced (more than twice as many as by the Indian Ocean tsunami of 10 years ago), and there are still more than 2 million Haiyan refugees desperately trying to rebuild their lives.

When Superstorm Sandy traversed the areas of the Atlantic Ocean windward of New York and New Jersey in 2012, the water temperature was nine degrees Fahrenheit warmer than normal. The extra convection energy in those waters fed the storm and made the winds stronger than they would otherwise have been. Moreover, the sea level was higher than it used to be, elevated by the melting of ice in the frozen regions of the Earth and the expanded volume of warmer ocean waters.

Five years earlier, denialists accused me of demagogic exaggeration in an animated scene in my documentary *An Inconvenient Truth* that showed the waters of the Atlantic Ocean flooding into the 9/11 Ground Zero Memorial site. But in Sandy's wake, the Atlantic did in fact flood Ground Zero – many years before scientists had expected that to occur.

Similarly, the inundation of Miami Beach by rising sea levels has now begun, and freshwater aquifers in low-lying areas from South Florida to the Nile Delta to Bangladesh to Indochina are being invaded by saltwater pushed upward by rising oceans. And of course, many low-lying islands – not least in the Bay of Bengal – are in danger of disappearing altogether. Where will the climate refugees go? Similarly, the continued melting of mountain glaciers and snowpacks is, according to the best scientists, already "affecting water supplies for as many as a billion people around the world."

Just as the extreme-weather events we are now experiencing are exactly the kind that were predicted by scientists decades ago, the scientific community is now projecting far worse extreme-weather events in the years to come. Eighty percent of the warming in the past 150 years (since the burning of carbon-based fuels gained momentum) has occurred in the past few decades. And it is worth noting that the previous scientific projections consistently low-balled the extent of the globalwarming consequences that later took place – for a variety of reasons rooted in the culture of science that favor conservative estimates of future effects.

In an effort to avoid these cultural biases, the AAAS noted this year that not only are the impacts of the climate crisis "very likely to become worse over the next 10 to 20 years and beyond," but "there is a possibility that temperatures will rise much higher and impacts will be much worse than expected. Moreover, as global temperature rises, the risk increases that one or more important parts of the Earth's climate system will experience changes that may be abrupt, unpredictable and potentially irreversible, causing large damages and high costs."

Just weeks after that report, there was shock and, for some, a temptation to despair when the startling news was released in May by scientists at both NASA and the University of Washington that the long-feared "collapse" of a portion of the West Antarctic ice sheet is not only under way but is also now "irreversible." Even as some labored to understand what the word "collapse" implied about the suddenness with which this catastrophe will ultimately unfold, it was the word "irreversible" that had a deeper impact on the collective psyche.

Just as scientists 200 years ago could not comprehend the idea that species had once lived on Earth and had subsequently become extinct, and just as some people still find it hard to accept the fact that human beings have become a sufficiently powerful force of nature to reshape the ecological system of our planet, many – including some who had long since accepted the truth about global warming – had difficulty coming to grips with the stark new reality that one of the long-feared "tipping points" had been crossed. And that, as a result, no matter what we do, sea levels will rise by at least an additional three feet.

The uncertainty about how long the process will take (some of the best ice scientists warn that a rise of 10 feet in this century cannot be ruled out) did not change the irreversibility of the forces that we have set in motion. But as Eric Rignot, the lead author of the NASA study, pointed out in *The Guardian*, it's still imperative that we take action: "Controlling climate warming may ultimately make a difference not only about how fast West Antarctic ice will melt to sea, but also whether other parts of Antarctica will take their turn."

The news about the irreversible collapse in West Antarctica caused some to almost forget that only two months earlier, a similar startling announcement had been made about the Greenland ice sheet. Scientists found that the northeastern part of Greenland – long thought to be resistant to melting – has in fact been losing more than 10 billion tons of ice per year for the past decade, making 100 percent of Greenland unstable and likely, as with West Antarctica, to contribute to significantly more sea-level rise than scientists had previously thought.

