



A QUARTERLY JOURNAL FOR DEBATING ENERGY ISSUES AND POLICIES

COVID-19 AND THE ENERGY TRANSITION

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INTRODUCTION

The COVID-19 pandemic may be giving us glimpses of what the future of the energy sector will bring; and the glimpses keep coming as the pandemic continues with no early end in sight. There are two general themes that run through the articles in this Forum, reflecting that we are still in the middle of a global crisis. One is that uncertainty about the longer term is even greater than usual, because we do not know how governments and consumers are going to behave in a post-COVID world. The other is the tension between short-term imperatives (financial stresses) and the longer-term need for investment and adaptation that is also unusually high.

The articles in this issue reflect a wide diversity of views on the effect of COVID-19 on the energy transition, ranging from acceleration of the process to slowing it down, with some arguing that it will have little lasting impact. The professional background of the contributors helps to explain the diversity of views, with articles from different parts of the energy sector, the financial sector, NGOs, and think tanks. Nevertheless, there is a general acceptance that the energy transition was already well underway before COVID-19 and that the recovery programme could well determine the nature and the speed of the transition in different parts of the world and reinforce global trends that were already apparent. Most authors believe that stimulus measures to limit the human and economic impact of the COVID-19 pandemic offer a chance to rebuild a cleaner and more sustainable world, but others are more sceptical. There also seems to be an acceptance that the pace of the energy transition will not be uniform across the globe and that weakened international cooperation reduces the chance of fast-tracking and mainstreaming the low-carbon transition globally.

To help the reader navigate this exceptionally long issue, we have organized the 21 articles in five sections: lessons, electricity, oil and gas, financing, and geopolitics and regions.

Lessons

Giacomo Luciani argues that the impact of COVID-19 on energy transitions cannot be discussed unless other impending crises are also considered. The international market system is compared to the Earth's crust, where tectonic movements accumulate stress along fault lines that are generally well known, until an earthquake unexpectedly releases the stress. The list of fault lines is quite long: globalization, which has been the main engine of global growth but now has passed its peak; the ballooning of public debt; the clogging of the arteries of global finance; the growing inequality within countries, which has become a source of political tension; and sharp differences in population growth and structures. COVID-19 exacerbated all of these creeping crises and has brought the world much closer to potential major discontinuities, especially as international cooperation continues to deteriorate. Luciani argues that a potentially positive development is occurring within the EU, where the health crisis seems to have precipitated the consolidation of strong will among the leading EU countries to deepen their integration with the launch of an EU instrument (joint debt issuance) to finance investment in a recovery programme in which the green agenda is a central component. Given this background, can COVID-19 lead to an acceleration of the energy transition? Luciani argues that the crisis has brought forward in time the adoption of solutions and behavioural changes that support the transition, such as greater reliance on remote working and education. However, other imposed changes are unlikely to last. Less mobility will reduce oil consumption in the OECD, but there is little reason to expect that the same will happen in the rest of the world. Luciani argues that while it may make sense to invest in creating a cleaner world, the identification of interests and political forces that may bring about this result at the global level is lacking. Also, investment expenditure needed to restart the economy must not only be large but also arrive very quickly. Some may argue that, differently from 2008–2009, clean energy projects are ready to be launched, but this does not seem very convincing; there is a wide array of interesting possibilities, yet no pipeline of projects that may be activated within months. Green investment may progressively become more important over time but will be of limited help in the next year or two. At the global level, cheaper fossil fuels will support demand and discourage clean energy solutions. For most emerging countries, climate change is not an immediate threat. In the end, the environment will benefit primarily because the economic downturn will last.

Lord Adair Turner and Faustine Delasalle argue that governments in partnership with civil society and businesses must build back a better economy in the wake of the COVID crisis. They emphasize that clean energy and low-carbon and digital solutions are fundamental to achieving a more resilient economy. This could be achieved by putting seven key priorities at the heart of economic stimulus packages: (1) unleash massive investment in renewable power systems; (2) boost the construction sector with green-buildings and green-infrastructure projects; (3) support the automotive sector while pursuing clean air; (4) make the next waves of government support to businesses conditional on climate commitments; (5) provide targeted support to innovative low-carbon activities; (6) accelerate the transition of the fossil fuels industry; and (7) do not let carbon pricing and regulations spiral downwards. The authors conclude by arguing that building a zero-carbon-emissions economy is not an impediment to that economic agenda and that governments have the means and the responsibility to simultaneously enhance the health of people and ecosystems, boost economic recovery, and mitigate the risks of future systemic crises.



Pedro Linares analyses the short-term impacts of the pandemic and explores ways to make a positive long-term impact during the recovery phase. Linares argues that the pandemic's direct impacts on the environment, consumption patterns, and mobility are unlikely to be lasting. However, recovering from the crisis is an opportunity to take advantage of a massive economic stimulus. He recommends using stimulus packages to meet short-term liquidity requirements, subject to the condition that they are consistent with sustainable strategies. Long-term investment decisions should meet four requirements: (1) be compatible with sustainability objectives, including fighting poverty; (2) create jobs and economic activity in the long and short term; (3) be in sectors with future potential and in regions with competitive sustainability; and (4) be shovel-ready. Although Linares recognizes the environmental potential of renewables, he stresses the importance of investments that create jobs and address sustainable development, including education, health care, and urban planning. He also calls for use of the recovery period to promote fundamental social change, develop an intelligent industrial policy, and promote a wider public debate over decisions that will shape the future of our societies.

Pedro Gómez Pensado and Harsh Vijay Singh explore the parallels between COVID-19 and the energy transition and discuss transferable lessons between the responses to these two systemic shocks. They argue that COVID-19 is impacting the energy transition and will continue to do so in multiple ways for years to come. They recognize the positive impacts of COVID-19 on the energy transition, but also raise some causes for concern. Specifically, they focus on potential challenges for two key enablers of the energy transition – international cooperation and individual behaviours – and analyse both direct impacts on these two areas as well as lessons that can be drawn for energy transition from the health emergency experience so far.

Rolando Fuentes, Marzio Galeotti, Alessandro Lanza, and Baltasar Manzano argue that the pandemic has the potential to change the energy transition by transforming the whole economic system through a change of consumers' behaviour and preferences and changes in government policy. An underlying assumption of their analysis is that COVID-19 is likely to force a worldwide transition towards a 'low-contact' economy. Activities that reduce physical interaction, or are considered safe, will flourish. In that case, the question is whether this low-contact economy will also be a low-carbon economy. The authors argue that the rebalancing of activities would indirectly determine a different level of energy consumption and the overall energy mix. While the final outcome in terms of primary energy source is difficult to predict, it is likely that these changes will reinforce a transition towards electrification, which is the best potential energy carrier for the decarbonization of the economy. Under this 'new normal', work and leisure activities are largely conducted through digital platforms – like Zoom, Netflix, and Amazon – whose energy source is electricity. Office work can at least partially be achieved without commuting time, congestion, and transport emissions. If some or most of these adjustments endure after the lockdowns have ended, they will have impacts on domestic electricity loads, oil demand, and emissions. Longer stays at home impact demand for both electricity and transport. In general, reduced need for travel diminishes incentives to own a car, and consequently demand for oil products. For electricity, the impact of staying at home is at least twofold. First, longer stays at home increase domestic electricity demand as people spend more time at home, keep more food in their refrigerators, and use home cooling systems, which are probably less efficient than office cooling. If distributed energy resources technologies offer the possibility of reducing domestic bills, there would be an increase in the deployment of these technologies. Second, there is an increase in home-made goods, since home production avoids interaction and physical contact. Preferences for homemade electricity (e.g. rooftop solar) might increase. The authors see a trend towards more electricity consumption with an increasing share from local sources.

Pedro Antonio Merino Garcia argues that the COVID-19 pandemic has created both challenges and opportunities for the energy transition. He explores these under three themes: economic conditions, demand for legacy fossil fuels, and geopolitics. He argues that stimulus measures first and foremost must be directed towards activities that contribute to a fast economic recovery. Some investments, such as subsidizing energy savings in residential buildings, help to speed the recovery in the construction sector and also to mitigate CO₂ emissions, but some investments may be at odds with these objectives. Accelerating the transition should not take place at the expense of a slower recovery, as this could create supply/demand imbalances undermining both conventional and green energy. In terms of fuel legacy, lower oil prices during the pandemic have benefitted the transition through reductions in fuel subsidies for gasoline and diesel. However, they have also negatively affected oil companies' profitability and thus the energy transition either directly, through lower investment by the international oil companies (IOCs) in low-carbon technologies (e.g. carbon capture and storage) and adjacent sectors (e.g. solar), or indirectly via lower dividend payments that could have been invested in low-carbon energies. Also, lower oil prices reduce the operating cost difference between gasoline/diesel vehicles and electric vehicles (EVs), thus making EVs less competitive. More generally, recessions also slow the renewing of the global vehicle fleet, meaning older and less efficient cars remain operational for longer. Geopolitically, two major events will shape the energy transition moving forward: the US election in November and US–China relations. The pandemic created open hostility between the two countries, accelerating competition and making it increasingly



difficult, and this will be reflected in the energy sphere. While China has made no secret of its determination to dominate green technology, it will turn to its abundant coal resources if threatened. The author concludes that COVID-19 has adversely impacted the energy transition through the reduction in investments, the decline in fossil fuel prices, and a deteriorating geopolitical backdrop, though it may have increased the awareness of the need to fight greenhouse gas emissions in the long run.

In contrast, *Richard Black* argues that the question is not whether the coronavirus will delay the world's clean-energy transition, but whether the need to 'build back better' will accelerate it. Black notes that even at the very top levels of government, there is seen to be little conflict between the short-term need to 'get the economy moving' after lockdown and the longer-term imperative to decarbonize: in fact, they are increasingly seen as two sides of the same coin. Black describes four key factors at play. All of them individually, but more pertinently the relationships between them, suggest that the COVID-19 crisis will spur the move away from fossil fuels towards a zero-carbon economy. The first is simply real-world experience. The hollowing out of the traditional energy system is being amplified by renewables gradually undercutting gas generation as well as coal. The second factor is money. In contrast to the post-crash environment of 2009, fossils look risky while 'clean' looks safe. In many countries, to invest in solar or wind power is virtually to guarantee single-digit returns for a period of up to 25 years – which is not highly attractive for high-stakes investors, but is perfect as a foundation for risk-averse vehicles such as pension funds. The third factor is the ability of the proponents of the clean-energy transition to win the battle of ideas on grounds not directly concerned with climate change and the case for emission cuts. The fourth factor is the public mood. In many nations there are discernible indications that the public will not stand for government throwing their money at companies such as airlines and oil majors that are perceived to do very nicely when times are good but who come running cap in hand in more difficult times. The author argues that individually, none of these four factors would have been enough for COVID-19 to accelerate us toward the low-carbon future, but collectively, they are – not necessarily in every country and every sector, but enough to make a real difference.

William Todts argues that the beginnings of tremendous change in the transport sector were already apparent in recent years but COVID-19 will accelerate those trends and make them irreversible. Todts argues that the main battlefields will be cities, the automotive sector, and aviation. For instance, cities across Europe are taking radical action to promote walking and cycling and limit car traffic. Meanwhile millions of employees are working from home. This means that for the first time there is actually free road space, but this won't last: cars or cyclists will occupy this free space, and for mayors the choice is simple: protect cities against air pollution, even if it requires giving more public space to walking, cycling and public transport. The direct impacts of such changes on oil demand will probably remain limited, but the indirect effects could be much greater, as cities are quietly preparing to close their gates to polluting cars. Todts argues that the developments in cities will play into a second big trend: electrification. Before COVID-19 brought the economy to a halt, the electric car market in Europe was booming. Rather than suffering from the crisis, mobility has gotten further impetus through recent government stimulus packages. The part of the car market where electrification is really taking off is the company car market. Even the picture for trucks is about to change, and the author expects 2025 – when the first EU truck CO₂ standard kicks in – will be a turning point. In terms of aviation, the short-term impacts of COVID are staggering. However, aviation always returns to growth; what is less clear is the kind of sector that will re-emerge this time. Given all the pressure that aviation was under before COVID-19, it is hard to imagine companies and governments will not (voluntarily or otherwise) rethink their travel policies, which may have a significant long-term impact on the economics of the sector in Europe. In addition, airport expansion plans are likely to be put on hold, and the EU is considering the world's first advanced fuels mandate for aviation.

Malcolm Keay and David Robinson argue that COVID-19 may offer an early glimpse of what most long-term forecasts anticipate for the energy sector – for instance: declining demand for fossil fuels, increasing shares of electricity in final energy markets, greater consumer participation, and the need for flexibility in the power sector to facilitate penetration of intermittent renewables and manage congestion on the network. The crisis has revealed some of the new challenges and opportunities that companies should reflect in their strategies. Electricity companies have already had 10 years to adapt to an industry turned upside down by the penetration of intermittent renewables and changes in information technology; they are starting to develop new business models. Oil and gas companies have not yet had to face the full force of this kind of systemic change; most argue that they will have time to adapt, using revenues from existing businesses to make the needed adjustments. COVID-19 may be a useful wake-up call. If there is one message, it is that the energy business has changed: it is no longer about selling oil, gas, and electricity and gradually changing to a lower-carbon mix. We are entering into a new paradigm where bottom-up (technology and economics) and top-down (political) pressures are moving in the same direction, towards the need for integrated, fully decarbonized energy systems, where consumer decisions are especially important. Corporate strategy for all energy companies needs to reflect this emerging new paradigm.

Electricity

Carlo Papa, Giuseppe Montesano, Nicolò Sartori, Carlo Napoli and Mirko Armiento argue that one of the key – albeit less debated – messages that emerged from the pandemic is the evidence of the importance of infrastructure and technology. In particular, they emphasize the fundamental function of a robust and sustainable electricity system in a modern, efficient, and resilient society. Post-COVID recovery planning should recognize this and build on the results already achieved by the energy transition; this is true everywhere, but the decarbonization process should be especially encouraged in developing countries. Investment in sustainable electricity generation and infrastructure offers both short- and long-term benefits, contributing to an inclusive low-carbon transition pathway, the benefits of which – in terms of GDP growth, employment, and income inequality reduction – will be distributed progressively across citizens and businesses in both advanced and developing economies.

Francisco Laverón focuses on the lasting impact that the COVID-19 crisis will have on the energy sector. He argues that the short-term impact has been very negative, but that clean energies have been more resilient. The more important question is how COVID-19 affects investment. Although investment throughout the energy sector will fall substantially this year, renewable electricity and electrification have very positive investment prospects. He examines a number of lessons from the crisis that reinforce this view. First, we will listen more carefully to warnings from the scientific community about our vulnerability to environmental risks, especially climate change and local pollution. Second, we have learned that being unprepared for phenomena that are inevitable but whose timing is uncertain can be very costly. Another lesson is that we can change our lifestyles rapidly if we want to. Fourth, we have learned that decarbonization policies are urgent because they lead to environmental improvements that are beneficial for our health and our economies. Finally, there is a growing recognition that recovery from COVID-19 can and should reconcile short-term goals (economic recovery and job creation) with longer-term aspirations of climate change mitigation and a sustainable economy. He concludes that the COVID-19 crisis will accelerate the energy transition, and that an electricity sector powered by renewable energies will be the cornerstone of the fight against climate change.

Jacquie Ashmore, Cutler Cleveland, and Peter Fox-Penner examine the impact of the US clean-energy transition in the era of COVID-19. They argue that although the US federal government did not bolster the clean-energy economy in its first COVID-19 economic stimulus measures, big new renewable-energy and storage projects continue to be planned and approved nonetheless, driven by the market and economics and by political and societal forces; therefore, the prospects for the US clean-energy transition remain strong. Wood Mackenzie is projecting that the US will add 18 GW of new photovoltaic capacity and 1.2 GW of energy storage capacity in 2020 – both record amounts – and near-term plans for major projects continue to advance under the leadership of state-level policymakers and utilities, bolstered by the entrepreneurship of technology providers and the support of the finance community. The authors note that while the federal-level discussion of green stimulus measures is not bipartisan at this time, the outcome of the US election in November has the potential to substantially reshape the dialog. In June, the Democrats put forward substantial stimulus proposals with the aim of reducing power-sector emissions to zero by 2040, a zero-emission vehicle sales standard that ensures all light-duty vehicles sold are zero-emission by 2035, and new tax incentives for EVs, solar, storage, and offshore wind, plus other policies that cover energy efficiency and agriculture. The authors conclude that in working to address the economic damage wrought by COVID-19, it is key to prioritize investment in the clean-energy economy to mitigate climate change, and the future economic damage it will inflict, and to accelerate the transition to a low-carbon energy system that is already underway.

Oil and gas

In his article, *Bassam Fattouh* looks at oil companies' adaptation strategies in an environment of increased uncertainty. He argues that in the context where pre-virus engines for growth have stalled, government stimulus measures to kick-start economies are key to the global economic recovery. But unlike the 2008 global financial crisis, there has been much more pressure for stimulus measures this time to be directed towards projects that accelerate the energy transition and move us closer to a zero-carbon emission economy. Also, COVID-19 has accelerated the shift in perceptions (and aspirations) about the changes in the energy mix. These shifts are occurring much faster than what could realistically be achieved on the ground. In this context, international oil companies (IOCs) find themselves in a very challenging position. An accelerated transition would pose a significant challenge for IOCs, disrupting their business models and undermining their profitability. IOCs are also required to make such a transformation at times when investors' appetite for financing the sector is waning. Fattouh argues that the dilemma that IOCs face reflects a deeper issue. There are costs associated with the energy transition and shifting these costs solely to IOCs, shareholders or consumers is not realistic and will not achieve the desired objective. These costs should be shared. It also shows that business as usual for IOCs is not a choice regardless of what happens to oil demand. IOCs are making investments to lower emissions compared to business as usual, for instance by improving efficiency, capturing and



storing carbon, reducing methane emissions, decarbonizing natural gas and setting carbon offsetting schemes. These are areas where IOCs as well as some national oil companies have comparative advantage, and in which they could demonstrate leadership. IOCs should tap these packages and demonstrate that decarbonization of their activities and products can be achieved, the projects are scalable, and that they have the ability to manage big projects and complex supply chains, integrate projects and develop technologies to decarbonize the energy mix in the most effective and least costly manner. Through such demonstration projects, IOCs can establish the costs and benefits and prove scalability, enhancing their position as leaders in the transition and competing with other players for public funds. Fattouh concludes that irrespective of which strategies IOCs take, there is a fundamental trade-off between expected return and the variance of return, i.e. the cost of reducing the long-term risks and increasing resilience is to accept lower expected return on existing assets, by investing in measures that align the hydrocarbon sector with low carbon scenarios. This lowers the overall return but reduces the risk of business disruption in the long run. Both IOCs and shareholders should acknowledge this trade-off.

Eirik Wærness highlights the strategic challenges facing the IOCs. To remain relevant in the long term, IOCs must deliver on the short-term objective of satisfying the increase in energy demand. At the same time, acting on carbon emissions is a must, especially as stakeholder pressure on companies accelerates, notably in Europe. A common prerequisite over both the short and long term is that these activities must meet investors' requirements for satisfactory returns. The author argues that achieving a successful energy transition while at the same time meeting investors' and customers' expectations requires a combination of stamina, stakeholder dialogue, selective strategic decisions, and managing investors' expectations, particularly in terms of what the risk/reward balance is for investments both in oil and gas and in new renewables/low-carbon energy. It also requires clear regulatory mechanisms and good dialogue with governments in relevant jurisdictions. Wærness concludes that the current extraordinary situation in which the global economy and energy market find themselves will make it increasingly difficult for the IOCs to show visible progress on their decarbonization ambitions over the next couple of years.

Perdro Haas argues that COVID-19 has not spared national oil companies (NOCs), most of which have adopted responses similar to those of other private-sector oil companies, such as capex and opex cutbacks, headcount reductions, cash conservation measures, and technical and organizational adjustments. But a key question remains: will these measures be enough to tide the NOCs over a temporary rough patch, or is a more fundamental restructuring necessary to steer these companies onto firmer ground? Haas argues that the challenges facing NOCs are happening in the context of a compounded hit to the public finances of every government. The natural tension between the state and the NOC is thus intensified. Even for the richest NOCs and countries, the paradigm has shifted; for the weaker NOCs it is quickly becoming an impossible challenge. Haas argues that the pandemic and its aftermath are causing (or should cause) an acceleration of the strategic rethink of the NOC and its role in society. He concludes that a successful transition for the NOCs of hydrocarbons-producing countries is crucial not only to their nations, but to the stability of the global energy sector. Everyone has a stake in the NOCs and their owners getting it right.

Tatiana Mitrova and Jonathan Stern conclude that the impact of the energy transition on gas demand will be less severe than for other fossil fuels because of its lower CO₂ emissions. The immediate impact of the COVID-19 crisis has been lessened by historically low international gas prices, which have provided incentives for fuel switching. But in the longer term, fuel switching is a large-scale option in only a few countries and will depend on whether substantially increased gas and LNG imports are considered an acceptable energy security risk, and whether imported gas and LNG prices remain affordable in lower-income countries. After 2020, a return to modest growth in global gas demand depends critically on Asia, not just China and India but also the Middle East and South-East Asia. Net-zero emission targets in Europe, the largest regional gas importer, mean that unabated gas demand will need to decline substantially post-2030 but with the possibility that 'blue' hydrogen from reformed natural gas (with carbon capture and storage) will offset some of that decline. Elsewhere, transition targets mean demand decline could be delayed until the 2040s, and competitiveness of new gas and LNG export projects with emerging zero-carbon alternatives will be the key issue.

Financing

Ahmed Attiga and Leila Benali argue that the post-COVID 19 energy sector will not see all-out 'creative destruction,' where entire parts of the system are replaced by new technologies and value chains. Rather, the energy sector will probably witness a new era in which most existing energy technologies as well as new low-carbon technologies will be needed, as each brings its intrinsic value. But funding is key for this to occur, and the energy sector faces a double dilemma: relatively low shareholders' returns and squeezed margins across the value chain. Even if renewable energy is perceived by investors as one of the preferred infrastructure sectors, it generally does not yet offer all the characteristics that conventional funding looks for in terms of market capitalization, dividends, and liquidity. Meanwhile, conventional funding remains available for well-rated large



companies, leaving smaller players, which are typically testing new technologies, tapping into other forms of financing such as mini-perms, green bonds, and aggregation of projects, as well as soft loans and crowdfunding. While the renewables industry has benefited from these new financing mechanisms, the rest of the low-carbon value chain – such as carbon capture, utilization and storage – is lagging. Equity investments have also become more attractive, as the cyclical nature of the energy sector provides unique investment opportunities during downturns in almost every sector, including renewables, infrastructure, oil and gas companies, oilfield services, and technology. But confidence in the energy sector and the players are minimum prerequisites for financing to play a true countercyclical role. Another prerequisite is the ability to extend 'patient capital', as it may take some time before value is realized. In times like this, institutional investors with long-term visions and access to long-term funds can play a supporting and stabilizing role.

Helena Viñes Fiestas argues that the COVID-19 crisis offers a unique chance for a genuine transformation in the EU. Many of the hardest-hit sectors were already under pressure before the crisis; the recovery packages are an opportunity to launch bold and ambitious plans. EU policy is sending a clear signal to these companies. A central feature of that policy is the EU Taxonomy, which classifies economic activities considered to be environmentally sustainable – helping companies, investors, project promoters, and other stakeholders to understand whether an economic activity is environmentally sustainable, and to navigate the transition to a low-carbon economy. The author emphasizes the importance of strengthening company governance on sustainability and notes that state aid – whether through debt or government equity stakes – will and should come with strings attached. She also stresses that the EU will be introducing climate disclosure obligations for companies, whether they receive government support or not. Finally, she argues that investors – asset owners and asset managers – have an important role to play in supporting companies in their transition and recovery efforts. As demand for sustainable investment rises, investors will be motivated to align their portfolios with the Taxonomy and to decrease their exposure to high-carbon-intensive assets. This may explain why a group of 109 investors managing €11.9 trillion put their names to a proposal made to EU leaders demanding a sustainable recovery from COVID-19.

Geopolitics and regions

Lara Lázaro Touza and Gonzalo Escribano Francés analyse underlying geopolitical trends regarding the low-carbon transition prior to the COVID-19 outbreak and offer a preliminary analysis of how these trends can be reinforced or altered in the current context of the pandemic. Focusing on China, the EU, and the US, they argue that pre-existing decarbonization trends are likely be reinforced: the chances of a green recovery are better than they were in 2008 in the EU, the US is unlikely to embrace a green recovery under the current administration, and China's plans are unclear. The likelihood of fast-tracking and mainstreaming the low-carbon transition globally will only improve if stronger Sino–EU cooperation is forged by pressing ahead with a green recovery of unprecedented scale. However, within a complex geopolitical context, it might be wise to explore ways to build a wider coalition, reinforcing the EU's bonds with China, Canada, the UK, and other ambitious countries in Latin America, Asia-Pacific, the Middle East and North Africa, and Africa more generally.

