Time for adaptation to climate change

As world leaders gather in Madrid for the United Nations Climate Change Conference (COP25), they must address more than future targets for reducing greenhouse-gas emissions.

They must also address the harm to people and livelihoods that climate change is already causing.

Strengthening our ability to adapt to climate change has never been more urgent.

Many regions are experiencing major difficulties as a result of higher global temperatures and changing weather patterns.

We must do more to help citizens and governments tackle issues such as rising sea levels, wildfires, hurricanes and other natural disasters, and increased coastal erosion.

Even if we meet the Paris agreement’s goal of limiting the average global temperature increase to well below 2C, at least 570 cities and some 800mn people will be at risk from rising sea levels and more frequent and destructive storms.

And these dangers will grow as temperatures climb ever higher.

The very existence of some island countries and coastal communities will be threatened.

It is thus essential to reduce the risks that climate change poses to humans and the economy.
Unless action is taken, climate change will reduce global GDP per capita by more than 7% by 2100, with equally severe consequences for countries, whether they are rich or poor, hot or cold.
The economic and broader social benefits of adaptation to climate change are clear.
In September, the Global Commission on Adaptation issued a report calling on governments, businesses, and communities to take urgent action to step up adaptation measures.
The report finds that an investment of $1.8tn across five key areas – early warning systems, resilient infrastructure, agriculture, mangrove protection, and resilient water supplies – from 2020 to 2030 could generate $7.1tn in benefits.
Still, today's investment gap is huge.
The climate challenge demands much deeper co-operation between the public and private sector to increase green investment.
We need to ensure that infrastructure is built to cope with the increased impact of climate change and develop clear global standards for disclosing the climate risks that investment projects pose.
For example, how will a city cope with increased flood risk, and how will agricultural land be maintained productively as droughts grow more severe? Big and small investors alike should know exactly how their money could be affected by a changing climate.
Here, public investment institutions like the European Investment Bank can assist with adaptation in many ways.
The EIB has long invested in projects that reduce emissions and help countries adapt to climate change.
But now we are making even larger strides toward strengthening adaptation, by deepening our expertise, creating new systems to ensure the resilience of our investments, and working closely with the public and private sectors.
For example, we will no longer fund infrastructure projects that are not climate resilient.

Accordingly, we have introduced a climate risk-management system, and are adding climate adaptation criteria to all infrastructure projects.
The EIB will also be focusing on adaptation from the very earliest stages of project preparation, both through advisory services and technical assistance.
Whereas we have gained much experience in the field, many of our public- and private-sector clients may lack the resources or expertise to assess climate risks.
For example, the EIB has been working closely with the Caribbean Development Bank to ensure that all of its projects consider climate risks, and to develop a pipeline of climate-friendly investment projects worth more than $300mn.
Finally, the EIB plans to increase its support for innovative technologies such as weather analytics and climate-resilient food systems, to help companies, individuals, and communities prepare for climate change.
To that end, the EIB now supports the Climate Resilience and Adaptation Finance and Technology Transfer Facility (CRAFT), the first private-sector fund dedicated to addressing these problems in developing countries.
The EIB is also raising its climate-finance target, so that at least 50% of its lending will support environmental sustainability by 2025 – an increase from around 30% today.
And by 2030, the EIB Group plans to support $1.1tn of climate action and environmental sustainability investments through loans and grants, including for developing countries to help them strengthen the resilience of roads, railways, ports, farmland, sanitation and drinking water systems, and digital-communication networks.
Underinvestment in adaptation is particularly a problem for low-income countries, most of which are located in hotter, more vulnerable regions.
Supporting these countries' efforts to adapt to climate change is essential to their ability to develop.
Yet we also must not lose sight of the big picture.
The higher global temperatures rise, the less we will be able

to rely on adaptation.
Scientists estimate that we are now heading for a temperature increase of 3-4C by the end of the century, with disastrous consequences for people around the world.
The world’s most vulnerable populations are already bearing the brunt of climate change, because they are the most exposed to the risks and have the fewest resources with which to adapt.
But, given that all cities, regions, and countries are facing some type of climate risk, the adaptation imperative simply cannot be ignored. – Project Syndicate

* Emma Navarro is Vice President of the European Investment Bank.

Climate change crisis: global action needed before it’s too late

Scientists said that average temperatures from 2010-2019 look set to make it the warmest decade on record.

Provisional figures released by the World Meteorological Organisation (WMO) suggest this year is on course to be the second or third warmest year ever.

If those numbers hold, 2015-2019 would end up being the warmest five-year period in the record.

This “exceptional” global heat is driven by greenhouse gas emissions, the WMO says.

The organisation’s State of the Global Climate report for 2019 covers the year up to October, when the global mean temperature for the period was 1.1C above the “baseline” level in 1850.

Many parts of the world experienced unusual levels of warmth this year.

South America, Europe, Africa, Asia and Oceania were warmer than the recent average, while many parts of North America were colder than usual.

Two major heat waves hit Europe in June and July this year, with a new national record of 46C set in France on June 28.

