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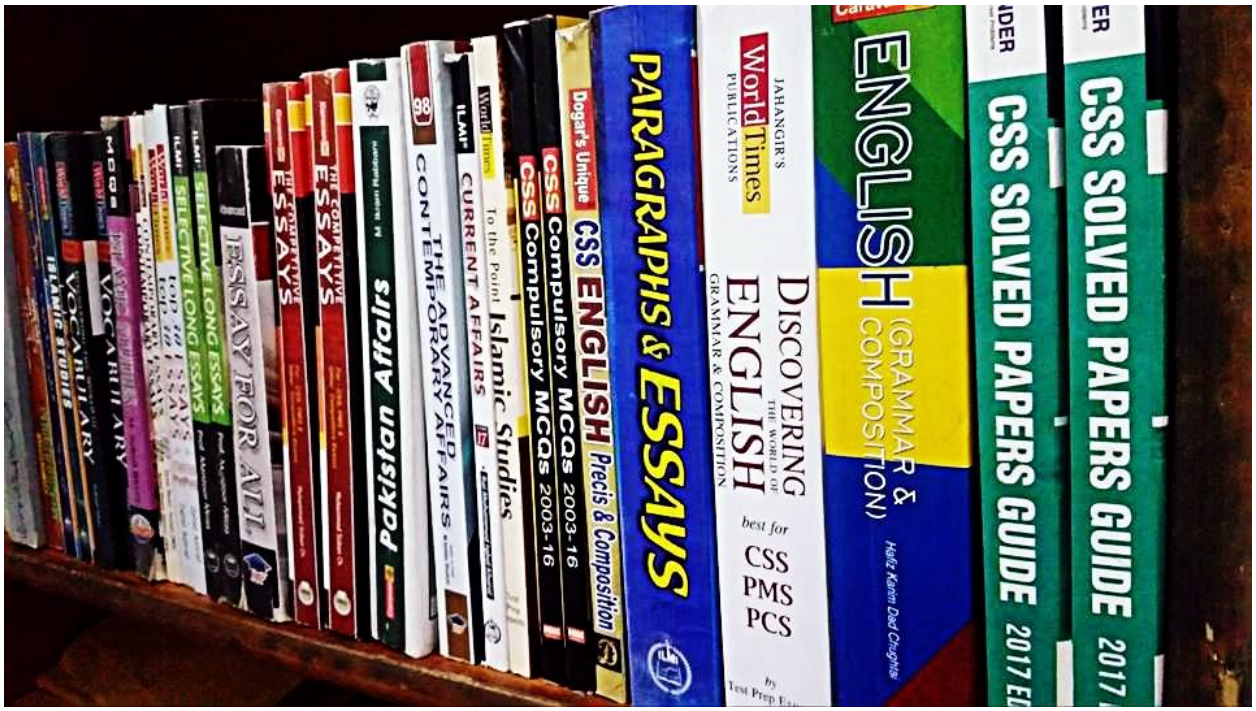

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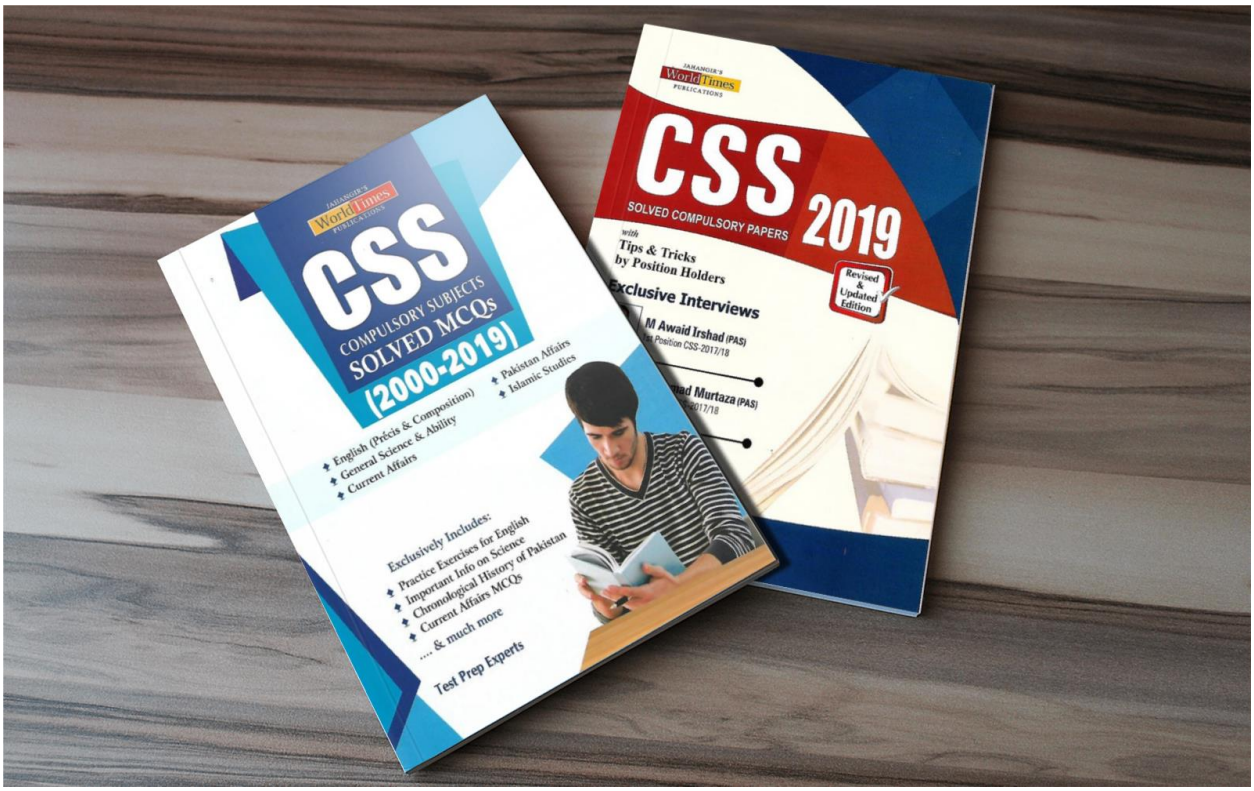

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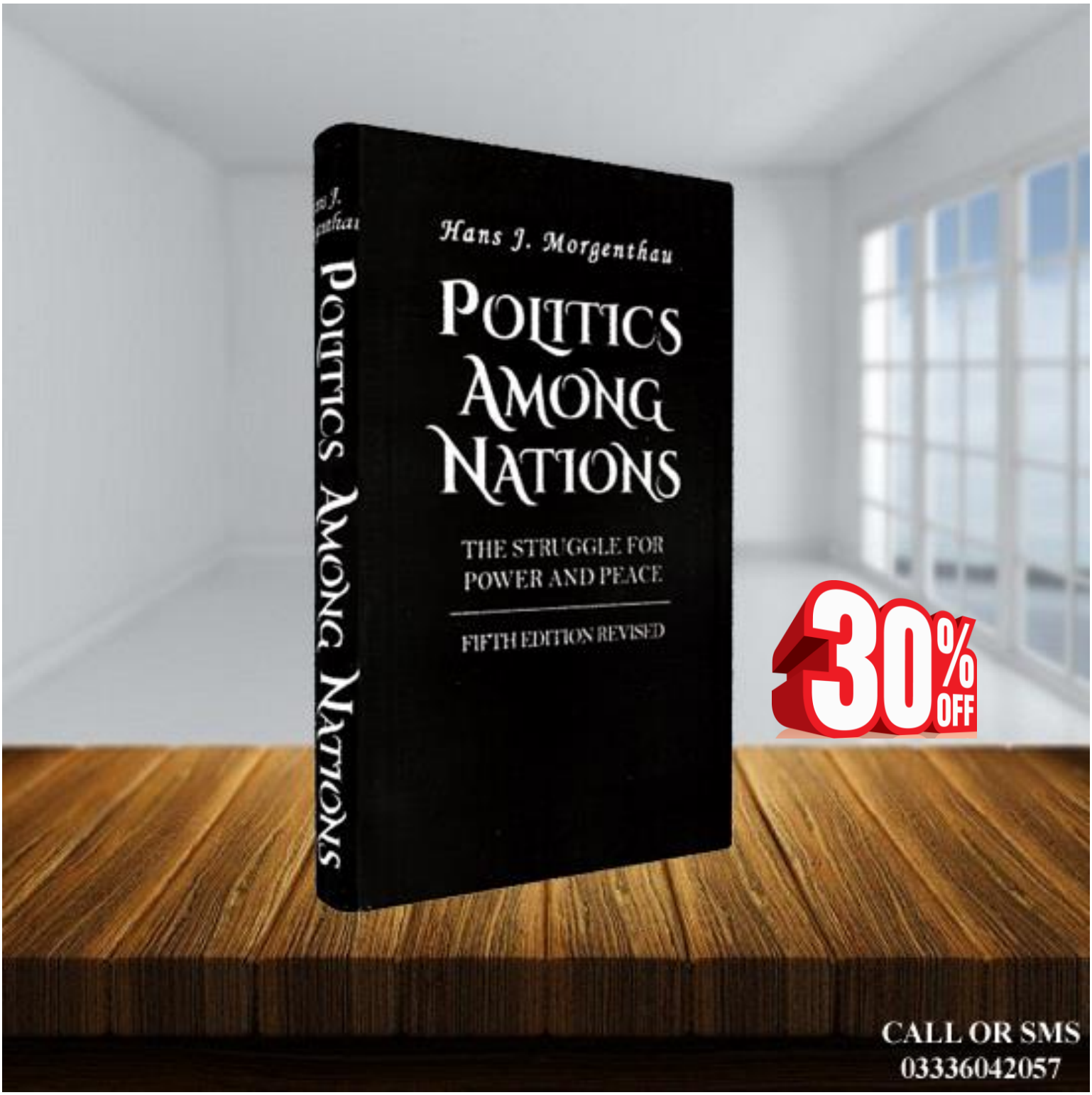


Contents

SPACE RESEARCH CAN SAVE THE PLANET—AGAIN

The solutions to climate change lie far, far away.

BY GREG AUTRY

JULY 20, 2019

The first glimpse humanity got of the world from above was transformative. In 1968, the U.S. astronaut William Anders returned from circling the moon in Apollo 8 with a photograph. It was a simple snapshot of the Earth, the whole Earth, rising above the desolate lunar surface. But it was also momentous, representing the very first time anyone had gotten far enough away to view how fragile the world was. The contrast between the lone blue-and-green marble and the cold emptiness of space was beautiful and shocking. As Anders later remarked, “We came all this way to explore the moon, and the most important thing is that we discovered the Earth.”

Anders’s Earthrise photo provided conservationists with the iconic illustration they needed. On April 22, 1970, 20 million people turned out for the largest civic event in U.S. history: Earth Day.

Today conservationists and other critics are more likely to see space programs as militaristic splurges that squander billions of dollars better applied to solving problems on Earth. These well-meaning complaints are misguided, however. Earth’s problems—most urgently, climate change—can be solved only from space. That’s where the tools and data already being used to tackle these issues were forged and where the solutions of the future will be too.

Space research has already been critical in averting one major environmental disaster. It was NASA satellite data that revealed a frightening and growing hole in the ozone layer over the South Pole, galvanizing public concern that, in 1987, produced the Montreal

Protocol: the first international agreement addressing a global environmental problem. Since then, thanks to worldwide restrictions on damaging chlorofluorocarbons, the ozone situation has stabilized, and a full planetary recovery is expected. As this case showed, space can provide the vital information needed to understand a problem—and a surprising range of ways to solve it.

Climate change is a poster child for the critical role of space data. Trekking across the globe to measure ice sheets with drills and gauge sea temperatures from the sides of ships is an expensive, slow, and insufficient way to assay the state of the planet. Satellites operated by NASA, the U.S. National Oceanic and Atmospheric Administration, and an increasing number of commercial firms provide a plethora of multispectral imaging and radar measurements of developments such as coral reef degradation, harmful plankton blooms, and polar bears negotiating thinning ice. Much of the technology involved in observing the Earth today was initially developed for probes sent to explore other planets in our solar system.

IT WAS NASA SATELLITE DATA THAT REVEALED A FRIGHTENING AND GROWING HOLE IN THE OZONE LAYER OVER THE SOUTH POLE, GALVANIZING PUBLIC CONCERN THAT, IN 1987, PRODUCED THE MONTREAL PROTOCOL: THE FIRST INTERNATIONAL AGREEMENT ADDRESSING A GLOBAL ENVIRONMENTAL PROBLEM.

Indeed, understanding the evolution of other planets' climates is essential for modeling possible outcomes on Earth. NASA probes revealed how, roughly 4 billion years ago, a runaway greenhouse gas syndrome turned Venus into a hot, hellish, and uninhabitable planet of acid rain. Orbiters, landers, and rovers continue to unravel the processes that transformed a once warm and wet Mars into a frigid, dry dust ball—and scientists even to conceive of future scenarios that might terraform it back into a livable planet. Discovering other worlds' history and imagining their future offers important visions for climate change mitigation strategies on Earth, such as mining helium from the moon itself for future clean energy.

Spinoff technologies from space research, from GPS to semiconductor solar cells, are already helping to reduce emissions; the efficiency gains of GPS-guided navigation shrink fuel expenditures on sea, land, and air by between 15 and 21 percent—a greater reduction than better engines or fuel changes have so far provided. Modern solar photovoltaic power also owes its existence to space. The first real customer for solar energy was the U.S. space program; applications such as the giant solar wings that power the International Space Station have continually driven improvements in solar cell performance, and NASA first demonstrated the value of the sun for powering communities on Earth by using solar in its own facilities.

Promisingly, space-based solar power stations could overcome the inconvenient truth that wind and solar will never get us anywhere near zero emissions because their output is inherently intermittent and there is, so far, no environmentally acceptable way to store their power at a global scale, even for one night. Orbital solar power stations, on the other hand, would continually face the sun, beaming clean power back through targeted radiation to Earth day or night, regardless of weather. They would also be free from clouds and atmospheric interference and therefore operate with many times the efficiency of current solar technology. Moving solar power generation away from Earth—already possible but held back by the current steep costs of lifting the materials into space—would preserve land and cultural resources from the blight of huge panel farms and save landfills from the growing problem of discarded old solar panels.

Sustainable energy advocates in the U.S. military and the Chinese government are actively pursuing space-based solar power, but just making solar cells damages the environment due to the caustic chemicals employed. Space technology offers the possibility of freeing the Earth's fragile biosphere and culturally important sites from the otherwise unavoidable damage caused by manufacturing and mining.

The U.S. start-up Made in Space is currently taking the first steps toward manufacturing in orbit. The company's fiber-optic cable, produced by machinery on the International Space Station, is orders of magnitude more efficient than anything made on Earth, where the heavy gravity creates tiny flaws in the material. Made in Space and others are eventually planning to build large structures, such as solar power stations, in space. As

these technologies develop, they will augment each other, bringing costs down dramatically; space manufacturing, for instance, slashes the cost of solar installations in space.