The heating of the oceans not only melts the ice and makes hurricanes, cyclones and typhoons more intense, it also evaporates around 2 trillion gallons of additional water vapor into the skies above the U.S. The warmer air holds more of this water vapor and carries it over the landmasses, where it is funneled into land-based storms that are releasing record downpours all over the world.

For example, an "April shower" came to Pensacola, Florida, this spring, but it was a freak – another rainstorm on steroids: two feet of rain in 26 hours. It broke all the records in the region, but as usual, virtually no media outlets made the connection to global warming. Similar "once in a thousand years" storms have been occurring regularly in recent years all over the world, including in my hometown of Nashville in May 2010.

All-time record flooding swamped large portions of England this winter, submerging thousands of homes for more than six weeks. Massive downpours hit Serbia and Bosnia this spring, causing flooding of "biblical proportions" (a phrase now used so frequently in the Western world that it has become almost a cliché) and thousands of landslides. Torrential rains in Afghanistan in April triggered mudslides that killed thousands of people – almost as many, according to relief organizations, as all of the Afghans killed in the war there the previous year.

In March, persistent rains triggered an unusually large mudslide in Oso, Washington, killing more than 40 people. There are literally hundreds of other examples of extreme rainfall occurring in recent years in the Americas, Europe, Asia, Africa and Oceania.

In the planet's drier regions, the same extra heat trapped in the atmosphere by man-made global-warming pollution has also been driving faster evaporation of soil moisture and causing record-breaking droughts. As of this writing, 100 percent of California is in "severe," "extreme" or "exceptional" drought. Record fires are ravaging the desiccated landscape. Experts now project that an increase of one degree Celsius over pre-industrial temperatures will lead to as much as a 600-percent increase in the median area burned by forest fires in some areas of the American West – including large portions of Colorado. The National Research Council has reported that fire season is two and a half months longer than it was 30 years ago, and in California, firefighters are saying that the season is now effectively year-round.

Drought has been intensifying in many other dry regions around the world this year: Brazil, Indonesia, central and northwest Africa and Madagascar, central and western Europe, the Middle East up to the Caspian Sea and north of the Black Sea, Southeast Asia, Northeast Asia, Western Australia and New Zealand.

Syria is one of the countries that has been in **the bull's-eye of climate change**. From 2006 to 2010, a historic drought destroyed 60 percent of the country's farms and 80 percent of its livestock – driving a

million refugees from rural agricultural areas into cities already crowded with the million refugees who had taken shelter there from the Iraq War. As early as 2008, U.S. State Department cables quoted Syrian government officials warning that the social and economic impacts of the drought are "beyond our capacity as a country to deal with." Though the hellish and ongoing civil war in Syria has multiple causes – including the perfidy of the Assad government and the brutality on all sides – their climate-related drought may have been the biggest underlying trigger for the horror.

The U.S. military has taken notice of the strategic dangers inherent in the climate crisis. Last March, a Pentagon advisory committee described the climate crisis as a "catalyst for conflict" that may well cause failures of governance and societal collapse. "In the past, the thinking was that climate change multiplied the significance of a situation," said retired Air Force Gen. Charles F. Wald. "Now we're saying it's going to be a direct cause of instability."

Pentagon spokesman Mark Wright told the press, "For DOD, this is a mission reality, not a political debate. The scientific forecast is for more Arctic ice melt, more sea-level rise, more intense storms, more flooding from storm surge and more drought." And in yet another forecast difficult for congressional climate denialists to rebut, climate experts advising the military have also warned that the world's largest naval base, in Norfolk, Virginia, is likely to be inundated by rising sea levels in the future.

And how did the Republican-dominated House of Representatives respond to these grim warnings? By passing legislation seeking to prohibit the Department of Defense from taking any action to prepare for the effects of climate disruption.