New national records were also set in Germany, the Netherlands, Belgium, Luxembourg and the UK.
In Australia, the mean summer temperature was the highest on record by almost a degree.
Wildfire activity in South America this year was the highest since 2010.
The WMO clearly links the record temperatures seen over the past decade to ongoing emissions of greenhouse gases, from human activities such as driving cars, cutting down forests and burning coal for energy.
“On a day-to-day basis, the impacts of climate change play out through extreme and ‘abnormal’ weather.
And, once again in 2019, weather and climate-related risks hit hard,” said the WMO’s secretary-general Petteri Taalas.
“Heatwaves and floods which used to be ‘once in a century’ events are becoming more regular occurrences. Countries ranging from the Bahamas to Japan to Mozambique suffered the effect of devastating tropical cyclones. Wildfires swept through the Arctic and Australia,” Taalas continued.
“It’s shocking how much climate change in 2019 has already led to lives lost, poor health, food insecurity and displaced populations,” said Dr Joanna House, from the University of Bristol.
The World Health Organisation (WHO) has warned that climate change is mostly affecting human health, affirming that it causes the death of 7mn people annually in the world’s various regions.
A large number of people suffer annually from pollution, heat stress, injuries and deaths resulting from extreme climate variability and insect-borne diseases such as Malaria, revealed Maria Neira, Director of WHO’s Department of Environment, Climate Change and Health, in a report about the impact of climate change on human health, during the UN Climate Change Conference in Madrid.
Neira urged governments to take serious measures to reduce greenhouse gas emissions, as air pollution and climate change kill 7mn people annually.

“Health is paying the price of the climate crisis, because our lungs, our brains, our cardiovascular system is very much suffering from the causes of climate change which are overlapping very much with the causes of air pollution,” said Neira, calling the lower than 1% of international financing for climate action that goes to the health sector “not enough and absolutely outrageous”. The Director considered climate change as potentially the greatest health threat of the 21st Century, explaining that governments find difficulties in obtaining international climate finance to protect the health of their people and prevent the effects of this ongoing climate change.
The Climate Change Conference in Madrid, we hope, will strengthen the global action against this climate emergency and fulfil Paris’ climate agreement starting 2020.

Will Judges Have the Last Word on Climate Change?

In the fight against climate change, one tool is proving increasingly popular: litigation. From the U.S. to India, activists, governments and concerned citizens are suing at a breakneck pace. Supporters want the courts to force oil companies, energy users and governments to pay for past harms and avert future threats. Opponents say climate change policy is a matter for national governments and international treaties, not a handful of judges.

1. Why turn to the courts?

Activists and environmentally minded lawyers are seeking new ways to use the law to slow global warming and assign responsibility for the resulting economic damages. They've been given new urgency by President Donald Trump's decision to remove the U.S. from the 2015 Paris climate agreement. Some believe courts are uniquely suited to impose controls where legislatures and government agencies have failed. U.S. states and cities seeking redress in the courts say it is the only avenue open to them as the federal government has spent the past three years trying to undo climate regulations put in

place by President Barack Obama.

2. Who are the defendants?

In the U.S., it’s mostly the big oil companies, but energy producers and state and federal agencies have also been sued. Governments are the targets in much of the rest of the world, including Canada, Pakistan, India and Uganda. In Europe, local and national governments have been sued because their clean-air plans fail to meet minimum European Union requirements. These include emissions caps that target older, less efficient diesel cars that are more harmful to the environment.

3. What’s the argument?

Some claim the oil and gas industry created a “public nuisance” – an illegal threat to community welfare. Others target their products as unreasonably dangerous to the planet’s health. In the U.S., state officials have claimed that the oil corporations knew about the dangers of climate change for decades and schemed to hide the information. Many cases are based on the claim that the health of the environment is a public trust, held by the government for the benefit of future generations.

4. So it’s about human rights?

Yes, human-rights arguments are a small but growing approach. Plaintiffs make the case that climate change has threatened or taken away the basic rights to shelter, health, food, water and even life. Arguments range from Colombian children’s claims that the deforestation of the Amazon deprives them of a healthy environment, to the assertion of hundreds of elderly Swiss women that their country has not done enough to protect them from rising global temperatures.

5. How have governments responded?

They argue that judges should not be setting government policies. And they often say that the social and economic benefits from pollution sources outweigh the environmental concerns. That was the case South Africa made when it was challenged for building a coal-fired power station, since 16 percent of the population still has no access to electricity.

6. What about energy companies?

They point to the vast economic benefits created by their products. And they say that individuals, industries and governments willingly contributed to climate change through their use of fossil fuels. They deny seeking to mislead consumers about global warming and accuse plaintiffs' lawyers of demonizing them in search of a big bonanza.

7. How have the cases fared?

Environmentalists have won major cases against the Netherlands, Colombia and South Africa. And pending suits have changed behaviors. Germans, for example, are avoiding buying diesel cars since more of them are getting banned from cities that fail to meet standards for particulate matter and nitrogen oxides.