MINING THE SOLAR SYSTEM COMES WITH ITS OWN POTENTIAL IMPACTS, BUT EXTRACTING RESOURCES FROM DISTANT AND LIFELESS WORLDS IS CLEARLY PREFERABLE TO THE CONTINUED DEGRADATION OF THE EARTH.

Eventually, firms will be able to supply endeavors in space with materials from the moon and asteroids, avoiding the cost and environmental impact of lifting them into orbit. Mining the solar system comes with its own potential impacts, but extracting resources from distant and lifeless worlds is clearly preferable to the continued degradation of the Earth.

Perhaps the most powerful role space can play is as inspiration. Space tourism might seem like a frivolity for the rich, but it can be so much more. I've spent some time with astronauts, and they all report that seeing the Earth without borders and observing its fragile atmosphere shook them to their core, inspiring in them a powerful sense of connection and respect for the environment. As Andrew Newberg, a neuroscientist and physician who has studied this "overview effect," put it, "You can often tell when you're with someone who has flown in space. It's palpable." Subjecting thousands of the world's wealthiest and most powerful individuals to a transcendent experience couldn't hurt—especially if less wealthy Earthlings soon get a chance to follow them.

The leaders of the biggest space firms are already thinking way beyond tourism. Tory Bruno, the CEO of United Launch Alliance, envisions a future in which a thousand or more people work in Earth and moon orbits. These people would build stations, conduct research, and produce goods for use in space and on Earth. The Amazon mogul Jeff Bezos imagines a spacefaring civilization that keeps our home planet pristine and protected, as a sort of national park, while dirty extractive and manufacturing processes take place in orbital facilities. SpaceX's Elon Musk wants to transform Mars back into the healthy world it once was and then fill it with life-forms from Earth—including a significant human population. Some experts have mocked this idea. But experts also lampooned

Musk's plans for reusing rocket boosters and building a high-performance electric car for the masses.

The fact is that while some of the plans described by Musk, Bezos, and others might seem utopian or hubristic, given the realities of climate change, humanity needs hope. A future that concentrates only on managing apocalypse, without offering the potential for something better, is no future at all. In the worst scenario, our precious blue-and-green marble will end up looking like its neighbors Venus or Mars simply because we chose not to learn from them.

WHY CENTRAL BANKS NEED TO STEP UP ON GLOBAL WARMING

A decade after the world bailed out finance, it's time for finance to bail out the world.

BY ADAM TOOZE

GRAPHICS BY VALERIO PELLEGRINI JULY 20, 2019

In October 2012, the global financial system got its first taste of the effects of climate change when Hurricane Sandy roared through lower Manhattan, shutting down Wall Street. Amid the blackout, the power remained on in the tower containing the headquarters of Goldman Sachs, offering to the world a striking if accidental symbol of a future age of climate inequality.

As the investment bank stood firm, the U.S. government's outpost on Wall Street, the New York branch of the Federal Reserve, made plans to pull up stakes. In response to the hurricane, the Fed created new backup capacity for market operations farther inland, at the Federal Reserve Bank of Chicago.

Descended from historical port cities, it is not by accident that the world's leading financial centers—New York City, London, Singapore, Hong Kong, Shanghai—are vulnerable to flooding. But the larger challenge that climate change poses is not so much the physical as the systemic risk. What central bankers—the world's preeminent economic decision-makers since the 1980s—are beginning to worry about is the potential for climate change to trigger financial crisis.

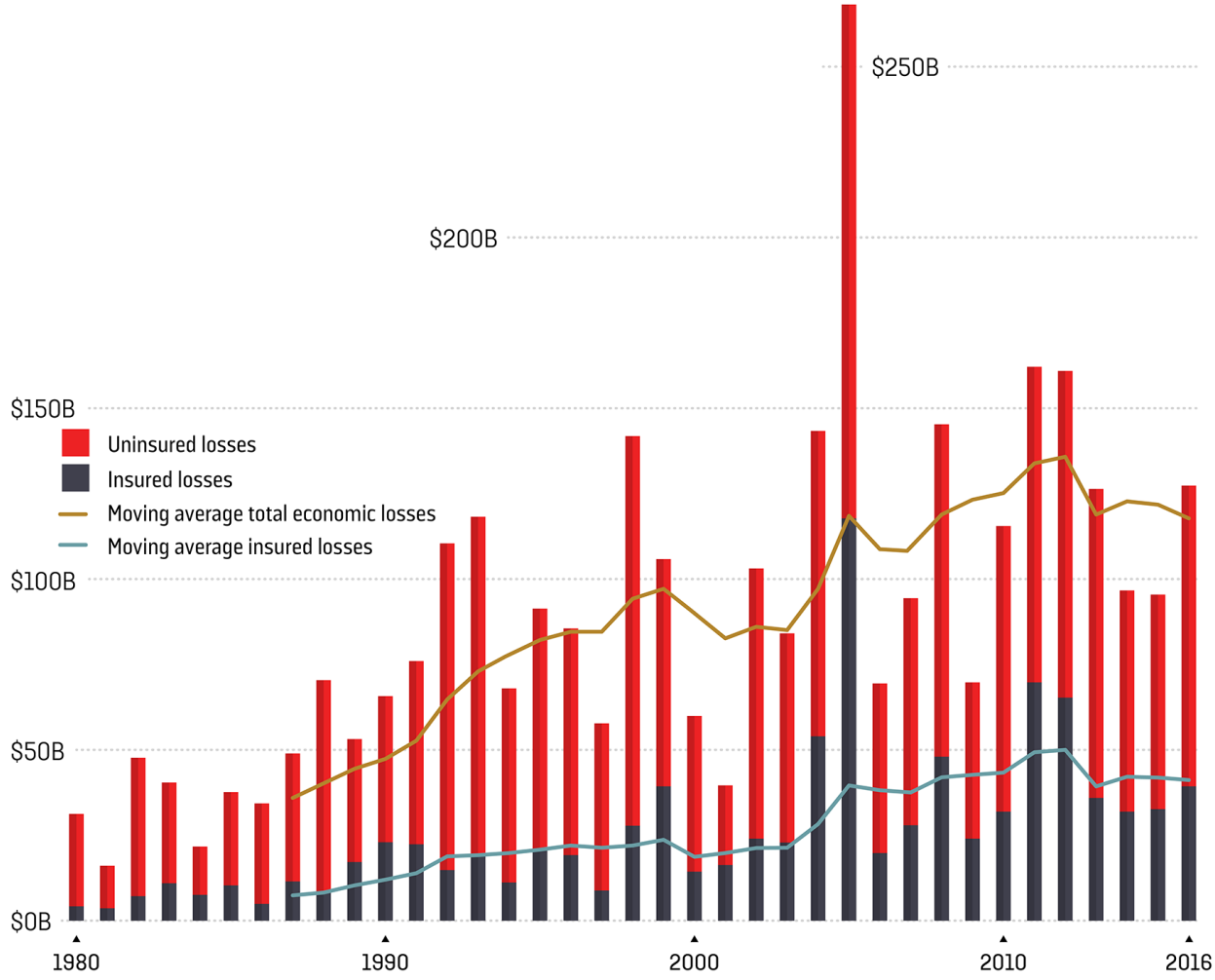
They have been relatively late to the problem. Mark Carney—formerly of Goldman Sachs and the Canadian central bank, now governor of the Bank of England—can take credit for first raising the issue in financial circles at an after-dinner speech at Lloyd's of London in September 2015. Two years later in Paris, leading central bankers and regulators

founded the Network for Greening the Financial System (NGFS), which aims to throw the weight of key financial institutions behind the goals of the Paris climate agreement. The membership of the NGFS now includes most of the central banks of the G-20, such as the European Central Bank and the People's Bank of China.

THE CENTRAL BANKS HAVE THE POWERS TO BE A MAJOR PART OF THE CLIMATE RESPONSE. AS OF YET, THEIR RESPONSE IS DEFENSIVE, FOCUSING ON MANAGING FINANCIAL RISKS.

Private financial actors have also joined the green finance bandwagon. At the One Planet Summit in New York City in 2018, 23 leading global banks, eight of the top 10 global asset managers, the world's leading pension funds and insurers, the two preeminent shareholder advisory service companies, and other major financial firms—which are together responsible for managing almost $100 trillion in assets—committed themselves to the transparency principles of the blue-ribbon Task Force on Climate-related Financial Disclosures, which was launched by Carney in his capacity as head of the Financial Stability Board and is chaired by Michael Bloomberg.

It is telling that the only financial authority not to be involved in these initiatives is the U.S. Federal Reserve, the most powerful central bank in the global financial system. But even if it were to come aboard, the most critical question would remain whether the green agenda of the world's central banks is adequate to the challenge of mitigating the effects of the climate crisis—and perhaps holding it within manageable bounds. The central banks have the powers to be a major part of the climate response. As of yet, their response is defensive, focusing on managing financial risks. The rest of us have no choice but to hope that they move into a more proactive mode in time.



Weather-Related Losses Worldwide, 1980-2016

NOTE: VALUES ADJUSTED TO REFLECT 2015 INFLATION RATES BASED ON COUNTRY CONSUMER PRICES INDEX. MOVING AVERAGE BASED ON EIGHT-YEAR CALCULATIONS. SOURCES: GEO RISKS RESEARCH, MUNICH REINSURANCE COMPANY, AND NATCATSERVICE 2017 VIA THE BANK OF ENGLAND.

As Carney laid it out back in 2015, three types of risk could strike the financial system: losses in the insurance system, climate change liability, and the problem of stranded assets.

The insurance system is the economy's shock absorber. Its role is to spread the impact of losses from those immediately affected to those with the wherewithal to bear the shock. In good times, the insurers earn handsome returns for accepting this risk. They cover their own liabilities by taking out reinsurance, further spreading the losses.

It is a highly effective system and enormous in scale. Property and casualty insurance (as distinct from life and health insurance) generates global premiums in excess of $1.5 trillion a year. The business is profitable so long as the risks remain within familiar limits and largely uncorrelated with each other. But that is precisely what climate change has called into question. As Carney put it in 2015, as a result of climate change, "the tail risks of today" will be "the catastrophic norms of the future." Since the 1980s, the scale of weather-related insurance losses has risen fivefold to about $55 billion a year. Uninsured losses are twice as much again.

In theory, the costs due to this shift in risk profiles should be capable of being contained within the insurance sector itself. But as the fate of AIG made painfully apparent in 2008, insurance firms are key nodes in the global financial system. The money accumulated by the insurers is reinvested in money markets, banks, and other funds. Nine major insurers are listed as globally systemically important by the Financial Stability Board. They are too big to fail.

Driven by the desire for self-preservation, insurers and actuaries have begun to develop highly sophisticated models for handling catastrophic risk. But that is precisely the kind of reassurance doled out all too often in the years before the 2008 financial crisis. A recent modeling exercise by the rating agency S&P suggested that the insurance industry may still be underestimating possible losses from extreme weather by as much as 50 percent. Given the complexity of physical and financial interactions, the margins for error are terrifyingly small. Research sponsored by Lloyd's of London calculated that the 20-centimeter rise in sea level near Manhattan in the prior decades increased the insured losses inflicted by Hurricane Sandy in New York by 30 percent. The far more dramatic rises forecasted for the coming decades will do incalculably more damage.

WITHOUT THE ABILITY TO INSURE AGAINST CATASTROPHIC LOSS, THE GLOBAL CREDIT SYSTEM AS WE KNOW IT WOULD SIMPLY CEASE TO FUNCTION.

Given the increase of catastrophic risk, the basic question for the insurance industry is who will pay. Will it be the industry and its shareholders, or will it be those forced to purchase coverage at exorbitant rates? One likely outcome is the worst of all: that nobody in the market could afford to pay. As the former CEO of AXA insurance group warned, referring to potential changes in average annual temperatures, whereas “a [2 degrees Celsius] world might be insurable, a [4 degrees Celsius] world certainly would not be.” Without the ability to insure against catastrophic loss, the global credit system as we know it would simply cease to function.

At some point, market solutions won’t be sufficient for the financial problems posed by climate change. Disaster will be so frequent that there will be no alternative either to abandoning insurance protection or to nationalizing risks and transferring them to taxpayers at large. In some places, that is already happening. In the United Kingdom, for example, after a bout of catastrophic flooding, a national fund was established in 2016 to offer affordable insurance to buildings in exposed areas. A bitter argument promptly ensued about whether the insurance industry or the taxpayer should provide the ultimate backstop. As of now, it is funded through a flat-rate levy on everyone taking out home insurance in the U.K., transferring the cost from owners of riverside mansions to inner city apartment dwellers.

For large countries with solid tax bases and relatively favorable climates, the socialization of climate risk may be manageable. For smaller, highly exposed island nations, it will be overwhelming. Before they are physically inundated, their sovereignty will be drowned under an economic and financial deluge.

From the point of view of humankind’s collective survival—certainly of the economic and political systems we have come to know—it seems obvious that the world needs to do

everything possible to mitigate the risks of climate disaster. But that comes with its own costs, so-called “transition risks.”

As optimists never fail to point out, decarbonization need not be an economic damper. It will bring spectacular new business opportunities for renewables and low-carbon technologies of all sorts. There is no reason why an environmentally sustainable economy should be one of zero growth. Nevertheless, there are bound to be losers. Investment in renewables is not free. If undertaken on the scale needed, which will run into the tens of trillions of dollars over several decades, it will squeeze consumption and investment spending in other activities, in the same way that the shale boom squeezed out other activities in Texas and Oklahoma.

Furthermore, legacy energy assets have to be taken out of commission. Assuming no spectacular breakthrough in carbon capture, if we are to stabilize temperatures below catastrophic levels, the vast majority of the world’s known fossil fuel reserves will have to stay in the ground.

Leaving that energy untapped will mean as much as $28 trillion in lost revenue for oil, gas, and coal companies over the next 20 years. And that matters for the financial system because investors already own bonds and shares connected to those assets. All told, one-third of equity and fixed income assets issued in global financial markets can be classified as belonging to the natural resource and extraction sectors, as well as carbon-intensive power utilities, chemicals, construction, and industrial goods firms. Decarbonization would essentially strand those assets, resulting in losses in asset values for the energy sector of $1 trillion to $4 trillion. In the broader industrial sector, the stranded asset risks could rise to $20 trillion.

IN THE SUBPRIME MORTGAGE SECTOR, WHICH WAS WORTH AROUND $1 TRILLION, LOSSES RAN TO A FEW HUNDRED BILLION DOLLARS.