There are so many knock-on consequences of the climate crisis that listing them can be depressing – diseases spreading, crop yields declining, more heat waves affecting vulnerable and elderly populations, the disappearance of summer-ice cover in the Arctic Ocean, the potential extinction of up to half of all the living species, and so much more. And that in itself is a growing problem too, because when you add it all up, it's no wonder that many feel a new inclination to despair.

So, clearly, we will just have to gird ourselves for the difficult challenges ahead. There is indeed, literally, light at the end of the tunnel, but there is a tunnel, and we are well into it.

In November 1936, Winston Churchill stood before the United Kingdom's House of Commons and placed a period at the end of the misguided debate over the nature of the "gathering storm" on the other side of the English Channel: "Owing to past neglect, in the face of the plainest warnings, we have entered upon a period of danger. . . . The era of procrastination, of half measures, of soothing and baffling expedience of delays is coming to its close. In its place, we are entering a period of consequences. . . . We cannot avoid this period; we are in it now."

Our civilization is confronting this existential challenge at a moment in our historical development when our dominant global ideology – democratic capitalism – has been failing us in important respects.

Democracy is accepted in theory by more people than ever before as the best form of political organization, but it has been "hacked" by large corporations (defined as "persons" by the Supreme Court) and special interests corrupting the political system with obscene amounts of money (defined as "speech" by the same court).

Capitalism, for its part, is accepted by more people than ever before as a superior form of economic organization, but is – in its current form – failing to measure and include the categories of "value" that are most relevant to the solutions we need in order to respond to this threatening crisis (clean air and water, safe food, a benign climate balance, public goods like education and a greener infrastructure, etc.).

Pressure for meaningful reform in democratic capitalism is beginning to build powerfully. The progressive introduction of Internet-based communication – social media, blogs, digital journalism – is laying the foundation for the renewal of individual participation in democracy, and the re-elevation of reason over wealth and power as the basis for collective decisionmaking. And the growing levels of inequality worldwide, combined with growing structural unemployment and more frequent market disruptions (like the Great Recession), are building support for reforms in capitalism.

Both waves of reform are still at an early stage, but once again, Churchill's words inspire: "If you're going through hell, keep going." And that is why it is all the more important to fully appreciate the incredible opportunity for salvation that is now within our grasp. As the satirical newspaper *The Onion* recently noted in one of its trademark headlines: "Scientists Politely Remind World That Clean Energy Technology Ready to Go Whenever."

We have the policy tools that can dramatically accelerate the transition to clean energy that market forces will eventually produce at a slower pace. The most important has long since been identified: We have to put a price on carbon in our markets, and we need to eliminate the massive subsidies that fuel the profligate emissions of global-warming pollution.

We need to establish "green banks" that provide access to capital investment necessary to develop renewable energy, sustainable agriculture and forestry, an electrified transportation fleet, the retrofitting of buildings to reduce wasteful energy consumption, and the full integration of sustainability in the design and architecture of cities and towns. While the burning of fossil fuels is the largest cause of the climate crisis, deforestation and "factory farming" also play an important role. Financial and technological approaches to addressing these challenges are emerging, but we must continue to make progress in converting to sustainable forestry and agriculture.

In order to accomplish these policy shifts, we must not only put a price on carbon in markets, but also find a way to put a price on climate denial in our politics. We already know the reforms that are needed – and the political will to enact them is a renewable resource. Yet the necessary renewal can only come from an awakened citizenry empowered by a sense of urgency and emboldened with the courage to reject despair and become active. Most importantly, now is the time to support candidates who accept the reality of the climate crisis and are genuinely working hard to solve it – and to bluntly tell candidates who are not on board how much this issue matters to you. If you are willing to summon the resolve to communicate that blunt message forcefully – with dignity and absolute sincerity – you will be amazed at the political power an individual can still wield in America's diminished democracy.