Kenneth Medlock argues that the dual goals of economic growth and environmental sustainability are paramount, but that this was also true before COVID-19. Successfully addressing each was already setting up to be among the world's most pressing challenges over the next couple of decades; the COVID-19 crisis has made this even more salient. But Medlock notes that the burden of this two-pronged challenge will not be distributed evenly around the world. In many respects, the world of energy is a world of 'haves' (OECD countries) and 'have-nots' (non-OECD countries). While the paradigm is rapidly changing with the emergence of developing behemoths such as China and India, a large proportion of the global community remains mired in energy poverty. OECD demand growth has generally fallen over the last 50 years and has virtually stagnated over the last decade. By contrast, non-OECD demand growth has been strong. The evolution of fuel mix has also differed between OECD and non-OECD countries. For instance, the growth in coal use in developing Asia drove a large increase in non-OECD coal demand, so much so that it more than offset the declines in coal use in the OECD. Energy demand growth and changes in energy mix are expected to continue, meaning the non-OECD countries must now shoulder the majority of the shift to non-fossil energy sources if the world is to make a successful energy transition. The sheer size of the populations and economies of non-OECD countries presents a scale that will drive growth across multiple energy value chains. There has been astounding growth in the use of renewables alongside strong growth in the use of fossil fuels in non-OECD countries. This pattern is likely to continue given the magnitude of the infrastructure required to deliver energy services to the more than 6 billion people in non-OECD countries. Thus, any discussion of energy transitions must be able to reconcile legacy, scale, and technology. Economic viability also matters, because the cost-benefit of any capital investment decision must be favourable for it to be sustainable. Also, the principle of comparative advantage will ultimately define how transitions occur in different parts of the world. There is a portfolio of options available for a lower-carbon energy future, and not every option in the portfolio is suitable everywhere. Recognition of this diversity will enable locally appropriate and economically resilient solutions. Absent this, the energy transition will occur in fits and starts and do little to change the global energy mix in the near to medium term.



Sam Geall charts the change in China's climate policy, from UN climate talks in Paris in late 2015, when the country aimed to reposition itself as a global climate leader, to a much more ambiguous position, especially with the election of Donald Trump and the ensuing trade tensions. Coal consumption began to rise, and China's commitment to climate policies at the UN became equivocal. COVID-19 injected a further element of uncertainty, which might cut both ways. On the one hand, it has increased international tensions, which could spur further retrenchment and a focus on energy security, boosting coal-fired power. On the other hand, it may lead to calls from inside China for renewed environmental ambition, with Beijing taking the opportunity to lead in the technologies of the future. The debate is taking place as the government defines its recovery program while preparing China's 14th five year plan (2021–2025). The opportunity exists for a commitment to industrial and energy transformation – much as the green strategies are at the centre of the economic recovery and energy planning in Europe – and signals that 'neo-infrastructure' will form a pillar of that recovery suggest some commitment to that pathway. Government-connected figures are arguing, in private at least, against any further expansion in coal-fired power capacity under the 14th five-year plan. If coal continues to receive a boost this year, it will call into question China's claim to the 'driver's seat' on climate.

Jean-Michel Glachant analyses the feasibility of greening the COVID-19 recovery in the EU and the challenges of implementing such a recovery. On feasibility, he argues that a green recovery policy is now a real possibility, primarily due to political support from Germany and France, something that seemed impossible in March due to the resistance of the 'frugal northern' states. Furthermore, he argues, there is a macroeconomic (multiplier) rationale for placing the green agenda at the centre of the EU's strategy, and there are reasons to be optimistic about an agreement being reached by member states through a 'traditional' fierce EU fight. Regarding implementation, he identifies many questions related to two key elements of the green recovery agenda: the massive penetration of renewable electricity, and the strategy for developing a significant hydrogen sector. He concludes that implementing the green recovery policy is as much of a challenge as defining and agreeing to it. The EU needs a proper implementation framework to achieve the economic multiplier effects and to deliver its climate targets. This is a defining moment for the EU.

OTHER IMPENDING CRISES

Giacomo Luciani

The COVID-19 crisis has been both unexpected and severe, causing the worst international economic crisis since 1929. We still do not know when the virus might be contained, even less defeated. In this context, there has been a tendency to forget that numerous other crises were impending even before COVID-19.

Climate change is but one of several such crises – it is neither the sole, nor possibly the gravest of the problems ahead of us. The impact of COVID-19 on energy transitions cannot be discussed unless other impending crises, and the way they interact, are also considered.

The international market system (including both economic and political 'markets') always tends towards equilibrium, but adjustment does not take place along the well-behaved, smooth, convex curves shown in textbooks. Rather, it is frequently blocked by intrinsic inertia: stress is allowed to build up in the system, until eventually one blockage gives, and adjustment takes place precipitously. In this, the international system resembles the Earth's crust, where tectonic movements accumulate stress along fault lines that are generally well known, until an earthquake, which we are unable to predict, releases the stress.

Which fault lines are the most relevant today? The list is quite long.

1. Globalization, which has been the main engine of global growth for the past 70+ years, has passed its peak. This was already evident before COVID-19, but the pandemic greatly increased the feeling that dependency on internationally stretched value chains has become excessive and should be contained. Resentment towards China has grown rapidly, in Europe as well as in the US, because of perceived misbehaviour on its part. Deindustrialization weakened the middle class in all formerly industrial countries and exacerbated income inequality. At the same time, the push to make trade conditional upon respect for human rights and/or protection of the environment has also grown. It is then almost certain that international trade will no longer grow more rapidly than GDP, and an alternative engine for global growth is lacking.
2. Public debt has ballooned in all countries. In the short term, expansionary fiscal policies are indispensable, but the outcome will be much increased debt/GDP ratios for all states. In theory, a period of fast growth may make it possible to restore previously existing balances; but how growth can be sufficiently revived, no one knows. In the past, wars led to a huge accumulation of public debt, which was then managed with high inflation; but will sustained inflation be an acceptable way out in the coming years? In particular, the special case of the US should not be forgotten: so far, the rest of the world has been happy to accumulate balances in US Treasury bonds, but something may happen that



changes this preference, potentially setting in motion a decline in the value of US paper and increase in interest rates which would impact governments, financial intermediaries and most investors.

3. The arteries of finance are clogged. Expansionary monetary policies led to low or negative interest rates, yet funds are not flowing to where they are needed or likely to be employed for productive investment, due to institutional or governance barriers. In and of themselves, low interest rates are positive for the energy transition, which is capital intensive; but the profile of most clean-energy or energy-efficiency projects remains too risky, and potential investors not sufficiently creditworthy, so that some degree of risk mitigation on the part of the state remains necessary. Finally, the flow of funds to emerging countries remains constrained by governance issues.
4. Inequality is growing *within* countries, even though some (but not all) emerging countries are closing the gap with the industrialized countries. This is a growing source of political tension in all democratic countries, and is aggravated by both the pandemic and the energy transition, as the cost of both falls predominantly on the shoulders of the poor. Inequality is at the centre of political debate in liberal democracies, but a reinforcement of the state's redistributive role is hindered by the already high level of taxation and public debt. In the past, major wars led to destruction of legacy wealth and considerable flattening of its distribution. But is deliberate wealth destruction an acceptable solution? (Energy transitions explicitly envisage some wealth destruction – e.g. write-offs of fossil-fuel-related investment – but not enough to reshuffle the cards to the extent required.)
5. Different countries are experiencing sharp differences in population growth. Some, mostly rich countries, are undergoing rapid aging and consequent economic stagnation, while others are still in a phase of rapid population growth. Migration pressure, compounded by the rapid increase in refugees from wars and political oppression, elicits nationalistic or even racist responses, to the point of endangering the political stability of even well-rooted democracies.
6. In addition to these unsustainable socioeconomic trends, there is a growing gap between military power and international influence, which threatens to result in increased readiness to engage in open conflict. Superpowers possess enough weapons to destroy the world several times over, but end up being defeated by poorly armed guerrilla such as the Taliban in Afghanistan – to name just one example. The revanchist temptation ('make America/Russia great again') undermines international law and governance, and creates a poisonous international environment where cooperation is impossible.

COVID-19 exacerbated all of these creeping crises and has brought the world much closer to potential major discontinuities. The virus has not elicited enhanced international cooperation; rather, it has undermined the role of the one international institution that should govern and enable cooperation in the fight against it (the World Health Organization). It has been turned into a tool for domestic and international propaganda, creating resentment and mutual accusations. It has led to the collapse of international trade and growth, considerably weakened government finance, and increased volatility in financial markets, which have been supported by vast liquidity injections but are still exposed to negative economic prospects. It has weighed more heavily on the poor; and, depending on how it develops in the emerging world, may lead to a surge of migration pressure.

The only potentially positive development in the response to COVID-19 has occurred within the EU. After a problematic initial response, the leading EU countries (Germany, France, Italy, and Spain) have consolidated their commitment to deepen the integration process, with the launch of an EU instrument to finance investment and counter the recession with joint debt issuance. This was made possible by Brexit, which has propitiously lifted the persistent UK brake to closer integration. Opposition remains from a small group of so-called frugal member countries, but this is a rearguard fight, which is unlikely to alter the importance of this development.

In light of all the above considerations, why should we expect that COVID-19 might lead to an acceleration of the energy transition? Appeals to target climate goals while reviving the global economy remain largely voluntaristic. Arguably, it makes good sense to invest in creating a cleaner world rather than simply restoring the old one, but the interests and political forces that could bring about this result at the global level have not been identified. It is only in Europe that the association of economic recovery and environmental goals has any popular traction, and even there it is far from universal. In the US, the clumsy response of the Trump administration to the COVID-19 crisis has increased the likelihood that the November election will bring a Democrat back to the presidency, which would almost certainly renew US commitment to environmental and climate goals. But elsewhere in the world it is hard to see any sign of a shift towards giving greater priority to the environment.



It is true that the crisis has hastened the adoption of solutions and behavioural changes that were expected to take hold gradually. The most important of these is probably the shift towards greater reliance on remote work and distance education, which has offered multiple advantages and is likely to be consolidated even after lockdowns and social distancing end. This will be positive for the environment, primarily because of reduced travel. But other imposed changes are unlikely to last, and have not been welcomed by the public.

Even at its best, working from home is a solution almost exclusively for white-collar workers in advanced countries with good interconnectivity. In the global context, it is a relatively marginal phenomenon. Due to the importance of mobility for oil demand, it is possible that decreased mobility will further reduce oil consumption in the OECD, but there is little reason to expect that the same will happen in the rest of the world.

In the OECD, important policy decisions are being made, not always in an environment-friendly direction. Two files that can make the difference are related to the automobile and aviation industries, which both appear to be on the verge of long-term downsizing.

For the car industry, a crisis was evident even before COVID-19, due to uncertainty deriving from three concurrent transitions – from internal combustion to electric engine, human-driven to autonomous, and privately owned to shared. In the EU, the coming into force of more stringent emission standards in the current year raises the threat of major fines that car manufacturers will have to pay for noncompliance (which is almost inevitable), while customers are not keen to buy a new car just now. In fact, why should they? Buying a new car is a decision that can in most cases be easily postponed, especially considering that a majority of recently produced and sold cars are large, solid, durable machines; in addition, oil prices are down, so running costs are less of a consideration. Propensity to save (or to avoid adding to debt) has increased, as it normally does in times of uncertainty.

Automobile manufacturers need to sell SUVs, because that is where profits come from, and BEVs (battery electric vehicles), to compensate for the excess emissions of the rest of their fleet. It is not at all clear that demand will spontaneously conform. But the automobile industry is a major pillar of the European economy and employs millions. Hence the request that governments devote resources to special incentives to persuade people to get rid of their old cars and buy new ones – a policy that runs flatly against any idea of circular economy, and would immediately increase emissions in connection with the production process. Emissions during production are especially high for SUVs and BEVs, so a rational environmental policy would call for a slowdown in the replacement of the existing fleet, and substitution of large and heavy with smaller and lighter vehicles – the opposite of what the industry wants.

With respect to air travel, basically all airlines are now on the verge of bankruptcy and have requested massive state aid. In France this has been granted with at least some environmentally motivated conditions; but elsewhere there will probably be no conditionality at all. The crisis affecting airlines will inevitably also impact the aerospace sector, where government intervention for strategic reasons has also been the norm. Large subsidies to airplane manufacturers and air travel do not support the energy transition.

Of course, there will also be some allocation of public funds to support decarbonization, but what share of the total? Investment expenditure needed to restart the economy must be not only substantial but also timely. Some have argued that today, unlike in 2008–2009, clean energy projects are ready to be launched and make the difference, but this does not seem very convincing. There is a wide array of interesting possibilities, but not a pipeline of projects that can be activated within months. Any money allocated to reduce emissions from buildings or industry, or to carbon capture and storage or hydrogen or batteries or public transportation, will require significant preparation before it can be actually spent. Therefore, green investment may gradually become more important over time, but will be of limited help in the next year or two. Opportunities available ‘off the shelf’ seem restricted to further adding wind and solar capacity. However, the decline in electricity demand during lockdowns has shown that penetration of non-dispatchable renewables already results in rather frequent cannibalization, as was widely predicted. Return on additional investment of this kind can only be confidently expected if guaranteed by the state.

At the global level, market forces rather than political preferences will prevail. Cheaper fossil fuels will support demand and discourage clean-energy solutions. For most emerging countries, climate change is not an immediate threat; commodity exporters will be negatively affected by slower growth in the OECD, fiscal crises, devaluations, and growing popular discontent.

In the end, the environment will benefit primarily because the economic downturn will last, and economic activity is the main determinant of energy demand and emissions. Rapid recovery is only possible if there is a return to business as usual. Opening a new green phase of economic growth is also possible, but requires time. Do we have the time? Slow growth exacerbates all the other crises discussed in this article. An earthquake along the other fault lines may happen sooner rather than later.



7 PRIORITIES TO HELP THE GLOBAL ECONOMY RECOVER WHILE BUILDING A HEALTHIER, MORE RESILIENT, NET-ZERO-EMISSIONS ECONOMY

Lord Adair Turner and Faustine Delasalle

The COVID-19 pandemic spread around the world with alarming speed and, as the health and human toll continues to grow, the economic damage caused by a near global lockdown is evident. As countries start to come to terms with both the 'new normal' and the threat of a second spike of the virus, it is imperative that we learn from the current crises. One thing is clear – the unpreparedness of the international economy for systemic risks.

In response to the immediate emergency, trillions have already been committed by governments around the world to support immediate economic stabilization and longer-term economic recovery. These economic stimulus packages are vital to sustain economic activity, jobs, and communities over the next decade. The current crises reduced the already low interest rates at which advanced-economy governments can borrow, while it increased the risk premium paid by many private-sector players as well as countries perceived as riskier. This not only allows governments from developed countries to make the substantial investment required to stimulate the global economy; it gives them the responsibility to do so – by using their own balance sheets to invest in the necessary infrastructure as well as in energy provision, by reducing the cost of private capital through various forms of financial de-risking, and by increasing development finance to less fortunate countries through both bilateral and multilateral channels.

Investing in high-carbon activities without climate conditionality in the hope that it will help the global economic recovery would only prepare the ground for future systemic crises. Economic stimulus packages should contribute to building a healthier, more resilient, net-zero-emissions economy. This should be one that enhances the health of people and ecosystems, and that builds our resilience by better anticipating and mitigating risks. In particular, it is vital to reinforce action to address the climate-change-related risks – the very tangible physical risks related to climate change as well as the systemic risks that the transition to a lower-carbon and eventually zero-carbon economy entails. Addressing those risks demands achievement of net-zero greenhouse gas emissions by mid-century and support for the transition of heavy-emitting sectors over the next decades.

The recent Energy Transitions Commission report [7 Priorities to Help the Global Economy Recover While Building a Healthier, More Resilient, Net-Zero-Emissions Economy](#) highlighted the steps that governments in partnership with civil society and businesses must take to build a better economy in the wake of the COVID-19 crisis. Clean-energy, low-carbon, and digital solutions are fundamental pillars to achieving a more resilient economy: they can improve the quality of the air we breathe, enhance our quality of life, and limit the occurrence of climate-related disasters. They can also underpin new businesses and new jobs: according to the International Renewable Energy Agency, the cumulative gains for transforming the energy system could reach US\$98 trillion between 2020 and 2050, greatly exceeding the related investment costs.

We are already seeing governments learning the lessons of the past and focusing on new economic solutions, but signals remain mixed as temptations are high to accelerate short-term job creation through investment in shovel-ready high-carbon activities. China's government is starting to recognize that investment stimulus should go not only to new high-carbon infrastructure but also to 'new infrastructure' like high-speed rail, electric vehicle (EV) charging, and digital infrastructure to support higher-quality urban development. The Energy Transitions Commission and the Rocky Mountain Institute have argued, in [Achieving Green Recovery for China: Putting Zero-Carbon Electrification at the Core](#), that zero-carbon electrification should also be a priority of the Chinese post-COVID-19 recovery.

Closer to home, the European Commission has pledged €750 billion in a sustainable recovery package designed to kick-start the economy in member states. [Next Generation EU](#) puts the European Green Deal at the heart of building back a more resilient economy and creating jobs and boosting growth. The stimulus programme aims to accelerate the transition to clean transport, increase energy savings, and boost the production of renewable energy. However, policy signals from individual member states appear to be more mixed.

Governments have the choice, the power, and the responsibility to build a new resilient and zero-carbon economy faster, working with businesses and civil society. The Energy Transitions Commission believes they can do this and help the global economy recover by putting seven key priorities at the heart of economic stimulus packages.



1. Unleash massive investment in renewable power systems

Clean power systems offer the single biggest investment opportunity of the next decade. Massive investments in renewable electricity generation, flexibility provision, and power grids are indispensable to both decarbonize existing power provision and meet growing electricity demand from rapid electrification of buildings, transport, and industry.

The Energy Transitions Commission forecasts a multiplication by four to five of electricity demand globally by 2050. This would require a multiplication by 10 of the pace of renewable deployment (from 160 GW of new wind and solar capacity installed in 2019 to 1,500 GW per year on average over the next 30 years), along with substantial investment in grid infrastructure.

In the midst of the crisis, there has been much written about the necessity and value of investing in renewable power systems, with leading power companies confirming their investment. But many governments have also delayed or cancelled planned auctions for 2020. History has shown that making clean energy a priority in stimulus packages can be a driver of job creation in the following years. After the 2008 financial crisis, the US recovery spending prioritized funding for clean energy, creating 900,000 jobs over a five-year period. A recent analysis from the International Renewable Energy Agency indicated that more than 17 million jobs could be created in the renewable energy sector globally by 2030, doubling the size of the workforce in the sector.

Governments should accelerate investment in renewable power generation, flexibility provision, and grid infrastructure. They can achieve it by de-risking private investment through competitive auctions for renewable power generation, enabling investment in transmission and distribution grids, and fast-tracking the planning process on shovel-ready projects.

2. Boost the construction sector with green-buildings and green-infrastructure projects

The construction sector has often been at the forefront of economic recovery plans: while consumer demand is depressed, this sector can be boosted by demand arising from the public sector. Construction also has the double advantage of being labour-intensive and having a knock-on effect on many industry sectors in its supply chain (e.g. equipment manufacturing, steel, aluminium, and cement).

Today, a massive investment plan is needed to revitalize the economy and get people back to work; and where to direct this investment flow should be obvious: US\$50 trillion of investments are required across key energy and energy-using sectors by 2030 to put the global economy on path to low-carbon energy systems. The construction sector can initially be boosted by focusing on energy retrofitting of public buildings, then on retrofitting of commercial and residential buildings, as well as on energy-efficient new builds in urbanizing countries. Beyond buildings, major infrastructure projects focused on new energy networks, low-carbon transport, digital, and urban development would stimulate the economy and improve quality of life in developed and developing countries.

3. Support the automotive sector while pursuing clean air

The automotive sector has been severely hit by the global economic standstill. At the peak of the crisis, sales of passenger cars dropped 40–80 per cent across regions. Sales of EVs have similarly experienced sharp decreases. This sudden stop comes at a critical moment in the deployment of EVs. The cost-competitiveness of EVs versus internal combustion engine vehicles is approaching a tipping point. This tipping point needs to be reached in the 2020s for EVs to dominate two/three-wheelers and car purchases by 2030 and heavy-duty vehicle purchases in the early 2030s. This in turn is essential to reach a full renewal of the fleet by mid-century. But this tipping point will only be reached with learning-curve and economy-of-scale effects driven by ever-increasing EV sales.

In the meantime, the COVID-19 crisis has also had two direct consequences which could lastingly impact urban transport in contradicting ways. On the one hand, several dense cities have experienced large outbreaks. In the near future, many people are likely to have a bias against public transport and prefer private vehicles for their commute. On the other hand, studies have shown that bad air quality may be a vector of transmission of respiratory viruses like SARS and COVID-19 and is associated with higher mortality rates. During lockdown, urban populations have also experienced first-hand what clean air looks like.

In this context, both urban populations and automotive manufacturers would benefit from incentives such as car-scrapping and purchase subsidies, with greater support for electric vehicles and a rapid phase-out of support for internal combustion engine vehicles. Direct financial support to car manufacturers could also be subject to setting a phase-out date for internal combustion engine production (ideally in the early 2030s) and focused on investments needed to shift to electric mobility.

4. Make the next waves of government support to business conditional on climate commitments

Direct economic support to small and medium-sized enterprises and bigger corporate entities will be a lasting feature of recovery packages. Emergency cash injections were initially rightly focused on protecting economic activities and jobs as effectively as possible. But the second and third waves of economic support from governments will be focused on rebuilding national economies. This spending should incentivize the transition to more sustainable and resilient business models and supply chains to strengthen each country's economic fabric ahead of future climate-related shocks.

Climate commitments are not only good for climate, they also increasingly prove to be good for business. Companies that pay particular attention to their social and environmental footprint are likely to be more financially sustainable than the average in the medium term. Over the past 10 years, listed companies with green activities have performed better than fossil fuels stocks; and since the start of the pandemic, ESG (Environmental, Social and Governance) portfolios have withstood the crisis better than conventional portfolios on financial markets.

Lasting government funding – in the form of direct subsidies or other forms of financial support like loan guarantees – should therefore be conditional on clear climate conditionalities. These should focus on medium-term targets so as not to slow recovery. They should include clearly defined decarbonization targets for 2030, in line with an objective of net-zero emissions by 2050, an obligation to disclose climate-related financial risks from 2021, and investment plans demonstrating how new investments will contribute to the companies' emissions-reduction trajectory. In heavy-emitting sectors such as automotive, aviation, and energy-intensive manufacturing, specific commitments could be developed in line with sectoral low-carbon transition requirements.

5. Provide targeted support to innovative low-carbon activities

Innovation in both technologies and business models is a major driver of economic growth. While supporting incumbent businesses, stimulus packages should also continue championing the development and early deployment of innovations which have the potential to drive the competitiveness of national economies over the next decades.

Many of these innovative activities can also contribute to the reduction of greenhouse gas emissions. This is the case for zero-carbon hydrogen production, low-carbon fuels for the shipping and aviation industry, low-carbon materials (like green cement or green steel), circular business models (in particular used materials collection and recycling activities), and digital solutions for system and energy efficiency, among many others.

Government can support these new economic sectors through continued innovation support focusing on early-stage development and industrial-scale deployment, financial support mechanisms such as loan guarantees to de-risk and lower the cost of capital for early deployment, and new regulations like fuels mandates or lifecycle emissions regulations to create demand at scale for new products.

6. Accelerate the transition of the fossil fuels industry

Before the COVID-19 crisis, the rise of electric mobility was already making peak oil in the late 2020s probable, and cheap renewables were squeezing coal assets out of the power market. As the world progresses towards a lower-carbon economy, demand for fossil fuels is going to shrink; oil majors like BP are acknowledging that trend. If that transition is not anticipated, it could result in the creation of significant stranded assets. Fossil fuels players should be encouraged to announce and strengthen their climate ambitions and commitments, reducing emissions in upstream oil and gas production, reducing the carbon-intensity of the fuels they provide to their clients, and growing new low-carbon activities, for instance in the renewable energy, bioenergy, and hydrogen spaces.

For major energy importers, this crisis represents a key opportunity to remove any remaining fossil fuel consumption subsidies, made unnecessary in a period of low prices, and to increase fossil fuel taxes without triggering significant consumer price increases. Those reforms could provide a useful source of fiscal revenues in a period of high countercyclical public spending. For oil- and gas-producing countries and coal-rich economies, fiscal stimulus could usefully be invested in an early phase-out of the least competitive assets, the diversification of their economy, and supportive measures for workers and regions which will be impacted by the transition.