If financial markets have time to adjust, even such huge losses could be absorbed. But if the changes strike lenders and investors suddenly and unexpectedly, they risk triggering

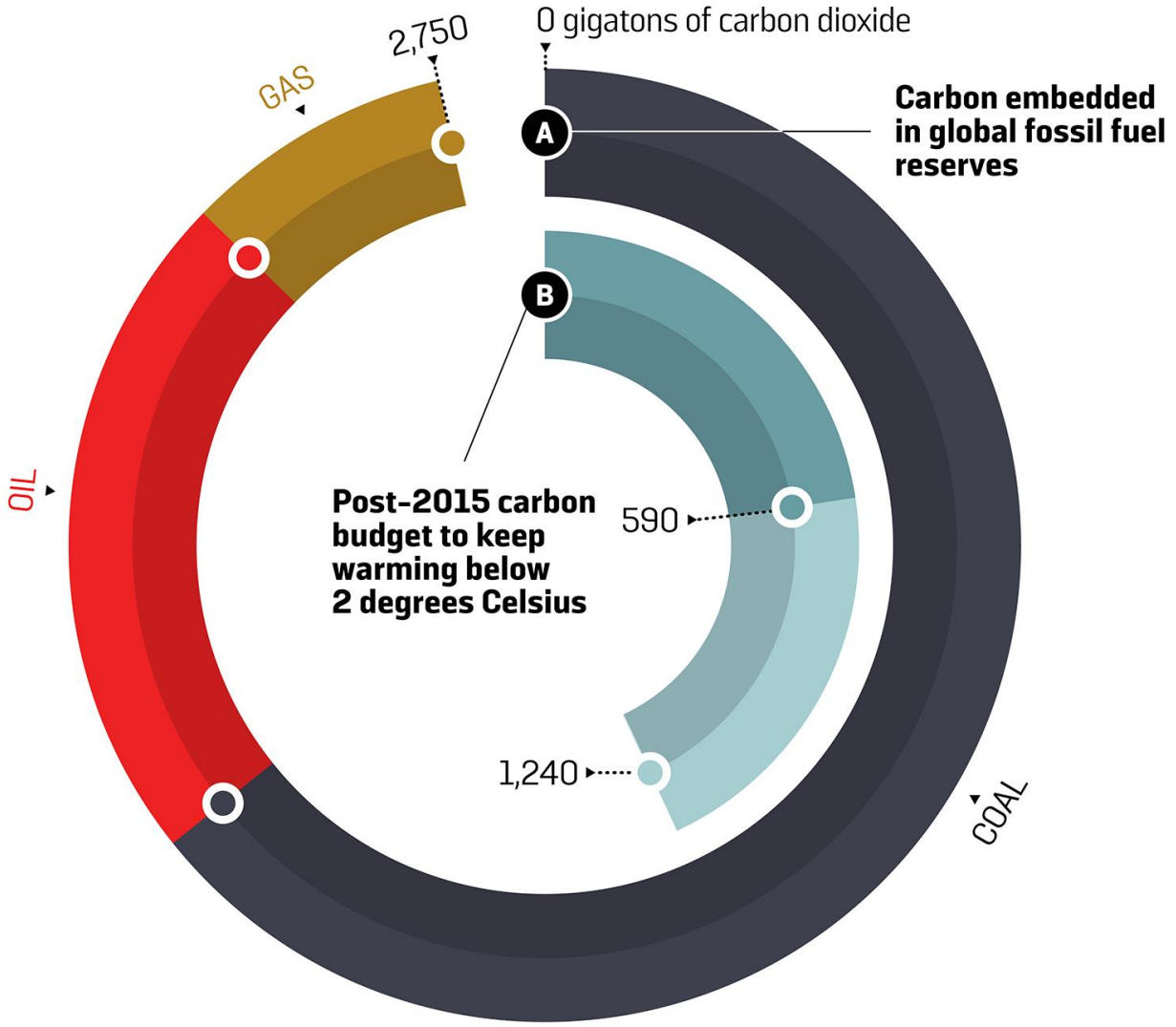
what Carney referred to as a “climate Minsky moment.” Hyman Minsky is the legendary financial economist whose model was widely deployed to understand the 2008 financial crisis. What Minksy describes is the way that unsustainable financial bubbles tend to expand on waves of confidence and then burst, threatening not just a recession but a financial heart attack, a crippling blow to bank balance sheets that radiates, as we saw in 2008, to the entire economy. In the subprime mortgage sector, which was worth around $1 trillion, losses ran to a few hundred billion dollars. The carbon bubble is far larger. The question is whether the losses from shifting to a zero-emission economy have the potential to unleash a financial chain reaction as in 2008.

Optimists insist that there will be no shock. Markets will adjust smoothly. The present decline of the coal industry, they argue, is a case in point; there have been a string of bankruptcies, but the misery has been concentrated and has not triggered a systemwide crisis. In advanced economies, coal has already effectively been priced out of the market by much cheaper gas, oil, and renewables. For rich countries, abandoning coal ought to be a no-brainer. Oil, by contrast, remains too cheap and too convenient to forgo. Ending its consumption will require deliberate government action.

And that is precisely what fossil fuel interests have been lobbying hard to prevent. This resistance may make sense from the industry’s narrow point of view, but by blocking proactive decarbonization and clinging to a vision of a fossil-fueled future, it also maximizes the risk of a large-scale buildup of stranded assets. It is the old dilemma of conservative politics: By resisting progressive adjustment, they are courting a revolution. For the financial system, that is very bad news.

Carbon Budget vs. Carbon in Fossil Fuel Reserves

Scientists refer to the cumulative carbon emissions needed to maintain a global temperature rise below 2 degrees Celsius as the carbon budget, estimated at between 590 and 1,240 gigatons of carbon dioxide. The carbon potential of total reserves of fossil fuels is estimated at 2,750 gigatons of carbon dioxide after 2015, most of it from coal.



NOTE: CARBON BUDGET ESTIMATES DEPEND ON A NUMBER OF FACTORS, INCLUDING THE PROBABILITY OF WARMING STAYING BELOW 2 DEGREES CELSIUS AND THE CONTRIBUTIONS OF NON-CARBON EMISSIONS.

Economists at the Bank of England have laid out two divergent economic scenarios for the transition away from fossil fuels. One is a world in which governments are able to persuade industry that they are serious about zero emissions. Steep taxes on carbon are backed by all parties and stakeholders and are telegraphed far in advance. This clarity of vision encourages industry to invest heavily in alternatives to carbon. As a result of large-

scale investment, the cost of renewable energy falls swiftly. That, in turn, makes it more credible for governments to commit to full-scale decarbonization because the trade-offs will be less painful. Financial markets' positive assessment of government climate policy then serves to confirm the investment decisions of the private sector. In this scenario, those with fossil fuel assets face losses, but those losses are clearly identified and can be efficiently priced. The financial system doesn't suffer a shock.

In the other scenario, governments talk about climate change but take no credible steps to shift the energy mix. As a result, private sector investment in renewables remains low. Fossil fuels continue to enjoy significant cost advantages in key areas such as motor vehicles, airline travel, and electricity generation in poorer countries. Oil companies continue to deploy sophisticated new technologies to unlock new reserves. The fracking revolution continues at pace and spreads worldwide. The low cost of fossil fuels makes it hard to believe that politicians are serious about a zero-emissions future. In this scenario, fossil fuel companies like ExxonMobil and their shareholders are the winners—at least until catastrophic global warming takes hold.

When it does, the insurance industry is not the only institution that will face calamity. As people struggle to maintain their way of life, severe clashes will ensue. In 2015, Carney discussed what he called "liability risk"—the risk that heavy polluters will be sued by victims of climate change and will face crippling court-ordered damages. Among U.S. states, Massachusetts, New York, and Rhode Island have all begun to take legal action against fossil fuel companies, as have at least nine major cities and a bevy of children's charities. Those cases are making their way up the chain of appeals. The business lobby is fighting back.

But to assume that the distributional struggles unleashed by massive climate change will take the form of courtroom drama is to indulge in wishful thinking. Climate change is not the same as asbestos poisoning or tobacco litigation. It is not individualized medical conditions but an environmental shift that will affect the very basis of human existence on the planet. It will likely create hundreds of millions of refugees. If that happens, the distribution of costs is unlikely to be decided mainly in the form of financial liability

assigned by the courts. Rather, more direct and unpredictable forms of political action will come into play. Some seeking redress will be reduced to social protest; the better-off will have direct access to levers of political power.

Against that backdrop, how will politicians react, and what economic consequences will those reactions have? Having failed to manage climate change, it is easy to imagine a variety of scapegoating tactics. German Chancellor Angela Merkel's snap decision to end nuclear power generation in Germany after the Fukushima nuclear accident in Japan in 2011 may be a foretaste. Sensing the popular mood, she overturned an elaborately negotiated phasing-out timetable for Germany's atomic power plants. Germany's energy utilities have still not recovered from the shock to their share prices.

THIS KIND OF SCENARIO—PROTRACTED DENIAL FOLLOWED BY PANIC-DRIVEN DECARBONIZATION—IS WHAT CONCERNS THE CENTRAL BANKERS MOST OF ALL.

This kind of scenario—protracted denial followed by panic-driven decarbonization—is what concerns the central bankers most of all. And it is closest to our reality.

On the basis of a report by the Intergovernmental Panel on Climate Change (IPCC), the world is already past the point at which a drastic turn away from fossil fuels can be avoided. In a few decades' time, nothing less than a revolution will be required. Yet under President Donald Trump, energy and environmental policy in the United States is headed in the wrong direction. And even if the Democrats gain the White House in 2020, there is little prospect that they'll manage to muster a congressional majority for rapid decarbonization. The Europeans remain nominally committed to targets set out by the 2015 Paris climate change agreement, which the United States has abandoned. But even supposedly enlightened Germany still cannot envision giving up coal before 2038.

China's authoritarian regime has come closest to following the first scenario outlined by the Bank of England—a government-assisted glide path away from fossil fuels that prevents the stranding of fossil fuel assets. Beijing has supercharged its solar power,

battery, and electric vehicle industries. But overall economic growth remains Beijing's main priority, and it has struggled to contain the runaway construction of coal-fired power plants by regional governments. The same is true in India. All the signs suggest that we are headed for a scenario of continued growth in carbon dioxide emissions, disastrous global warming in the 3 to 4 degree Celsius range, and a multitrillion-dollar problem of stranded assets.

One might think that this terrifying scenario would shake even the most sanguine technocrat into radical action. But central bankers and financial regulators have found a way to translate it into familiar terms. Since the 2008 financial crisis, they have busied themselves with something called macroprudential regulation. Bank regulators oversee private balance sheets, and they conduct resilience and stress tests. Financial stability is their most important goal. The financial sector is proposing to take the same approach—of oversight and regulation—to climate change.

That is the thinking behind Bloomberg's financial disclosures task force: identify and disclose risks so that markets and regulators can prepare themselves for the worst case. As Carney envisions it: "[Stress testing] is another area where insurers are at the cutting edge. Your capital requirements are based on evaluating the impact of severe but plausible scenarios. You peer into the future, building your defenses against a world where extreme events become the norm. … Stress testing, built off better disclosure and a price corridor, could act as a time machine, shining a light not just on today's risks but on those that may otherwise lurk in the darkness for years to come."

Taken at face value, the macroprudential approach makes sense. It is better for the financial system to be resilient. But in adopting this approach, the central banks are using the same conservative approach to climate change that proved lacking when it came to financial reform. In the years since the 2008 financial crisis, they have perfected their tools of crisis management but without addressing the root cause of the problem: that banks were too big to fail. More than a decade on, they still are.

Of course, everything possible should be done to make the financial system resilient in the face of climate-related Minsky moments. But why is financial stability the principal concern? Central banks and financial regulators should instead be urgently exploring what they can do to alter the course of economic growth so that the world can rapidly decarbonize and thus prevent worst-case climate change—and the related financial fallout—in the first place.

One of the goals of the NGFS is to promote markets for green bonds. This is commendable. The first green bonds were issued by the World Bank in 2008. By 2018, that market had expanded to an annual volume of $170 billion. The central banks hope to further encourage that growth by developing legal standards and an agreed classification of what actually constitutes green finance. China is leading the way in this regard. Indeed, it is one of the first areas of financial governance in which China is setting the pace. But this almost certainly won't be enough.

NOTHING IN THE CENTRAL BANKERS' DISCUSSION SO FAR ACKNOWLEDGES THE SPECTACULAR DIMENSIONS AND URGENCY OF THIS CHALLENGE.

According to authoritative estimates by the Organization for Economic Cooperation and Development and the IPCC, an energy transition adequate to stabilize global warming will involve investing trillions of dollars per year over the next two decades. Nothing in the central bankers' discussion so far acknowledges the spectacular dimensions and urgency of this challenge.

What could central banks do to help sustain a historic investment drive running into the tens of trillions of dollars? One promising—though rather technical—possibility is to use capital requirements and collateral rules to favor green investments. Capital requirements govern the amount of money banks must hold against the risk of losses on their loans and other investments. If central banks required lower capital allocations for green investments, private banks would be keener to lend for that purpose. The incentive would be reinforced if central banks gave privileges to green bonds when they were offered as

collateral in exchange for cash borrowing by stressed banks. Such a system would involve a bias by the central banks toward a particular class of investment. But precisely such preferences have been routinely used to favor both sovereign borrowing and mortgage lending. They are the foundation of government bond markets and private homeownership. And, as critics point out, bond purchases under quantitative easing programs in the wake of the financial crisis have been heavily biased toward bonds issued by fossil fuel companies.

The problem is not that favoring green bonds would induce bias. The problem is that the bias might still not be sufficient to address the urgency of the climate crisis.

If the world is to cope with climate change, policymakers will need to pull every lever at their disposal. Politicians will need to abolish carbon subsidies and replace them with a steep and growing carbon tax. Only when carbon is properly priced will there be a major economic incentive to large-scale private investment. But even that may not be enough. To generate substantial private investment, governments will need to establish a credible commitment to decarbonization. The scale of the leap required is huge. Between fiscal years 1978 and 2018, spending by the U.S. Energy Department on research in renewable energy came to a grand total of $27.65 billion in constant 2016 dollars. That's less than Americans spent on pet food and treats last year.

Accomplishing the necessary transformation will require a huge redirection and increase in public spending on infrastructure, research and development, and assistance to lower-income countries. Those in the United States who call for a Green New Deal or a Green Marshall Plan are, if anything, understating the scale of what is needed. Compared to what the global energy transition demands, the historic programs evoked as namesakes were modest in scale and short in duration. What is needed is something less than the kind of mobilization achieved by rich democracies such as the United States and Britain during World War II, let alone the total war efforts of the Soviet Union or Nazi Germany; nevertheless, the energy transition must be sustained over decades, and it offers no promise of the restoration of pre-crisis lifestyles in years to come.

Such a gigantic mobilization will have to be financed. Carbon taxes may look tempting. But as the yellow vest protests in France have shown, such taxes are politically disastrous. By trying to impose new fuel taxes while cutting taxes for the most affluent, French President Emmanuel Macron only succeeded in driving a wedge between lower-income taxpayers and green politics. It would be far better to distribute the proceeds of the carbon tax to the entire population, as a carbon dividend, and to rely on conventional revenue sources—progressive taxes on income, wealth, and borrowing—for the other necessary investments.

Given the long-term nature of those investments, there is a strong case for funding a large part of this decarbonization drive through the issuance of long-term debt. It is not the business of central banks to issue such loans. The debts should be issued by public investment banks or directly by national governments. But it should be the job of central banks to support this push by acting as a buyer of last resort for those long-term debts.

The public discussions of the central bankers have not yet extended this far. But managing the secondary market for public debt is historically the essential function of central banks. It is what makes them one of the most powerful agencies of the state. Like any major financial mobilization, this will no doubt raise fear of inflation. But this is one respect in which the world is fortunate: As advanced economies age, central bankers are struggling not to tame inflation but to ensure that it remains at least 2 percent per year.