Something else is also new this summer. **Three years ago, in these pages**, I criticized the seeming diffidence of President Obama toward the great task of solving the climate crisis; this summer, it is abundantly evident that he has taken hold of the challenge with determination and seriousness of purpose.

He has empowered his Environmental Protection Agency to enforce limits on CO₂ emissions for both new and, as of this June, existing sources of CO₂. He has enforced bold new standards for the fuel economy of the U.S. transportation fleet. He has signaled that he is likely to reject the absurdly reckless Keystone XL-pipeline proposal for the transport of oil from carbonintensive tar sands to be taken to market through the United States on its way to China, thus effectively limiting their exploitation. And he is even now preparing to impose new limits on the release of methane pollution.

All of these welcome steps forward have to be seen, of course, in the context of Obama's continued advocacy of a so-called all-of-the-above energy policy – which is the prevailing code for aggressively pushing more drilling and fracking for oil and gas. And to put the good news in perspective, it is important to remember that U.S. emissions – after declining for five years during the slow recovery from the Great Recession – actually increased by 2.4 percent in 2013.

Nevertheless, the president is clearly changing his overall policy emphasis to make CO₂ reductions a much higher priority now and has made a series of inspiring speeches about the challenges posed by climate change and the exciting opportunities available as we solve it. As a result, Obama will go to the United Nations this fall and to Paris at the end of 2015 with the credibility and moral authority that he lacked during the disastrous meeting in Copenhagen four and a half years ago.

The international treaty process has been so fraught with seemingly intractable disagreements that some parties have all but given up on the possibility of ever reaching a meaningful treaty.

Ultimately, there must be one if we are to succeed. And there are signs that a way forward may be opening up. In May, I attended a preparatory session in Abu Dhabi, UAE, organized by United Nations Secretary General Ban Ki-moon to bolster commitments from governments, businesses and nongovernmental organizations ahead of this September's U.N. Climate Summit. The two-day meeting

was different from many of the others I have attended. There were welcome changes in rhetoric, and it was clear that the reality of the climate crisis is now weighing on almost every nation. Moreover, there were encouraging reports from around the world that many of the policy changes necessary to solve the crisis are being adopted piecemeal by a growing number of regional, state and city governments.

For these and other reasons, I believe there is a realistic hope that momentum toward a global agreement will continue to build in September and carry through to the Paris negotiations in late 2015.

The American poet Wallace Stevens once wrote, "After the final 'no' there comes a 'yes'/And on that 'yes' the future world depends." There were many no's before the emergence of a global consensus to abolish chattel slavery, before the consensus that women must have the right to vote, before the fever of the nuclear arms race was broken, before the quickening global recognition of gay and lesbian equality, and indeed before every forward advance toward social progress. Though a great many obstacles remain in the path of this essential agreement, I am among the growing number of people who are allowing themselves to become more optimistic than ever that a bold and comprehensive pact may well emerge from the Paris negotiations late next year, which many regard as the last chance to avoid civilizational catastrophe while there is still time.

It will be essential for the United States and other major historical emitters to commit to strong action. The U.S. is, finally, now beginning to shift its stance. And the European Union has announced its commitment to achieve a 40-percent reduction in CO2 emissions by 2030. Some individual European nations are acting even more aggressively, including Finland's pledge to reduce emissions 80 percent by 2050.

It will also be crucial for the larger developing and emerging nations – particularly China and India – to play a strong leadership role. Fortunately, there are encouraging signs. China's new president, Xi Jinping, has launched a pilot cap-and-trade system in two cities and five provinces as a model for a nationwide cap-and-trade program in the next few years. He has banned all new coal burning in several cities and required the reporting of CO2 emissions by all major industrial sources. China and the U.S. have jointly reached an important agreement to limit another potent source of global-warming pollution – the chemical compounds known as hydro-fluorocarbons, or HFCs. And the new prime minister of India, as noted earlier, has launched the world's most ambitious plan to accelerate the transition to solar electricity.