8. How have lawsuits fared in the U.S.?

Initially badly. A federal judge threw out a suit by New York City against five of the world's biggest oil companies in 2018. (An appeals court is considering the city's arguments to reinstate the case.) But the Trump administration, like its predecessor, has so far been unsuccessful in derailing a suit brought by youths who claim the government's role in causing climate change is a violation of their Constitutional rights. A federal appeals court in San Francisco is considering

whether the case can go forward to trial. There are more than a dozen “public nuisance” lawsuits seeking to hold energy companies responsible for billions of taxpayer dollars spent on acclimating to a warming world, or picking up the pieces following unprecedented hurricanes, floods and wildfires. Exxon Mobil Corp. is being sued in New York City (the trial is over and a judge is considering the case) and Massachusetts for allegedly hiding its early knowledge of climate change from the public and misleading investors about the future financial impact of global warming.

9. Why do environmentalists keep trying?

They’re seeking their tobacco moment. Anti-smoking activists and the families of cancer-stricken smokers lost claims against Big Tobacco for decades in the U.S. before the 1990s. A group of state attorneys general turned the tide by teaming up with top private lawyers to take on the industry in state courts. The victory resulted in settlements totaling $246 billion and permanent changes in the sale and marketing of cigarettes. It’s a model that climate change activists would love to duplicate.

Persistent emissions signal global climate goal out of reach

Bloomberg/ Sydney/New York

Wednesday, 04 December 2019 10:07 PM

While global carbon emissions growth is slowing, the persistent rise is a warning that governments aren't doing enough to stave off the worst consequences of climate change, according to a new report.

Carbon-dioxide emissions from burning fossil fuels likely increased by 0.6% this year, down from 2.1% in 2018, according to a report from the Australia-based Global Carbon Project. Declines in the US and Europe were offset by increases in the fast-growing economies of China and India, it said.

"Current climate and energy policies are not enough to reverse the trends in global emissions," the report's authors said in a press release. "Continued support for low-carbon technologies need to be combined with policies directed at phasing out the use of fossil fuels."

The warning comes as envoys from nearly 200 countries gather this week for UN-organised climate talks, aimed at implementing the 2015 Paris Agreement to limit fossil fuel pollution, and as a global protest movement calling for tougher action on climate change gathers momentum. The global climate outlook is "bleak" and the planet's pathway back to a safe climate is narrowing, the UN warned last week.

The increasingly dire estimates about the pace of climate change are leading to calls for more extreme solutions than the actions that nations have already committed to.

The slowdown in global emissions growth was still significant, Canadell said. Given the margin of error in the projection, an actual decline could not be ruled out, he added.

“It’s never good news when emissions go up, but it’s still not as bad as I had feared,” said Corinne Le Quere, professor of climate science at the University of East Anglia and a member of the GCP.

The GCP results were published in three different journals: an atlas of international emissions in Environmental Research Letters, an analysis of emissions by fuel type in Nature Climate Change and a planetary overview in Earth System Science Data.

Coal use accounted for 42% of global emissions from fossil fuels, but its importance in power generation is on the wane. In the US, an abundant supply of cheap natural gas is helping accelerate the transition away from the dirtiest fuel.

At the same time, increased gas use was an important driver of emissions growth in 2019, Canadell said.

China’s emissions growth is projected at 2.6% this year, similar to the pace in 2017 and 2018 and the nation is catching up with European emissions on an individual basis at about 6.7 tonnes per person per year. India’s increase is expected to ease to around 1.8% from 8% last year, due to an economic slowdown and a particularly wet monsoon season, which saw strong hydropower generation displace some coal-fired generation.

“The failure to mitigate global emissions, despite positive progress on so many aspects of climate policy, suggests that the full bag of policy options is not being effectively deployed,” the report said.

Amid climate worries, Mexico

doubles down on fossil fuels

On the same September day that activist Greta Thurnberg gave a fiery speech in New York demanding world leaders tackle climate change, Mexico's president was touting achievements of a wholly different kind: increasing funding for oil production.

"We're investing in refineries. It hasn't been done for a long time," President Andres Manuel Lopez Obrador told reporters at a news conference in Mexico City.

"What was invested this year is going to be repeated next year," promised Lopez Obrador, noting that the government had already funnelled more than 12bn pesos ($600mn) towards revamping oil production.

The leftist leader, who was elected in a landslide last July, has framed the investment as a way to wean Mexico off its dependency on foreign energy supplies, as well as fuelling economic development through increased oil production.

But at a time when countries are facing mounting pressure to curb emissions and stave off threats from a warming climate, environmental experts say the Mexican government is moving in the wrong direction.

"While Mexico should be abandoning (oil) production, they're rehabilitating refineries … under a logic of national sovereignty," said Leon Avila, a professor of sustainable development at the Intercultural University of Chiapas.

"It's an archaic perspective, based on production in the 70s during the oil boom, and they think they can do the same thing – when really we're in another context," he told the Thomson Reuters Foundation.

Last Monday, Mexico's government announced it would expand the rules of its "clean energy certificates" (CEL) programme to make them available to older hydroelectric plants operated by state utility company CFE.

The programme previously applied only to new projects, creating an incentive for local and foreign firms to invest in green energy.

The CEL-certified energy can be sold to big companies that are required to obtain a percentage of their electricity from clean sources.