WHEN FACED WITH THE PROSPECT OF GLOBAL FINANCIAL COLLAPSE, THEY ENGAGED IN EXTRAORDINARY MEASURES TO STABILIZE THE GLOBAL BANKING SYSTEM AND FLOOD THE WORLD WITH LIQUIDITY. THE CLIMATE EMERGENCY POSES A RISK THAT IS EVEN MORE EXISTENTIAL.

Acting as a backstop to the issuance of a massive volume of publicly issued green bonds is certainly a novel role for the central banks. But after their exertions in the 2008 financial crisis, central bankers, of all public officials, can’t plausibly retreat into an insistence on

the limits of their mandate. When faced with the prospect of global financial collapse, they engaged in extraordinary measures to stabilize the global banking system and flood the world with liquidity. The climate emergency poses a risk that is even more existential. Faced with this threat, to indulge in the idea that central banks, as key agencies of the state, can limit themselves to worrying about financial stability and can confine themselves to designing better rules for the private issuance of green bonds, is its own form of denial.

If the central bankers need inspiration, they should remember Mario Draghi's decisive intervention as president of the European Central Bank (ECB) at the height of the eurozone crisis. In the summer of 2012, with the future of the eurozone on the line, Draghi did not talk about regulation or risks or even the technicalities of the intervention he planned. What turned the tide was his determined declaration of the role of the ECB as an agency of an emerging European state: "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough." In 2012, it was the financial markets themselves that were panicking, so Draghi's words had an immediate, almost magical, effect in restoring confidence.

Decarbonization is a vastly more complex technical, economic, and social problem. But to embark on solving it we need to mobilize all the resources we can muster. The essential responsibility of the central banks is to ensure that money does not stand in the way.

CAN 'SUPERCHARGED' PLANTS SOLVE THE CLIMATE CRISIS?

Crops already suck up a lot of carbon dioxide. One scientist thinks they can do much more.

INTERVIEW BY RAVI AGRAWAL
JULY 20, 2019

The fight against climate change may seem hopeless, but humanity has a simple and powerful ally in plain sight: plants. At least that's the belief of the botanist Joanne Chory and her team of scientists at the Salk Institute for Biological Studies in San Diego.

As part of her Harnessing Plants Initiative, Chory is focused on genetically modifying plants to absorb more carbon dioxide—and then hold on to it for longer—than their wild cousins through a larger and deeper network of carbon-storing roots, creating so-called Ideal Plants. Every year, humanity emits 37 gigatons of carbon dioxide; photosynthetic life can process and capture nearly half of that amount. Chory believes that coaxing a little more productivity out of plants could make a dramatic difference. And she has no shortage of backers: In April, Chory received a more than $35 million Audacious Project prize to drive her team's research.

Any project on climate science is a race against time. That's particularly true in Chory's case: Now in her 60s, she has been battling Parkinson's disease for several years.

Foreign Policy: Tell us about the Ideal Plant project. When did it start?

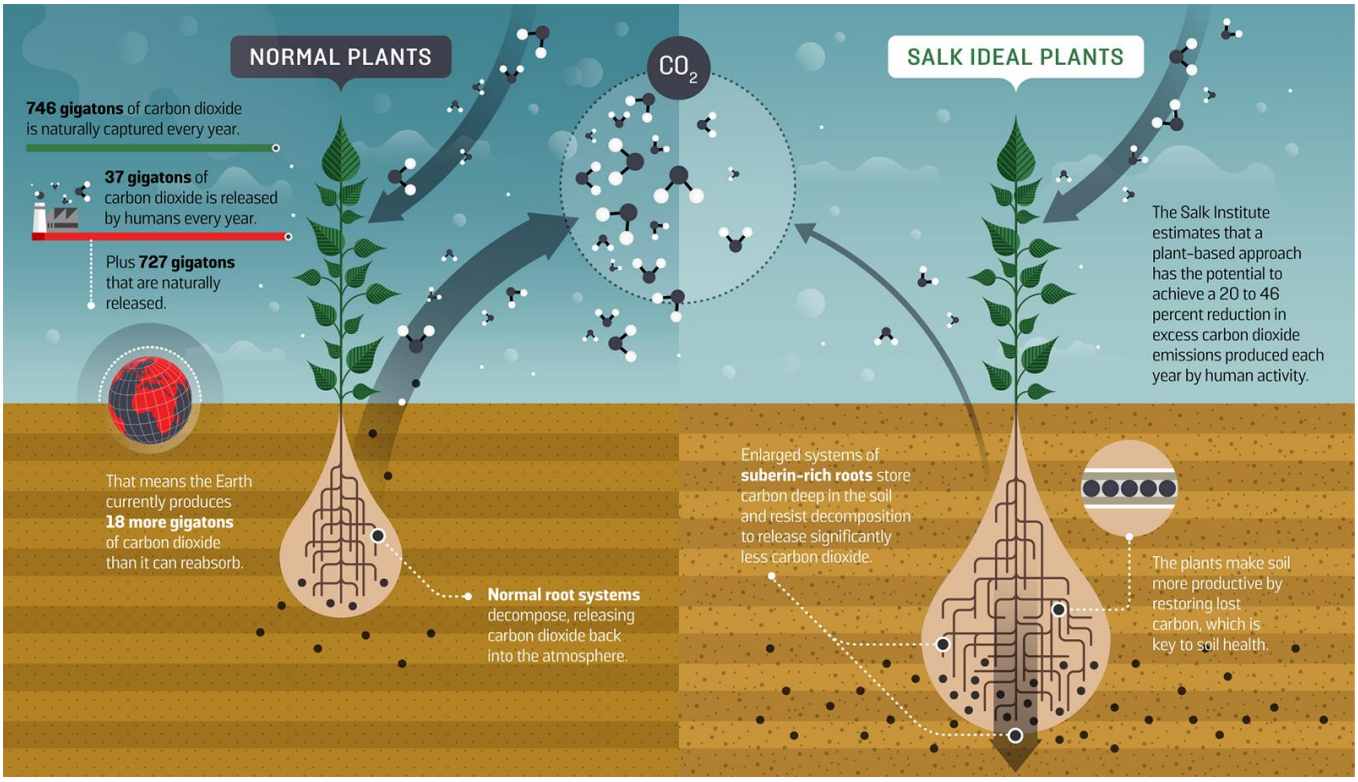
PLANTS HAVE EVOLVED OVER THE LAST 500 MILLION YEARS TO SUCK UP CARBON DIOXIDE. THEY'RE REALLY GOOD AT IT.

Joanne Chory: The Ideal Plant project was officially launched in 2017. It proposes a different way of thinking about climate change in casting carbon dioxide as a friend—as opposed to a villain in some epic, horrible science fiction story. Plants have evolved over the last 500 million years to suck up carbon dioxide. They're really good at it. We decided to take advantage of that to come up with a cost-effective and efficient way of actually pulling carbon dioxide down from the atmosphere and sequestering it down into the soil—where it should be.

FP: What's so important about carbon dioxide?

JC: There's this huge system called the carbon cycle [the process by which organisms absorb atmospheric carbons and then transmit them back into the atmosphere]. We're throwing the carbon cycle out of balance by creating an extra 37 gigatons of carbon dioxide every year. Our ecosystem can naturally take up 17 gigatons of that carbon dioxide in the soil and the ocean. But the other 20 gigatons is what's been heating up the atmosphere and wreaking havoc with our weather systems. There's an urgency to deal with that. And one way to solve that problem is to have plants absorb some of those carbons. The Ideal Plant project has chosen a compound that all plants make in their roots: It's called suberin, and it's the perfect carbon storage device. We're trying to get plants to make more suberin. All we have to do is make them about 2 percent more efficient at redistributing carbon than they are right now, and we can effect a global change.

How the Salk Institute's Ideal Plants Work



SOURCE: SALK INSTITUTE; GRAPHIC BY VALERIO PELLEGRINI FOR FOREIGN POLICY

FP: Explain what exactly suberin is and how you would increase its production.

JC: You know the cork tree? That's a form of suberin—cork is one kind of suberin molecule. All of these molecules are characterized by this middle portion, which is just carbon after carbon after carbon. That's the part that doesn't break down. It's called refractory or recalcitrant. So that carbon will stay in the soil. If you look at a carbon-rich soil like peat, it's full of molecules that are carbon-rich, and these molecules look a lot like suberin. Most soil in the United States is depleted of carbon. If we put carbon back into soils, that would be a co-benefit of the sequestration process that we're expanding.

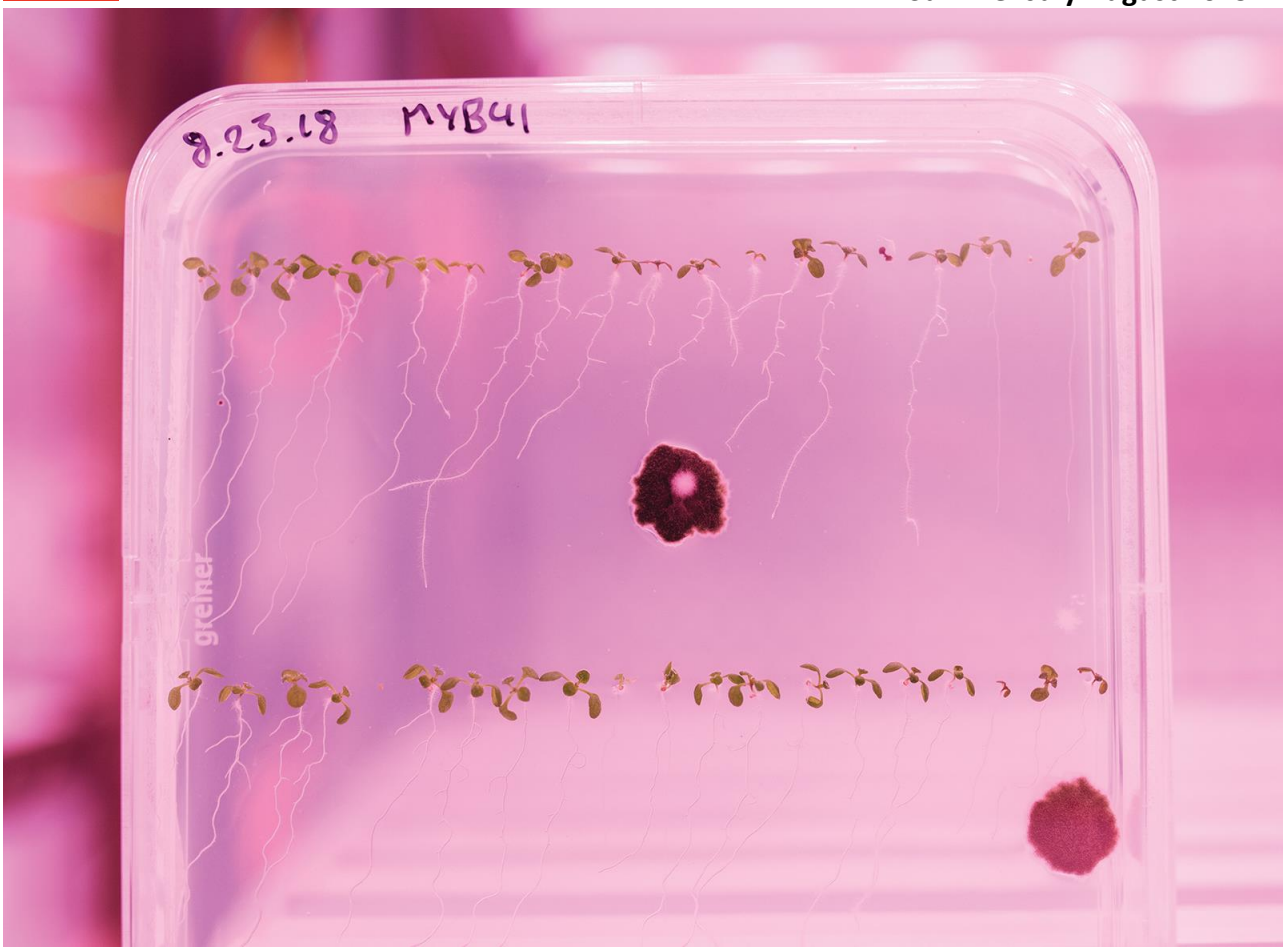
FP: So, in a sense, you're accelerating what nature already does?

WE'RE SUPERCHARGING PLANTS JUST BY GIVING THEM A LITTLE MORE OF A MOLECULE THEY ALREADY MAKE.

JC: That's right. We're supercharging plants just by giving them a little more of a molecule they already make. The Ideal Plant is so cool because it's sequestering carbon safe in the earth from human activity that's causing the planet to overheat.

FP: How much are you hoping to achieve through this supercharging process?

JC: If we could pull down 10 percent of those 20 gigatons [of extra carbon dioxide in the atmosphere], so 2 gigatons, that's a global change. If you just put a plant in the soil and you don't till the soil, some amount of carbon will get trapped. And then if we have our suberin-supercharged plants in the same soil, how much carbon will be sequestered in it? It's going to take a couple of years of making measurements once we have those plants in the soil. The main thing about what we're doing is it's scalable. Land is what's really missing here for the Earth right now because we have a lot of ecosystems that have been destroyed. Climate change is causing more destruction.



Seedlings in a grow room at the Salk Institute.JOHN FRANCIS PETERS

FP: How do you get farmers on board to use these supercharged plants? What's their incentive to join you?

JC: Farmers have a tough life as it is. They're always mortgaging their house every year when they start their growing season. They can't tolerate a loss in yield. That's something we have to be very cognizant of and make sure that we have plants that will be attractive to the farmers. Also our plants are going to take about 10 years to really get online, and by then, things might be so bad that maybe we will have carbon taxes on companies that aren't compliant on carbon footprint regulations. Maybe there will be credits for farmers who have crops that suck up carbon dioxide.

FP: Some critics might say that solutions such as yours merely maintain the status quo, especially since any real solution would have to focus on actually reducing carbon emissions. How do you respond?

JC: I think we have to reduce our carbon emissions, but it's taking us a while to even make a dent in that. People don't have the bandwidth to think about enduring hardship right now to help future generations—people they don't even know yet. I think that philosophically it's a hard thing to reduce emissions to the level that we've been asked by the Intergovernmental Panel on Climate Change, for instance. The second issue is the fact that photosynthesis can reduce the carbon that's already up there as long as everybody pitches in. If we all were aware of our carbon footprint so that we emitted less and we brought on new technologies that don't rely on carbon for energy, then we could reduce emissions even more. We're not claiming that we can do it by ourselves. We just want to be a part of the process. We think we have a good idea and it's worth exploring.

I THINK WE HAVE A GREAT TEAM, AND THEY'LL CARRY ON WITHOUT ME IN A YEAR OR TWO OR THREE.

FP: There's also some opposition to genetically modified organisms, especially in the European Union, which has outlawed them. What will those restrictions mean for your project?

JC: I'd like to say we don't think fears about genetic modifications are the biggest issue right now. We really think we should try to save the planet first. But if there is opposition in Europe and India and a few other countries that aren't on board with genetically modified organisms, then we have to take that into consideration because we need the land that their crops are being grown on as well. There's a way to do it by breeding, of course, because there's a lot of natural variations for a trait like the amount of suberin a plant makes. I think it can be done, but it'll just take longer.