7. Do not let carbon pricing and regulations spiral down

After the global financial crisis of 2008, depressed economic activity resulted in lower carbon prices which persisted for many years, undermining incentives to improve energy efficiency or to adopt new low-carbon technologies. It is essential that such a development is not repeated after this crisis.

Carbon markets have been significantly hit by the COVID-19 crisis. In Europe, smart use of the Market Stability Reserve has absorbed excess allowances, with the effect of supporting market prices in the EU Emission Trading System but the structure of the market means that low economic activity could durably subdue future carbon price levels. Meanwhile, carbon taxes and carbon regulations, which create an implicit carbon price, will play an essential role to keep incentivizing carbon emissions reductions across the globe. Although low-carbon solutions are increasingly cost-competitive in some sectors like power and automotive, significant carbon prices, eventually reaching US\$100 per tonne of CO₂ or more, will be required to drive carbon emissions reduction in some of the harder-to-abate long-distance transport and heavy industry sectors.

In the wake of the COVID-19 crisis, carbon prices and carbon regulations are under renewed attack. Governments should stand firm: stimulating demand across multiple sectors of the economy will be more effective for economic recovery and have more lasting economic effects than deregulation.

Conclusion

The COVID-19 crisis has dramatically demonstrated the unpreparedness of the global economy for systemic risks, despite early warnings from scientists. It also brought the world economy to a near standstill, provoking an abrupt fall in GDP and in international trade. As countries emerge from the crisis, the immediate priority is to prevent a deep and lasting recession. Building a zero-carbon-emissions economy is not an impediment to that economic agenda. On the contrary, clean energy systems can be a driver of short-term job creation as well as a pillar of more resilient long-term economic growth. Governments have the means and the responsibility to simultaneously enhance the health of people and ecosystems, boost economic recovery, and mitigate the risks of future systemic crises.

CAN WE USE THE COVID-19 CRISIS TO MOVE TOWARDS A MORE SUSTAINABLE ECONOMY?

Pedro Linares

The lockdown to which many countries have been subject in order to slow the spread of COVID-19 is having a deep impact on our economies and on the environment, one that most of us are feeling personally. Although it is more difficult to perceive right now, the recovery phase will have an even deeper and more lasting impact. The good news is that, if we make the right decisions, we can make this long-term impact positive. In the middle of the current global tragedy that this virus is bringing, this may provide some hope and help us convert the crisis into an opportunity to achieve a more sustainable economy. This article reflects on the relevance of the short-term impacts, and on how to create a positive long-term impact with the way we conduct the recovery phase.

Short-term impacts and lessons learned

The short-term impacts on the environment are quite irrelevant once put into perspective. The current reduction in mobility (and the corresponding reduction in the demand for oil), and the decrease in the demand for the natural gas and coal that feed our industries and shops is indeed causing a drastic reduction in CO₂ emissions – some put it at 20 per cent of annual emissions – as well as an even more noticeable reduction in urban pollution levels.

However, these will return to their pre-COVID-19 levels once we get back to our normal, or new-normal, lives. One of the major lessons we can draw from this crisis – besides the acknowledgement of the fragility of our societies when confronted with the forces of nature – is the extent of our capacity to affect the environment. Commoner, Holdren and Ehrlich showed us with their [IPAT identity](#) (later particularized to climate change by [Yoichi Kaya](#)) that our impact on the environment can be disaggregated into several explanatory forces: population, affluence, and technology (which in turns determines energy or carbon intensity). Of these, affluence (or economic activity) has been the most important since the 1970s, as shown for example by the [Intergovernmental Panel on Climate Change](#), with technology not yet able to counteract it.

Therefore, when we are able to get back to our jobs and other economic activities, and at least in the short term (until we are able to change our technology), pollutant emissions will climb back again. In cities we may see some positive impacts on the



pollution-induced health damages driven by instantaneous concentrations of pollutants. In the case of CO₂, however, this will be only a minor blip, without a significant change in its concentration in the atmosphere and its impacts on climate.

Can we draw other, more positive lessons from the fight against COVID-19 for the fight against climate change? This seems unlikely. Although some commentators have argued for this, the two problems are too different. COVID-19 is a much closer and more urgent threat right now, and the sacrifices required are expected to be limited in time; climate change still looms far away, and will require permanent changes in the way we live. We seem to be more certain about the impact of our actions on COVID-19, and hence more willing to spend the resources required, than to invest them fighting climate change.

What about the reduction in mobility and consumption imposed by the lockdown? Will we be able to keep some of the good parts when we don't need to? Will we be able to enjoy similar levels of wellbeing without that much mobility and consumption? That will depend on two aspects: how we change our behaviour, and how we direct the investments associated with the recovery phase.

There appears to be little reason for optimism about the change in behaviour. While we may have learned to appreciate the bright side of remote work or videoconferences (if we survive them), many people are likely to return to leisure travel with even more enthusiasm – as occurred after 9-11 – especially while oil prices remain low. If we want to keep the positive changes in behaviour, we will need to reinforce them with monetary signals or even constraints. But we will also need to create an economy that does not depend that much on our behaviour to be sustainable. That means investing in the right economic sectors, and in the right technologies. This is the focus of the second part of the article.

The much-needed transformation of the economy

Getting out of the dramatic economic situation in which many countries have found themselves as a result of lockdown measures will require huge amounts of money, already promised by the European Central Bank and the US Senate – an economic stimulus much larger than the one used in the 2008 financial crisis.

The temptation will be there to use this money for short-term expenses (with immediate electoral returns), and to try to remove any constraints on spending it easily, such as environmental requirements or environmental taxes. But that temptation should be fought earnestly, even more in the current populist-prone political situation. What to do instead?

First, do not spend the money: invest it. And invest it wisely. Because trying to avoid the temptation described above may drive some into throwing the money away into seemingly green, rent-seeking businesses, without actually changing the economic model into one that is less consumerist and more sustainable. One way to invest the money to maximize the chance of achieving a positive, long-term economic impact is described below.

First, it is important to differentiate between the first stage of the stimulus, in which the focus should be on ensuring that the money arrives quickly to households and businesses, and the second stage, in which there is more time to think and plan carefully.

In the first stage there should be few constraints, to ensure speed. But that does not mean that governments should abstain from helping decide how households and firms use the money. In particular, we should make sure that it is not used for the wrong purposes. For example, if we consider bailing out companies, we should make that conditional on sustainable strategies (including for decarbonization). But this has limits: it is unrealistic to expect short-term decarbonization from the airline industry, for example. It doesn't make much sense, either, to bail out sectors which have a short lifetime (those related to coal). But other sectors, such as tourism or car manufacturing, may have a bright future if they are able to develop sustainable business models (e.g. low-impact tourism and electric vehicles).

At this stage we could also profit from the low fuel prices to introduce environmental taxes, which will prevent a rebound effect. This may seem counterintuitive, but the low prices make it possible to introduce the taxes without harming consumers, and the revenue will be much better spent reducing public deficits (instead of sending it to fossil-producing countries).

The second stage is the critical one. This is when we can create the deep, long-lasting impact that may transform our economies in a positive way. To achieve this, we must ensure that we make the right investments in not only physical but also human capital. These investments must meet several requirements:

- They must be compatible with long-term decarbonization strategies or with sustainable-development criteria in general (including the fight against poverty).

- They must create jobs and economic activity within the region that is deploying the funds, in the long term but also in the short term (patience is short).
- They must be made in sectors with future potential, in which the region may be competitive sustainably.
- The projects they support must be shovel-ready.

Renewable energy projects seem to fit this bill. But should we put all our money into them, as some suggest? Probably not. Yes, they do help decarbonize the economy, and they replace expenses in fossil fuels with value-added activities. But they only make sense in this context if the activities (not only building the power plants, but also manufacturing the equipment) take place domestically. Curiously, even when focusing on the energy transition, most of the requests are for building renewables, and fewer for energy efficiency (in which there is arguably less money to make).

It is important to remark that the need to create jobs domestically should not be translated into protectionist measures, but rather, as [Rodrik proposes](#), into investments in local gains that at the same time increase global gains, as happens with green industrial policy. Of course, one could argue that investing overseas might also, in the long term, bring benefits to all economies...but that will take time and suffering along the way, which I consider not to be desirable in these circumstances.

Other investments may also help create jobs and address sustainable development; education and health care are clear examples. Investments in urban planning can also result in better, more liveable cities and can lower environmental impacts.

We must avoid quick and simplistic answers like ‘let’s use the money to accelerate the energy transition’, and instead assess different investment opportunities carefully, considering not only their environmental benefits but also their macroeconomic returns and their speed of implementation. [A recent study](#) surveyed several experts about this, and concluded that investment in renewable energy does indeed look promising, but so does investment in clean technologies research and development. Healthcare and education do not provide that many environmental benefits, but offer a larger macroeconomic return. Money paid directly to households and businesses presents a larger macroeconomic return, with a somewhat negative environmental impact. The choice of where to invest, or how to combine all options into a reasonable portfolio, is therefore a multiple-criteria decision, which needs to be made based on public debate and political consensus.

Sustainability is not only about the environment. It demands a change towards a less consumerist economic model, more respectful of the environment, with a larger share of human and social capital and a more just distribution of resources. The European Green Deal may provide a good roadmap to some of these outcomes, but not necessarily all of them. We also need an intelligent industrial policy, with institutions that promote private–public collaboration and risk-sharing, with constant monitoring and rigorous assessment, and with transparency and public accountability. And we need to open this debate to the wider society, rather than limiting it to interest groups and closed meetings. These decisions will shape the future of our societies, and therefore need to be made collectively, and with enough information.

DRAWING ENERGY TRANSITION LESSONS FROM COVID-19 ON INTERNATIONAL COOPERATION AND INDIVIDUAL BEHAVIOR

Pedro G. Gómez Pensado and Harsh Vijay Singh

The challenge of establishing a unanimous narrative on drivers, priorities, enablers, and destination of the energy transition can be likened to the parable of blind men trying to describe an elephant. Approaches vary across stakeholder groups, disciplines, and countries. Energy transition in general can be defined as an effective and timely transformation of energy systems making progress in the three corners of the energy triangle: energy security and access, economic development and inclusive economic growth, and environmental sustainability. This paper focuses on the environmental sustainability imperative, which requires transition to a lower-emissions system.

The COVID-19 pandemic has proven to be a true ‘black swan’ event, taking the world by surprise. Its cascading effects are being felt across all sectors of the economy, including energy. It has led to unprecedented market volatilities and erosion of demand for energy, particularly oil. However, there are also indications of positive developments. For example, clean energy has gained relevance in discussions on the design of stimulus packages. In some cases, conditionality clauses have been mentioned, including in the aviation sector, which was hit the hardest by the crisis and is one of the hardest sectors to



decarbonize. Public investment in infrastructure and innovation after the 2008 recession was a key driver of energy transition over the past decade, and efforts are on to leverage current economic recovery programs to pursue moonshot ideas that can help unleash the next wave of transformative progress in this space.

Moreover, many key private investors and financiers are actively communicating their intentions to prioritize decisions that decrease their carbon exposure. The share of renewable energy in electricity generation has reached record highs in many economies. In addition, social and economic practices have been forced to evolve as people stayed home to slow the spread of the virus, and consumption patterns during confinement have delivered some immediate benefits, like the return of clear skies and birdsong, which may be a catalyst for long-term transformation.

However, energy transition is not a sprint but a marathon, and quick wins should not be mistaken for structural changes that are likely to persist across time and geographies. The long-term implications of COVID-19 for energy systems remain to be seen. But lessons (including cautionary ones) can be learned from the ways that international cooperation and individual behaviours – two key enablers of the energy transition – have developed during the COVID-19 crisis.

International cooperation

With the rise of globalization, stakeholders at different levels – including governments, businesses, and end consumers, are more connected across countries than ever before. Consequently, challenges with impacts at global scale – such as energy transition, require increasing levels of international cooperation and coordinated action. Key lessons from the COVID-19 response for international efforts on energy transition and climate change include the following.

Coordination challenges

The emerging global consensus on the need for urgent and decisive action on climate change has been a key driver of progress on energy transition. This has been supported by frameworks for global cooperation on pursuing environmental targets, technology transfer, financing, and policy development. However, as the COVID-19 crisis has shown, international collaboration has limits, and there is a pressing need to further strengthen the collaborative frameworks. In the wake of a quickly escalating health emergency, and despite warnings from experts on the need for quick and coordinated international action, the immediate response from countries was uneven in scale and asynchronous in timing. Coordination, not just horizontally across countries but also vertically within countries at different levels of administration, has been challenging, and this has exacerbated the pandemic's healthcare and economic consequences.

This phenomenon is not necessarily new, but it raises important questions regarding the ability of the international community to coalesce and articulate a unified strategy for addressing shared challenges, including the energy transition. Achieving an effective energy transition requires collective action, and that requires policy coordination at global and local levels.

Inward-looking approach

As the health crisis unfolded, many countries were forced to increase their inward-looking focus. This manifested in a number of ways, like the competition in securing supplies of masks, ventilators, and drugs. Moreover, the immediate stimulus measures announced so far, and the longer-term recovery packages under discussion are, not unsurprisingly prioritizing national socio-economic and political agendas. For example, specific allocations to clean energy are not confirmed in the US government's largest-ever stimulus plans; China dropped its energy-efficiency targets in the pursuit of economic recovery; and India recently launched its first-ever auction for commercial mining at coal blocks across the country. Governments have primary accountability to their citizens. Hence, to some extent, responses that focus on national needs rather than international processes are to be expected. However, this may deter the development of an effective response to global concerns.

Of the three key elements of energy transition described above, economic growth and energy security are more in the realm of national priorities, while environmental sustainability is a globally shared concern. This complexity remains at the root of the trade-offs necessary for effective energy transition, and the evidence from the response to COVID-19 suggests that national interests take precedence in crisis situations. It takes years, if not decades, to design effective international processes to address global challenges, establish trust across countries, and persuade top leaders to empower the processes. The reflex of countries to look inwards during a rapidly unfolding crisis can undermine support for international processes, which have been critical for the energy transition.



Impact on emerging economies

Most forecasts indicate that emerging economies will account for an increasing share of energy demand and emissions growth over the next few decades. This will be driven by trends such as rising income levels, urbanization, and industrialization. Bilateral and multilateral agreements, capacity-building programs, technology transfer, and investment from developed economies are key enablers of energy transition in emerging economies. The combination of two factors discussed above – coordinated policy response and a growing focus on national priorities – highlights the underlying challenges in ensuring emerging economies continue timely progress towards energy transition. The implications of climate change mitigation measures for the economic growth of emerging economies has been a contentious issue in global climate negotiations through the years, most recently evident in the impasse at COP 25 (the 2019 UN climate change conference).

There is an emerging consensus on the need to support local economic recovery from COVID-19 through purchase of local products, or imposition of tariffs on imports. Such actions at large scale by consumers in developed countries could impact consumer demand for exports from emerging economies, hitting their bottom lines. Faced with economic headwinds, policy makers and industries in emerging economies can choose to prioritize lower-cost and energy-intensive production mechanisms with shorter-term payoffs, further exacerbating the carbon lock-in. If developed economies are forced to look inward, the priorities and pace of energy transition efforts in emerging economies might shift.

Individual behaviours

Individuals play a critical role in the energy transition, not just as consumers but also as key actors determining the course of policies and private-sector actions. Given the ubiquity of energy consumption for lighting, appliances, and transportation, choices made by end consumers are critical. Behavioural and economic lock-ins – especially on measures relating to energy efficiency, public transportation, responsible consumption, and related issues – have proven challenging to overcome. Recently, there has been a gradual shift in awareness among end consumers, including active participation by the youth demanding fast and decisive action on climate change through widespread protests.

Public response to COVID-19 sheds light on decision-making by individuals, which could also be relevant to energy transition. Trends have been observed in three categories.

Consumer behaviour

The uncertainties of COVID-19's effect on lives and livelihoods have led to abrupt changes in consumer behaviour. Data on potentially longer-term or permanent effects is scarce; however, preliminary analysis suggests that consumers are making more conservative and risk-averse decisions. In other words, when possible, people are saving more and are focusing more on immediate needs. An outlook of potential economic hardship can limit consumers' willingness to pay a premium for environmentally friendly product alternatives and citizens' willingness to support increased taxes to finance green policies. Moreover, since the effects of climate change and the return on green investments are not necessarily felt in the short term, consumers might postpone planned upgrades to more efficient, environmentally friendly appliances or vehicles. Similar effects were observed after the economic recession in 2008, when the 'green consumerism' trend declined as consumers displayed less willingness to pay for products with cheaper substitutes, according to a 2011 [study](#).

Support for collective efforts

Another behavioural pattern emerging from the COVID-19 experience relates to compliance with rules and regulations imposed to control the spread of the pandemic. Although there is only limited data available, it seems that higher levels of compliance were observed among people with the flexibility to work remotely, with the effective economic safety nets in place, and primarily in countries where there is a higher level of trust in public institutions. Support for collective efforts, even in the face of clear and present danger, was uneven for economic reasons (as observed among daily wage workers) and differences in values (as observed in anti-lockdown protests in some countries). This demonstrates the challenge in bringing stakeholders from all sections of society on board for transformations that demand social, economic, and individual concessions and, to some extent, sacrifices. The social fault-lines that have weakened efforts to contain COVID-19 are likely to also challenge the energy transition, which requires a societal effort of a similar magnitude.

Information flow

Misleading information relating to COVID-19 has proven to be as contagious as the pandemic itself, undermining the efficacy of emergency healthcare measures. As the saying goes, a lie can travel halfway around the world before truth can get its boots on, and different communication media have been used to spread falsehoods. The divisive nature of systemic challenges is leading



to disagreement and polarization of public opinion, making it harder to establish a narrative based on consensus of all affected stakeholders. This applies to energy transition too, as multiple narratives can coexist depending on choice of metrics, starting points, timelines, and country-specific priorities. The tools that enable fast and seamless connectivity can be leveraged to advocate for specific narratives, making them self-fulfilling. As decision-makers attempt to forge an inclusive roadmap for energy transition, fact-based, transparent, and consistent communication is necessary to ensure all hands are on deck.

Conclusion

COVID-19 and the energy transition share similar attributes in terms of global scope, exponential spread, their impact on lives and livelihoods, the importance of scientific evidence, and disproportionately severe consequences for less prepared countries and vulnerable populations. An effective response to both COVID and the energy transition requires coordinated and collective action across stakeholder groups. The challenges at hand are complex and quickly evolving, and little if anything can be done to solve them by a single actor in isolation. In both cases, 'flattening the curve' – whether of contagions or emissions – requires an all-hands-on-deck approach, and will require serious effort to change individual behaviours and social practices.

In today's hyper-connected and fast-paced economy, systemic shocks such as COVID-19 can trigger cascading effects at rapid speed, leading to the loss of millions of jobs and the collapse of the global supply chain. Energy transition involves a similar systemic shift, with interlinkages across technological, economic, social, and political systems. Lessons learned from COVID-19 can inform energy transition roadmaps to ensure that we build forward better.

A CLIMATE-CHANGE APPROACH TO COVID-19 AND ITS IMPLICATIONS FOR THE ENERGY TRANSITION

Rolando Fuentes, Marzio Galeotti, Alessandro Lanza, and Baltasar Manzano

This article discusses whether the COVID-19 pandemic can help or hinder the energy transition. It presents an alternative approach to structuring an intricate problem such as COVID-19, drawing on elements from another overarching, yet fairly well-studied problem: climate change. This approach is discussed in detail in [COVID-19 and Climate Change: A Tale of Two Global Problems](#) (Social Science Research Network, 2020). By drawing the links between the pandemic and climate change, the article indirectly links COVID-19 to the energy transition. As argued in [A Road Map to Navigate the Energy Transition](#) (Oxford Institute for Energy Studies, 2019), the transition towards low-carbon energy sources is fundamentally policy led, driven by concerns over climate change. The pandemic has the potential to change the energy transition by transforming the whole economic system via changes in consumers' behaviour and preferences and in government policy.

One of the underlying assumptions of this analysis is that COVID-19 is likely to force a worldwide transition towards a low-contact economy. A key question therefore is whether such an economy will also be a low-carbon economy. While energy is at the heart of the low-carbon economy, in a post-COVID-19 world, proximity or contact-related considerations are likely to determine the organization of the economy and therefore the energy mix.

Viewing COVID-19 through the lens of climate change

COVID-19 and climate change are both global, exponential, and potentially catastrophic. From an economic standpoint, they also share some similar features. One useful way of looking at them is through the concept of public goods, or in this case, a public bad. The two main criteria that distinguish a public good are that it must be non-rivalrous and non-excludable. A good is non-rival in consumption if one person's use does not diminish other's use. A good is non-excludable if a person cannot be prevented from using it. An economic bad is the opposite of an economic good, as its consumption results in lower wellbeing.

In the case Covid-19, the pandemic has the characteristics of a public bad: it is not excludable (the virus is highly contagious) and it is non-rival in consumption (getting the virus does not limit or prevent other people from getting the virus as well), though countries can exclude carriers by shutting borders and imposing quarantines, and individuals can self-quarantine, though these steps are of limited duration and effectiveness. A changing climate is also non-rival in consumption and is costly to exclude countries from, regardless of their actions.

Another similarity is that both climate change and COVID-19 are transboundary, global externalities. Like pollution, COVID-19 originates in one country but can cause damage in another by crossing borders through pathways like water or air (for pollution) and people's movements (for the virus).

There are also important differences. One is irreversibility. There may be thresholds and tipping points which would make climate change irreversible; we cannot re-engineer the climate back to where it was. The COVID-19 pandemic entails some reversibility, with some costs being temporary and others irreversible. While economic damages can be reversed with time, irreversible losses like deaths cannot. Uncertainty, the time frame, and the discount rate treatment are also different, as the impact of Covid-19 is suffered more immediately than the impact of climate change.

The economic characteristics described above have led to similar policy responses. The two main responses, mitigation and adaptation, are implemented with the best current technologies. The objective of mitigation is to delay and reduce unwanted effects, which in both cases is about reducing rates – one of emissions, the other of infections. The objective is to delay stock accumulation and keep it below the absorptive capacity – one of the atmosphere, the other of hospital capacity.

The objective of adaptation is to anticipate adverse effects and take action to prevent or minimize them. For climate change, actions include building more resilient infrastructure, using scarce water resources more efficiently, adapting building codes to future climate conditions and extreme weather events, and building flood defences. Adaptation to COVID-19 can take many forms, too. It may consist, for example, of investing in hospitals, medical equipment, and health infrastructure as well as in facilities that allow social distancing.

Will the low-contact economy also be a low-carbon economy?

COVID-19 is a new phenomenon. As a historical event in the making, it still presents huge uncertainties about how it will unfold and eventually end and what its long-lasting consequences will be. It is not yet possible to identify definitive lessons. However, based on the argument that climate change and COVID-19 share a similar structure, that conceptually their economics are fairly similar, and that policy responses follow the same format, some insights derived from the COVID-19 experience may be relevant to the energy transition. This article adopts a bottom-up approach of individual incentives and behaviour, rather than a top-down sectoral approach.

In a narrow view, the energy transition is the switch from an economic system dependent on specific energy sources and technologies. Historically, a new energy source or technology displaces another because it can produce services that are either cheaper or better (e.g. cleaner, easier, or more flexible).

The pandemic could alter the current energy transition path by transforming the economic system. In this new economy of low contact, the prime objective is to reduce the risk of infection. Therefore, activities that reduce physical interaction, or are otherwise considered safe, will flourish. The energy footprint of each economic activity is independent of how risky it is in terms of COVID-19 infections. This rebalancing of activities would indirectly determine a different pattern of energy consumption, and in that way affect the overall energy mix. While the final outcome in terms of primary energy source is difficult to predict, it is likely that these changes will reinforce a transition towards electrification.

The extent to which this transition takes place would depend to a large extent on the length of the quarantine (and any subsequent quarantines). Under this 'new normal', both work and leisure activities are largely conducted through digital platforms – like Zoom, Netflix, and Amazon – whose energy source is electricity. The nature of the 'new normal' would also depend on whether the pandemic has lasting impacts on the organization of work and leisure and on commuting behaviour. For example, the use of office space now seems highly inefficient. Office work can be at least partially achieved without commuting time, traffic congestion, and transport emissions. If some or most of these temporary adjustments endure after the lockdowns have ended, they will have impacts on domestic electricity loads, oil demand, and emissions.

Longer stays at home affect demand for both electricity and transport. In general, less need for travel diminishes incentives to own a car and consequently demand for oil products. However, less need for travel also reduces the prospects of electric vehicles. Weakening of incentives to buy a car improves prospects for ride sharing, which could be more energy efficient. If this were the case, overall energy consumption would be reduced. However, driving one's own car seems much safer than sharing one, even with careful disinfection between passengers. This could partially offset the weaker incentives for new car purchases. The overall effect on transport-driven oil demand is thus unclear in the absence of government pandemic-recovery policies that can move the transition in one direction or another.