But in a statement on Tuesday, CFE director general Manuel Bartlett Diaz said that, in line with the president's vision for energy sovereignty, there was "no reason to subsidise private (electricity) generating companies". Industry leaders and environmental experts said the move weakens incentives for renewable energy investment, and risks Mexico's compliance with the 2015 Paris Agreement to fight climate change.

The Mexican CCE business council said on Tuesday that the change could jeopardise up to $9bn in foreign and local clean energy investments tied to the original CEL rules.

"The decision detracts from the only mechanism considered by law to drive Mexico's energy transition and meet the mandatory national clean energy adoption goals," the CCE said in a statement.

The Lopez Obrador administration has emphasised its commitment to tackle climate change and adhere to the Paris accord.

At a UN climate conference last December, Sergio Sanchez, then undersecretary for environmental protection, said the government would implement "concrete policies and actions focused both on reducing emissions and adapting to climate change".

The Mexican senate last week also called on the federal government to declare a "climate emergency" and take necessary steps to address climate threats.

Those can range from wilder weather and rising seas to more crop-killing droughts that can drive worsening poverty and migration.

But at a press conference the following day, the president shied away from recognising climate change as a crisis.

“We have already considered a series of measures to face the climate change phenomenon in the Development Plan,” Lopez Obrador said.

But the president’s description of the plan – listing conservation efforts but omitting any policies to reduce emissions – irked environmentalists.

“There is a lack of understanding for the climate crisis we are confronting,” said Claudia Campero from the Mexican Alliance Against Fracking, an advocacy group.

According to Avila, the university professor, the president has prioritised ending Mexico’s entrenched poverty but is using oil as the primary engine to drive prosperity.

“He should care about climate change, but between climate change and going down in history for ending poverty…

well obviously he prefers that,” Avila said.

Among Lopez Obrador’s most important projects is the construction of a new oil refinery in his home state of Tabasco.

The project is set to cost $8bn, and the government says it would generate up to 23,000 jobs.

But besides boosting Mexico’s carbon footprint, the refinery, at a coastal site, is vulnerable to climate threats, environmental experts said.

Local media reported this week that the property had flooded due to heavy rains.

Environmentalists also point with concern to the government’s proposed 2020 budget, which would see fossil fuel funding continue to increase.

Under the proposal, the energy ministry’s budget would jump more than 70% compared to last year, to 48.5bn pesos ($2.4bn), following a budget increase this year of over 900% compared to 2018.

According to an analysis of the budget published in September by a coalition of environmental groups, 96% of the money is intended to support oil and natural gas related projects.

“There is no room for more development of fossil fuel extraction,” said Campero, the fracking opponent.” (But) that’s far from being the vision of this government.”

The budget does include about 56bn pesos ($2.8bn) for “adaptation and mitigation of the effects of climate change,” but of this, 70% is being set aside for transporting natural gas, a somewhat cleaner fossil fuel, Campero said.

A spokeswoman for the Mexican environment ministry did not respond to numerous requests for comment.

Conspicuously absent from the budget, advocates say, is funding for expanding renewables, despite the country’s potential to adopt clean energy.

According to a 2017 study from the Friedrich Ebert Foundation, which focuses on promoting democracy and social programmes, 80% of Mexico’s energy currently comes from fossil fuels.

But the country’s landscape and weather conditions mean it could supply its electricity needs entirely from renewable sources, the study noted.

The Lopez Obrador administration has appeared reticent to capitalise on this potential, however.

In January, the government cancelled a public auction for companies to bid on clean energy contracts.

“Mexico is a very rich country in terms of its potential in renewables,” said Pablo Ramirez, a campaigner at Greenpeace Mexico.

“But since the arrival of the new administration, that’s been completely scrubbed off the map.”

Mexico’s 2020 budget is awaiting final approval by congress this month. – Thomson Reuters Foundation.

Qatar stresses role of natural gas in meeting economic and environmental challenges

Qatar has stressed the importance of natural gas in meeting the economic and environmental challenges facing energy consumers around the world.

Many countries around the world are searching for the right balance of reliable and secure sources of energy, which can drive their growth, while addressing environmental concerns at the same time, HE the Minister of State for Energy Affairs Saad bin Sherida al-Kaabi told the 21st ministerial meeting of the Gas Exporting Countries Forum (GECF).

“In this effort, many are discovering the versatile, flexible, economic, and environmental qualities of natural gas as a key enabler in the journey to achieve a lower-carbon economy,” he said.

He stressed on Qatar’s commitment to ensuring the continued availability of reliable LNG (liquefied natural gas) supplies to world markets, and to promoting greater growth in the LNG industry, as well as to serving the growing needs of its clients.

“We all have the same objective: To place natural gas at the heart of the energy industry as a fuel of the future to affirm

our true belief that natural gas is a cornerstone in the energy transition and a destination fuel, not merely a transition fuel," he said.

Drawing attention to unprecedented recurrent climatic conditions, including mean temperatures, turbulent seasonal cycles and extreme events, al-Kaabi had recently said it is time to take another look at natural gas and the number of advantages it has to make it a pivotal element in any strategy to tackle environmental challenges.