FP: What are the other roadblocks you face?

JC: I think the major roadblock was science. It's really new science. But that's the part that we feel most at ease with just because it's something we've been doing. The other big challenge for us is policy. We have to start thinking ahead to three years from now when we might have seeds. What are the laws that we would like to have in place? What are the regulatory affairs that might get our plants approved faster if the government thought about it now? Another bottleneck is to get the farmers to want our product because that would ease regulatory affairs a little bit. If we don't get the message out there, then people who might be willing to help us in some way won't know we exist.

FP: You've spoken quite openly and powerfully about the constraints of time. Not only is the climate crisis truly upon us, but you've been battling a debilitating disease yourself.

JC: My Parkinson's definitely made me sit back and think. I've had a wonderful career. I've raised two children during that career while I've had Parkinson's. They don't really remember me without the disease, unfortunately. But that's life—it's my life anyway. I've had a really lovely time at the Salk Institute. I've had great colleagues here and a wonderful work environment to be in. I get to enjoy the Pacific Ocean and beautiful sunsets every day. But I said I'd wake up and start doing something for the planet and for my kids and grandchildren who might come along someday. I feel like I have the weight of the world on my shoulders. And we have no choice but to try. I think we have a great team, and they'll carry on without me in a year or two or three. I don't know how long I'll be around. But they can do it. I know that.

DEMOCRACY IS THE PLANET'S BIGGEST ENEMY

Young people care a lot about climate change—but most of them can't vote. Here's how governments can adapt to accommodate them.

BY DAVID RUNCIMAN
JULY 20, 2019

In today's Britain, a rare public figure can bring together Brexiteers and Remainers, Conservatives and Labour. Yet the teenage climate activist Greta Thunberg did just that on a visit to London in April, when she was feted by British politicians from across the political spectrum.

In an address to Parliament, Thunberg said she spoke for the children who had been betrayed by politicians and voters who had failed to prevent climate change. She also claimed to speak for the unborn billions of people who will bear the brunt of a rapidly warming world. "I am 16 years old," she said. "I come from Sweden. And I speak on behalf of future generations. … Now we probably don't even have a future anymore."

It would have taken a very brave politician to downplay the stark moral power of this message. None of her British interlocutors—from Labour leader Jeremy Corbyn to would-be Tory leader Michael Gove to the speaker of the House of

Commons, John Bercow—dared. Instead, they all accepted the charges laid against them and promised to do better.

THE CLIMATE CRISIS IS AN ISSUE THAT REQUIRES LONG-TERM THINKING ACROSS THE GENERATIONS, YET ELECTORAL POLITICS IS GEARED TOWARD RESPONDING TO IMMEDIATE GRIEVANCES.

Thunberg's remarks showcased the profound gulf between younger and older generations when it comes to climate politics: the clash between those with the power to act and those who must live with the consequences if they don't. The climate crisis is an issue that requires long-term thinking across the generations, yet electoral politics is geared toward responding to immediate grievances. Politicians can talk about taking the long view, but without institutional changes to the way we practice democracy, they are unlikely to look beyond short-term political gains.

The young and the old increasingly look like two distinct political tribes, and the differences are perhaps starkest over climate change. Recent polling in Britain indicates that for nearly half of all voters aged 18 to 24, global warming represents the most pressing issue of our time. Less than 20 percent of voters over 65 think the same. In the United States, only 10 percent of eligible voters aged 18 to 29 describe climate change as a "not very serious problem," compared with 40 percent of those over 65 who call it that.

Observing the generational divide on climate change is easier than accounting for it. Thunberg's rhetoric implies the distinction is a matter of morality: The older generations simply don't care about the interests of the younger ones. Yet it is

far from clear that older voters are less worried about climate change primarily because they won't be around to see the worst of it. Older voters care about many things that don't directly concern them. For instance, in the U.K., education ranks almost as highly for those over 65 as it does for those under 30.

Nevertheless, climate change has become a contest of worldviews split along generational lines—and it's a contest that older voters are winning. That should be no surprise. After all, they are both more numerous and more likely to vote than their younger counterparts. When Thunberg speaks for the generations yet to come, she has the numbers on her side—the unborn limitlessly outnumber the currently living. But when it comes to actual voters, the math favors the climate skeptics or at least the people who have other priorities. Our world hasn't just warmed rapidly in recent decades—it has also aged even faster.

TACKLING CLIMATE CHANGE IS GOING TO REQUIRE SIGNIFICANT BEHAVIORAL CHANGE: IN WHAT WE EAT, WHERE WE LIVE, AND HOW WE TRAVEL.

If democratic politicians are to make good on their promises to Thunberg and her peers, one of the largest barriers in their way are their own electorates. And citizens may become more antagonistic as governments push forward on new policies. Tackling climate change is going to require significant behavioral change: in what we eat, where we live, and how we travel. Current patterns of food and energy consumption are unsustainable. If we and the planet are to survive, that will mean less meat, smaller homes, and fewer cars.

The old, however, tend to find changing their behavior to be more difficult than the young do. Again, this is not because they don't care about the future of the planet nor simply because they won't have to live with the consequences of failing to change. It is because age brings experience, and experience brings an aversion to loss. The older we are, the more likely we are to have things we don't want to give up. People who have never driven a car will find it far easier to do without than people who have used one for their entire lives.

One solution to this generational imbalance might be to simply wait it out, since younger generations will replace older ones before too long. If generational divisions are primarily attitudinal rather than material, there is reason to think that young people will persist in their concern about climate change as they age. Eventually the college-educated young of the present will become the college-educated old of the future. The climate crisis will rise up the political agenda as climate-conscious generations ascend the age ladder.

The problem is that the climate can't wait that long. Today's enlightened young will not age quickly enough; decisive action needs to be taken before 2030, as the Intergovernmental Panel on Climate Change now insists.

One way to make that happen would be to redress the imbalance directly by lowering the voting age. Watching the 16-year-old Thunberg put Britain's political leaders in their place, it was hard to think of a good reason why she should not be allowed to vote. But still, the politically plausible proposals—such as extending the franchise to 16- and 17-year-olds—would not be enough to make a decisive difference. The changes that could actually tip the numerical balance—such as extending the vote to all school-age children—are too contentious to be practicable. Giving children the vote is unlikely to lessen generational divisions over climate change. It could make those divisions

worse—and thus set back progress on climate policy—if it looks like an obvious ploy to diminish the voting power of their grandparents. Maintaining the current voting age but phasing out votes for the very elderly is likely to be just as divisive. Appearing to gerrymander the entire electoral system, even with the best of intentions, will do little to bring the tribes together.

Bridging the generational divide is likely to require other kinds of institutional change. The evidence of the last 30-plus years of climate politics suggests that electoral democracy is not well suited to reaching a consensus on what is to be done. The inevitable partisanship of this form of politics reinforces wider social divisions. Different perspectives on the long-term future get turned into polarized positions on climate change, making it harder to reach a shared perspective on carbon emissions and renewable energy. Party politics drowns out the pursuit of common ground.

PEOPLE WHO HAVE NEVER DRIVEN A CAR WILL FIND IT FAR EASIER TO DO WITHOUT THAN PEOPLE WHO HAVE USED ONE FOR THEIR ENTIRE LIVES.

If electoral democracy is inadequate to the task of addressing climate change, and the task is the most urgent one humanity faces, then other kinds of politics are urgently needed. The most radical alternative of all would be to consider moving beyond democracy altogether. The authoritarian Chinese system has some advantages when it comes to addressing climate change: One-party rule means freedom from electoral cycles and less need for public consultation. Technocratic solutions that put power in the hands of unelected experts could take key decisions out of the hands of voters.

But there are two reasons to doubt that this is what the climate emergency needs. First, any transition from a democratic to a post-democratic system would be massively disruptive. The barriers in the way of action on climate are also barriers to other forms of radical political change. There would be resistance, including from older generations. Second, it would not satisfy Thunberg's generation either. She was not asking for less democracy. She was asking for a democracy in which she could be heard.

What's needed instead are democratic reforms capable of moving past the generational impasse in electoral politics. One alternative is more deliberative democracy, which would allow individuals with different points of view to engage with each other directly, free from partisan representation. They might not end up agreeing, but at least they would be speaking for themselves and encountering new opportunities to reach consensus. In citizens' assemblies, school-age children and their grandparents' generation could jointly participate in political discussion and decision-making—so long as policymakers agree to bind their own decisions to the outcomes of these deliberations. Another alternative would be more radical direct democracy. Politicians who are unmoved by electoral threats, and citizens otherwise committed to status quo policy, can sometimes be jolted into action by street protests, especially if they are sustained over long periods of time. Thunberg's London trip coincided with widespread protests by the group Extinction Rebellion, which has adopted tactics inspired by Martin Luther King Jr. and the U.S. civil rights movement. Acts of civil disobedience brought parts of London to a halt to raise awareness of the moral urgency of the issue. Some of those taking part were very young—Extinction Rebellion has a youth wing. But others were not, including Phil Kingston, who was arrested after climbing onto the roof of a train at 83 years old. Channeling more energy into these other forms of democracy—into

citizens' assemblies and civil disobedience, rather than elections and party-building—will change our politics drastically. But it may be the only way to ensure our planet does not change beyond recognition.

CLIMATE CHANGE REQUIRES BIG SOLUTIONS. BUT BABY STEPS ARE THE ONLY WAY TO GO.

Dramatic projects to mitigate climate change often don't work. Slow, quiet, incremental policies are the planet's best hope.

BY TED NORDHAUS
JULY 20, 2019

Recent months have seen something of a turnaround in the conventional wisdom about how to address climate change. In December, on the weekend before the Swedish Academy presented the Nobel Prize to my uncle, the economist William Nordhaus, for his work on climate change and carbon taxes, France's yellow vest movement flooded into the streets, shutting down Paris and other cities across the country and forcing President Emmanuel Macron to rescind the carbon tax he had recently imposed on transportation fuels.

A month earlier, voters in Washington state, as environmentally minded a place as you will find in the United States, soundly rejected a ballot initiative that would have established a carbon tax in that state. Meanwhile, residents of New York's 14th District elected Alexandria Ocasio-Cortez to Congress. Ocasio-Cortez, a self-described democratic socialist, promised to return the Democratic Party to its working-class roots with a Green New Deal that would combine massive public subsidies for clean energy

with universal health care and a government jobs guarantee. She explicitly contrasted her proposal with market-based efforts to price carbon, which she dismissed as a sellout to corporate interests. Within weeks, most of the major contenders for the Democratic presidential nomination had jumped on her bandwagon.

The prospects of implementing a price on carbon—long a north star for economists, policy wonks, and much of the institutional environmental movement—now appear to be severely diminished. In the face of voters unwilling to pay higher energy prices, politicians wary of an increasingly populist electorate, and center-left political parties skeptical of market-based policies, much of the advocacy community has moved on to other strategies. For the first time since climate change emerged as a significant issue in the early 1990s, establishing a price on carbon is no longer the starting point and central focus of the climate policy response at the federal level.

The Green New Deal, as Ocasio-Cortez and others have proposed it, is unlikely to offer a practical alternative to pricing schemes. But even as it has become a lightning rod for partisan conflict, it does point the way toward other opportunities for substantive climate action—quiet, more incremental steps that might prove capable of breaking the deadlock that has paralyzed progress on mitigating climate change.

Carbon pricing's greatest strength has turned out to be its Achilles's heel. Theoretically, pricing works because it sends a signal to consumers and businesses to reduce their consumption of things that produce a lot of carbon dioxide emissions. Firms invest in new equipment or switch to less carbon-intensive materials. Consumers turn down the thermostat, drive less, buy more fuel-efficient automobiles, and fly less frequently.

ONE RESPONSE TO A CARBON TAX IS TO WRAP YOUR HOT WATER HEATER IN A THERMAL BLANKET AND INSTALL DOUBLE-PANED WINDOWS. ANOTHER IS TO RIOT.

In the parlance of economists and political scientists, carbon taxes are highly salient, meaning that people will do more to avoid paying the tax than they would in response to

the same increase in the market cost of energy. But that salience also makes carbon pricing politically toxic; taxes often stoke an outsized reaction even when they are very modest. One response to a carbon tax is to wrap your hot water heater in a thermal blanket and install double-paned windows. Another is to riot.

It is also not clear that consumers' reactions to carbon prices translate very well into a national or global response capable of deeply cutting emissions. Much of the real-world evidence that carbon pricing might be effective derives from observations about how economies respond when energy prices spike sharply upward, as they did after the oil shocks of the 1970s.

But in most cases, the reaction to price shocks has extended well beyond consumers and businesses responding to prices. Governments also invested in new infrastructure, such as mass transit and nuclear power plants, and ploughed money into research and development for new energy technologies. Historically, energy scarcity, whether due to an act of God or malice, has sparked a very broad response from the entire political economy.

Such an effort, of course, is exactly the sort of thing that many people believe is necessary to address climate change. But producing scarcity by political fiat is much harder in the real world than in an economist's model. And the factors that work for you when the price shock is exogenous—the mobilization of the public, businesses, and government to solve the problem—more often work against you when it is self-administered.

Climate advocates commonly reduce this dynamic to the outsized economic power of the fossil fuel industry. But the economic interests of that industry are often closely aligned with the interests of many others. Members of Congress end up hearing concerns not only from fossil fuel players but from local manufacturers worried about how higher energy prices will affect the cost of manufacturing widgets, from farmers worried about fertilizer prices, and from the John Deere dealer around the corner who worries about tractor sales. Compared with these sorts of local and immediate concerns, appeals to intergenerational equity and the vulnerability of the global poor simply can't compete.

There is little reason to believe that a major climate initiative wrapped in the language of socialism and the Green New Deal is likely to fare any better than have similarly ambitious measures that have claimed the mantle of markets. Already, the Senate has voted 57-0 against the Green New Deal resolution sponsored by Ocasio-Cortez, with most Democrats voting present in order to avoid having to place a vote on the measure on the record.

Yet the Green New Deal contains a crucial insight. Economists argue for carbon pricing because it makes the social cost of carbon visible in our day-to-day consumption. Voters and politicians, by contrast, have generally preferred to hide the costs of climate mitigation. Policies to subsidize clean energy technology—including nuclear, wind, and solar—have tended to be far more successful politically than efforts to price carbon.

Government subsidies typically make economists pull their hair out. They encourage rent seeking and require policymakers with imperfect knowledge to make decisions about which technologies to champion. And it's true, from synthetic fuels to biofuels, Solyndra solar cells to plutonium breeder reactors, governments have bet on plenty of energy technology losers.

But governments have picked plenty of winners as well. Washington may have wasted billions of dollars in the 1970s and 1980s on synthetic fuels, but during the same period, it spent a fraction of that on shale gas, which has brought such extraordinary economic benefits to the U.S. economy that it alone has probably made up for the cost of all other federal energy investments since the end of World War II. It has also turned out to be an extremely cost-effective climate policy. Calculated on a per ton basis, the investment pencils out to perhaps a few dollars per ton of carbon emissions avoided, a cost that continues to fall with every ton of coal that shale gas replaces.