For electricity, the impact of staying at home is at least twofold. First, domestic electricity demand obviously rises as people spend more time at home, refrigerators have to keep more food cool, and home cooling systems are probably less efficient than office systems. If distributed energy resources technologies offer the possibility of reducing domestic bills, there would be an increase in the deployment of these technologies.



Second, there is an increase for home-made goods, since home production avoids interaction and physical contact (see *The Economist*, America rediscovers the joys of vegetable-growing, 20 June 2020). Preferences for home-made electricity might increase too. These two impacts could lead to an increased demand for batteries and storage that would indirectly benefit electric vehicles. A trend towards more electricity consumption is likely, with an increasing share from local sources.

In the aftermath of the coronavirus crisis, there is likely to be a change in preferences that can lead to changes in the structure of demand. As mentioned earlier, the assumption is that economies will adapt first to reduce the risk of contagion by reducing contact and demanding strict hygiene. Low-carbon approaches are likely to be adopted only if they are compatible with the goal of reducing contact. Otherwise, chances are that people will prefer activities with no contagion to activities with no emissions.

This problem can be illustrated with the 'packaging paradox'. Before the pandemic, key concerns with packaging were to reduce waste and preferably to use recyclable material. But with COVID-19, packaging can protect people and keep them healthy, and in that regard its main desirable attribute is material that is easy to clean or inhospitable to germs. Package designs with a single contact point touched by many hands will no longer work. The future of packaging might therefore include personal disposable handlers, which would keep people safe at the expense of increased waste.

Conclusion

Energy transitions have historically occurred at a very slow pace, even when climate change requires expedited action. In contrast, response to the COVID-19 pandemic is happening at an unprecedented speed. This might result in a reorganization of the economy to reduce the risk of contagion. If so, the new organization would have the potential to affect the level of energy consumption and the energy mix. Whether this rapid change is compatible with a zero-emissions economy is unclear, and there is a risk of locking in polluting technologies again. The good news is that the pandemic might accelerate the transition towards electrification, which would be the best energy carrier for the decarbonization of the economy.

COVID-19 AND THE ENERGY TRANSITION

Pedro Antonio Merino Garcia

The COVID-19 pandemic has created both problems and opportunities for the energy transition. This article explores them with a focus on three themes: economic impact and responses, demand for legacy fossil fuels, and geopolitics.

Economic Impact and Responses

The pandemic effectively caused the turning off and rebooting of the global economy, creating an economic shock that will have repercussions, both positive and negative, for the energy transition. With the global economy forecast to shrink around 5 per cent, governments have drawn up unprecedented aid packages to keep businesses and workers afloat. Despite this, the shock has caused mass long-term unemployment and economic damage. The impact on the transition will depend on the duration and severity of the subsequent downturn, but forecasts suggest it will cause the largest-ever fall in energy sector investment.

Lower tax revenues at a time of higher socioeconomic expenditure mean governments theoretically have fewer opportunities to provide the financial incentives needed to accelerate the transition. Given public-sector revenue shortfalls and less abundant liquidity and financing in the private sector, significant numbers of future projects are likely to be placed in jeopardy of delay or cancellation.

In 2020, fewer projects will be completed due to supply-chain delays and lockdown measures. Growth is expected to resume next year as delays work themselves out of the system. But in the longer term, the higher government debt incurred during the pandemic will present lasting risks to investment in the transition. Projects that are not yet financed will have to compete for a much smaller pool of resources, meaning fewer will be approved. This will be particularly detrimental in developing countries, where financing options are limited and governments are more constrained in the implementation of expansive fiscal and monetary policies.

To alleviate this, those who favour accelerating the energy transition are looking to the nations that are considering large stimulus or recovery packages such as Germany. Another example is the EU proposal for a new €750 billion recovery instrument, Next Generation EU. One of the objectives of the Recovery plan is to invest in a green EU and to use the funds to reach the EU objective of climate neutrality.



However, the most pressing need is to address the damage caused by the pandemic and, in addressing that priority, the recovery funds should be used in the most effective way to achieve a return to the pre-pandemic level of employment. This can only be done if we chose the policies with more leverage in terms of creating economic activity and if we avoid mixing objectives that can be detrimental the one for another. In doing so, we could avoid the transitory fall in the global GDP becoming a structural problem; the more time we take in recovering pre-crisis activity level the more structural the crisis will be. We need to speed up the recovery, independently of other considerations which will become more relevant as the economy returns to a 'normal' level of activity. Of course the recovery should be sustainable, but it needs to be strong and sound if we want to achieve sustainability in the long run.

The argument of those advocating an acceleration of the energy transition is that the pandemic arrived at a critical point when companies and governments were facing future-defining decisions on decarbonization strategy. They believe the Recovery packages should be focused on advancing the transition by locking in investments and key technological developments while improving energy security. Doing so would permit the transition to leapfrog steps that might otherwise take years. China (Made in China 2025) and the EU (Next Generation) have already defined the direction their stimulus packages will take, including significant investment in the transition.

Of course stimulus funding must support the energy transition, but only in ways that contribute efficiently to a fast recovery. Subsidizing energy-saving investments in residential buildings contributes to both objectives: speeding the recovery in the construction sector and reducing CO₂ emissions. A government's primary objective is always to serve its citizens, and the stimulus will be required to create and protect jobs, support businesses, protect healthcare infrastructure, and support other essential goals. Under these criteria it is easy to see some investments being at odds with the transition. Examples include Norway granting \$100 billion in tax breaks to its oil industry and the US administration offering financial assistance to distressed oil and gas companies.

Without a strong economic recovery, the global economy also faces a structural oversupply of energy. Investing in new green or not-green energy at this juncture will worsen the imbalance. However, it will make sense to reduce the CO₂ footprint of current activities, for example by promoting carbon capture, utilization, and storage. In other words, accelerating the transition should not slow the recovery or create supply/demand imbalances.

Another important step is to achieve public support for the transition; remember, a modest increase in the carbon tax in France launched the '*gilets jaunes*' movement, which inspired riots. This is also a reason to choose investments that simultaneously benefit both the environment and employment. There is no point in a government subsidizing the import of electric vehicles (EVs) whilst letting its own non-EV car industry close. Car manufacturing is one of the industries with the most jobs at risk due to the pandemic and the related reduction of mobility.

Demand for legacy fuels

Government policy and economic conditions will help determine the supply of transitional (decarbonized) energy, but the demand for legacy fossil fuels will determine if the equation balances.

The oil market has had a roller-coaster ride during the pandemic, with around 30 million barrels per day of crude oil demand temporarily lost at its height. Even a historic cut by OPEC+ and closing of unprofitable production in the US and Canada could not prevent oil prices turning negative.

Demand is expected to rebound as lockdowns ease but is still expected to be down 5–10 million barrels per day at the end of 2020 compared to 2019. Some predict that 2019 may have seen peak oil demand, but most analysts expect oil demand to return to 2019 levels during 2021–2022 and for demand to peak sometime between 2025 and 2035.

Low prices during the pandemic have benefitted the transition by reducing fuel subsidies for gasoline and diesel by countries like Nigeria and India. This enables transitional energy sources to compete on a more equal basis because fossil fuels become relatively more expensive. Reducing subsidies also discourages unnecessary use of gasoline and diesel, helping reduce air pollution and greenhouse gas (GHG) emissions.

But low oil prices also have some negative effects on the energy transition:



- Oil company profits help fund the transition either directly, through investment in technology (e.g. carbon capture, utilization, and storage) and adjacent sectors (e.g. solar), or indirectly via dividend payments that are reinvested in low-carbon energy. Low prices reduce this investment.
- The dominance of oil in road transport, which had never been challenged, is under pressure from EVs for the first time. But lower oil prices reduce the operating cost difference between gasoline/diesel vehicles and EVs, thus making EVs less competitive and reducing the incentive to buy.
- Recessions also slow the renewing of the global vehicle fleet, meaning older, less efficient cars remain operational for longer.

One approach to encouraging the uptake of lower-emissions EVs, used by Germany, is to support their purchase, through subsidies and other means, while taxing the highest-polluting cars. However, these are usually the oldest cars, so increasing pollution taxes unfairly burdens the poorest, who typically own these vehicles.

Even with subsidies, the upfront costs of EVs are nowhere near parity with gasoline vehicles, and EVs are therefore unaffordable for most people. The world's best-selling EV, the Tesla Model 3, costs €49,000 or more in Europe. The electric versions of Europe's best-selling Volkswagen Golf and Renault Clio (Zoe) start at €34,000 and €29,000, respectively, while their gas-driven models start at around €20,000 and €10,000, respectively. Thus, this policy subsidizes the rich, who are less affected by the pandemic, and increases inequality. Therefore, subsidizing EVs may not be the best use of finite resources to reduce emissions, either economically or socially. A more appropriate policy to reduce carbon emissions is to increase subsidies for scrapping old, polluting vehicles.

However, in the longer term, the current low oil prices are not bad news for the transition. Low prices mean less investment in future oil production. The oil market was already expected to be tight during 2022–2025 after reduced investment during the 2014–2016 price crash. Further reductions in investment during 2020–2021 will create an overly tight oil market, potentially creating a price spike, which incentivizes the migration to EVs.

Natural gas, on the other hand, did not suffer as badly as crude oil. US gas production fell as low oil prices shut-in shale wells, reducing the amount of associated gas production. Resulting price increases were limited by the demand destruction caused by COVID-19 lockdowns and falling LNG exports.

US LNG exports to both Europe and Asia became uneconomic, with 125 cargoes expected to be cancelled this summer. Gas prices in Europe and Asia hit record lows as gas demand fell due to warm weather, renewable generation substitution, and high inventory levels. Some analysts are expecting European storage to be filled by August, with prices potentially turning negative.

Prices for gas will likely remain low as more associated gas returns to the market in the US as a result of oil price increases that bring wells back online. Low gas prices will aid demand and make gas an attractive and affordable alternative, helping to reduce emissions mainly through the switch from coal to gas. This will likely lead to more investment in regasification plants and pipelines to bring the gas to market. But low prices will also reduce or delay investment in production and infrastructure such as LNG liquefaction facilities.

In the longer term, gas will remain a fundamental part of the energy mix, particularly as back-up to renewable generation.

Geopolitics

Two major geopolitical events will shape the energy transition moving forward. The first is the result of the US election in November. If President Trump is re-elected, the US will continue to minimize the importance of global warming.

If former Vice President Biden is elected, it could give a significant boost to the transition. The climate emergency will be prioritized through sweeping re-regulation. The new federal government will prioritize reducing GHG emissions, with likely drilling bans on federal lands and waters. There will also be an attempt to reinvigorate the Paris Agreement and stimulate multilateralism to support standards and protocols to improve the energy transition and energy efficiency.

The second variable is US–China relations. Although the two countries are highly interdependent, their relationship was already decoupling pre-virus as China's economic power increased and US hegemonic power declined. The first-phase trade agreement in January seemed to de-escalate some of the tension in the relationship, which had been rising since President Trump was elected in 2016.

The trade agreement provided hope in the early days of the pandemic that it would lead to increased cooperation between Beijing and Washington, as they needed each other more than ever. Their interdependence was clear to see as China needed US money to jump-start its economy while the US needed Chinese-made medical supplies to fight the coronavirus and keep the economy running. It should have been a win-win situation.

Instead, the pandemic created open hostility between the two, accelerating and reinforcing their competition and leaving their capacity for cooperation almost non-existent.

On the US side, the rhetoric is expected to ratchet up further from both sides as election day approaches. But whoever wins the election is unlikely to change the course of Sino-US relations by much. There remains deep bipartisan support in Washington for containing China. The COVID-19 outbreak and the Chinese government's response to the Hong Kong democracy protests have only hardened bipartisan American views towards Beijing.

The latest US strategic approach is to engage with China only selectively. The current administration believes that integrating China into international institutions and trade structures was a mistake – that while the aim was to turn the country into a benign and trustworthy partner through mutual dependence, China has instead used the institutions to gain leverage. In response, the US is working harder to reduce its reliance on Chinese supply chains.

China before President Xi had followed Deng Xiaoping's policy of 'hiding your strength and biding your time.' Xi appears to think that it is China's time to arm its diplomats with a new 'wolf warrior' diplomacy. In this heightened state of aggression, diplomats attack anyone from anywhere who says anything negative about China, particularly regarding the virus.

But both countries should be careful not to fall into a Thucydides Trap – which can arise from the changing dynamics between emerging and established powers. Thucydides, a Greek philosopher, identified two key drivers of the dynamic: the rising power's growing demand for recognition, and the established power's insecurity and determination to defend the status quo.

The past 500 years have seen 16 cases of a rising power attempting to displace a ruling one; 12 ended in war. Although war between China and the US is unlikely due to their interdependence, the tension between them will inevitably lead to other countries being asked to choose a side, in effect starting a new cold war. The US will invoke shared values and military might, while China will use economic vulnerability to find allies.

Despite Trump's more confrontational approach, China would probably prefer him to win the US election. Trump has weakened relationships with traditional US allies through his transactional view that every country cheats the US. His continued unravelling of alliances is seen as a benefit to China's quest for more power, particularly in Asia. Biden would prove a more formidable opponent if he could re-establish relationships and work with allies to present a united front against China.

How will this affect energy? All great powers go to great lengths to guarantee the energy needed to sustain wealth and power and remain competitive in the international system. A cold war will see both China and the US resort to exploiting the resources they control. Although China has made no secret of its determination to dominate green technology, it will turn to its abundant coal resources if threatened, as it did during the recent conflict over tariffs. The US would turn to its most prominent energy resource, natural gas, to try to fuel its competitive advantage. This would in turn slow technological innovation in the context of abundant fossil fuels and reduced competition.

Finally, with China the biggest producer of rare-earth metals and controlling much of the rest of the world's production, the US may decide not to buy from China and to develop its own resources. The US is already following this path through the Onshoring Rare Earth Act, which demands an end to dependence on China for rare-earth metals for defence and high-tech industries. These resources will take time to develop, thus further delaying the transition.

Conclusion

COVID-19 has had a mainly negative effect on the energy transition. Its effects on a reduction of consumption and investments, the decline in fossil fuel prices, and geopolitical dynamics have, at the very least, delayed it. However, the depth of the COVID-19 crises which nobody expected could increase the awareness of the need to fight GHG emissions in the long run. The call is clear: we need to avoid the next catastrophe.



COVID-19: ACCELERATING THE CLEAN-ENERGY TRANSITION

Richard Black

Just 10 years ago, discussion of whether the energy transition could continue while the world's peoples laboured under a global pandemic would have been framed as a question of competing priorities. 'Green' costs money, the argument would have run, and money is tight. The conclusion would likely have been that while the energy transition would continue, its pace and urgency would inevitably be diminished by the uncomfortable clash of desire and reality.

In the UK and other nations of western Europe, the discourse and the conclusions are now of a very different hue. Even at the very top levels of government there is seen to be little conflict between the short-term need to get the economy moving after lockdown and the longer-term imperative to decarbonize; in fact, they are increasingly seen as two sides of the same coin. Now, the question is not whether the pandemic will delay the world's clean-energy transition, but whether the need to 'build back better' will accelerate it.

Acceleration is the likely outcome, driven by four mutually reinforcing factors – changes to the global energy system that predated the pandemic, pandemic-driven changes to the investment climate, recovery priorities that mesh well with clean-energy goals, and growing public support, especially in Europe.

A changing energy landscape

Over the last decade, vast swathes of the world's energy landscape have changed. Exhibit A is the tumbling cost of renewable energy and the now-inevitable demise of coal. This is complemented by the fact that many nations now generate a major slice of their electricity (up to 60 per cent in the case of Denmark) from variable renewables, and do so at reasonable cost with no sign of the power cuts that doubters insisted would inevitably follow such wind and solar abandon.

The hollowing out of the traditional energy system is being amplified by renewables now progressively undercutting gas generation as well as coal, reduced support for gas as a transition fuel, utilities procuring battery storage instead of backup gas generators, and the failure of the nuclear industry to remotely match up to renewables in terms of price and build rate. Storage is being followed quickly by electric vehicles, with almost every transport analyst now acknowledging that the end of the internal combustion engine is inevitable, and the most bullish projecting that all cars purchased will be electric within six years.

It is worth reflecting on just how wrong the climate and energy contrarians, who once warned of societal oblivion if humanity weaned itself off fossil fuels, have proven to be. The clean-energy transition has not led industry to flee to less discerning corners of the world; the denizens of western Europe have not grown materially poor by endeavouring to become renewables-rich; and the lights have stubbornly stayed on.

Changing investment priorities

As these energy trends have developed, business and investment appetites have changed. One of the most remarkable aspects of current UK discourse on 'building back better' is the almost universal support among business organizations and lobbyists – for example, the Confederation of British Industry, EnergyUK, the energy utility SSE, and the National Farmers' Union – for a 'green' recovery.

Hence the second key factor behind the likely acceleration of the clean-energy transition is money – more precisely, the places where investors want to deposit it. In straitened, uncertain times – a category into which the COVID-19 pandemic period decidedly falls – money eschews risk for security. Now, in contrast to the post-crash environment of 2009, fossil fuels look risky while 'clean' energy looks safe. In many countries, to invest in solar or wind power is virtually to guarantee single-digit returns for up to 25 years: not highly attractive for high-stakes investors, but perfect as a foundation for risk-averse vehicles such as pension funds. As Lord Adair Turner and others have suggested, the attractiveness redoubles at a time when sovereign governments are offering bonds at negative interest rates, and finding takers.

Meanwhile, while owners of extant fossil fuel resources will generally seek to maintain those resources through the COVID-19 crisis and into the anticipated recovery, incentives to invest in replenishing the global stock of operating mines and wells as existing ones deplete are virtually non-existent. The demise of coal as a serious global fuel is already assured, with the only real attempts at investment coming from national governments such as India's and China's which are seeking to prop up domestic production at the expense of imports. COVID-19 is pushing oil towards the same fate, with some analysts arguing that 2019 may prove to have been the year of peak global consumption.

Whether such forecasts turn out to be precisely correct or not is beside the point. What matters in terms of the impact on the global energy transition is how the possibility of them being correct steers investment. Already CEOs such as BP's Bernard Loomey are acknowledging that oil companies were already in transition before COVID-19 struck and will be in faster transition as a result of the virus. In fact, it is hard to envisage a single oil (let alone coal) company that will not find COVID-19 accelerating the end of its business model, with only a number of carbon-states able to buck the trend by extending the life of their industries for reasons other than good economics.

Convergence of economic-recovery and clean-energy priorities

In recent months, as the scale of COVID-19's economic disruption became clear, a vast array of academic institutions, business groups, think tanks, and others have turned this mass of real-world experience into reports and analyses advising that governments can and should 'build back better'. In part the analyses have drawn on experience gained through rebuilding after the 2008/2009 crash, when a few governments, notably the US under President Barack Obama, did invest public money along 'green' lines, producing data on job creation that has acquired contemporary relevance.

The consistency of argument has been remarkable, with little if any support for 'building back exactly the same' – even though it is equally clear that this is what many companies in high-carbon sectors such as oil and gas, coal, automotive manufacturing and aviation have been lobbying for. In a few cases, such as in the UK with the Committee on Climate Change, statutory advisors have been able to fold existing analyses in with their own and submit them as official recommendations to government, which carries additional weight.

This support for focusing investment in clean energy is reinforced by the fact that its proponents were able to win the battle of ideas on grounds not directly concerned with climate change and the case for emission cuts. Instead, 'go for clean' beat 'stick with dirty' on issues far closer to the heart of the immediate problem – near-term job creation, near-term return on investment, and the need to spend now-scarce public money prudently. And the arguments were made convincingly – with the UK research organization Vivid Economics, for example, showing that every £1 invested in energy efficiency returns £3–8 to the local economy; the Energy Transitions Commission flagging up the rationale for governments making adherence to Task Force on Climate-related Financial Disclosures processes a precondition for bailouts; and the Energy and Climate Intelligence Unit showing that in the UK context, home energy efficiency upgrades have the biggest potential for job creation in areas where there is the greatest need. Thus the evidence shows that at least some 'green' measures are among the most effective for job creation and job retention – a marked change, again, from the situation a decade ago.

Growing public support for clean energy

The fourth factor is the public mood. While no opinion survey can truly capture where the global public stands along the axis from 'building back better' to returning to the status-quo-before-COVID-19, an Ipsos-MORI poll conducted in 16 nations in May found that citizens in all those nations expect their governments to prioritize environmental concerns as they build back. Altogether about three in four poll participants expressed this view, rising to 91 per cent in China.

In many countries there are indications that the public will not stand for governments throwing their money at companies such as airlines and oil majors that are perceived to do very nicely when times are good but to come running cap in hand in more difficult circumstances. Although this may partially have its roots in distrust of elites, it appears to speak also to the substantial public majorities supporting action on climate change.

This is so far a largely European phenomenon – of necessity, because Europe has been quicker than most regions to control the spread of coronavirus and implement economic support measures. It will be interesting to see how the global picture unfolds, particularly in nations such as Brazil, where President Jair Bolsonaro has based his populist posture on dismissal of science as it concerns both climate change and COVID-19.

But in Europe, the public clearly does not want to go back to business as usual. For example, a recent UK survey commissioned by the Conservative Environment Network found around 70 per cent of the public supporting rebuilding efforts that incorporate decarbonizing measures such as home energy retrofits. About the same proportion said that if government failed to initiate such a programme, they would see it as a sign that ministers were not listening to them. This is noteworthy in that it not only demonstrates that taxpayers want to see their money spent on decarbonization, but also raises the possibility that the British public would see failure to tackle climate change as elite and out of touch. Equally noteworthy was the conclusion of the French Citizens' Assembly on climate change, which produced 149 recommendations on decarbonization in areas ranging from homes and diets to taxation and constitutional change, and did so while coronavirus raged around it.



This has not come about because of a Damascene conversion to acceptance of the evidence on climate change and commitment to its solution. Awareness and support have been rising year by year and heatwave by heatwave. Rather, the coronavirus pandemic seems to have inspired a greater public focus on clean-energy concerns, for a range of reasons that may include renewed appreciation for clean air and nature, distrust of big business, and the idea that as governments are inevitably going to spend previously unimaginable sums of money supporting jobs and businesses, they might as well spend it in ways that deliver other goals simultaneously.

Conclusion

On its own, none of the four factors discussed above would have been enough for COVID-19 to accelerate progress towards the low-carbon future. Collectively, however, they can have a powerful impact – not in every sector (it is hard, for example, to argue that they will drive a global uptake of carbon capture), and not in states whose economic interests are heavily dependent on fossil fuel exploitation – but enough to make a real difference.

The issue cannot be judged, as some would, simply by how ‘green’ governments make their recovery packages – still less by how much public money they put into the ‘better’ element of ‘building back better’. The effect is far more subtle than that, and the interplays between factors more nuanced.

And all of the trends discussed in this article will be modified as the pandemic and its aftermath play out – not least because current expectations about beginning to recover from the pandemic within a few months are likely to prove wildly unrealistic. Much of Europe may be through the pandemic’s intense initial phase, but most of the wider world is not; and the trends shaping investment, public opinion, and government spending may play out over far longer timescales than is often assumed in politicians’ speeches and media coverage.

Meanwhile, as science discovers more about how this virus spreads, it is possible that the virus itself may come to be seen through an emissions lens. There is evidence that air pollution makes infection more likely and more serious; a significant number of recent outbreaks are associated with meat packing and distribution. Confirmation of either trend would provide new arguments and, one must assume, further movement of public opinion in favour of low-carbon measures, such as outlawing petrol and diesel cars, or raising less livestock.

Christiana Figueres’s climate change campaign Mission2020 argues that a transition away from fossil fuels by mid-century is ‘necessary, desirable and feasible’. The climate change impacts that make it necessary are still present, largely unchanged by the coronavirus. The recent taste of clean air, the jobs reboot, and a renewed need to invest money prudently are all increasing the transition’s desirability. And the willingness of governments to open their coffers for COVID-19 has proven, in case anyone seriously had their doubts, that swiftly combatting a global emergency is absolutely feasible.

COVID-19 AND THE END OF THE COMBUSTION ENGINE ERA

William Todts

It is said that crises are great accelerators; that appears to be the case for COVID-19. The world didn’t go digital in March 2020; it had been going digital for 30 years, but when it comes to teleworking and digital meetings, things will never be the same again. Similarly, European and American attitudes to dependence on China had been changing for many years. But COVID-19 has given massive impetus to calls for strategic autonomy. The same can be said of oil demand in the transport sector: the beginnings of tremendous change were already apparent, but COVID-19 will accelerate those trends and make them irreversible.