Qatar has highlighted the efforts to reinforce its position as the world's leading LNG producer, which include the North Field expansion to increase the LNG production capacity to 110mn tonnes per annum by 2024, and a major ship-building campaign to build up to 100 LNG carriers over the next decade.

Musk Says Tesla Has Finally Made a Ready-to-Deploy Solar Roof

Almost three years after Tesla Inc. Chief Executive Officer Elon Musk unveiled solar roof shingles as part of his push to buy SolarCity, the automaker says it finally has a version of the tiles that it can mass produce.

“It’s been quite hard,” Musk said on a conference call late Friday. “Roofs need to last a long time. When you add electrification to the roof, it’s a fair bit of complexity.”

The sleek roof is a key part of Tesla’s push to revive its struggling solar business. Musk unveiled the product in 2016, but the company hasn’t been able to bring production up to full scale. The photovoltaic tiles are designed to resemble regular shingles, unlike solar panels atop a roof.

The latest version of the shingles was introduced after Tesla lost its status as the biggest U.S. rooftop solar company. It’s also been sued by Walmart Inc. over fires at a half-dozen of the big-box stores that had Tesla solar systems, and the company still faces litigation from shareholders over the controversial SolarCity acquisition.

Signs of a Bounce Back

Tesla’s quarterly solar installations increase for first time in a year

Tesla initially said it would have a slow roll-out of the solar roof. But issues with aesthetics, cost and manufacturing process have dogged production. At one point in 2018, Tesla was making enough solar-roof shingles for just three to five homes a week.

Earlier this year, Musk declared 2019 as “the year of the solar roof.” In July, he tweeted that Tesla was “spooling up production line rapidly,” and that he hoped to manufacture about 1,000 roofs each week by year-end.

On the call Friday to discuss the third version of the roof, he reiterated the goal of getting to 1,000 roofs per week in the next several months but acknowledged that there might be setbacks.

“It’s an odd and weird product,” he said. “Why would anyone make a solar roof? How strange. But it just is a thing that should be. So we’re going to make it.”

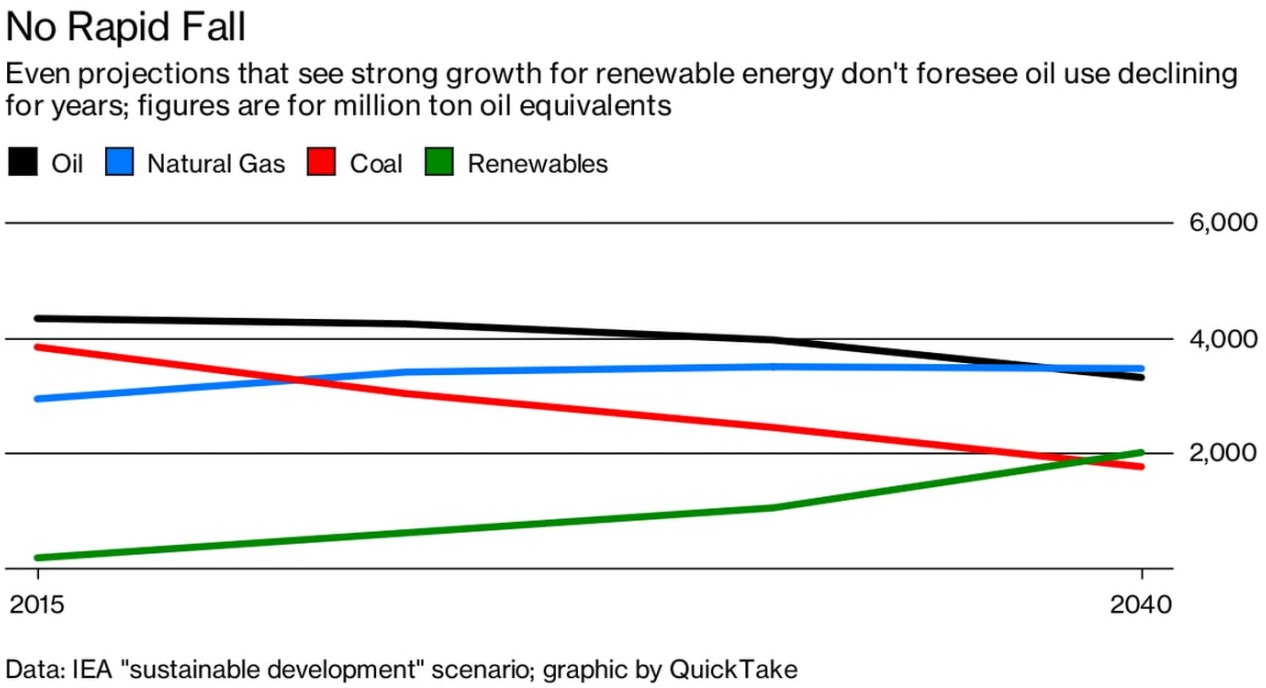
How Climate Divestment Won Converts With Deep Pockets

Can you strike a blow against climate change by getting rid of your oil company stocks — and can you do it without losing money? The idea is not just for activists anymore. Norway took a partial step in selling off oil and gas stocks in its massive $1 trillion wealth fund. And a growing number of investors who control trillions more are using the threat of divestment as a cudgel to force energy companies to adopt greener ways. Together these approaches are producing a notable disruption in the energy field.