OVER THE LAST HALF-CENTURY, NUCLEAR PLANTS HAVE AVOIDED SOMEWHERE BETWEEN 15 AND 20 GIGATONS OF CARBON EMISSIONS, AT A COST OF LESS THAN $5 PER TON.

U.S. investments in nuclear energy have proved similarly efficient. Over the last half-century, nuclear plants have avoided somewhere between 15 and 20 gigatons of carbon emissions, at a cost of less than $5 per ton. Renewable energy subsidies, although costly today, may also wind up being low-cost climate mitigation over the long term.

Beyond the efficacy of those investments, the fact that they obscure the cost of climate mitigation policies is a political feature, not a bug. Pricing carbon is hard because it demands that people pay today to avoid uncertain climate impacts far off into the future. Because public subsidies are usually paid for with general tax revenue, they work in exactly the opposite manner, promising tangible benefits—better air quality, new jobs, perhaps even new industries—today while burying the costs in much larger government budgets.

Federal carbon tax proposals and the Green New Deal may seem antithetical to each other, insofar as the former would pull technology into the market by increasing the cost of dirty energy whereas the latter depends on pushing it into the market through public investment. But they share a common assumption: Concern about climate change is significant enough to support an explicit, far-reaching, economywide approach to the problem.

Unfortunately, there is little evidence to back that idea. For this reason, it is likely that a quieter and less sweeping approach to addressing climate change, one that disaggregates the costs of the policy and avoids becoming a rallying point for either climate advocates or their opponents, will prove more effective.

In contrast to most current climate advocacy efforts, which seek to raise the salience of the climate problem in order to motivate politically difficult and economically costly climate action, quiet climate policy seeks to deescalate the political controversies associated with climate change and break up the costs of climate action.

DEMOCRATS USE CLIMATE CHANGE TO RALLY THEIR BASE. REPUBLICANS, MEANWHILE, STOKE FEAR AMONG THEIR BASE AND DONORS THAT

CLIMATE ACTION WILL WRECK THE ECONOMY AND EXPAND THE POWER OF THE FEDERAL GOVERNMENT.

Examples include establishing a federal clean energy standard that would require utilities to gradually transition entirely to zero-carbon technologies over the coming decades. Or government procurement at the U.S. Defense Department and national laboratories could be used to create initial markets for promising small nuclear reactors and geothermal and energy storage technologies. Providing U.S. farmers with technology and incentives to become more carbon efficient could bring huge benefits for the climate, as could government investment to develop zero-carbon technologies for industrial heat and power.

Working toward decarbonization, technology by technology and sector by sector, on a bipartisan basis and through careful negotiation with key stakeholders is the sort of thing that Congress still occasionally manages to do—as recent legislative efforts to support commercialization of advanced nuclear and carbon capture technologies demonstrate.

Unfortunately, quiet climate policy presently serves the broader political and institutional needs of almost none of the parties involved. Democrats use climate change to rally their base, and environmental nongovernmental organizations use it to raise money from their members. Republicans, meanwhile, stoke fear among their base and donors that climate action will wreck the economy and expand the power of the federal government.

Even so, a number of Republican officeholders have quietly concluded that outright climate denial is a political liability and have recently offered a series of modest proposals explicitly focused on climate mitigation and adaptation. Democrats, meanwhile, have come around to the view that nuclear energy, carbon capture, innovation, and adaptation will be necessary to address the climate challenge.

ULTIMATELY, THE CHOICE WE FACE IS BETWEEN SOME ACTION AND NO ACTION.

In these evolving attitudes, there is the possibility of progress. By shifting the climate debate from one in which one party posits an existential threat demanding solutions that serve its own interests and the other denies that the problem even exists for similar reasons to one in which both parties acknowledge that the problem exists and offer competing solutions to address it, there is at least the possibility of compromise.

Ultimately, the choice we face is between some action and no action. Neither economists' dreams of rationalizing environmental policy through the power and efficiency of markets nor progressive environmentalists' hopes of heroic state-led mobilization to save the planet are likely to do much to address the problem.

Quiet climate policy, by contrast, is the art of the possible, focused on reducing the costs of action, disentangling climate policy from the ideological disputes and electoral calculations that drive the national political conversation, and lowering the political threshold for meaningful action. The solution it offers may be rather less satisfying. But it is also likely to accomplish far more than any of the alternatives.

Why Young Koreans Love to Splurge

Sometimes blowing your paycheck can be a rational choice.

JEONGMIN KIM

ILLUSTRATION BY MR. MISANG FOR FOREIGN POLICY

JULY 4, 2019, 9:00 AM

In 2017, young people around the world fired back at an Australian millionaire who chided them for "spending $40 a day on smashed avocado and coffees" and still expecting to be able to buy a home. But in South Korea, a generation of frustrated young people is reclaiming the idea of frivolous expenses—from cab rides to expensive sushi—as a psychological survival tool dubbed *shibal biyong*.

Loosely translated to "fuck-it expense," the term is a compound noun combining *shibal*(a swearword for frustration) and *biyong* (expense). It first appeared in late 2016, with the earliest tweet about it referring to "an expense that I would not have spent if I weren't under stress," such as "an impulsive food delivery or a cab ride." The post caught on, and the term was named "neologism of the year" by several South Korean media outlets.

A shibal biyong is an expense that might seem unnecessary but that helps you get through a bad day. It's the $20 you splurge for a cab home instead of taking the subway after you've been denied a promotion or the comforting but expensive sushi you buy after you've been berated by your boss. The term implies that you might as well make yourself happy right now because your prospects in the long term seem bleak. Buy that nice coat, because you'll never get on the housing ladder. Eat that steak, because you'll never save up enough to retire.

Shibal biyong didn't come out of nowhere. It shares a sensibility with phrases like *geumsujeo* (gold spoon) and *hell Joseon* (hellish Korea), which became popular several years ago and express the collective despair of a generation of South Koreans who find life in their country intolerable because it seems rigged to benefit people born into wealth (like gold spoon kids) or rich enough to emigrate.

According to Statistics Korea, in 2015 seven out of 10 young people believed inequality was a major problem—and with reason: Among countries in the Organization for Economic Cooperation and Development (OECD), for example, South Korea ranks 31 out of 36 on income inequality, according to the latest available data. In 2018, youth unemployment reached its highest level since 1999, in the aftermath of the 1997 Asian financial crisis. Part of the blame for these problems lies with South Korea's *chaebol*—giant family-owned conglomerates—which still monopolize much of the country's economy and stifle entrepreneurship, leaving young Koreans competing to enter the hierarchical and gerontocratic world of chaebol jobs for want of any alternative.

The title of a recent South Korean bestselling book, *I Want to Die, but I Want to Eat Tteokbokki* (spicy rice cakes), captures the essence of shibal biyong.

Inequality and a sense of economic despair have taken a fierce toll on South Koreans' mental health. Nearly half of all deaths among South Koreans in their 20s are due to suicide, compared with just under 1 in 5 Americans of the same age. The country's overall suicide rate was the highest among OECD countries from 2003 to 2016.

The title of a recent South Korean bestselling book, *I Want to Die, but I Want to Eat Tteokbokki* (spicy rice cakes), captures the essence of shibal biyong. Or as BTS, the most famous Korean boy band, sings in "Go Go": "No money but I want to eat Jiro Ono [sushi] / worked hard to get my pay / … / let me be even if I overspend / even if I break apart my savings tomorrow."

According to one survey from 2017, the usual maximum amount people spent on a single shibal biyong was around $90. The rate of increase in consumer spending among millennials—those born in the early 1980s to mid-1990s—since 2014 is twice as high as that of baby boomers, according to credit and debit card usage data obtained by South

Korean media last year. At this pace, by 2020 the average millennial may outspend the average baby boomer (a generation that in Korea is a decade younger than its U.S. counterpart, dating to the boom at the end of the Korean War), despite having far less wealth.

Shoppers crowd a street of Seoul's Myeongdong district in June 2012.LOOP IMAGES/UNIVERSAL IMAGES GROUP VIA GETTY IMAGES

If South Korean millennials are squandering their money, it's not because they've lost touch with reality. Quite the opposite: For many of them, short-term consumption has become a rational choice maximizing the utility of money based on a realistic assessment of the future. A 2018 survey by the National Youth Policy Institute showedthat 46 percent of young people in South Korea believed that buying a house would either "take more than 20 years" or "never be attainable." The Seoul metropolitan area, where nearly half the country lives, now has housing prices that equal New York City's—without the salaries

to match. Many millennials have begun avoiding traditional investment options, such as stocks and bonds, either because they can't save enough money or because they think the gains can't possibly keep up with rising expenses.

When influencers manage their stress by, for example, posting beautiful pictures of an impulsive excursion to Bali with the hashtag #shibalbiyong, it normalizes a culture of instant gratification.

"Shibal biyong and *tangjinjaem* [squandering fun] are symbolic endeavors responding to social problems via individual consumption," said Alex Taek-Gwang Lee, a professor at Kyung Hee University in Seoul. "As saving cannot guarantee the future, unlike in the past, the idea of investing in the present rather than the future gains strength."

Social media is another driving force in the shibal biyong phenomenon. South Korea has the highest smartphone ownership and internet penetration in the world. Most millennials use platforms like Instagram, Facebook, and KakaoTalk, where conspicuous consumption is celebrated and "fuck-it expenses" have gained social approval. When influencers manage their stress by, for example, posting beautiful pictures of an impulsive excursion to Bali with the hashtag #shibalbiyong, it normalizes a culture of instant gratification.

Shibal biyong has begun to resonate with millennials outside South Korea. Young Americans have also started splurging on short-term pleasures despite—or perhaps because of—the fact that so many of them graduated from college in the years following the 2008 financial crisis. And despite years of wage increases lagging behind the rate of inflation until recently, "treat yo' self" consumption has taken hold among American youth spending on indulgences such as Uber rides—around half of adults under 30 in the United States regularly use ride-hailing services—or food delivery from Grubhub.

Policymakers need to take the concerns of millennials seriously instead of dismissing an entire generation as self-indulgent. In 2018, the Bank of Korea reported that people in their 20s scored the lowest on "financial behavior and attitude"—at least in the bank's definition of sensible saving—among the working population, despite having the highest level of financial knowledge of all age groups. To respond, the bank suggested, the

government should adopt policies that “nurture proper values, as the youths today put too much emphasis on consumption.”

But such arguments miss the point. Cathartic consumption is based on young Koreans’ sincere—and perhaps accurate—belief that new policies alone won’t rectify systemic economic problems. Koreans have begun blowing their money not out of ignorance but out of common sense. A small pleasure now is better than a promised future contentment that will never come.

Korean millennials might not be spending like their parents, but they are actually doing a reasonable job budgeting their shibal biyong, trying to balance today’s happiness against a potentially grim financial future. Millennials know they can’t afford their small pleasures. But they can’t afford anything else either, even if they give up the splurges that get them through the day. Only when measures are taken to make them believe that affluence is attainable will saving for the future make sense.

China's Overrated Technocrats

Beijing is famous for putting engineers and scientists in charge. But that doesn't make for better leaders.

BY JAMES PALMER
| JULY 4, 2019, 9:00 AM

ILLUSTRATION BY JOAN WONG FOR FOREIGN POLICY/PHOTO BY STEPHANE CARDINALE/CORBIS/GETTY IMAGES

Many Western parliaments are dominated by people with law degrees, but China's leaders are mostly trained as engineers and scientists—or so goes conventional wisdom. Advocates for this supposed Chinese approach, such as the entrepreneur Elon Musk, argue that it produces leaders who adopt a pragmatic and technocratic framework to solving problems. And those scientist-politicians, the theory goes, are more likely to govern efficiently, in part because they are unburdened by ideology.

But advocates for China's supposed technocracy are not only wrong about the background of Beijing's current leadership. They are also fundamentally mistaken about how their training shapes policymaking. China's leaders today—including President Xi Jinping himself—have been molded less by their education and more by the need to consolidate control and prevail in the brutal internal power struggles of the Chinese Communist Party.

It's true that a generation of engineer-leaders once dominated the Communist Party. But they're now mostly retired, dead, or in prison. The current crop of leaders is distinctly lacking in engineers; Xi is the only member of the party's seven-person standing committee with an engineering or science degree. That is in line with a steady trend: Among high-ranking officials born before 1948, who made up the majority of the leadership before this current generation, around one-third had engineering degrees. But

for those born after 1948, including China's so-called "fifth generation" of leadership, only 1 in 7 were trained as engineers. The ratio continues to fall; legal or economic training has become far more common.

China is not like the West, where a rigorous degree in law or economics often leads to a career that in turn becomes a path to politics.

Education matters less than most observers think. China is not like the West, where a rigorous degree in law or economics often leads to a career that in turn becomes a path to politics, such as former U.S. President Bill Clinton's days teaching law or London Mayor Sadiq Khan's human rights work. For some Chinese officials, their schooling was cursory at best—and very rarely translated into actual work experience. As the Carnegie Mellon University professor Vivek Wadhwa and others have demonstrated, the quality of engineering education in China, especially before 2010, was well below international standards. Many engineering degrees would barely qualify as technical certificates in the United States.

Although Xi nominally graduated with a degree in chemical engineering from the prestigious Tsinghua University in 1979, his curriculum contained an outsized number of classes on Marxism rather than mechanics, as was common at the tail end of the Cultural Revolution. And Xi never worked as an engineer. As the son of Xi Zhongxun, one of the founders of the People's Republic of China, his first job out of college was as a personal secretary to a high-ranking government official, his father's friend Geng Biao. Like many other so-called princelings, Xi was fast-tracked to power, and his career was entirely contained within, and shaped by, officialdom.

A similar trajectory holds true for four other members of the standing committee, each of whom worked as official functionaries or party chiefs since virtually the moment they left their undergraduate studies in politics or economics. The two exceptions are Li Keqiang, a noted economist and theoretically China's second in command, and the ideological strategist and law professor Wang Huning.

The idea that China is governed by a class of educated mandarins goes back to an 18th-century fascination with Qing-dynasty China. The virtues of the examination system, which supposedly promoted the wise and learned, were held up by figures such as Voltaire looking for a stick to beat their own societies with. While the examination model certainly had its merits, a majority of official appointments in that era, as recent research has shown, were a result of political patronage or bribery.

The determination among outsiders to see apolitical or meritocratic technocracy in the Chinese leadership reveals more about Western fantasies about China than it does about politics in Beijing.

The determination among outsiders to see apolitical or meritocratic technocracy in the Chinese leadership—based largely on decades-old degrees—reveals more about Western fantasies about China than it does about politics in Beijing. In fact, the struggle for power inside the Communist Party is cutthroat and intense, as the number of suicides and life sentences resulting from Xi's purges and the rampant corruption of figures such as the fallen leader Bo Xilai have shown. And that's just the small part outsiders can glimpse: When the windows open up even a little, the blood spills out.

Chinese leaders still do everything they can to promote the facade of a meritocracy. On paper, they remain a highly educated group: Xi got a doctorate in law from Tsinghua in 2002, while Chen Quanguo, the architect of Xinjiang's detention camps, received a doctorate in management from Wuhan University of Technology in 2004. But the lofty degrees are less impressive in reality. Apart from Li and Wang, the advanced degrees of each of the top leaders were obtained while working full time as officials—an almost impossible time commitment, which calls into question exactly who did the work.