The most important and immediate factor impacting oil demand is the state of the global economy. The health crisis and ensuing lockdowns have triggered a major economic recession. The return of the virus in the US, European cities, and other parts of the world suggests there will not be a quick, V-shaped, return to ‘normalcy’. By the time the economy returns to pre-crisis growth levels, and this may take several years, a number of developments will have started to eat away at oil demand growth, bringing forward peak oil demand. The main battlefields will be cities, the automotive sector, and aviation.

Cities across Europe are taking radical action to promote walking and cycling and limit car traffic. Over a thousand kilometres of new cycling lanes have been announced, half already rideable, the rest in preparation. Cities like Brussels and London have also created new low-traffic or fully car-free zones. Those measures are supposedly temporary, but are likely to be prolonged and expanded, as this was the direction that cities wanted to take even before COVID-19.

The rationale for immediate action is compelling. Governments are asking people to keep a safe distance and avoid public transport. Meanwhile, millions of employees are working from home. This means that for the first time in ages there is actually free road space, and summer holidays are prolonging that period. But this won't last: cars or cyclists will occupy available road space. For mayors, the choice is simple: three in four Europeans polled across 21 cities demanded protection against air pollution, even if it requires giving more public space to walking, cycling, and public transport. This was also borne out in recent elections; for example, in France Paris, Bordeaux, Lyon, and Strasbourg just voted in Green city council majorities.

What will this mean for oil demand? The direct impacts will probably remain limited. According to the European Commission, urban mobility accounts for roughly 40 per cent of road transport CO₂. In reality, only a small part of that comes from driving in dense inner cities. In Ghent, a Belgian city that introduced a radical circulation plan in 2018, rush-hour traffic levels in the inner city fell by nearly 40 per cent, whilst ring road traffic remained roughly constant. In Copenhagen, Europe's leading cycling city, car traffic declined by just 3 per cent between 2005 and 2015. In Amsterdam, kilometres driven by urbanites fell by more than 10 per cent in that same period. Even if road traffic across all European city agglomerations were cut by 10 per cent over the next decade, car fuel use in Europe would only drop by a few percentage points.

The indirect effects, however, could be much greater. Whilst most of the talk focuses on cycling lanes and green spaces, cities are quietly preparing to close their gates to polluting cars. Brussels, Amsterdam, London, and Paris have already announced that they will gradually introduce bans on cars with internal combustion engines. Hundreds of European cities have low-emission zones designed to push out dirty vehicles and promote clean vehicles, which increasingly means zero-emission (hydrogen and electric) vehicles. Cities are starting to force taxis, ride-hailing services, and buses to go electric. A seldom-mentioned effect of this is that it forces local administrations to develop capacity and expertise to deal with the key enabler of a zero-emission future: charging infrastructure and grids.

It is impossible to properly quantify the impact of these policies, as the knock-on effects are much more important than the direct effects. But that it will be significant is clear. The Dieselgate scandal was a massive shock but did not initially lead to a reduction in diesel car sales. It was only when Paris and a host of German cities announced that diesel cars were no longer welcome that diesel's market share started to drop from over 50 per cent to below 30 per cent. That's because almost everyone buying a car in Europe will at some point drive into one of Europe's major cities.

The developments in cities will play into a second big trend: electrification.

Before COVID-19 brought the economy to a halt, the electric vehicle (EV) market in Europe was booming. This is a result of the EU car CO₂ rules, as 95 per cent of cars sold throughout 2020 have to produce emissions of on average less than 95 g CO₂/km. In Germany and France, sales of EVs in March hit record highs; EU EV sales were 8 per cent of total car sales between January and May. Despite waiting until the last possible moment to shift their strategy, almost all carmakers are on track to meet their 2020 car CO₂ targets.

It is no surprise that one of the first Volkswagen factories to reopen is the Zwickau plant, where the landmark Volkswagen EV, the ID.3, is manufactured. Across Europe carmakers have invested €60 billion in emobility and EV supply chains in 2019. Around 3.5 million EVs are set to be produced in Europe in 2020–2021, and a dozen battery gigafactories will be operational by 2023.

Rather than suffering from the crisis, emobility has gotten further impetus through recent government stimulus packages. The German recovery plan will inject billions in recharging, EV purchase aids, and battery and EV production. The French and Spanish plans are less targeted – they also support conventional vehicles – but still present a significant injection of public money into EU mobility. The EU's €750 billion recovery plan is expected to add many more billions to this.

The current EU car CO₂ law would require 30–40 per cent of new vehicles to be electric in 2030. This is expected to cut oil demand by 11 per cent. But given how much we have advanced in the last two years, it is not unreasonable to require a significant acceleration from 2025. Whether or not that will happen will be decided when the EU updates its car CO₂ law in 2021.

Equally significant is the fact that whilst the public debate is focused on purchase incentives for private buyers, the part of the car market where electrification is really taking off is the company car market. Germany just lowered taxes on electric company cars and opened up the system to Tesla, now also made in Germany. The UK introduced a generous benefit-in-kind regime for EVs, and Belgium is considering a plan for all company cars to be electric by 2025. This market represents over half of new



vehicles sold, and company cars are driven almost twice as many kilometres as private cars. A rapid shift towards EVs in the company car market could cut oil demand by up to 24 per cent in 2030 – leading to higher savings per EV, because company cars drive more kilometres.

At first sight, the picture for trucks is very different. Whilst most of Europe was under lockdown, its truckers kept delivering goods. Online sales and deliveries did extremely well, and it is clear that at least in that respect, COVID-19 is a watershed moment. There also appears to be no immediate momentum for alternatively fuelled trucks. Trucking is oil's most reliable bulwark – or at least, that is the conventional wisdom.

But conventional wisdom is often wrong. In 2015, the conventional wisdom was that EVs were good for urban hipsters and rich Californians but not serious businesses. To people paying attention to technology, it was clear that change was coming. Dieselgate was a catalyst in Europe; but in fact, the rise of EVs is the result of better and cheaper technology, driven by industrial policy established by China and California.

At €133/kWh, battery electric trucks capable of driving 500 kilometres can be cost-competitive with diesel trucks; and thanks to some recent tweaks to EU laws, there will be no weight penalty. Meanwhile, \$133/kWh batteries are close, and 60 per cent of road freight travels less than 500 kilometres, with lots of return-to-base operations where charging can be done overnight. This is a huge market opportunity. For now, traditional truck manufacturers don't seem keen to compete with their own product (diesel), but it wouldn't be the first time they are forced to follow where a Californian upstart leads.

And this time there is another US upstart: Nikola. Valued at €20 billion and buoyed by partnerships with Iveco, Siemens, and other big names, Nikola promises hydrogen trucks with better performance than diesel trucks but a positive total cost of ownership. With the European Commission, Germany, and other countries ready to spend big, this may actually be hydrogen's moment.

So competition for diesel trucks is coming; 2025, when the first EU truck CO₂ standard kicks in, is likely to be a turning point. How big an impact will that have on oil demand? The rise of electric and hydrogen trucks probably won't lead to a significant drop in demand in the short run. But combined with improved fuel efficiency, fuel demand for trucks is likely to drop 9 per cent by 2030. Beyond 2030, things could start to accelerate. California just announced that it will require 40 per cent of truck sales to be zero-emission tractor-trailer trucks, by 2032. Once battery production is up to scale and batteries are no longer scarce, e-trucks will make an impact on the trucking industry and start cutting oil demand rapidly.

For that other bulwark of oil demand growth, aviation, the short-term impacts of COVID-19 are staggering. Air travel has been cut by up to 80 per cent, and airlines need over 30 billion euros in public bailouts simply to survive the coming months. Analysts expect the sector will only return to pre-COVID-19 passenger numbers after 2023. But return it will. After oil shocks, the Gulf War, the SARS epidemic, 9/11, and the financial crisis, aviation always returned to growth. What kind of sector will re-emerge this time is not clear. Businesses and governments across the world have adapted to teleworking at record speed. Zoom, Skype, Teams, and other video-conferencing facilities have proven remarkably effective. Given all the pressure that aviation was under before COVID-19, it is hard to imagine companies and governments will not (voluntarily or otherwise) rethink their travel policies, which may have a significant long-term impact on the economics of the sector in Europe.

Airport expansion plans are also likely to be put on hold and after the industry got a 30-plus billion euro bailout, it may be harder to resist calls for it to be taxed like any other industry. At the same time, the EU is considering the world's first advanced fuels mandate for aviation. Blending numbers will be single digits initially but offer the first credible non-fossil alternative to kerosene. So whilst this crisis may not lead to peak aviation demand globally, aviation's long-term growth potential does appear to have declined in Europe.

It is likely that this combination of factors will bring forward peak oil demand. This would likely lead to lower oil prices, eroding the profitability of the sector and cutting the revenues of oil-producing countries. Stagnating or declining demand will also make it harder to control the oil price. The recent OPEC+ attempt to shore up the price shows the limitations of cartel practice in a market where demand is falling. Keeping barrels in the ground will become even less attractive for oil producers if the long-term outlook is declining demand. Cheap oil could lead to a rebound effect through cheaper transport fuels. But since China, India, and Europe have fuel economy standards, the impact of this is chiefly going to be on kilometres travelled, not new vehicle choices. Also, consistently low oil prices would create more space for governments to levy higher fuel and carbon taxes, which in times of budgetary pressures they are almost certain to pursue.



This is not just a European story. China, India, Europe, and to some extent the US do have something in common. They are all major oil importers and are all vulnerable to higher oil costs and price volatility. In different manners and varying levels of intensity (e.g. California vs the US federal government), all are pursuing climate policies that seek to reduce oil consumption in road transport. And since the main driver for lower oil demand will be technology (i.e. the cost and performance of EVs), a breakthrough in Europe, California, or China – and we're right in the middle of exactly that – will in fact spell the beginning of the end for internal combustion engine vehicles and oil producers globally.

COVID-19: GLIMPSES OF THE ENERGY FUTURE?

Malcolm Keay and David Robinson

The question mark in the title of this article is deliberate. The authors have not set out to demonstrate that the impact of Covid-19 on the energy sector is necessarily a harbinger of things to come. Rather, the article presents a question: if COVID-19 does indeed offer a glimpse of the future, as seems possible, what conclusions should energy companies draw about their strategies and business models?

The first section looks at some of the ways in which the impact of COVID-19 could provide insights into a future decarbonized energy sector. It lists a number of features of the energy scene since the start of the lockdown period which seem consistent with forecasts for the longer term in many climate scenarios.

The second section looks in more detail at electricity, which is further down the road to decarbonization than other energy sectors. It examines the changes arising from decarbonization measures, in many cases accelerated by COVID-19. These changes have altered most of the fundamental characteristics of the industry, turning it 'upside down'. Recent experience has accelerated the trends, providing some useful (and perhaps unexpected) lessons for the future.

The third section brings together elements from the first two sections to indicate what sorts of change could be in the cards in relation to oil and gas and what they might imply for industry strategies and business models.

Glimpses of the future

During the COVID-19 epidemic, the world has witnessed changes which are consistent with developments that have been widely forecast for 2030 and beyond. For instance:

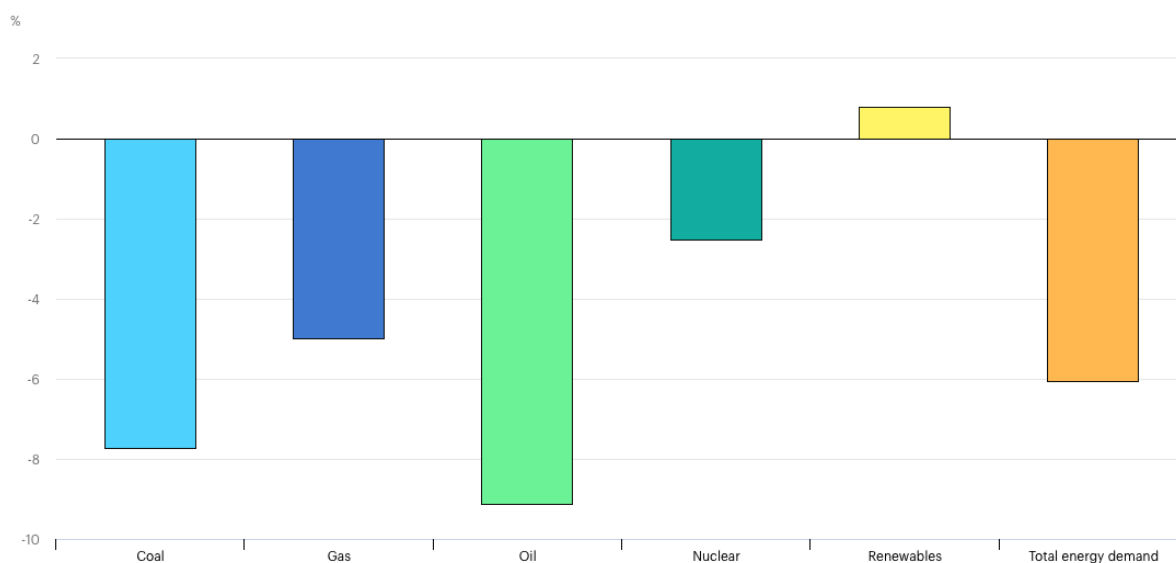
- Global energy demand fell by 3.6 per cent in the first quarter of 2020, and the International Energy Agency forecast a decline of about 6 per cent in 2020, equivalent to the increase of the last five years.
- Global coal demand fell by 8 per cent in the first quarter of 2020, due to falling demand in the power and industrial sectors and substitution by natural gas and renewables in the power sector.
- Global oil demand was down by about 5 per cent in the first quarter of 2020, reflecting travel restrictions and a decline in shipping. The International Energy Agency expects global oil demand to fall by 9.3 million barrels a day this year, equivalent to almost a decade of growth.
- There has been a shift towards electricity, especially in residential use. Electricity demand has fallen by much less than demand for other types of energy, due to increasing residential consumption – matching a shift seen in many decarbonization scenarios.
- Renewables have provided an increasing share of energy generation, while base-load operations have declined. Renewable energy generation increased by 1.5 per cent, while generation from other sources fell.
- Absorbing renewables has presented major challenges. Rising renewable output and lower demand have caused problems for many systems. In California, for instance, for the first quarter of 2020, renewable curtailments were twice as high as in the first quarter of 2019.
- Falling and negative wholesale electricity prices have coincided with rising final tariffs. Lower demand and rising renewable output is driving wholesale prices down, while negative prices have become more common as generators have to be paid to reduce output in the face of low and inflexible demand. In a small number of cases, consumers have been able to enjoy these negative prices; more commonly, final tariffs are rising or will rise. In Germany, for instance,

network charges (per kWh) increased to recover fixed costs from lower throughput, renewable subsidies rose with higher renewable output, and balancing charges increased.

- Confinement at home has significantly increased consumer use of the internet for work from home, online shopping, and communications. The accelerated digitalization of society is consistent with an increase in the potential for more active consumer participation in the power sector, especially with the support of aggregators and energy communities, and, more widely, with the increase in telework and reduction in business and leisure travel.

Experience during COVID-19 has thus introduced and tested new patterns of energy demand and supply in line with those that have been widely predicted for a more distant future. It is reasonable to ask what the implications of these changes are for policymakers and companies in the energy sector.

Projected changes in primary energy demand by fuel in 2020 relative to 2019



Source: International Energy Agency, [Global Energy Review 2020](#).

Electricity

In recent years, the Oxford Institute for Energy Studies (OIES) has researched and analysed the changes under way in the electricity industry. These have been driven by two main forces: the increasing penetration of intermittent renewable sources, in response to climate change measures and declining cost; and developments in information technology, which have transformed the industry's capacity to control, monitor, and coordinate different sources and activities. Together these developments have fundamentally changed the nature and operations of the sector, turning it 'upside down'. The table below summarizes the ways in which the industry of the future is likely to differ.

Projected changes to the electricity industry

	2020	Future
Cost structure	Mainly marginal	Mainly capital
Generation structure	Mainly centralized	Decentralized
Pricing	kWh	?
Planning and operation	Flexible supply to match demand	Flexible demand to match supply
Control and dispatch	From centre	Throughout system (internet)
Role of demand side	Passive	Interactive
Role of grids	Neutral conduit	Smart player

To a significant extent the glimpses discussed above have provided a preview of this future system – for instance, in the UK, in the first quarter of 2020, generation from renewables exceeded that from fossil fuels for the first time. With the still significant nuclear component, that meant that the dominant element in the cost structure of generation was capital rather than marginal cost, and that the flexibility of generation diminished substantially. Meanwhile, generation from decentralized sources has grown – for instance, output of solar power (mainly decentralized) at its peak on 20 April 2020 met around 30 per cent of UK demand, a record. At times intermittent renewables as a whole have reached 60 per cent or more of generation. During the weekend of 23–24 May, renewable generation in the UK amounted to 73 per cent of the total, while, not coincidentally, carbon intensity reached the lowest level recorded, at 46g/kWh – well below the target for 2030 and a reduction of over 90 per cent compared with the 1990 baseline. Changes on the supply side are capable of meeting even very ambitious carbon targets.

But there have also been challenges. Renewables output has been volatile – for instance, during the week commencing 4 May, wind averaged 9.2 per cent of the generation mix for the first six days of the week before jumping to 41 per cent on 10 May. In short – in line with expectations for the future – the system has been much less carbon intensive, but it has also had to adapt much more rapidly and flexibly than in the past and without the tools it used to rely on.

It may prove helpful that the future has arrived more quickly than expected (even if only temporarily). In the process, we may be able to learn some practical lessons which, while consistent with the general trends above, were not necessarily obvious in advance. For instance:

- Role of nuclear** – Many industry observers have seen decarbonization as paving the way for a nuclear renaissance, arguing that no other source can provide large quantities of secure, carbon-free baseload power. But experience in 2020 suggests that nuclear may not be such a good fit in a decarbonized system – the concept of ‘baseload’ is becoming less relevant, and large quantities of inflexible generation are proving more of a problem than a solution in a renewables-dominated system. An agreement reached this spring between the UK System Operator and EDF Energy to reduce output from the 1.2GW Sizewell B nuclear power station was one illustration of the problem. If nuclear is to have a role in the low-carbon future, it may have to be by providing flexibility rather than baseload power. Indeed, in France, this seems to be happening already – the French system operator has described itself as acting like ‘permanent acrobats’. The design and operation of any new nuclear plants may need to be based on their acrobatic abilities.
- Role of the demand side** – Although overall energy demand has seen the big shifts described above, electricity demand has in fact changed relatively little (at least in terms of the scale of the changes needed to make a significant contribution to decarbonization), and its role may need to be rethought. Traditionally, the demand side has been seen as passive and the main policy focus has been on energy efficiency. Even in relation to ‘demand response’, most attention has been on shifting consumption away from times of peak demand. But recent experience has created a new focus on peak supply and the need to find efficient ways of increasing demand to match it (e.g. by filling storage). However, the instruments for doing so remain rudimentary – negative wholesale prices rarely get through to consumers (and sometimes not even to generators sheltered by renewable support schemes). They have been supplemented by ad hoc instruments, like the UK System Operator’s Optional Downward Flexibility Management service, to encourage large users and generators to increase demand or reduce generation during low-demand periods, but these remain marginal elements. In the longer term, more fundamental market reforms will likely be needed to encourage active consumer participation, for example as outlined in a 2017 OIES proposal for a [‘two market’ model](#).
- Platforms** – The old model of electricity supply was straightforward: electricity flowed from a central generating unit, through transmission and distribution systems, to the consumer. Now the picture is much more complicated. Not only are consumers increasingly active participants via flexible demand, they may also be producers themselves (e.g. via rooftop solar panels), and their demand patterns may be more complex (e.g. for electric vehicles), while more real-time information about their consumption is available via smart meters. Meanwhile, a host of other sources (e.g. decentralized generation, storage, and community energy systems) also need to be coordinated. Future business models may depend on the effectiveness of a company’s platforms for integrating all the sources in real time (just as Uber, which is essentially a platform, has revolutionized the car hire business). Two recent developments may illustrate this: in March 2020, Octopus Energy announced a partnership with E.ON in the UK to migrate about 6 million customers to its Kraken platform over the next two years; and in May, Origin Energy, one of the three big Australian suppliers, acquired a 20 per cent stake in Octopus Energy, reportedly attracted by its platform. When these rollouts are complete, some 17 million customers will be on the Kraken system.



The changes in electricity brought about by the COVID-19 lockdown are providing not only glimpses of what a decarbonized energy future might look like, but also some useful practical lessons on how businesses and consumers might need to respond. The key message is that while new technologies are needed to lower carbon emissions, they are not the end of the story. Their effect is to change the whole underlying system's operation and dynamics. For companies in the sector, developing new lower-carbon products is not enough. They must reappraise their role in the context of the new system dynamics and may need a fundamental change in their business models.

Oil and gas

This key message also applies to oil and gas companies facing a decarbonized future. The energy transition will require new ways of thinking, and new business models. In transport and heating, as in electricity, the energy transition will not be simply a matter of replacing fossil sources with renewables; companies will need to consider the dynamics of the prospective new system and their role in it.

In transport and heat, as in electricity, technology change will of course be required as a first step, probably to a mixture of electricity and hydrogen. But either approach leads to a completely new set of system requirements. For instance, electric vehicles would be an active part of the complex new electricity system described above – a key source of short-term storage and flexibility. Government policy and corporate strategy for energy and transport companies will have to change to reflect the nature of the new business.

The new platforms described above, which may be a key source of competitive advantage, will also help to link the transport and electricity sectors. In this new world, companies will need to think about the energy system as a whole, not just particular sectors like transport or heat.

While electrification will be one key vector for decarbonizing transport, buildings, and some industrial sectors, it will also need to be integrated with a range of non-electric technologies, including decarbonized gases, thermal water storage, wastewater heating and cooling systems, and more. Downstream, energy system platforms will assist in the optimization of all energy services, not just electricity.

Upstream, energy system thinking is also important – perhaps particularly for hydrogen, because the economics almost certainly require combining multiple end-product markets for hydrogen in multiple countries, which in turn requires coordination of infrastructure both between and within countries. For instance, in June 2020 Repsol announced a project combining green hydrogen from electrolysis with CO₂ to manufacture net-zero emissions transportation fuels. Projects like Repsol's, linking electricity, hydrogen, and transport, may be the norm rather than the exception in future; companies will need the skills and expertise to prosper in this complex new world.

Conclusion

COVID-19 offers an early glimpse of what most long-term forecasts anticipate for the energy sector: declining demand for fossil fuels, increasing shares of electricity in final energy markets, growing residential electricity consumption and consumer participation, and the need for flexibility to cope with high penetration of intermittent renewable energy sources. We cannot know how quickly this future will arrive, but the COVID-19 crisis is foreshadowing some of the new challenges and opportunities and should be used by companies to reflect on their own strategies.

Electricity companies have already had 10 years to adapt to an industry turned upside down and have had to develop new business models. Very few of them anticipated the enormous scale of the changes, and it remains to be seen how many will succeed in the new business environment. Oil and gas companies have not yet had to face the full force of this kind of systemic change; most companies argue that they will have time to adapt, using revenues from existing businesses to make the needed adjustments. COVID-19 may be a useful wake-up call. If there is one message, especially noticeable from the experience of the power sector, it is that the energy business has changed: it is no longer about selling oil, gas, and electricity and gradually changing to a lower-carbon mix. We are entering a new paradigm where bottom-up (technology and economics) and top-down (political) pressures are moving in the same direction, towards the need for integrated, fully decarbonized energy systems, where consumer decisions are especially important. Corporate strategy for all energy companies needs to reflect this emerging new paradigm.

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A CLEAN AND RESILIENT ELECTRICITY SECTOR FOR A POST-COVID RECOVERY

Carlo Papa, Giuseppe Montesano, Nicolò Sartori, Carlo Napoli and Mirko Armiento

The COVID-19 pandemic is already having and will continue to have a dramatic influence on global, regional, and national pathways towards development, including the move to a more sustainable, resilient, and affordable energy sector. A key aspect that has emerged from the pandemic – though not necessarily a much debated one – is the importance of infrastructure and technology to secure the continuity and progress of our economies and societies. The availability and resilience of communication infrastructure and digital services allowed many people to continue working from home, students to continue attending classes, families and friends to remain in touch, and customers to order food and other essential supplies online.

In this context, the electricity infrastructure has more than ever proved to be fundamental for the functioning of society. The key role played by electricity-powered services – emphasized by the consumption shift driven by the emergency measures adopted by governments – confirms the fundamental function of a robust and sustainable electricity system in a modern, efficient, and above all resilient society.

The governments and companies that had already invested in sustainable business models run by skilled and motivated workers and enabled by state-of-the-art digital technologies – used for both infrastructure management and general purposes – have coped better with the emergency.