1. What's the climate divestment movement about?

It was started in 2012 by the activist group 350.org, whose name is a reference to what some scientists consider the maximum safe level of atmospheric carbon in parts per million. Its goal is to "keep carbon in the ground," in part by weakening the oil, gas and coal industries. Adopting a tactic from the fight in the 1970s and 80s to force South Africa to give up apartheid, it urges universities and other investors to divest themselves of stocks from the 100 largest coal companies and the 100 largest oil and gas firms.

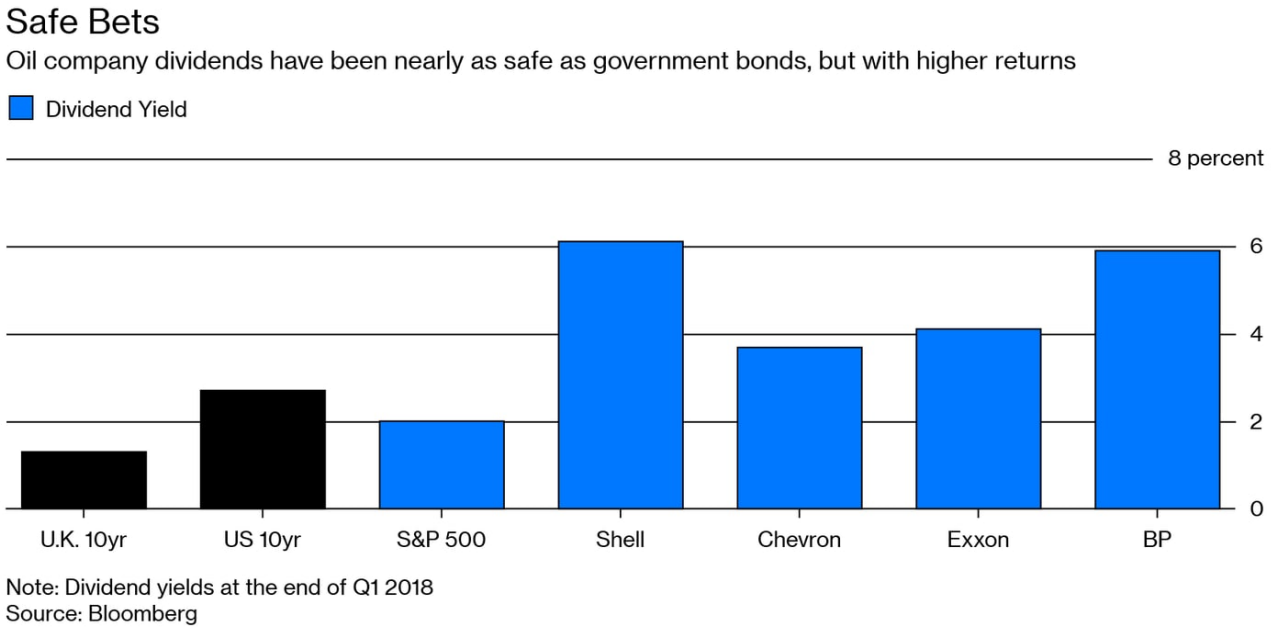
2. How has that gone?



The initial movement has had some success. The group says that so far more than 1,100 institutions, from pension funds to family foundations, mostly in North America and Europe, have made some level of commitment to divesting. But the biggest steps have come from investors acting independently. The Norwegian fund decided to dump $6 billion of oil and gas exploration companies' stocks as a hedge against a long-term decline in crude prices, although it also argued that existing producers are investing heavily in the transition to renewable power. And BNP Paribas Asset Management said it would dump almost 1 billion euros ($1.1 billion) of coal stocks from its actively managed funds.

3. Is this all about coal?

Coal, the dirtiest fossil fuel, has been the primary focus but that's starting to change. One of Exxon Mobil Corp.'s largest shareholders, Legal & General Investment Management, sold $300 million of the oil giant's stock when it wasn't satisfied with the company's emissions reductions strategy.



4. Have those moves had an impact?

In some ways. The biggest success has been how very large shareholders have been using the idea for their own purposes. A coalition of mega-investors called the Climate Action 100+, which collectively oversees more than $35 trillion, has been engaging with companies they feel are most at risk as the world transitions away from fossil fuels. The group has extracted pledges from some of the biggest companies, including BP Plc, Royal Dutch Shell Plc and coal giant Glencore Plc, to better align their businesses with the goals of the Paris climate accord. Royal Dutch Shell also agreed to publish a report on its lobbying of governments.

5. Is this a split in the movement?

Not really. Though the largest and most powerful money managers tend to use the threat of divestment to push companies to succeed, rather than disappear. For example, after freezing out Rio Tinto Group for more than a decade for owning a highly polluting copper mine, the Norwegian sovereign wealth fund re-invested when Rio sold it. It’s now one of Rio’s top 10 shareholders. One of Climate Action 100+’s largest members, Legal & General Investment Management, with about $1 trillion under management, divested its holdings in

some large companies in June, saying they failed to engage over global warming.