Instead of Bringing Jobs to the People, Bring the People to the Jobs

How transportation subsidies can fix seasonal poverty.

BY AHMED MUSHFIQ MOBARAK
| JULY 4, 2019, 9:00 AM

Economists and government officials generally think of poverty as a chronic, binary phenomenon: People are either poor or they are not. But reality is not so simple. Worldwide, 300 million people live nominally above the poverty line but regularly go hungry for some portion of the year. This seasonal deprivation is related to the agricultural crop cycle. The period between planting and harvest is a so-called lean season during which prices of staples rise and job opportunities become scarce for landless agricultural workers.

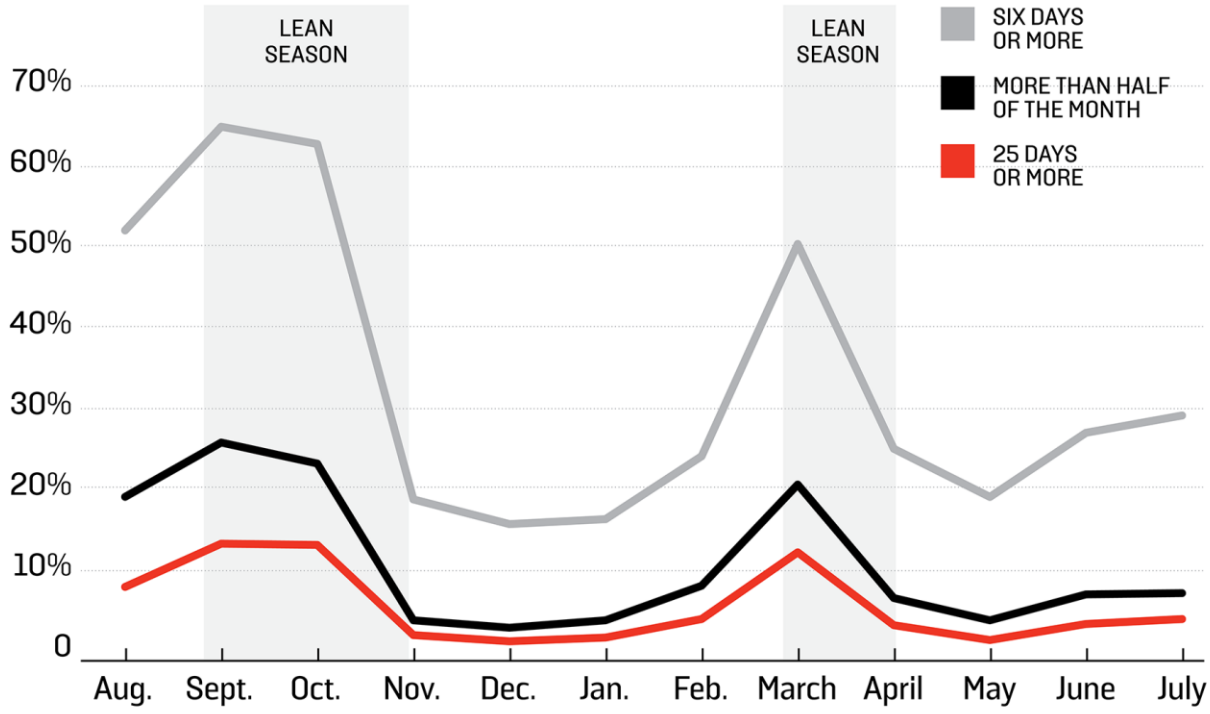
This period is predictable in timing and geography. Colloquially known as the "hunger season" in many parts of Africa, it is called *njala* in Malawi, *musim paceklik* in Indonesia, and *monga* in Bangladesh. And its impact is extremely widespread, given that 80 percent of the world's poor still depend on agriculture for their livelihoods. In some places, the only solution is to migrate temporarily in search of work in cities; in others, the rural poor need cash to buy food while breadwinners are away or seasonal loans to increase the productivity of their land.

Researchers have found that during Kenya's hunger season, grain prices in the country's major markets regularly rise by 25-40 percent and often more than 50 percent in more isolated areas. Seasonal hunger isn't a problem only in Africa. In 2016, my colleagues and I collected large-sample data in rural northern Bangladesh and learned that up to 60 percent of households regularly miss meals or restrict portion sizes during the lean period. Such drops have damaging consequences for children's physical and cognitive

development. Children who are regularly undernourished for parts of the year are more likely to be stunted and unproductive later in life.

Hunger in Northern Bangladesh

The frequency with which households restrict portion size or number of meals in a given month (August 2015 to July 2016).



SOURCE: AUTHORS' CALCULATIONS USED DATA COLLECTED IN NORTHERN BANGLADESH IN JULY 2016. (U.N. FOOD AND AGRICULTURE ORGANIZATION, 2008)

Seasonal food insecurity is among the biggest challenges to global poverty reduction—but it has remained largely under the radar. Understanding the phenomenon requires tracking the same people across seasons within the year, which is difficult and expensive.

Yet with climate change, seasonal deprivation could get worse, as lean seasons grow longer, more frequent, and more severe.

Policymakers seeking to reduce and eliminate poverty therefore need to find ways to address seasonal deprivation. A number of governments have already tried to do so, by introducing food-for-work programs. In Africa, 39 countries currently have government-supported public works programs; India's National Rural Employment Guarantee Act is another well-known example. However, creating nonagricultural jobs in an economy that is temporarily stalled as farmers wait for crops to grow can be complicated and expensive. Indeed, a rigorous evaluation of the national public works program in Malawi found disappointing results: Even when the food-for-work initiative was targeted to the poor during the lean season, there was no improvement in food security. Nongovernmental organizations can extend microcredit, but many such credit contracts impose biweekly repayment requirements—even though seasonal hunger can last up to three months.

My colleagues and I have experimented with a different approach: Instead of forcing job creation where people are, why not move people to where the jobs are?

Instead of forcing job creation where people are, why not move people to where the jobs are?

Even during lean seasons, when employment opportunities dry up in rural areas, many low-skill jobs in nearby urban areas remain available. Some seasonally impoverished rural residents in Bangladesh already move to cities to work at construction sites or to pull rickshaws. A program we introduced in northern Bangladesh in 2007 offered round-trip transport subsidies to poor households to enable one member to temporarily move to nearby cities like Dhaka, Bogra, or Munshiganj in search of work. We then measured the effects of this program through a series of randomized controlled trials.

The original trial found that the program increased the number of people migrating and that this increase raised the amount of calories consumed by the families of such migrants by 550-700 calories per person per day. During subsequent lean seasons, many of the

initial migrants chose to move again—at their own expense—especially if they'd formed a connection to an employer in the city.

Between 2011 and 2017, while incrementally scaling up the subsidy program, we continued to collect data to study the unintended consequences of migration on family relationships and happiness—and to look for broader changes in the rural economy. The second set of results in 2014-2015 looked even stronger, as it became easier for people to travel together when many friends and neighbors received transport subsidies simultaneously. However, new complexities arose as the program grew. The organization offering the subsidies targeted the wrong set of people—those who didn't need external support and who would have likely migrated on their own. In the future, governments and NGOs will have to innovate to ensure the subsidies are targeted appropriately.

Migration subsidies are working in Bangladesh because the poorest households seem otherwise unable to take advantage of profitable but risky opportunities to move for jobs. The risk of failing to find a job in the city after using one's meager savings to finance the trip can be overwhelming, especially when a family is living close to subsistence levels.

The Dangerous Politics of Playing the Victim

The leaders of Israel and Serbia share one thing: They've perfected the politics of persecution. Here's why that strategy won't keep working.

BY DAHLIA SCHEINDLIN
| JULY 4, 2019, 9:00 AM

Critics of Israeli Prime Minister Benjamin Netanyahu have long compared him to illiberal nationalists, such as Donald Trump and Jair Bolsonaro, and strongmen who have consolidated control to stay in power, such as Viktor Orban and Recep Tayyip Erdogan. But to understand Netanyahu's ability to survive against daunting political odds—he faces potential indictment for alleged corruption and recently failed to form a government—there is a better comparison: Aleksandar Vucic, the president of Serbia.

Netanyahu and Vucic each preside over unresolved violent conflicts in which their more powerful countries are widely viewed as the aggressors. Both began as propagandists who learned to portray their countries as victims to the world. And both later leveraged their narrative skills to drive their individual political ascents—by portraying themselves, simultaneously, as victims and saviors.

Like Israel, Serbia is a small country with outsized problems and one that lives in the shadow of vicious recent wars. The last one—fought in 1999 over Kosovo, with NATO intervention—has never been resolved.

Vucic rose to public prominence during Yugoslavia's crackup. He had just turned 28 when he became information minister under then-President Slobodan Milosevic in 1998, three years after the Srebrenica massacres in Bosnia. Three weeks before he started the job, Serbian forces launched a deadly two-day attack in Kosovo, killing dozens of civilians and

sparking international media attention. Serbia needed a lot of explaining, and Vucic cut his teeth defending Belgrade in the face of foreign criticism.

Netanyahu also began his diplomatic career during a crisis in which his country was seen as the aggressor: the Lebanon war of 1982. He was 32 when he became the deputy chief of mission at the Israeli Embassy in Washington. Shortly afterward, Israeli forces allowed an allied Lebanese militia to massacre civilians in two Palestinian refugee camps, Sabra and Shatila, shocking the world. Netanyahu then became explainer-in-chief as ambassador to the United Nations from 1984 to 1988 while Israel dug into its occupation of both southern Lebanon and the Palestinian territories.

Both men insisted to the world that their countries' aggression was justified because their people were the victims.

Both men insisted to the world that their countries' aggression was justified because their people were the victims. Vucic arguedthat military force was necessary to defend against the Kosovo Liberation Army, which Serbia viewed as a terrorist organization. Netanyahu staked his career on Israel's war of survival against terrorism. Both criticized the Western press for maligning their countries and denounced news organizations for falling for propaganda.

Netanyahu lost an election in 1999, and Vucic lost his job in 2000 after Milosevic's fall. But they honed their skills while waiting in the political opposition. By the time they returned—Netanyahu in 2009 as prime minister, Vucic in 2012 as deputy prime minister—each began to depict himself as the underdog who would overcome influential international pressures and entrenched local interests to save his nation.

After Netanyahu took office again, the international media once again became the enemy. In 2010, Israeli commandos raided a flotilla seeking to break Israel's siege on Gaza, killing 10 Turkish citizens. Erdogan as Turkish prime minister lauded the victims as martyrs, and global media denounced the attack. Netanyahu rushed back from abroad and called an urgent press conference. Speaking in Hebrew, he said, "Israel is facing an attack of

international hypocrisy—and not for the first time." At home, those words transformed the incident from an Israeli blunder into an assault on the country.

Over the next few years, Netanyahu relentlessly called out the foreign media, the U.N., or any vocal public critic of his government for "delegitimizing" Israel. Israelis clung to the idea that they were David rather than Goliath. Silver-tongued Netanyahu, with his polished English, was their savior, defending Israel from its purported enemies, from Erdogan to the *New York Times*.

In Serbia, the unresolved status of Kosovo, and the Serb minority living there, similarly reinforces the country's self-image as a victim. The brutal wars of the 1990s are remembered in Serbia today as necessary to protect Serb minorities in other republics seceding from Yugoslavia or are fused with the older history of Serb suffering at the hands of the Nazi-aligned Croatian Ustashe during World War II. Despite the well-established atrocities perpetrated by Bosnian Serb forces in Bosnia, a survey conducted by the Organization for Security and Cooperation in Europe in 2011 showed that 69 percent of Serbs surveyed felt that Serbs had suffered the most in the wars.

Pandora's Vox

Thousands of years ago, the ancient Greeks anticipated robots and artificial intelligence—and they didn't trust them.

BY ADRIENNE MAYOR

JULY 4, 2019, 9:00 AM

A wine vessel attributed to the Niobid Painter of Athens. THE TRUSTEES OF THE BRITISH MUSEUM

A woman looks out at us, her arms stiff and doll-like. She resembles a robot, perhaps a distant twin of Maria, the automaton of Fritz Lang's 1927 classic film *Metropolis*. But this unique female figure—a depiction of Pandora—was painted on a clay vase nearly two and a half millenniums ago. And while humanity lacked the tools or the science to build an actual robot back then, the Greeks of that period were already imagining the possibility of artificial life.

As in our own era, the Greeks were ambivalent, even fearful, about the idea of imitating nature. But they had the story of Pandora as an example: According to Greek mythology, the young woman depicted on the vase was a trick devised by Zeus to punish mortals for accepting Prometheus's stolen gift of fire. She was constructed by Hephaestus, the brilliant blacksmith god of invention and technology. According to ancient myths first written down around 700 B.C., Hephaestus forged marvelous weapons for the gods and heroes and built self-moving devices and wonders, including automated bellows for his forge, a crew of feminine automatons, automatic gates for the heavens, the colossal robot Talos that guarded the island of Crete, and a host of other animated machines.

Zeus commanded Hephaestus to create a *kalon kakon* ("beautiful evil") in the form of an uncannily beautiful young woman who would arouse men's lust. This bewitching fembot called Pandora would be dispatched to earth with one mission: to open a sealed jar filled with all the suffering and misfortunes that plagued humankind.

Zeus instructed Hephaestus to give Pandora the power to move on her own and assembled the gods to contribute to her making. Athena dressed her in dazzling clothing; the Graces endowed her with charm and persuasion; Aphrodite filled Pandora with irresistible sex appeal; and Hermes gave her the "shameless nature of a female dog," according to Hesiod. Pandora was described by the poets as made, not born. Essentially, she was a lifelike replicant with no parents, childhood, or memories; no desires or emotions; no agency of her own, no past, and no future. Unaware of her origins and purpose, Pandora's only function was to be accepted as a real woman among humans and then unleash everlasting misery.

Many ancient vase paintings illustrated the myth; each of them emphasized Pandora's artificiality. One arresting scene on a vase of about 500 B.C. shows Zeus holding up a small, manikinlike Pandora, admiring Hephaestus's handiwork, as Athena brings a wreath to crown her.

But the most remarkable image of Pandora is on a magnificent krater, a vessel for mixing wine, more than a foot high, painted by the famous Niobid Painter of Athens in about 460 B.C. and now stored in the British Museum. Pandora stands with her arms at her sides, looking straight ahead. She resembles a windup doll, an automaton waiting to be set in motion, as the gods bustle around her.

A detail of the rare frontal depiction of Pandora on the circa 460 B.C. wine vessel. THE TRUSTEES OF THE BRITISH MUSEUM

Yet Pandora is facing us—a depiction very rare in vase painting, where the faces of people and animals are almost always shown in profile. This is not an intimate view but an ominous one. In Greek paintings, a full-frontal face indicated a kind of mindlessness, a technique used to depict dead or inanimate figures, such as theatrical masks and statues. Frontal views could also suggest a mesmerizing gaze. On the Niobid vase, both effects are in play: Pandora's forward-facing stance suggests a blank mind and a compelling stare.