The need to reinforce the capability to secure the continuity of these functions in any operating conditions, including during emergencies, the non-deferrable imperative to address climate change, and the urgent need to promote a sustainable economic recovery, all confirm that investing in a robust decarbonized energy system is a top priority for both advanced and developing economies.

For this reason, it is fundamental to plan (and implement) the post-COVID recovery keeping in mind the importance of a sustainable and resilient electricity sector and infrastructure, capitalizing and building on the results already achieved by the energy transition. Short-term, emergency-driven policy approaches have to be matched with a long-term approach capable of fuelling sustainable prosperity in the next decades. Moving in a different direction would not only jeopardize our capacity to face new social, economic, and humanitarian shocks, but would also limit our ability to respond to the key challenge for the future of the planet, the effects of climate change and global warming.

Energy consumption patterns and trends during the emergency

The pandemic has significantly affected all aspects of life, including the energy sector. In particular, the demand for electricity has contracted significantly almost everywhere, as a result of the lockdown and social distancing policies adopted by governments. It has begun to bounce back in places where these measures have started to be phased out at a larger scale. In Italy, for instance, electricity consumption went up 12 per cent on a monthly basis between April and May 2020, when restrictive measures were gradually lifted at the national and regional levels.

During the peak of the crisis, the power sector was affected in terms of both overall demand and consumption patterns, in particular in those economies where more restrictive measures were implemented. According to the International Energy Agency (IEA), electricity demand decreased by 2.5 per cent globally during the first quarter of 2020, when the lockdowns started. (China, the epicentre of the pandemic, whose lockdown started at the end of January and remained in place until the end of March, experienced the largest reduction, 6.5 per cent.)

The full effects of these measures were felt in the following weeks, pushing electricity demand further down, with daily consumption dropping by at least 15 per cent in major global economies such as France, India, Italy, Spain, the United Kingdom, and the US west coast. As mentioned, demand started recovering promptly as soon as emergency measures were lifted; future trends still depend on how the emergency evolves globally and on recovery stimulus measures.

Along with overall demand decline, another important (and partly temporary) effect is the sectoral shift in electricity consumption patterns, from services (and to a lesser extent from manufacturing) towards greater use in the residential and healthcare sectors. With restrictive measures fully in place, electricity demand during work days – affected by commercial and industrial slow-down – became more similar to demand on weekends, while weekend consumption remained relatively consistent, driven mainly by household activities.



With millions of people forced to stay home and carry out routine activities such as working and studying remotely, electricity consumption in the residential sector went up significantly. In the last week of March and first week of April, residential demand during the week was up to 40 per cent higher in some European economies than in the same weeks in 2019. However, this did not fully offset the huge decline in services such as retail, office work, hospitality, education, and tourism. Manufacturing – where electrification rates are generally lower than in the services sector – had a less pronounced effect on demand for electricity, because a number of factories had adopted precautionary measures that enabled them to continue operations despite the lockdown.

The potential of clean energy to support sectoral transformations

These trends have had direct effects not only on the way the power sector is run, but also on the availability of electricity-enabled services for people across the world. In certain regions – such as the EU and North America – electricity is abundant and services are reliable and affordable to almost anyone; but in other parts of the world, the increasing role of electricity to meet these new and emerging needs (i.e. smart-working, remote education programs, and home-based activities in general) could present major challenges.

Indeed, the capacity of electricity systems to support essential healthcare services and to ensure people's well-being and livelihoods, in particular for the poorest and most vulnerable, is still limited in many areas of the globe. In Latin America, for example, despite growing investments and financial flows in renewable energies and smart infrastructure, most electricity systems are probably still not able to sustain this change of paradigm and ensure access to reliable and affordable services to meet the new trends in demand. Due to the steep decline in demand that started in March – a contraction of 4 to 28 per cent in the last week of the month compared to the same period in 2019 – the continent's power sector is facing liquidity concerns, exacerbated by the fact that many governments (e.g. in Argentina, Paraguay, and Peru) suspended or postponed the payment of electricity bills for up to three months. If not duly supported by public intervention, these decisions might affect the balances of utilities and distribution companies, as well as their capacity to ensure vital services to their citizens and businesses.

These changes add to trends taking place on the supply side, as power generation needs to become greener to address both the immediate risks of pollution and environmental degradation and the mid- to long-term (but not less urgent) challenges of climate change. The COVID-19 emergency has contributed to an increase in the share of renewable energies in the power mix of the main global economies, thanks to low operating/variable costs and priority access to the grid guaranteed through regulations. In Europe, with coal-based production down 25 percent during the first quarter of 2020, renewables have taken the reins of power generation, reaching a 43 percent share throughout the period. In Italy, renewables outperformed even this excellent result, as in March they reached almost 45 percent of total national production, with a significant increase compared the same month in 2019, when they accounted for 38 percent of the total. These have been great tests of how power systems with higher penetration of variable renewables can work.

In other regions – in particular in developing countries – decarbonization should be further encouraged, as sustainable, resilient, and digitalized electricity systems become fundamental to meet the ongoing evolutionary trends. This is needed to respond to the short-term challenges generated by crises such as the COVID-19 pandemic and to meet the changes of paradigm on the demand side that the emergency has activated and that are likely to remain, at least partially, in the future. It is also needed to support the fight against air pollution and climate change, both of which represent existential challenges for human beings and are considered drivers, and possibly amplifiers, of similar crises.

Positive short- and long-term effects of clean-energy investments

Investing in sustainable electricity generation and infrastructure can have significant positive effects, both on immediate and long term. The first short-term effect is the reduction in cost for electricity generation, as wind and solar are undergoing a significant cost decline, at the same time as the costs of batteries and other storage technologies are dropping. As recently disclosed by the International Renewable Energy Agency (IRENA), utility-scale wind and solar photovoltaic generation has become cost-competitive almost everywhere across the world, and could easily replace coal-fired power plants. This trend is confirmed by an Enel Foundation study on Argentina, Brazil, Chile, Colombia, Ecuador, and Peru, which shows that almost 50 gigawatt (GW) of photovoltaic and 71 GW of wind can be installed by 2030, covering about 25 per cent (up from today's 1 per cent) of the total electricity demand, with economic benefits estimated at about US\$3.6 billion by 2030, considering the fuel savings and the annuity of the investments needed for the additional renewable capacity.

At the same time, post-COVID clean investments could help governments to reduce reliance on fossil fuels (as already demonstrated by Enel's decision to accelerate the phase-out of the Bocamina coal-fired power plant in Chile, to be replaced by 2 GW of renewable power capacity), phase out costly fossil subsidies, and get rid of their price volatility. This is the right moment for them to cut subsidies on oil, gas, and coal in order to allow renewables to compete – and win – also in the short term, leading to a progressive replacement of fossil fuel usage in the mid to long term. Public money saved from subsidies could be invested to reduce energy poverty and/or to address huge social inequalities, in particular in regions such as Latin America.

Promoting investments in renewable capacity and digitalized networks contributes to increased access to electricity and reduces energy poverty. In many areas of the world, especially sub-Saharan Africa but also Latin America, there is still a gap in access to electricity and clean cooking services. By their nature, renewables improve access to services, or the quality of services, for the areas and people most affected by energy poverty. Flexible electricity systems – based on a balanced combination of appropriate technologies and operational practices (for example, renewables, storage, smart networks, and demand-response services) – can also help support essential social services such as public health, education, and communications after COVID-19, including in the poorest parts of societies.

As pointed out by Hepburn, O'Callaghan, Stern, Stiglitz, and Zenghelis in their latest [paper](#), the expansion of distributed renewable generation and smart network infrastructure ensures occupational benefits and overall positive economic impact in both the short and long term. This is particularly true in Latin America, where, according to the Transforming Energy Scenario developed by IRENA in its *Global Renewables Outlook*, employment will rise significantly more in energy-transition-related technologies than in conventional technologies, reaching 3.2 million people employed by 2050, almost 8 per cent of total jobs on the continent.

Last but not least, clean power generation and transmission technologies are fundamental to address the challenges of air pollution and climate change. The drop in CO₂ emissions during the outbreak (8 per cent on a yearly basis, according to the International Energy Agency), if accompanied by sound sustainable recovery policies to promote global decarbonization, is certainly a positive outcome emerging from the COVID-19 crisis. The World Health Organization lists air quality as the greatest environmental risk to global health, and decarbonization reduces not only CO₂ emissions but also other pollutants. The reported role of air pollution in increasing vulnerability to COVID-19 is just the most recent demonstration of the negative impact of pollution on health, especially for the most vulnerable parts of society. In this context, renewable generation coupled with electrification of energy uses – e.g. the deployment of electric vehicles with electricity generated by renewable energy sources – will also help improve health and resilience to disease.

Recommendations

While heavily impacted by the COVID-19 pandemic, national governments and international organizations should develop and implement recovery strategies that prioritize the energy transition and the fight against climate change. This is essential because, in a widespread economic slowdown, the private sector might be reluctant to invest sufficiently in clean technology and decarbonization, not only pushing emissions up and putting the achievement of the Paris goals at risk, but missing the opportunity to create a more affordable and resilient electricity sector for all.

A well-balanced combination of decarbonization policies should support and help shape an inclusive low-carbon transition pathway, the benefits of which – in terms of GDP growth, employment rates, and income inequality reduction – will be distributed to citizens and businesses in both advanced and developing economies.

In this context, the following list offers a non-exhaustive set of recommendations aimed at strengthening sustainable and reliable electricity services for all, and allowing the global economy and society to bounce back greener and more resilient and equitable.

- Apply strict **'green' conditionality rules** to every loan, grant, and public funding mechanism, not only in the energy sector but across the economy and society, in order to encourage the broad adoption of low-carbon technologies, services, and practices.
- Promote adequate regulated access-to-finance schemes that encourage the private sector to **accelerate the phase-out of coal-fired power plants** and their replacement with renewable generation capacity.
- Take advantage of the current low prices to **cut fossil fuels subsidies** and allow renewables to compete fairly, speeding up the full removal of carbon-intensive energy options.



- **Use the financial resources generated by cuts in fossil fuels subsidies** to reduce energy – and more generally socio-economic – inequalities and boost economic recovery, to the immediate benefit of businesses and citizens.
- **Simplify and speed up procedures** to authorize ‘green’ investments and project development.

Fine-tune regulations at the national and international levels that **enable higher flexibility and coordination in electricity markets**, in order to ensure that economic and technical benefits of renewable energies and smart grids can be fully achieved and enjoyed by consumers.

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THE ROLE OF THE ELECTRICITY SECTOR IN THE ENERGY TRANSITION AFTER COVID-19

Francisco Laverón

Over the last couple of decades, the transition towards a decarbonized energy system has benefitted from a virtuous circle. Increased awareness of the impact of human activity on the climate has resulted in increasing policy support for investments in clean energy production and energy-efficient technologies. These investments have resulted in a drastic fall in the cost of those technologies and, as a consequence, facilitated the adoption of increasingly ambitious climate policies.

Now, therefore, electricity generation installations which use renewable primary energy sources (such as sun or wind) are competitive against traditional fuel-burning generation technologies. LED bulbs are the standard option for lighting, while heat pumps are becoming a lower-cost option than fuel-burning heating systems. And electric vehicles are already competitive with internal combustion vehicles in terms of life-cycle costs and are expected to reach price parity at the point of sale by around 2025.

This article focuses on the lasting impact that the COVID-19 crisis will have on the energy sector. It suggests ways that lessons arising from this crisis will affect future energy and climate policies, what impact this will have on the investment perspectives of electricity companies, and how this will, in turn, contribute to economic growth, energy system resiliency, and social welfare. It concludes that the COVID-19 crisis will accelerate the energy transition, and that an electricity sector powered by renewable energies will be the cornerstone of the fight against climate change.

COVID-19's impact on the energy sector

COVID-19 has hit the energy sector hard, in two ways: it has depressed energy demand and prices, and it has affected global supply chains.

Looking at the full year, the IEA (International Energy Agency) foresees a scenario where global energy demand contracts by 6 per cent, the largest fall in percentage terms since World War II. Fossil fuels have been the most impacted: oil demand for the full year could drop by 9 per cent, coal by 8 per cent, and natural gas by 5 per cent. Even nuclear could see a drop of 2.5 per cent. The only energies not negatively affected are renewables, which could see their production increase by 0.8 per cent as a result of new investments (IEA, [Global Energy Review 2020](#)).

However, to assess the long-term impact of COVID-19 on the energy sector, we must look at the trends in current investments. Global investment in energy in 2020 is expected to decrease by \$400 billion (20 per cent), in comparison to a quite stable situation in the previous three years and in contrast with the 2 per cent increase expected at the beginning of the year. But this reduction is not homogenous across all sub-sectors: oil and gas will be the most affected, with a reduction in investments by around one-third, while the electricity sector will probably see investments fall by about 10 per cent.

The oil and gas sectors are quite cyclical, while the electricity sector is much more stable and resilient due to the steady increase in demand and the impact of climate-change policies. Within the electricity sector, investment in renewables is expected to decrease by 10 per cent, less than the equivalent figure in fossil fuel generation. At the global level, over the previous four years the share of clean energies has risen from 33 per cent to 37 per cent (IEA, [World Energy Investment 2020](#)). In fact, the IEA foresees that investment in renewable energies will have completely recovered from the current slump by 2021 (IEA, [Renewable Energy Market Update. Outlook for 2020 and 2021](#)).

Looking at the transportation sector, the other big pillar of the energy transition, car sales are expected to be around 15 per cent lower in 2020 than 2019. But again, the impact is not the same across all segments. The reduction in battery prices together with clean energy policies means that the electric vehicle segment is much more resilient than other vehicle segments. After a

decade of strong growth in electric vehicle sales, with annual increases of more than 60 per cent every year except for 2019, the IEA expects electric car sales will continue their upward trend in 2020, with more than 2.3 million new electric cars and a record market share of more than 3 per cent of total sales (IEA, [As the Covid-19 Crisis Hammers the Auto Industry, Electric Cars Remain a Bright Spot](#)).

The investment situation of electricity companies

European utilities have been quite resilient to the COVID-19 impact, which will leave them in a good position from which to resume their investments after the crisis. In fact, most of them have confirmed their financial, dividend, and investments targets for the coming years, and some of the most important utilities are actually bringing forward procurement and accelerating investments. In the US, electric utilities are also bullish about their future, pushing ahead with capital spending. Indeed, Regulatory Research Associates, an S&P Global Market Intelligence company, recently published a report showing that all but eight of 44 utilities analysed have maintained or increased their capital expenditure forecasts through 2021, including four that have expanded spending plans by more than 40 per cent since the second half of 2019.

Consultancy firm AFRY has also just published a report for electric utility Iberdrola in which it identifies the least-cost pathway and energy mix for a successful decarbonization of the energy sector by 2050 in Europe, on the assumption that the COVID-19 crisis will not impact the European carbon-neutrality target for 2050. The electricity sector will be based on renewable energies, mainly using solar photovoltaic and wind as primary energy sources. Electrification of final energy uses in the EU will go from the current 22 per cent to 62 per cent in 2050. In some countries, it will be even higher, reaching 65 per cent in Spain and 69 per cent in Great Britain. Even Shell, whose core business is oil, foresees that more than 60 per cent of final energy demand will need to be electrified by 2050, compared to about 20 per cent now (Shell, [A Climate-Neutral EU by 2050](#)). This is also in line with other assessments such as the one made public by the Energy Transitions Commission which estimates that massive electrification, both direct and indirect via electricity-based fuels, will bring electricity up to 67–72 per cent of final energy demand in a global zero-carbon economy (Energy Transitions Commission, [Mission Possible, Reaching Net-Zero Carbon Emissions from Harder-to-Abate Sectors by Mid-century](#)).

Lessons from the COVID-19 crisis for the energy transition

What have we learnt from this crisis? Will we emerge from it unscathed? While big positive changes may be unlikely, we can learn useful lessons.

The first lesson is that we will now listen more carefully to warnings coming from the scientific world because we are more aware of how vulnerable our economies are to the environment. We have received warnings about possible pandemics for a long time, but we haven't done enough to prepare for or prevent them. After witnessing the consequences of a pandemic, people are more receptive to warnings from scientists, including warnings about the impact of climate change. The view that society must be more resilient and sustainable is becoming mainstream. Despite the dramatic fall in energy consumption and CO₂ emissions over the last few months, scientists are adamant that the pace of climate change has not slowed. In fact, CO₂ in the atmosphere reached its highest concentration in May 2020, despite the fall in emissions due to COVID-19, reaching a record 417.1 parts per million, as measured at Mauna Loa observatory in Hawaii. To meet the 1.5°C Paris target, global emissions would have to be reduced by 7.6 per cent every year over the next decade (UN Environment Programme, [Emissions Gap Report 2019](#)).

But the energy transition is not only about climate change. People, especially in cities, have seen how the reduction in road traffic and industrial activity has resulted in clean air and blue skies. We have experienced breathing clean air and walking down streets free of car fumes and noise. This will help us realize what we stand to gain if we transition towards clean mobility, with traffic restrictions imposed on internal combustion vehicles.

We have also learnt that being unprepared can be very costly. Just like we have known about pandemic risks, we have known for decades that climate change is real and that, if unchecked, it will have catastrophic impacts, and we are not doing enough to prevent that. Hopefully, we will now be more aware of the importance of taking early action, and that spending some money now will save us from having to spend a lot more money in the future.

Another lesson is that our lifestyles are not set in stone, and that we can do things differently and adapt if we have to. COVID-19 forced us – governments, companies, and individuals – to implement big changes in the way we do things, and we did so quickly and effectively. Now we know that if we really want to, if we are really convinced of the need, we can make big changes



to our lives, such as the changes that will be needed to fight climate change. Changes that previously seemed impossible now seem less of a stretch.

We have also learnt that decarbonization policies are more urgent than before, because they lead to environmental improvements that are good not only for our health but also for our economies. We can reconcile short-term economic goals (economic recovery and job creation) with long-term aspirations (climate change mitigation and economic sustainability).

The policy environment after COVID-19

Many governments are implementing unprecedented COVID-19 recovery packages to try to revive the economy and create jobs. But the amount of money involved is not the only difference. Most of these governments – certainly in the European Union – are declaring that the recovery packages not only need to create economic activity and jobs in the short term, but must also take into account their long-term effects, and most of them concur that betting on sectors with a clear future is the best way to succeed in the long run. Therefore, decarbonization strategies which existed before COVID-19 are being endorsed as the best way to spend a large share of this money – money that, by its sheer amount, will shape the future of our economy and our lives, and for this reason must be allocated in a wise manner. As a result, decarbonization, digitalization, resilience, and economic recovery are the main pillars of these plans.

On May 27, the European Commission outlined its recovery plan, known as Next Generation EU. If approved, it will amount to a €750 billion package, focused on the same areas as the European Green Deal, covering energy efficiency, renewable energies, clean hydrogen, and electric mobility. It is expected to increase GDP by 1 per cent and to create almost 1 million jobs. It will accelerate the transition to a carbon-neutral economy, which is now a formal target for 2050.

Although significant amounts of money are still being spent on subsidies for carbon-intensive industries across the globe, this doesn't take away from the fact that the clean energy transition is happening in almost every country; it just means that it is taking place at a different pace. And everywhere the levers used are essentially the same: renewable electricity to decarbonize the power system, and electrification to gradually phase out fossil fuel. There will be other levers – such as green hydrogen, renewable gases, or carbon-capture technologies – but the focus everywhere will be on having a clean power sector with electricity generated using renewable energy sources at its core.

It is also the economy

The focus on decarbonization and resiliency is not to protect the environment and our health at the expense of all else. As the president of the European Commission explained in her first speech at the European Parliament in November 2019, 'The European Green Deal is our new growth strategy. It will help us cut emissions while creating jobs'.

There is growing evidence that investments derived from climate action have a positive impact on the economy and jobs. The Global Commission on the Economy and Climate estimated that a bold response to climate change would have a cumulative positive economic impact of \$26 trillion by 2030 and create more than 65 million low-carbon jobs ([2018 Report of the Global Commission on the Economy and Climate](#)). Another assessment for a European country suggested that mobilizing €75–150 billion of capital could yield €180–350 billion of gross value added, generate up to three million new jobs, and enable a carbon-emissions reduction of 15–30 per cent by 2030 (McKinsey, [How a Post-pandemic Stimulus Can Both Create Jobs and Help the Climate](#)).

One of the main reasons to accelerate investment in clean energies is that, according to one assessment, for every million dollars spent on fossil fuels, 2.65 full-time-equivalent jobs are created, while if the same amount is invested in renewables or energy efficiency, 7.49–7.72 jobs result (Heidi Garrett-Peltier, [Green versus Brown: Comparing the Employment Impacts of Energy Efficiency, Renewable Energy, and Fossil Fuels Using an Input-Output Model](#)). Other intergovernmental organizations that foresee the green economy having a very positive effect on jobs include the International Labour Organization ([World Employment and Social Outlook 2018](#)) and the International Renewable Energy Agency ([Global Renewables Outlook: Energy Transformation 2050](#)).

Conclusion

The International Energy Agency has predicted that 'The energy industry that emerges from this crisis will be significantly different from the one that came before' (IEA, [World Energy Investment 2020](#)). But the COVID-19 crisis has not created new challenges or new trends – it has simply accelerated previously existing ones.



COVID-19 will make energy-transition and climate-action policies not weaker but stronger. We are now much more aware of our vulnerabilities as a society, of the consequences of failure to act, and of our ability to change the way we do things if we set our minds to it. And the electricity sector will be the cornerstone of the energy transition, creating new economic opportunities on the path to creating a more resilient and sustainable society. We now know that without a sustainable environment, there will not be a sustainable economy.

THE US CLEAN-ENERGY TRANSITION IN THE ERA OF COVID-19: THE PROSPECTS REMAIN ROBUST

Jacquie Ashmore, Cutler Cleveland, and Peter Fox-Penner

The devastating impact of COVID-19 is unprecedented – spanning the globe, disrupting daily life, and taking a substantial toll on every sector of the economy. The US energy sector was further roiled by a combination of COVID-19 supply chain challenges and demand reductions, as well as geopolitical tensions between oil-producing countries sending the price of US crude oil negative in late April. This article examines areas that are bright spots for clean energy in the US now and in the future in the midst of current turmoil. Although the US federal government has not bolstered the clean energy economy in its first COVID-19 economic stimulus measures, big new renewable-energy and storage projects continue to be planned and approved, driven by the markets and economics and by political and social forces. These developments are reviewed in the context of the global response to the social and economic disruption of COVID-19, including considerations of how green investments can be part of the economic recovery from COVID-19.

Immediate impacts of COVID-19 on the clean-energy industry

The negative impacts of COVID-19 on the clean-energy economy have been amply chronicled in recent months. A struggling economy will reduce demand for wind and solar development, and may limit the availability of tax equity financing. In early April, Wood Mackenzie reduced its forecast for global solar deployments to 106.4 GW – a reduction of 23.1 GW (18 per cent) relative to its prior forecast. Global electric vehicle (EV) sales are projected to fall 43 per cent in 2020 relative to 2019, from 2.2 million vehicles last year to 1.3 million this year, reflecting a combination of three effects: the impact of COVID-19 and of oil prices and the consumer response to a slower roll-out of new models.

In the US, residential energy-efficiency service providers have inevitably been hit hard, putting many of the 2.4 million jobs in the US energy-efficiency sector at risk. BW Research Partnership noted in early July that half a million jobs in the US clean-energy sector (15 per cent of jobs in the sector) had been lost since March. That number did not include workers who had been furloughed or were underemployed. Yet federal action to support the clean-energy sector has to date been minimal, and many state legislatures have been forced to suspend or postpone their sessions, substantially limiting opportunities to advance clean-energy policy at the state level.

Our current reality is alarming, especially in the context of the urgent need to drastically reduce emissions in the coming decade to avoid the worst impacts of climate change. Yet amidst the tumult, prospects for the US clean-energy transition remain strong. Wood Mackenzie is projecting that the US will add 18 GW of new photovoltaic capacity and 1.2 GW of energy storage capacity in 2020 – both record amounts – and near-term plans for major projects continue to advance under the leadership of state-level policymakers and utilities, bolstered by the entrepreneurship of technology providers and the support of the finance community.

Planned projects for wind, solar, and energy storage in the US

As lockdowns spread across the globe this spring, global electricity demand dropped by 2.6 per cent. This affected all fuels; in particular, generation from coal dropped by 10 per cent. In contrast, generation from renewables increased by 3 per cent, because renewables beat other sources based on cost. While the International Energy Agency forecasts electricity generation will be down by 5 per cent in 2020, it forecasts that coal generation will be down by 25 per cent and renewables generation will be up by 11 per cent. COVID-19 may ultimately speed the reduction in use of coal.