Underlying this new breaking of logjams in international politics, there are momentous changes in the marketplace that are exercising enormous influence on the perceptions by political leaders of the new possibilities for historic breakthroughs. More and more, investors are diversifying their portfolios to include significant investments in renewables. In June, Warren Buffett announced he was ready to double Berkshire Hathaway's existing \$15 billion investment in wind and solar energy.

A growing number of large investors – including pension funds, university endowments (Stanford announced its decision in May), family offices and others – have announced decisions to divest themselves from carbon-intensive assets. Activist and "impact" investors are pushing for divestment from carbon-rich assets and new investments in renewable and sustainable assets.

Several large banks and asset managers around the world (full disclosure: Generation Investment Management, which I co-founded with David Blood and for which I serve as chairman, is in this group) have advised their clients of the danger that **carbon assets will become "stranded."** A "stranded asset" is one whose price is vulnerable to a sudden decline when markets belatedly recognize the truth about their underlying value – just as the infamous "subprime mortgages" suddenly lost their value in 2007 to 2008 once investors came to grips with the fact that the borrowers had absolutely no ability to pay off their mortgages.

Shareholder activists and public campaigners have pressed carbon-dependent corporations to deal with these growing concerns. But the biggest ones are still behaving as if they are in denial. In May 2013, ExxonMobil CEO Rex Tillerson responded to those pointing out the need to stop using the Earth's atmosphere as a sewer by asking, "What good is it to save the planet if humanity suffers?"

I don't even know where to start in responding to that statement, but here is a clue: Pope Francis said in May, "If we destroy creation, creation will destroy us. Never forget this."

Exonmobil, Shell and many other holders of carbon-intensive assets have argued, in essence, that they simply do not believe that elected national leaders around the world will ever reach an agreement to put a price on carbon pollution.

But a prospective global treaty (however likely or unlikely you think that might be) is only one of several routes to overturning the fossil-fuel economy. Rapid technological advances in renewable energy are stranding carbon investments; grassroots movements are building opposition to the holding of such assets; and new legal restrictions on collateral flows of pollution – like particulate air pollution in China and mercury pollution in the U.S. – are further reducing the value of coal, tar sands, and oil and gas assets.

In its series of reports to energy investors this spring, Citigroup questioned the feasibility of new coal plants not only in Europe and North America, but in China as well. Although there is clearly a political struggle under way in China between regional governments closely linked to carbon-energy generators, suppliers and users and the central government in Beijing – which is under growing pressure from citizens angry about pollution – the nation's new leadership appears to be determined to engineer a transition toward renewable energy. Only time will tell how successful they will be.

The stock exchanges in Johannesburg and São Paulo have decided to require the full integration of sustainability from all listed companies. Standard & Poor's announced this spring that some nations vulnerable to the impacts of the climate crisis may soon have their bonds downgraded because of the enhanced risk to holders of those assets.

A growing number of businesses around the world are implementing sustainability plans, as more and more consumers demand a more responsible approach from businesses they patronize. Significantly, many have been pleasantly surprised to find that adopting efficient, low-carbon approaches can lead to major cost savings.

And all the while, the surprising and relentless ongoing decline in the cost of renewable energy and efficiency improvements are driving the transition to a low-carbon economy.

Is there enough time? Yes. Damage has been done, and the period of consequences will continue for some time to come, but there is still time to avoid the catastrophes that most threaten our future. Each of the trends described above – in technology, business, economics and politics – represents a break from the past. Taken together, they add up to genuine and realistic hope that we are finally putting ourselves on a path to solve the climate crisis.

How long will it take? When Martin Luther King Jr. was asked that question during some of the bleakest hours of the U.S. civil rights revolution, he responded, "How long? Not long. Because no lie can live forever. . . . How long? Not long. Because the arc of the moral universe is long, but it bends toward justice."

And so it is today: How long? Not long.

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