But there's one more twist here. Facial expressions showing emotion, such as grimaces, frowns, or smiles, are also very rare on ancient Greek vases, where feelings are indicated

by gestures or posture. But as Pandora stares at the beholder, she is smiling broadly. What message does her smile send? A knowing smile would have seemed inappropriate for a virginal maiden, but Pandora is a seducer, a destroyer. In some interpretations of the legend, Pandora, like Eve, was the first woman in an all-male world. The Greeks imagined some artificial helpers constructed in the image of women—like today's Alexa or Siri—but Pandora was an infiltrator and saboteur, similar to Maria of *Metropolis* or the seductive humanoid Cylons of *Battlestar Galactica*.

Pandora's unexpected facial expression is reminiscent of the *korai*, life-size marble statues of draped maidens that were created from about 600 to 480 B.C. The lips of a *kore*(and the male *kouros*) invariably curve up in a mirthless smile. Similarly incongruous smiles appear, for unknown reasons, on the implacable faces of archaic Greek statues, even those in scenes of violence. Art historians call the preternaturally serene—some would say vacuous—expression on such statues "the archaic smile."

With Pandora's artificial stance and uncanny grin, the Niobid Painter underscores her manufactured origin and the sense of menace that comes with it. Today, artificial intelligence's box of wonders and horrors has been opened—a possibility already imagined more than 2,500 years ago.

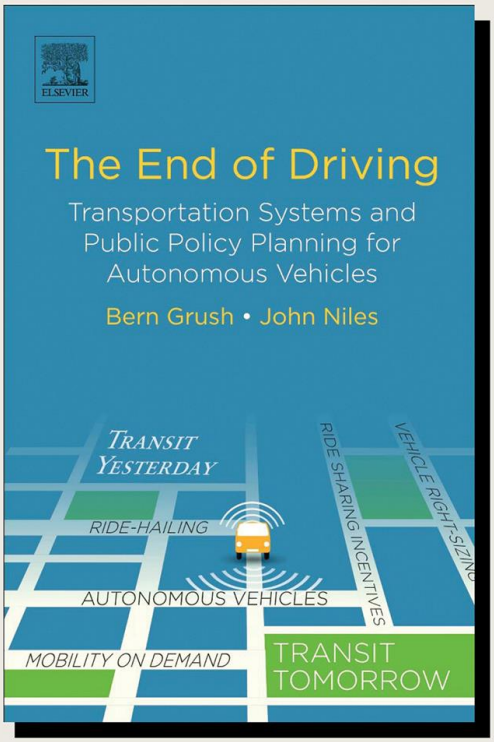
Who Will Win the Self-Driving Future?

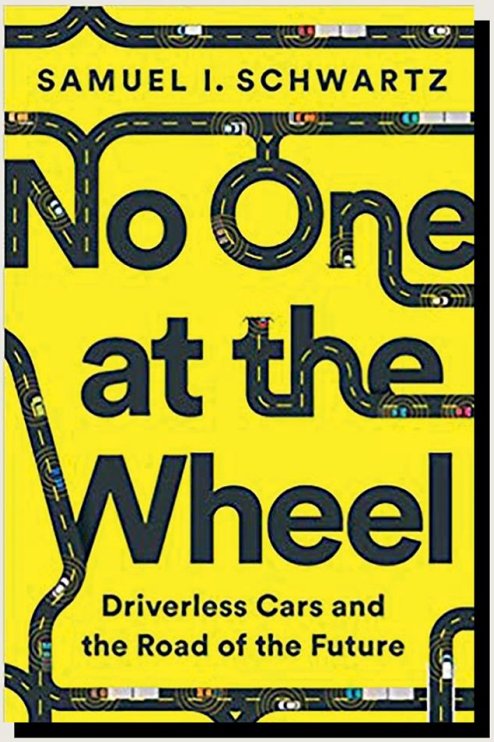
China and the United States have drastically different visions for autonomous transportation.

BY SALVATORE BABONES
| JULY 4, 2019, 9:00 AM

For Americans, cars are a way of life. They not only take people from one place to another; they also serve as entertainment systems, storage lockers, and status symbols. But thanks to ride-hailing services, personal cars are becoming less important, and the development of autonomous vehicles may accelerate that trend. Cutting out the driver could make ride-hailing so cheap, convenient, and safe that many Americans may go carless.

Will Americans really give up their cars? The transportation consultants Bern Grush and John Niles think they will. In ***The End of Driving: Transportation Systems and Public Policy Planning for Autonomous Vehicles***, they reckon that, 50 years from now, only hobbyists will drive cars. Between then and now, however, officials will have to do the complicated work of promoting a "transit leap" by deploying "fully automated shuttle vehicles"—that is, buses that don't require any human input—along limited routes and nudging people toward giving up their own cars. The task is the same for former New York City Traffic Commissioner Samuel I. Schwartz in ***No One at the Wheel: Driverless Cars and the Road of the Future***, who sees a future in which autonomous vehicles drastically change the physical look and feel of U.S. cities, widening sidewalks, narrowing roads, and eliminating parking.





The End of Driving: Transportation Systems and Public Policy Planning for Autonomous Vehicles, Bern Grush and John Niles, Elsevier, 332 pp., $125, June 2018. ***No One at the Wheel: Driverless Cars and the Road of the Future***, Samuel I. Schwartz with Karen Kelly, PublicAffairs, 272 pp., $17.99, November 2018.

Trending Articles

Good luck. Americans like minibuses about as much as they do speed cameras and carpooling. Grush and Niles are fundamentally correct that automation is coming and that the important thing is to get it right. But they seem to think that "getting it right" means successfully integrating autonomous vehicles into urban mass transit systems. That approach may work in a centrally planned economy like China's, but you can't herd cats (or people) in the United States.

As a result, China may win the race to develop effectively integrated autonomous mass transit. But residents of America's Sun Belt suburbs will already have a different option:

catching robotaxis to the grocery store. More than a new urban transportation infrastructure, then, autonomous vehicles' biggest impact may be new ways of living in the suburbs.

The last real leap forward in automotive transportation took place in the United States when Ford added automatic ignitions to its Model T range of cars in 1919. That single change meant the beginning of the end of the chauffeur. With no need to get dirty hand-cranking an engine, anyone could drive. It is true that cars have since become safer, more powerful, and more sophisticated, but the basic experience hasn't changed: Understanding what it means to drive today means understanding decisions made a hundred years ago.

That's why Schwartz begins *No One at the Wheel* with a look back at the rise and fall of a precursor to the car: the humble bicycle. In the late 19th century, the bicycle was the king of the road. It was bicyclists who in the 1880s lobbied state governments to improve intercity routes. They were soon run off those roads (figuratively and literally) by cars, as were pedestrians. Schwartz is keen to avoid such mistakes in designing the transportation systems of the future. He fears that the owners of autonomous vehicles will demand dedicated high-speed lanes, or even entire levels of cities, that will further marginalize pedestrians and cyclists.

One way to avoid that dystopia is to make sure that the future of transportation is shared. Like Grush and Niles, Schwartz is a big fan of the autonomous minibus. A public transportation booster with a New York-centric worldview, Schwartz also wants cities to use the transition to autonomous vehicles as an opportunity to implement congestion pricing and increase the ridership of mass transit. With no drivers to pay, bus routes that currently run at a loss—or are not offered at all—could be made economical.

Grush and Niles share Schwartz's vision of the automotive future, but they also inadvertently show why it may not be possible in the United States. Where Schwartz's writing is breathless and provocative, Grush and Niles write like the policy wonks they are; their vision of a government-run "harmonization management system" designed to

get people to give up their cars sounds like something dreamed up for a Chinese five-year plan. Grush and Niles are not wrong to focus on the policy tools that governments can use to optimize the social impact of autonomous vehicles, including the use of variable road pricing to manage congestion, the gradual reduction of space for parking, and restrictions on the amount of driving done by zero-occupancy “zombie” vehicles. But their approach doesn’t stand a chance of being implemented in a free and democratic society.

Europe's Ever Closer Confusion

A newly translated novel portrays the European Union's search for meaning as a historical reckoning—and a comedy of manners.

BY PETER POMERANTSEV
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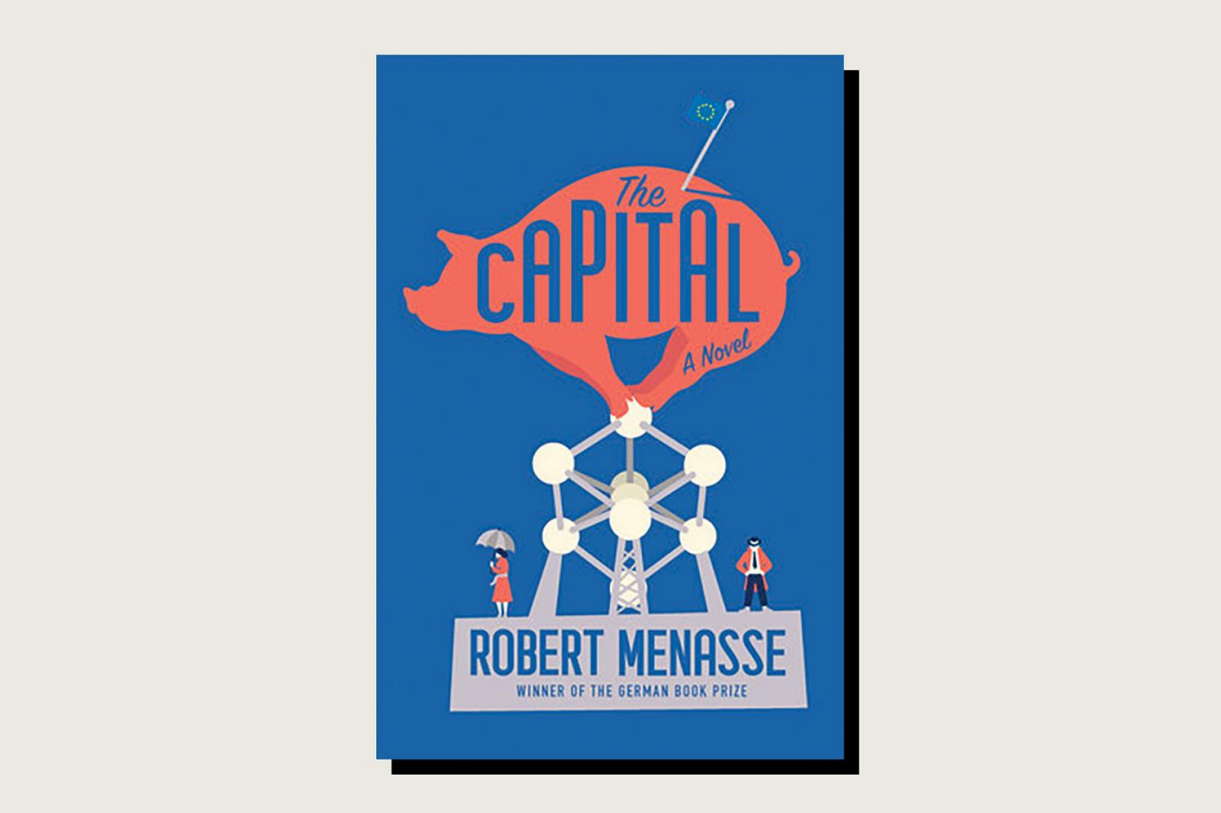
What exactly is the European Union? A post-national superstate or a mechanism to augment the power of nations? A neoliberal fantasia or a protectionist cartel? A Christian empire? A socially liberal paradise? Or is it something defined not by what it is but by what it is not—the lack of war in Europe, the taming of extremist ideologies, the avoidance of another Auschwitz? And what if nobody in the EU, including the people who work in its institutions, even knows the answer?

Such questions have riven the EU since it first came into existence, but in recent years, the latent tensions have risen to a breaking point. Now the Austrian writer Robert Menasse has dramatized Europe's existential agonies in his splendid novel, ***The Capital***, which won the 2017 German Book Prize, one of Germany's most prestigious literary awards, and was recently translated into English. The book should do more than any treatise or treaty to help readers understand the union's crises.

Menasse spent four years living in Brussels to research his subject, and it shows. The novel abounds with delicious observations about the European Commission, the bureaucratic behemoth that ensures the functioning of the EU. In a series of satirical scenes, Menasse explains which of the commission's directorates have status (trade) and which do not (culture); how bureaucrats scheme, sleep with one another, and undermine each other to gain promotion for themselves; the dynamics between the nationalities

(playful, subtle Italians and Hungarians, for example, gang up on direct and moralizing Swedes). If nothing else, *The Capital* serves as a fun primer on how Brussels works.



The Capital, Robert Menasse, Trans. Jamie Bulloch, Liveright, 416 pp., $27.95, June 2019.

But beneath the comedy of manners, Menasse has a serious point to make: On top of its perpetual crisis, the EU must confront the political demands of the moment—above all, a loss of historical purpose and a resurgence of political extremism. The way Europe meets this challenge—through bureaucracy and idealism, vanity and necessity—provides the core of Menasse's story and his critique.

The book's plot circles around the European Commission's jubilee celebrations. Shocked to discover that the European public dislikes the commission, which it often views (in real life as in the novel) as simultaneously aloof and bullying, bureaucrats set to work trying to improve the commission's image.

Martin Susman, a midranking nobody in the Directorate-General of Culture, comes up with the idea of parading Auschwitz survivors at a mass commemorative event in the heart of Brussels. After all, Susman argues, the commission needs to show that it is the institution that safeguards the promise of "never again." As he tells a colleague, "the Commission is a supranational rather than international institution, which means it doesn't mediate between nations but stands above them and represents the common interests of the Union and its citizens." Invoking Jean Monnet, a founding father of the EU, Susman argues passionately that the purpose of the commission is "to overcome nationalism, and ultimately the nations."

Susman's plans are eventually subverted by a slick senior official, the private secretary to the commission's president, who asks the representatives of the EU's collected nation-states how they feel about a jubilee celebration that, as he rewords Susman's idea, urges the overthrow of the nation-state. Unsurprisingly, they are not thrilled. The smaller nations, many of which joined the EU to guarantee their independence after centuries of invasions and occupations, are the first to push back against an idea that seems to question their identity and right to exist.

This storyline cuts to an unresolved tension at the core of the EU—between the post-nationalism Susman espouses and the EU's other job, which is to safeguard nations' more parochial interests. Both impulses have defined the union from the beginning. As the historian and sociologist Perry Anderson has shown in his essays about the history of the union, the impetus for the EU's creation was not just to create a "United States of Europe," in Winston Churchill's words, but to strengthen the states themselves after the devastation of World War II. More specifically, this meant helping Germany to rehabilitate its reputation and France to reclaim international status. Today, countries such as Ukraine and Georgia seek EU membership partly to escape neocolonial domination by Moscow.

At its best, the EU manages to embrace this paradox: It is at once a supranational structure that strengthens nations and a community of strengthened nations that have learned to work together through a common structure. When both parts work, the EU

defies the binaries pushed by the likes of Steve Bannon in the United States and some advocates for Brexit in the United Kingdom. It is simultaneously globalist and nationalist.