New wind projects continue to be announced, with ever larger capacities. American Electric Power recently announced state regulatory approval that enables it to pursue its North Central project in Oklahoma, supplying 1.5 GW of power. The project comprises three wind farms with the largest sized at 999 MW, set to be the largest single-phase wind farm in the US. Meanwhile, Xcel Energy is doubling its in-house wind capacity to 4.5 GW by the end of 2021, and will reach that in part by building a 552 MW wind farm, named the Sagamore Wind Project, in New Mexico.



In solar, the largest project in the US, which will be the eighth largest solar facility in the world, was recently approved – a 690 MW project to be built by NV Energy just north of Las Vegas, which could be completed by 2022. Coming in just below that is sPower's Spotsylvania project, which will add 620 MW solar in Virginia. Community solar continues to expand, prompting Arcadia and Nexamp to recruit additional employees as new states open up to community solar, e.g. Florida Power & Light getting approval for 1.5 GW of community solar arrays.

At the state level, California's Public Utilities Commission approved a new programme that is designed to resolve a limitation to building new utility-scale solar under the 1978 Public Utilities Regulatory Policies Act. In Massachusetts, the Department of Energy Resources doubled the capacity of small and medium solar projects that can benefit from the state's Solar Massachusetts Renewable Target (SMART) Program, from 1.6 GW to 3.2 GW.

Working to create equitable access to clean energy for socially vulnerable communities is critically important. The New York State Energy Research and Development Authority and the New York State Department of Environmental Conservation recently allocated \$10.6 million to enable disadvantaged and environmental-justice communities in New York to access solar power. This announcement came shortly after the New York Public Service Commission approved an additional \$573 million in funding for the NY-Sun programme, dedicated to the goal of installing an additional 6,000 MW of distributed solar in New York by 2025 – with almost one-third of that additional funding dedicated to serving socially vulnerable communities.

In their most recent quarterly US Solar Market Insight Report, Solar Energy Industries Association and Wood MacKenzie projected 113 GW of new solar installations in the US from 2020–2025, reduced by 3.6 GW relative to their prior forecast, made in 2019. This projected growth in the coming five years, only slightly dampened by the impacts of COVID-19, is consistent with broader plans for growth in renewables and storage recently announced by major energy companies and utilities.

NextEra is maintaining momentum through the COVID-19 shutdowns and anticipates adding 5 GW of renewables capacity this year. In addition, the company announced that it will spend \$1 billion on energy storage in 2021, on projects including the Manatee Energy Storage Center in Florida with 409 MW capacity. On a slightly longer time frame, they expect to add 10 GW of solar capacity through Florida Power & Light in the 2020s.

Meanwhile PacifiCorp – which serves 1.9 million customers across six states in the Pacific Northwest and Rocky Mountain regions – is preparing an all-source Request for Proposals to be announced in July, to meet the goals of its Integrated Resource Plan through 2024. Within the next three years, the company seeks to collocate 1.8 MW of new solar power and 595 MW of battery storage capacity, and establish 1.9 MW of new wind resources. This may enable four coal-fired power plants in Wyoming to be retired early.

In a similar story of displacing fossil fuel generation, Southern California Edison is pursuing battery storage rather than a gas peaker in Ventura County. This decision was affected by grassroots community pressure against the new fossil fuel generation. Strata Solar will build and operate the largest project for Southern California Edison, which will incorporate a 100 MW/400 MWh battery from Tesla.

Today there is already a compelling economic case for turning to wind, solar, and storage projects – and the levelized cost of energy for each continues to fall as technology continues to advance. Furthermore, as individual wind, solar, and storage projects increase in size, scale enables them to cut the costs associated with the balance of plant, equipment, operations, and maintenance – feeding a virtuous cycle which makes them even more competitive and will further accelerate their adoption. Broad understanding of the need to convert our energy system to one that has substantially lower greenhouse gas emissions and is climate resilient adds to the momentum of growth in clean-energy generation.

Boosting the economy, reducing GHG emissions globally

All these developments are unfolding at a time when COVID-19 has forced a reckoning on what kind of a society we want to live in, and how governments across the world can direct stimulus efforts to limit the pandemic's economic damage. Many people within and outside the clean-energy and climate community recognize that the emissions reductions and economic benefits that can be realized from a green stimulus effort are compelling. The International Renewable Energy Agency has published a Transforming Energy Scenario, which maps how a global investment of \$110 trillion would increase global GDP 2.4 per cent higher than their baseline scenario, quadruple renewable energy jobs to 42 million (without accounting for additional jobs in related sectors), and cut global carbon dioxide emissions by 70 per cent by 2050. The International Energy Agency is similarly advocating for green stimulus efforts, emphasizing opportunities to support increased energy efficiency, increased renewable energy, and investment in technologies such as lithium ion batteries and electrolysis for hydrogen production.

While the US federal stimulus measures passed to date have provided no direct benefit to the clean-energy sector, there are of course proposals for and discussions of ways in which a future stimulus measure can provide the requisite economic benefit and at the same time drive adoption of clean energy and improved climate resilience. One historical example of this is the success of the 2009 American Recovery and Reinvestment Act in supporting manufacturing related to clean energy such as EVs. That stimulus helped Tesla build its first major car factory in Fremont, California, and ultimately launch the Model S sedan. In addition to the economic benefits and emissions reductions that this investment can support, it also helps the US remain competitive in the global clean-energy economy.

While the federal-level discussion of green stimulus measures is not bipartisan at this time, the outcome of the US election in November has potential to substantially reshape the dialog. In June, the Democrats put forward three substantial stimulus proposals – the GREEN Act as part of the Moving Forward Act, the INVEST Act, and the Climate Crisis Action Plan – based on a framework that includes a national goal of net-zero emissions by 2050 and a price on carbon. The policy proposals include a federal clean-energy standard that reduces power-sector emissions to zero by 2040, a zero-emissions vehicle sales standard that ensures all light-duty vehicles sold are zero-emissions by 2035, and new tax incentives for EVs, solar, storage, and offshore wind. Additional policies cover energy efficiency and agriculture.

The INVEST Act, allocating \$494 billion over five years, focuses on reliable and resilient infrastructure and climate change mitigation for surface transportation. It proposes funding projects to reduce greenhouse gas emissions from transportation in states whose transportation emissions are highest, and includes funding for charging and fuelling stations for electric and zero-emissions vehicles, as well as investment in zero-emissions buses, rail networks, and projects that promote pedestrian and cyclist safety. Additional funding is set aside for climate-resilient infrastructure, including a disaster mitigation programme. Measures to promote equitable clean infrastructure development are woven throughout. The provision of low-cost capital invested to improve building, transit, and bicycle infrastructure to reduce energy consumption can be a significant source of employment to support economic recovery, in which the jobs created are diverse and high-quality, and span states that are traditionally Republican strongholds as well as others that are bastions of the Democratic Party.

The urgency to transition to clean energy rapidly to limit greenhouse gas emissions and safeguard the planet for future generations remains, even as we grapple with the profound consequences of COVID-19. The analogy between COVID-19 and climate change has been made many times: both are immensely disruptive on a global scale; both can be mitigated when science is used to inform prompt and large-scale action; both force us to consider vast and rapid systemic change. In addressing the economic damage wrought by COVID-19, we must prioritize investment in clean energy – to mitigate climate change and the economic damage it will inflict, and to accelerate the transition to a low-carbon energy system that is already underway. As [Enrique Dans wrote in Forbes](#), reflecting on the climate crisis in the midst of COVID-19, ‘Reconstructing the energy supply map of a country, even those in the developing world, has never made more sense ... The time has come to abandon outdated concepts, to change our mindset, and to put the use of renewables at the top of our list of priorities.’

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COVID-19, THE ENERGY TRANSITION AND OIL COMPANIES’ ADAPTATION STRATEGIES

Bassam Fattouh

The spread of COVID-19 and the dissolution of the OPEC+ agreement in March have generated one of the largest shocks in the history of oil markets. While the increase in supply due to the breakup of the OPEC+ agreement contributed to the price fall and accelerated its decline in March and April, this is first and foremost an oil demand shock caused by the severe contraction in economic activity. In fact, recent analysis shows that even without the increase in supply due to the breakup of the OPEC+ agreement, oil prices would have reached their low at about \$20 per barrel. However, the severity of the price fall had the effect of focusing the minds of the world’s largest producers and unlike the 1997-1998 and the 2014-2016 price cycles when it took years for the producers to reach an agreement to cut output, producers’ response was much faster during this cycle. OPEC+ was able to reach an agreement in April to implement a historic cut. Also, unlike the 2014-2016 cycle, the declines in oil output outside OPEC+, particularly in the US and Canada, were sharper and faster during this cycle.

Increased Uncertainty

These reductions in supplies, alongside the recovery in oil demand as lockdowns over the globe started to ease, lifted the oil price from below \$20 in April to the \$40-\$45 price range. However, looking forward, the price recovery could be choppy and remains shaped by a number of factors. As a result of OPEC+ cuts, there is plenty of spare capacity in the system and over time this capacity will start leaking back into the market either as part of a deliberate policy to ease cuts or if OPEC+ compliance weakens. Also, crude and products stocks have reached high levels which will act as additional buffers putting a cap on the oil price. However, the most important factor that will shape the price recovery is the demand side of the equation. In this regard, there are three key uncertainties surrounding global oil demand recovery:

- Will there be a second wave of lockdowns?
- When (or whether) will oil demand recover to the pre-virus level?
- Once the global economy stabilises, will the growth rate in oil demand return to the pre-virus level?

The reality is that no one knows the answers to these questions and at best one can construct different scenarios and assess the impacts on oil balances and prices under each. Also, the last two questions are directly related to the researchers' views on the speed of the energy transition and whether COVID-19 has accelerated its pace. Many are of the view that COVID-19 could hasten the peak of global oil demand with some even arguing that oil demand may have already peaked and that it will never reach its pre-virus level. But there is no clear evidence to support this view (or the alternative view).

The projections of oil demand growth are highly sensitive to the underlying assumptions such as economic and population growth, government policy and shifts in consumers' behaviour. One of the key assumptions relates to the growth rate. Many economists believe that the world economy is already experiencing 'secular stagnation' and COVID-19 will reinforce some of the underlying elements of that stagnation. The increased uncertainty will raise precautionary savings for households and reduce firms' incentive to invest, especially because many have seen their debt levels soar after months of crashing revenues. Also, many are of the view that globalization, which has been the main engine for growth for the past few decades, has peaked and that COVID-19 will accelerate the break-up of global supply chains. World trade is no longer expanding faster than world GDP and it is estimated that uncertainty may slow the expansion of global value chains by at least 35%. All these factors could shift the global economy to a slower growth path and thus lead to slower energy demand and emissions growth.

New Engine for Growth

In this context where pre-virus engines for growth have stalled, government stimulus measures to kickstart economies are key to the global economic recovery. Some governments are in a good position to increase spending and finance it through increased borrowing. According to the IMF, global public debt is expected to reach an all-time high exceeding 100% of GDP in 2020-2021, a surge of 19 percentage points from a year ago. Average overall fiscal deficit is expected to soar to 14% of GDP, 10 percentage points higher than 2019. The current environment of low interest rates is conducive for many governments to increase their debt ratios, stimulate the economy and spur growth of badly hit sectors.

But unlike the 2008 global financial crisis, there has been much more pressure for stimulus measures this time to be directed towards projects that accelerate the energy transition and move us closer to a zero-carbon emission economy. For instance, there have been calls for these stimulus packages to unleash massive investment in renewable power systems, boost the construction sector via green buildings and green infrastructure, provide targeted support to innovative low-carbon activities and accelerate the transition of the fossil fuels industry.

While the world should not miss on the opportunity to move to a more sustainable path and a decarbonised energy system, these calls to 'kill two birds in one stone' face serious challenges:

- Stimulus measures should first and foremost be growth-promoting and be implemented as early as possible. Some projects can achieve both targets of promoting green policies and stimulating the economy. For instance, through investment in more efficient buildings, governments could stimulate the construction sector. However, this dual target can't be achieved for all types of investments or projects, and in such cases, the green stimulus should not act as a barrier to economic recovery.
- Although it may be possible to scale up renewable projects such as solar and wind fairly quickly, this is not the case for other projects such as hydrogen and CCUS which still lack a functioning and mature hydrogen/CCUS industry that is able to absorb capital immediately and at a large scale.



- Different parts of the world will follow different paths depending on their portfolio of assets. For instance, some countries such as China and India could support both the solar and coal industries as the latter can achieve multiple objectives such as promoting growth in some regions and enhancing energy security.

In short, the confidence bands around oil demand projections are very wide and will depend among other things on the ability of governments to stimulate the economy and the type of stimulus packages put in place; the energy transition will not be uniform around the globe; and it will be far from linear as COVID-19 has shown.

Shift in perceptions

However, regardless as to whether oil demand will grow at the pre-virus level once the economies stabilise, the debate on peak oil demand matters because it has resulted in a massive shift in perceptions about the role of hydrocarbons in the energy mix and this is altering the behaviour of key players – be they governments, financiers, companies or consumers – with effects on the energy sector. For instance, there is evidence that the energy transition risks have impacted investors' risk preferences and their general attitude towards the sector. This could in turn affect the availability and cost of finance. Most of the international oil companies are already shifting their portfolios towards low carbon projects such as gas and renewables and restructuring their business models towards higher electrification.

COVID-19 will reinforce this shift in perceptions. For instance, there is a strong belief that oil consumption related to mobility and car ownership will fall sharply as more people decide to work from home. On the other hand, the pandemic could induce a drop in the use of public transport and a preference for more private passenger vehicles. People could also avoid planes in favour of cars. Furthermore, while there may be a change in people's purchasing habits through digital platforms, reductions in shopping trips could be offset by higher delivery truck miles. But here policy is key as governments could choose to 'ride the wave' of enforced changes in consumer behaviour and go for 'green recovery' initiatives, for instance by accelerating the electrification of the vehicle fleet and/or the adoption of hydrogen in trucking.

These shifts in perceptions (and aspirations) about the changes in the energy mix are occurring much faster than what could realistically be achieved on the ground. History shows that factors such as scale, legacy assets, and path dependency imply a slow change in the energy mix. And while COVID-19 may have accelerated shifts in consumers' behaviour, it is still early to tell how durable these changes will be and whether the new work and driving habits on their own will result in a massive reduction in oil demand. While it is true that stimulus packages may be directed more towards greener projects than previous recovery programmes, it is also true that the environment has become more challenging for many players. The IEA notes that **'the speed and scale of the fall in energy investment activity in the first half of 2020 is without precedent'; 'many companies reined in spending; project workers have been confined to their homes; planned investments have been delayed, deferred or shelved; and supply chains interrupted'**. COVID-19 has also hit households, very hard, particularly those in low income brackets, and thus governments will be reluctant to shift the cost of decarbonization to consumers. And although governments have introduced massive stimulus packages and have increased their debts ratio to stimulate the economy, concerns about **'fiscal imprudence'** may result in shifts in policy that weaken the stimulus. Furthermore, COVID-19 has exposed the weaknesses of existing frameworks of global cooperation and coordination.

IOCs' Challenges and Adaptation Strategies

In this context, international oil companies (IOCs) find themselves in a very challenging position. An accelerated transition would pose a significant challenge for IOCs, disrupting their business models and undermining their profitability. Decarbonization and maintaining high returns within the existing set of technologies and business models is not feasible and thus investment in low-carbon energy technologies, that are able to generate returns higher than current renewable projects is key for those companies aiming to participate in the energy transition, or to lead it. Also, while low carbon technologies represent a new and an expanded opportunity set, questions remain as to whether IOCs will be able to capture these opportunities and develop business models that ensure viability and profitability.

IOCs are required to make such a transformation at times when investors' appetite for financing the sector is waning and finance is becoming more restricted and more costly. Also, to increase their attractiveness, IOCs are under the pressure to return money to their shareholders through dividends and buyback programmes. COVID-19 and the lower oil price has made things worse by eroding their profitability and reducing the relative attractiveness of hydrocarbon projects vis-à-vis renewables which have lower long-term returns but offer low risk and stable cash flows.



The dilemma that IOCs face reflects a deeper issue. There are costs associated with the energy transition and shifting these costs solely to IOCs, shareholders or consumers is not realistic and will not achieve the desired objective. These costs should be shared. Direct government support and taxation (e.g. environmental taxation) should aim to get to net zero carbon as quickly and efficiently as possible, in a way that is technology-neutral. So far, government support for decarbonization has concentrated on decarbonizing electricity, but decarbonization of electricity and electrification will not take us to net zero emissions; at most, they may enable a country to decarbonize 60-70% of the economy. Other decarbonization measures are needed and IOCs are well suited to deliver some of them.

It also shows that business as usual for IOCs is not a choice regardless of what happens to oil demand. There is clear realization that any company that fails to appreciate the changes induced by climate change concerns and societies' desire for cleaner energy could lose its societal license to operate, its competitiveness, its ability to attract and keep talented personnel and even its access to capital. The IOCs are already well into the transition and are currently pursuing different opportunities that are broadly consistent with the decarbonization objective. These opportunities could be broadly divided into two. First, IOCs are investing in areas where decarbonization involves replacing fossil fuels, for instance renewable power and electrification of energy markets. These are opportunities for IOCs, but by doing so they move away from their core competitive advantage and will compete with many other players, for instance from the electricity sector and especially the digital world. Another more general challenge for IOCs investing in these low carbon technologies is to show that they are better placed than others to succeed; and in fact, most of their investment has concentrated in large offshore wind projects, where their know-how confers to them at least some competitive advantage. IOCs are yet to make a strong case to financial markets, shareholders and the wider society that they can prosper producing renewable electricity, if indeed there is such a case to be made.

Second, IOCs are also making investments to sustain existing lines of business and lower emissions compared to business as usual, for instance by improving efficiency, capturing and storing carbon, reducing methane emissions, decarbonizing natural gas and setting carbon offsetting schemes. These are needed as renewable power technologies and electrification alone will not come close to full decarbonization of the energy sector. These are areas where IOCs (as well as some national oil companies) have comparative advantage, and in which they could demonstrate leadership. The stimulus packages provide the IOCs with a unique opportunity to do so. They should tap these packages and demonstrate that decarbonization of their activities and products can be achieved, the projects are scalable, and that they have the ability to manage big projects and complex supply chains, integrate projects and develop technologies to decarbonize the energy mix in the most effective and least costly manner. One reason why carbon capture and sequestration (CCS) or hydrogen from methane do not receive much political support is that their feasibility and competitiveness at scale has not been demonstrated. Through such demonstration projects, IOCs can establish the costs and benefits and prove scalability, enhancing their position as leaders in the transition and competing with other players for public funds. This is the time to partner with policy makers and to push for public-private partnerships to promote innovation.

What the above shows is that, irrespective of which of the two strategies is taken (or a combination of the two), there is a fundamental trade-off between expected return and the variance of return, i.e. the cost of reducing the long-term risks and increasing resilience is to accept lower expected return on existing assets, by investing in measures that align the hydrocarbon sector with low carbon scenarios. This lowers the overall return but reduces the risk of business disruption in the long run. Both IOCs and shareholders should acknowledge this trade-off.

INTERNATIONAL ENERGY COMPANIES NAVIGATING COVID-19 AND DELIVERING ON THEIR ENERGY TRANSITION STRATEGIES

Eirik Wærness

The COVID-19 crisis has hit hard at a time when the energy industry's largest players are engaging in strategic repositioning. Over the last few years, international energy companies (IOCs), and in particular European IOCs, have been gradually shifting their strategy to respond to the climate challenge and finding ways to drive the energy transition from the supply side, while continuing to deliver on their obligations to provide energy, the demand for which remains strong and continues to grow.

Pressure on the industry has been massive from governments, consumers, and investors to deliver on the energy transition without increasing commodity prices or reducing shareholder returns, and without significant assistance from governments in

terms of changing consumer incentives (for instance through carbon taxes). The COVID-19 crisis has intensified these pressures, having a massive negative impact on the financial flexibility of global energy companies, which could affect their ability to deliver on their energy transition strategies, as well as on governments' financial flexibility and their ability to drive the energy transition.

The impact of COVID-19 on IOCs' cash flows, debt, and room to manoeuvre

The abrupt and steep decline in oil demand caused by the crash in economic activity and lockdown measures, in combination with the extremely ill-timed war for market share between key oil suppliers in March and April 2020, has resulted in a severe hit to the IOCs' revenues. This, in combination with an oversupplied gas market, is a poisonous cocktail that the companies have swiftly responded to, through a combination of measures which include cuts in planned investments, exploration, and drilling programs; postponement of projects heading for final investment decision; reductions in workforce; reduced dividend payments; and increased borrowing to secure liquidity.

The IOCs' capacity for new investments going forward will be significantly lower as a result of the crisis. With higher debt ratios and probably an even more cautious approach to risk, the hurdle for new investment is expected to increase. The severity of the oil price cycle also implies that risk aversion might be on the increase. Also, a reduced workforce could reduce the ability to handle new projects within the same time frame as previously. Consequently, the future supply of oil and gas will be significantly lower than it would have been without the crisis.

Generally, due to the relative size and maturity of the IOCs' investment portfolios in oil, gas, and new renewables/low-carbon projects, the negative impact on oil and gas investments has been much larger than on investments in green energy. However, given the significant limitations on the IOCs' room to manoeuvre over the next few years, there is also reason to worry about their capacity to invest in and drive the energy transition to the extent they had intended. A key question is how they will adapt to deliver on their updated long-term strategy of significant growth in low-carbon energy sources while continuing to satisfy demand for oil and gas with gradually lower emissions.

The impact of COVID-19, both the virus itself and the measures to contain it, is far from over. The impact of the virus affects different parts of IOCs' activities differently. Even if some of a company's activities might return to 'normal' soon (e.g. activities in north-western Europe), others cannot (e.g. upstream activities in Brazil, and activities that require frequent intercontinental travel). Amplified by the aforementioned reductions in workforce, this will affect the overall activity level and the ability to undertake investments and actions to drive the energy transition forward, and thereby the companies' ability to deliver both on their short-term obligations to provide energy and on their long-term strategies.

Challenges to supply- and demand-side investment

The COVID-19 crisis has illustrated vividly that fast (but still insufficient) reductions in global CO₂ emissions are possible. The decline in economic activity and transport will deliver a significant reduction in emissions from 2019 to 2020. The crisis has also shown that crashing the global economy to reduce emissions is an impossible long-term pathway for addressing the climate challenge. Delivering on the energy transition and the necessary emission reductions requires a different approach.

A prerequisite for a successful energy transition is substantial investment in energy carriers and energy infrastructure. These are necessary to address growing energy demand, particularly in emerging economies, and to ensure a transition away from existing fossil energy sources.

A low-carbon future will entail a more rapid increase in electricity demand, which requires investments in renewable sources of electricity and infrastructure like central and local grids and storage. These investments will gradually be profitable, as costs are declining and wholesale prices are still determined (and will be for some years to come) by fossil-fuel-based competitors. Profitability could, however, be challenged as the share of low/zero marginal cost sources of electricity in the system grows and energy market prices fall. Continued investment growth will depend on regulatory reform and market conditions that inspire investor confidence.

Until now, a large share of investments in renewable electricity have been undertaken in mature western economies with a well-functioning electricity system and markets, mainly to replace coal-based power plants. The need to accelerate investments in markets where electricity demand is rapidly growing, and the line of sight to future regulatory regimes is not clear, represents a challenge for our collective ability to deliver on the energy transition with enough speed and scale.

But the current challenging times also represent an opportunity for large players with financial capacity and ability to handle multiple sources of risks. Typically, this would mean players like the IOCs, but how much has their ability to deliver been hurt by

the COVID-19 crisis? Who else will be there, with the necessary engineering and risk-taking capacity, ready to undertake large-scale investments with high risk in the energy transition, if the IOCs are not?

Another element in the energy transition that is strategically difficult to balance is the need for continued investments in oil and gas to avoid supply falling more, and more rapidly than, demand. The immediate impact of the crisis is a significant reduction and delay in fossil fuel investments, entailing increased risk of shortage and future price spikes. A key strategic issue for the IOCs is whether to continue to invest in oil and gas while demand is increasing and not showing clear signals of rapid decline any time soon.

Another challenge will ultimately be to handle the combination of a gradual reduction in demand with the need to replenish supply capacity as long as supply decline rates are higher than reductions in demand. The alternative could be to leave the responsibility for ensuring sufficient supply during the transition to other players and shift completely away from new investments in fossil fuels towards other alternatives. If this were to be the strategic priority for large, global energy players, the risk of a messy, costly, and volatile energy transition would increase.