6. Is there an economic argument for divesting?

That depends on who you ask. Oil companies themselves see demand for their products peaking, but not until sometime between 2025 and 2050, and then slowly declining. Economics drove the thinking at Norway's sovereign wealth fund, the world's biggest, about whether it should dump about $37 billion of fossil-fuel stocks. It ultimately kept most of them, noting that oil and gas companies have become some of the biggest investors in renewables. The Norwegian finance ministry said that diversification may pay off for the fund in the long-term.

7. What are the financial arguments not to divest?

For most investors, having money in an oil company is almost unavoidable. Behemoths such as Exxon Mobil Corp. and Shell are included on every major equity index — core investments, like it or not, for the mutual funds that almost everyone's pensions or 401Ks are invested in. Then there are the dividends. Oil companies distribute money to shareholders with a fervor matched by few others. If you bought a share of Shell during World War II, you would have received a flat or increasing dividend payment every quarter without exception. Those dividend payments have endured through price collapses, the Arab oil embargo, wars, nationalization of assets, government sanctions, worries that supplies would run out and more. Few assets besides government bonds offer that kind of stability. And the yield of a Shell share is more than 6%, while a 10-year U.K. gilt will earn you less than 1%.

8. So does divesting mean taking a financial hit?

It's a question of the time frame. The absolute return of oil companies hasn't outperformed the broader index since 2014 because of an oversupply of crude that caused prices to slump.

Exiting now could mean passing up those fat dividends and possibly rising share prices, but also curbing exposure to the impact of climate legislation and competition from alternative forms of energy.

9. If everyone divested tomorrow, what would happen?

First of all, the sheer size of oil holdings means it would be hard for everyone to sell at once — the Norwegian selloff will be done over years. Even if could happen, it probably wouldn't cut demand for fossil fuels sharply right away. Renewable energy sources like wind and solar are growing rapidly but from a tiny base. In one scenario modeled by Shell, meeting goals set in the Paris climate accord without fossil fuels would require new energy sources to increase fifty-fold and the reforesting of an area the size of Brazil, among other measures.

10. What do energy companies think of the movement?

They don't like it. BP Chief Executive Officer Bob Dudley said in October a rising cost of capital for the industry could harm human development, pointing out that cheap energy is essential to economic growth. Executives have also argued that even with a large proliferation of renewables, fossil fuels will remain essential for a wide range of products such as plastics, pharmaceuticals and road surfacing.

—With assistance from Mikael Holter.

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How to halt global warming for $300bn

The world needs to spend $50 trillion on five areas of technology by 2050 to slash emissions and meet the Paris Agreement’s goal of halting global warming, Morgan Stanley analysts wrote in a report.

To reduce net emissions of carbon to zero, the world would have to eradicate the equivalent of 53.5 billion metric tons of carbon dioxide a year, according to the report, which identified renewable energy, electric vehicles, hydrogen, carbon capture and storage, and biofuels as the key technologies that could help meet the target.

Carbon emissions from fossil fuels hit a record last year, but estimates vary of how much it would cost to meet the Paris

target of keeping the global temperature rise to within 2 degrees. The International Renewable Energy Agency says $750 billion a year is needed in renewables over a decade. United Nations scientists say $300 billion spent on reclaiming degraded land could offset emissions to buy time to deploy zero-carbon technologies.

Here are Morgan Stanley's estimates for the five key technology areas and some of the companies leading the drive.

Renewables

- Renewable power generation will require $14 trillion by 2050, including investments in energy storage.
- Renewables would need to deliver about 80% of global power by then, up from 37% today, meaning an additional 11 000 gigawatts of capacity, excluding hydro-power.
- Solar energy's rapidly falling cost will make it the fastest-growing renewable technology over the coming decade with a 13% compound annual growth rate.
- Stocks that could benefit include: CGN New Energy Holdings Co., China Resources Power Holdings Co. and China Suntien Green Energy Co.

Electric vehicles

- With passenger cars currently pumping out about 7% of greenhouse gas emissions, some $11 trillion will be needed to build factories, expand power capacity and develop the batteries and infrastructure needed to switch to electric vehicles.
- With increased investment, annual EV sales could grow from 1.3 million units in 2018 to 23.2 million in 2030, lifting the total number of electric vehicles to 113 million by 2030 and 924 million by 2050.
- Some of the companies to watch: Beijing Easpring Material Technology Co., Rohm Co. and Panasonic Corp.

Carbon capture and storage

- Almost $2.5 trillion would be needed for technologies that capture carbon and store it.
- While it currently costs about $700 million to capture a million tons of carbon a year, the cost of building CCS plants is expected to drop 30% by 2050.
- With more than 200 000 megawatts of new coal-fired generation capacity under construction, CCS is the only option to offset the emissions of these plants, Morgan Stanley says.
- The bank’s top picks include Air Liquide SA and Bloom Energy Corp.

Hydrogen

- About $5.4 trillion is needed for electrolyzers to make the gas, which can help provide clean fuel for power generation, industrial processes, vehicles and heating.
- In addition, $13 trillion would be required to increase renewable energy capacity to power the plants.
- Another $1 trillion would be needed for storage, with additional investment for transportation and distribution.
- Leading players include: Johnson Matthey and Air Liquide.

Biofuels

- Almost $2.7 trillion should go into biofuels like ethanol, which are currently mixed with petroleum products but will spread eventually to areas such as aviation.
- About 4% of global transportation fuel will be biofuel in 2030.
- Ethanol, the most-used biofuel at the moment will grow at about 3% a year, while a type of biodiesel called hydro treated vegetable oil will achieve must faster growth, quadrupling production by 2030.
- Companies invloved include Neste Corporation and Sao

Martinho SA.

California’s cross-cutting climate strategy

We are parents, and one of us (Lenny Mendonca) is also a grandparent. We are keenly aware of how the intensifying impact of climate change could affect the futures of not only our children and grandchildren, but also of families throughout California and around the world. Thinking about the effects of climate change, however, doesn’t break our will; on the contrary, it only strengthens our resolve to work with California Governor Gavin Newsom to advance his vision for a more sustainable and inclusive economic-growth strategy in our great state.

In fact, California’s determination to act only grows as climate effects hit home. Our commitment to innovative climate

solutions deepens even as US President Donald Trump's administration attempts to demolish climate protections. (Trump has already taken action 129 times to repeal or weaken climate regulations. Attempting to revoke California's long-held authority to set its own auto-emissions standards is only the most recent manoeuvre.)

For example, on September 20, Newsom signed an executive order that seeks "to leverage the state's $700bn pension investment portfolio and assets to advance California's climate leadership." The order "also directs multiple state agencies and departments to review and update overall operations, transportation investments, and use of the state's purchasing power to advance groundbreaking climate goals."

Indeed, staying focused on solutions is the only sensible – and moral – option. Just ask Californians living with a longer and more severe "fire season" than ever before, or owners of coastal homes and businesses trying in vain to find insurance to protect their buildings against sea-level rise, or inland residents facing more frequent extreme-heat days. And of course, as with all disruptions, the state's low-income and disadvantaged communities will disproportionally feel the impacts of climate change. Without support, they will be the least able to adapt and build resilience.

That's why California is committed to climate leadership through an all-hands-on-deck approach. That means not only reducing greenhouse-gas emissions, but also integrating housing and transportation planning, economic development strategies, and workforce investments. The goal is to achieve a carbon-neutral economy by 2045 while advancing a community-driven transition strategy that implements climate-resilience measures to address the effects Californians are feeling today.

In California, climate change, housing, and transportation are inextricably linked. Nearly 70% of employment growth from 2010 to 2018 was concentrated in the coastal areas around Los Angeles, San Diego, and San Francisco. But housing in those areas is unaffordable for most, meaning that many live far

from their workplaces.

As a result, a growing number of Californians are now living a commuter's nightmare, spending more time in their cars and less time with their families. And longer commutes mean that California's transportation emissions – which already account for 51% of the state's total emissions – are on the rise.

So, beyond imposing stricter vehicle-emissions standards, Newsom has set a goal of building 3.5 mn new housing units by 2025. Working with the state legislature, his administration has allocated $1.75bn to boost housing construction by financing loans and tax breaks for developers of affordable housing, especially those building infill housing nearer to employment hubs.

At the same time, California's Regions Rise Together Initiative – led by our two departments under Newsom's direction – aims to create high-quality job opportunities in inland communities, not only in our state's $50bn agriculture industry, but also in advanced manufacturing, software development, and professional services. In addition to reducing commuter emissions, this will help to ensure that the benefits that have already begun to accrue from our climate and clean-tech investments are more widely shared.

This is not a top-down directive to these regions. Instead, we are focused on finding ways to support the work on sustainable, inclusive growth already occurring across every region of California, while also investing in the critical infrastructure connecting our regions to one another.

For those who must commute, California is investing in its statewide rail network and a high-speed rail strategy. By attracting more investment, jobs, and residents, such infrastructure investments can catalyse the revitalisation of downtown areas that may have lost their vigor.

Meanwhile, to protect the one in 12 California homes facing severe wildfire threats, we are expanding our firefighting resources and investing in cutting-edge technology. Such measures should help to stem the rapid increase in the price of homeowner insurance, which has further aggravated the

housing crisis.

Even as California promotes housing development, it is taking care to protect valuable lands, from farms to forests. As the Intergovernmental Panel on Climate Change recently highlighted, land use must play a central role in climate strategies. If adequately managed and protected, soils and forest lands can store carbon, act as fire breaks for more developed areas, and mitigate flooding and droughts – all while providing valuable economic opportunities.

In fact, California's experience has shattered the myth that climate action must come at the expense of economic prosperity. With a sustainable and inclusive growth strategy, the state has achieved 114 consecutive months of economic expansion. Zero-emission vehicles are now our eighth-largest export.

The climate crisis, decades in the making, is as hard to solve as they come. Building resilience demands a cross-cutting approach. We're proud to work for a state that has committed billions of dollars to developing efficient and alternative transportation, to building affordable housing, to creating good jobs in inland communities, and to expanding health care to help more residents. California is resolute about providing the tools, technology, and leadership to ensure a better tomorrow, for generations to come. – Project Syndicate

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