Another part of the energy transition that could be negatively impacted by the COVID-19 crisis is the need for investments in energy efficiency and new durable energy-using goods. More energy-efficient housing and offices require investments. They are generally profitable, but still happen much too slowly, if at all – for several reasons, including long payback times, large upfront investments, practical issues, and coordination problems between owners and tenants. With higher unemployment, lower income growth, and lower profits, the crisis will slow these investments even more. The same is true for investments in decarbonization of electricity and transport – investments in, for example, decentralized solar panels and replacement of private vehicles will probably slow during the crisis as consumers will be less inclined to undertake such large replacement investments.

Maintaining strategic momentum in a world of shifting and uncertain returns

The COVID-19 crisis clearly demonstrates the vulnerability of the energy transition, as key players in the transition will have much less financial flexibility to deliver on their strategic ambitions. The cash flow from oil and gas operations is significantly reduced, making new investments more difficult. It is a fact that much of the planned growth in new renewables, carbon capture and storage (CCS), and other components in the energy transition among IOCs were to be financed by oil and gas profits. Future oil and gas revenues have not necessarily been impacted by the crisis, but the perception that they are will probably affect companies' and shareholders' behaviour. Future returns from and market design for renewables, CCS projects, blue or green hydrogen, and other parts of our energy future are also uncertain and have not become less risky because of the crisis. Can the momentum on the supply side of the energy transition be maintained?

One further challenge is that governments will be more indebted. To the extent that government stimulus packages can be used to support the green transition, part of the problem might be alleviated. If governments are able to give central players on the supply side, including IOCs, more clarity and comfort about future market regulation, and security on future revenues and continued subsidies where these are still necessary, there is a chance that the slowdown in the energy transition can be partly avoided. Some governments might be able to keep the focus and the momentum intact in their fight against unemployment and recession. There is, however, every reason to be worried that the average government's ability to promote investments in the energy transition will be negatively impacted by the crisis. So, the IOCs cannot count on more clarity than before, but will rather have to prepare for less. Also, to the extent that governments will be able and willing to prioritize taxpayers' money to drive the energy transition, what will be the impact of an increased dependence on regulated markets and subsidies on the returns of the IOCs? Will such a change affect credit ratings and new investments further down the road?

Uncertainty also applies to another crucial ingredient in the energy transition, namely global policy measures aimed at delivering on global emission targets. COP26 (the 26th UN climate change conference) has been postponed by a year, so we must wait longer for any changes in framework conditions that could increase the potential for rapid changes in consumer behaviour. However, it is also clear that some IOCs consciously attempt to keep the energy transition in their list of strategic priorities, by explicitly adapting their price assumptions based on supply/demand balances that are claimed to be in line with Paris targets, for example using very high CO₂ price assumptions.

Firm strategy, but reduced ability to deliver quickly

There is no doubt that the strategic reorientation among the IOCs will continue. The companies intend to be responsible market players in both the short and long term. Acting on carbon emissions is a non-negotiable long-term 'mega-trend' for all, with increasing stakeholder pressure on the companies, especially in Europe. And to be relevant over the long term, companies



must deliver on the short-term obligation to provide energy to consumers who do not have the opportunity to change behaviour, and who demand more energy as their income and consumption opportunities keep growing. Over the long term, responsibility is about contributing from the technology and supply side to drive the energy mix towards low/zero carbon, which will only happen if parallel changes occur in consumer choices and framework conditions. And a common prerequisite over both the short and long term is that these activities must meet investors' requirement for satisfactory returns.

Success in driving the energy transition while keeping investors and customers happy will require a combination of stamina, stakeholder dialogue, and selective strategic decisions. In addition to the immediate measures to cope with the crisis mentioned above, the IOCs are implementing improvement programs aimed at lowering costs and enabling delivery on short-term obligations. These improvements are also a prerequisite for being able to stay on course to deliver on decarbonization and the energy transition. Other components of a successful strategy implementation are clarification of regulatory mechanisms and good dialogue with governments in relevant jurisdictions. Managing expectations of capital markets and investors is also a necessary ingredient: What can be expected in terms of risk/reward balance for both oil and gas investments and investments in new renewables/low-carbon sources of energy?

The current extraordinary situation in the global macroeconomy and in energy markets will make it more difficult for the IOCs to show visible progress on their ambitions over the next couple of years. Successful balancing of the short-term crisis with the long-term obligation to deliver on the energy transition therefore requires transparency, clear communication, sharing of responsibilities between governments and companies, and a stepwise, careful approach to gradual portfolio adjustments.

NATIONAL OIL COMPANIES AND THE POST-COVID-19 WORLD

Pedro Haas

The COVID-19 pandemic has accelerated and deepened the challenges that many, if not most, national oil companies (NOCs) around the world were already facing. They have not been spared from the impacts that private-sector oil companies have felt (exploration and production and trading companies declaring reorganization or bankruptcy, oil company stocks dropping in value, and accelerating retreat from hydrocarbon lending and equity investing). Most have adopted some of the same responses that private-sector oil companies have chosen (or been compelled) to take, like capex and opex cutbacks, headcount reductions, cash conservation measures, and technical and organizational responses. The central question this article addresses is whether purely quantitative measures will be enough to tide the NOCs over the rough patch, or whether a more fundamental restructuring is necessary to steer these companies onto firmer ground.

The challenges facing NOCs are happening in the context of a compounded hit to the public finances of every government: expenditures directly or indirectly related to the pandemic have accelerated, while fiscal revenues have shrunk and sources of borrowing have dried up or become much more expensive (even in a world of very low interest rates). Among the wealthiest hydrocarbon-producing nations, sovereign wealth funds have been mobilized and are being partially depleted. The natural tension between the state and the NOC is thus intensified, since NOCs have generally channelled less cash to their owners, and in many cases have required state support to remain in business. Even for the richest NOCs and countries, the paradigm has shifted; for the weaker NOCs it is quickly becoming an impossible challenge.

The purpose of NOCs is to support the nation – to maximize the flow of cash to the state, in the form of tax proceeds, dividends, or borrowings. And yet in many cases the support has had to flow in the opposite direction: an improvement in fiscal terms or a reduction in dividends, increasing equity injections or debt support. As long as the state believes that the COVID-19 pandemic is temporary and that the world will soon return to its previous condition, the perception that the NOC requires a severe overhaul can be avoided or postponed. But the longer the economic slump and the deeper the financial hole, the harder it is for the state and the NOC to pretend that they can both carry on with business as usual, even after the COVID-19 threat will seem to have passed.

The pandemic and its aftermath are causing (or should cause) an acceleration of the strategic rethink of the NOC and its role in society. In most if not all cases, NOCs are a distinctive and core part of the nation: they are a symbol of national ambition and achievement, a pillar of the financial viability of the state, in many cases the keystone of national development. Their successes are a source of national pride, their failures or mistakes a source of intense national pain.



The inevitability of the transformation of the NOC raises many challenges, as discussed below.

The nature of the NOC

In most cases, the NOC is a manager of state-owned assets, and it will have to transform itself into a profit-making company. This is caused by the economics of the business, which forces the NOC to transition from an economic rent-collecting activity to a profit-margin activity (whether recognized as such or simply *de facto*). In a more benign environment, the state and the NOC split the economic rent accruing from the company's upstream activities; in a more demanding and stringent environment, the state needs all the resources it can collect.

Does the NOC maximize the collectible rent to the state? When there is insufficient revenue, can the state continue to afford the confusion between economic rent (which accrues to the state) and profit (which accrues to the NOC, and later on partially to the state in the form of taxes and dividends)? Do the state and the NOC even have the management and reporting capabilities to distinguish between rent and margin? Are all the hydrocarbon assets of the nation suited to the financial, managerial, and technical resources of the NOC?

Does the NOC accelerate or slow the exploitation of commercial hydrocarbon resources? While some NOCs have ample natural resources to draw from and must receive guidance from the state regarding the speed at which they may exploit them, other NOCs may be constrained by financial, technical, and managerial limitations. In other words, the requirement that the NOC should be the sole funnel through which hydrocarbon resources are identified and exploited can turn into a brake on the production of the most plentiful and valuable resources.

Does the existence of the NOC necessarily equate to the existence of a state monopoly, or can/should the NOC compete in an open market? This question can apply to all the activities of an NOC, or to some of them only. For example, the monopoly can apply to the upstream, but not to the downstream, or vice versa, or to the NOC's hydrocarbon-related activities but not to the power markets. Domestic competition and international exposure can be a means to impose economic and managerial discipline on the NOC, in support of a particular governance model.

The governance of the NOC

Transitioning from rent-collection to profit-maximizing requires a redefinition of the roles of the state and the NOC, which means redesigning the governance model. The state has many roles, including energy policymaker, owner of the NOC, regulator of the sector, and tax collector. Too many times, these roles are collapsed into one, or even counteract each other. Better and clearer governance requires a better definition of the roles of the state, and especially the demarcation between the political and the regulatory. In other words, not everything about the NOC is political, and maintaining a healthy border between the operational and political is at the core of role demarcation between the NOC and the state that owns it.

Does the NOC contribute to or inhibit the control of the nation's hydrocarbon endowment? The usual endowment of technical and managerial resources tends to favour the NOC over the state. Does the NOC enhance or degrade the capability of the state to assess, manage, and control the nation's hydrocarbon resource base? Does the NOC have an overwhelming superiority over the state in terms of resources, which can favour a misalignment of the company's interests vs. those of its owner (the state-within-the-state syndrome)?

Does the NOC enhance or inhibit the transition to new, cleaner, and less costly energy sources? As economic, societal, and technological forces worldwide cause a transition to a new energy model increasingly reliant on renewable energy sources, does the NOC become a facilitator or an impediment to this transition? Is the interest of the NOC identical or antithetical to that of the nation in this respect?

Do the state and the NOC have clear and separate roles, and do they avoid impinging on each other's roles? It is not uncommon to see role reversals among NOCs and state agencies, where the state ends up involved in micro-management and the NOC in determining policy through *de facto* decision-making. The stewardship of the hydrocarbon resource is a case in point: the balance between resource monetization, market stability, and the potential for stranded resources is a role for the state rather than the NOC, although the NOC has to be clearly involved in the decision-making.

The scope of the NOC

It is tempting for governments with development agendas to broaden the role of the NOC, by leveraging its technical, financial, and managerial capabilities. NOCs can end up building and managing hospitals, schools and universities, housing, and



assorted infrastructure. A profit-oriented NOC is also a better-focused company, with measurable goals and well-defined attributions.

Does the NOC enhance or inhibit the expansion of managerial and technical capabilities in the nation? Just as the NOC is in most cases the largest, or one of the largest, absorbers of capital in the nation, it can also be the largest absorber of skilled technical and managerial resources. The attraction can be caused by better pay, a better career path, a better set of benefits (especially health, education, and pension), or simply a higher perceived prestige. Just as the NOC, at one point of its existence, can have contributed to the nation's endowment of human resources, it can later become a hypertrophied entity that captures a larger share of the skills than the nation can spare.

Can the NOC maintain financial and operational discipline, if it is tasked with several responsibilities that accrue to the state and not to the company? The classic counterargument is that NOCs are not purely profit-maximizing entities, like a private-sector company would be. Otherwise, what would be the purpose of the state owning a NOC? And yet the argument is not that the NOC should exclusively be profit-maximizing, but that it should be mostly so; otherwise the economic discipline of both the state and the NOC are diluted and accountability disappears. The NOC can and should support state goals with a specific purpose and economics in mind, like opening a new frontier or developing infrastructure – that is, addressing risks that the private sector cannot shoulder. This does not necessarily mean absorbing losses, since the capex activity of the NOC can and should be remunerated longer-term for its risk absorption.

Does the NOC have the commercial capability and flexibility to address the volatility and complexity of the hydrocarbon markets? The Atlantic and the Pacific Basin have switched roles; the hydrocarbon deficit will shrink in OECD countries and widen in developing countries; the need to forward integrate into refining and marketing will arise in complex and messy environments, whereas most of the downstream integration efforts of NOCs (Q8, Citgo, Statoil, and Pemex) took place in industrial countries, with a few developing-country exceptions (Petrobras, Saudi Aramco). International hydrocarbons markets have become much more sophisticated, requiring from the NOCs and their governments a corresponding integration and sophistication of their activities. OPEC policy, for instance, has to take into account the shape of the price curve and the way in which its policy decisions will impact the curve. Downstream buyers of crude oil and traders, for instance, benefit from contango, whereas crude producers and their governments much prefer backwardation.

It feels somewhat contradictory that NOCs are facing such major uncertainties, precisely at a time when they are supposed to come into their own, propelled by the logic of reserves ownership. Even before COVID-19, NOCs were challenged by the fact that peak demand had preceded peak production, contrary to most long-term analysts' earlier predictions. The new economics of crude oil production – brought about by the development of unconventional resources, the growing concerns about climate change, and the electrification of the modern economy, plus the advent of the pandemic – are all focusing NOCs on their existential challenges:

- What does the state expect of them, beyond cash generation?
- Are they supposed to focus on their core tasks, or on becoming an agent of change as well – a major resource in the nation's migration to new energy structures and technologies, an engine of progress – at a time when societies in developing countries, some richer, some poorer, are faced with a challenge that they could not have foreseen only a few months ago?
- Will the NOC support the goals of the state, even when they may appear to clash with the goals of the company?
- Can the NOC and the state develop new strategies, new forms of governance, and new management structures that evolve out of the current setup?

The answers to these questions are still unclear; even the questions themselves are in the process of being fully developed. A successful transition for the NOCs of hydrocarbon-producing countries is crucial not only to their nations, but to the stability of the worldwide energy sector as well. Everyone has a stake in the NOCs and their owners getting it right. A major effort of political and managerial imagination will be necessary for them to succeed.

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COVID-19 AND ENERGY TRANSITION IMPACTS ON GLOBAL GAS MARKETS

Tatiana Mitrova and Jonathan Stern

The immediate impact of the COVID-19 crisis on global gas markets remains unclear, other than that it is likely to be less severe than for oil or coal. The International Energy Agency has projected global gas demand in 2020 could fall by 4 per cent (compared with 9 per cent for oil and 8 per cent for coal) before increasing at 1.5 per cent per annum up to 2025. Prior to the crisis, the global gas supply surplus resulted in regional and international prices converging at historic lows. By reducing demand, the crisis forced prices even lower, resulting in strong incentives for short-term switching from coal and oil to gas where possible, but in the power sectors of many countries this will be tempered by gas-to-renewables switching. To the extent that switching to gas is possible in non-power (especially industrial) sectors, where use of renewables may be more complicated, air quality improvement will be a powerful incentive. But widely anticipated national and global recessions means it is possible that any strong rebound of gas demand may be delayed.

The impact of the energy transition on gas is also likely to be less severe, because of its lower carbon dioxide emissions compared with other fossil fuels. But fuel switching is a longer-term option in only a few countries – mostly in Asia – and will depend on whether much larger gas and LNG imports are considered acceptable in relation to energy security, and whether gas prices remain affordable in rapidly industrializing countries. Moreover, until methane emissions from pipeline and LNG value chains are measured with greater accuracy and independently certified, the greenhouse gas (GHG) footprint of natural gas will remain open to question.

Gas prospects will be strongly related to the details of how individual countries and regions will be impacted by, and choose to adapt to, both the health crisis and the energy transition. This in turn will be determined by a combination of economic and policy impacts. The former will be principally governed by the price and availability of imported gas and LNG, and the latter by the priority which governments give to environmental issues: meeting net-zero carbon-reduction targets which are more stringent than those set at COP21 (the 2015 UN climate summit), as well as targets for improvement of urban air quality.

This article considers the crisis-related impacts on gas demand and international trade and investment, particularly in LNG projects, as well as longer-term transition impacts in relation to the major national and regional gas markets.

Crisis-related impacts on major gas markets

Since the COVID-19 pandemic began, the European Union Parliament and many member state governments have expressed continued commitment to the Green Deal, which dictates net zero emissions by 2050 and increases emission-reduction targets for 2030, and to the use of recovery funds to fulfil these aims. But Green Deal policies may encounter delays, and the immediate emphasis of recovery programmes seems more likely to be on the power and transport sectors (acceleration of renewables and support for electric vehicles and associated infrastructure), which would have more immediate impacts on coal and oil demand. Retrofitting buildings for efficiency and lower-carbon energy would have a greater impact on gas demand, but probably on a longer time scale.

Prior to the crisis, natural gas was seen as part of the transition by many European governments but to be progressively replaced by ‘green gases’ (biogas, biomethane, and hydrogen) as those technologies evolve and their costs fall. Investments in green gas, particularly hydrogen-related technologies, are likely as part of recovery packages, but will have no significant impact on energy balances before 2030 (and may still be modest even by 2040).

Increased carbon-based prices or taxes, which consumers may not resist (or may notice less) given current fossil fuel price levels, are likely to have a more immediate impact and become popular with governments needing additional revenues. The introduction of national, and eventually EU, border taxes on GHG (carbon and methane) content would create significant problems for gas imports with high methane emissions in the value chain (or which are unable to provide independent certification of their emissions).

Indigenous gas production (Norway excepted) has been in long-term decline, and Europe will become increasingly dependent on imports. Some countries have used low-cost LNG to accelerate their drive to reduce dependence on Russian gas imports, for political and security reasons, but the majority are allowing commercial logic to dictate their supply choices. Prices in 2020 have created even more bad news for European gas producers, who were already under pressure following the 2018 price downturn. This will accelerate the decline of UK gas production. Norwegian gas production and exports will reduce somewhat due to oil production cuts (as part of the OPEC+ agreement), and low prices will also delay new developments. In the

Mediterranean, gas developments which looked marginal even at pre-2019 price levels will only progress if their destination can be regional countries (rather than European Union or global LNG markets).

Outside Europe and some other OECD countries (particularly parts of North America and possibly Japan), the policy focus of the energy transition in relation to GHG emissions will be significantly less urgent given the crisis-related fall in emissions. Immediate reactions will be based more on the historically low international gas prices in 2020, which look set to continue into at least 2021. There will be no change to the US energy dominance and self-sufficiency policy. However, should a Democratic administration be elected later in 2020, federal policy on GHG emissions could change. In any case, state and city initiatives to pursue GHG reductions will continue. Meanwhile, coal-to-gas switching, particularly in power, is supporting gas demand but, as elsewhere, this will be limited by growth in renewables. Investment in shale gas production has fallen sharply but will quickly pick up if gas and oil prices recover.

In China, low-cost gas imports are helping to accelerate market liberalization, raising the possibility of third-party access to pipelines and LNG terminals. Tensions with the US have prompted a greater focus on domestic gas production and clean coal, but the crisis will highlight security-of-supply concerns around import dependence and how to maintain domestic production at a time of very low import prices.

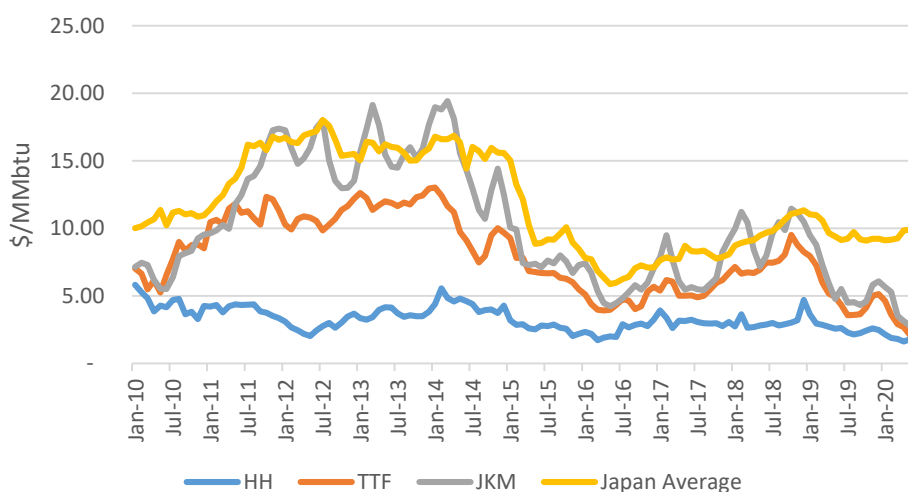
For India, low import prices are a particular benefit, since energy security is very much about minimizing fiscal deficits. In both countries, but especially in China, renewables are making significant progress, but coal development is also continuing, and the past two years have been negative for decarbonization. Indian private-sector gas production, which has been in long-term decline at low prices, is likely to collapse, while production by state-owned companies will fall, but not so dramatically. Air quality will also remain very important to promote gas, particularly for India, as coal-to-gas switching is already well advanced in China, and in both countries vehicle emissions may be an equally important focus.

In summary, COVID-19 will cause a significant reduction in global gas demand in 2020, but a return to a range of 1.5–2.0 per cent for the next several years is possible. The key region on which gas demand recovery depends is Asia, not just China and India but also South-East Asia which will be the principal locations of most coal-to-gas switching, and the Middle East where switching to gas will be from liquids. The main immediate impact has been coal-to-gas switching due to low prices, but this was already the case before the crisis. Some of this switching may be temporary, depending on relative coal and gas prices, but in countries where the coal-fired power fleet is very old, it may be permanent.

Shorter-term impacts on international gas and LNG exports and new project investments

The fall in gas prices and demand during the crisis means that all producing companies will have less money to invest in new developments. The fall in gas prices started well before the COVID-19 crisis and well before the fall in oil prices. Moreover, while it seemed possible by mid-2020 that the worst of the crisis's impact on oil prices had passed, for the gas sector 2020 price levels for US Henry Hub (HH), European spot (TTF) and Asian spot (JKM) could continue for several years.

Regional gas prices 2010–2020



Source: Platts.



This raises two interesting prospects: in Europe, that major suppliers (Russia, Norway, Qatar, and Algeria) may contemplate an informal arrangement to control volumes, particularly if European gas prices turn negative when storage becomes full; and in Asia, that a protracted global LNG surplus and very low spot prices could accelerate a move away from oil-linked long-term contract prices.

The fall in prices combined with reduced demand expectations means that, Qatar excepted, investments in gas production and new projects will also fall, possibly very substantially, as projects are deferred. LNG projects which are under construction may be delayed for both logistical and financial reasons. Final investment decisions (FIDs) for new projects will be stalled until the demand and price outlook provides greater clarity. This is most likely to impact the many US (and some Canadian) LNG export projects, yet to reach FID, which may need to make significant changes to their business models to attract buyers and secure financing.

In Australia, the crisis has caused A\$80 billion of investments in gas and LNG projects to be deferred, although where there is co-production of oil or an expectation of selling LNG at oil-linked prices, some of these decisions may be more directly related to oil price levels. Some existing Australian projects need additional gas to maintain current export levels, and consequently exports may decline modestly in the early 2020s. The government has stated that it will not support climate policies that harm the economy or put jobs at risk, and as a result, it has expressed support for the expansion of the domestic gas market.

Decarbonization has not been a significant policy driver in the Gulf countries. Although renewable-energy development is increasing (albeit from a low base in all countries other than the United Arab Emirates), the major impacts are likely to be seen after 2030. The crisis appears to have had little impact on Qatar's plans for a huge expansion of LNG export capacity, although delays, principally for logistical reasons, are possible. A protracted period of low prices could create incentives to increase regional exports, but this would require improved regional political relationships, specifically a resolution of the rift between Qatar and its Gulf Cooperation Council neighbours. Other Gulf countries will reduce gas investments, with the possible exception of those building LNG receiving terminals to take advantage of low prices.

In Russia, the government may use oil and gas investment support as a driver of general economic recovery, and rouble devaluation will soften some of the financial impact. Pipeline gas projects under construction will be completed, but the crisis could delay new Russian pipelines to China, while US sanctions are having a similar impact on the Nord Stream 2 pipeline to Europe. Extremely low European prices in 2020 resulted in sales to the Russian domestic market becoming more profitable than exports. But domestic prices have been frozen to support industry and prevent protests, and payment obligations for consumers have been relaxed – as a way of absorbing excess domestic production. Although an official national strategy for low-carbon development to 2050 should be submitted to the Russian government later this year, the current draft suggests it will have minimal impact, and the economic and health crises will most likely further weaken any initiatives.

In Russia, India, and Qatar, national oil and gas champions are likely to maintain and even increase their importance as private-sector and foreign investors pull back, leaving national companies as the major gas project investors using their governments' reserve and stabilization funds. We can expect these governments to protect their national companies and use them to promote economic recovery. In China, new domestic private and international companies are likely to be allowed to enter the gas sector and may choose to do so given that demand is continuing to increase.

In relation to longer-term strategies, the share of gas in the reserve portfolios of many national and international oil companies (IOCs) has increased over the past decade, and both groups of companies may see future gas investments as less risky than oil (given the potentially less certain future of oil demand under the energy transition). This can be represented as diversification until large-scale investments in non-fossil energy sectors become attractive. Portfolio players with large balance sheets will be able to progress new LNG projects without reliance on external finance. But the current global surplus and a potentially prolonged period of low gas prices may change the perceived attractiveness of such investments, particularly for IOCs experiencing much lower than anticipated returns on very large LNG projects which started operation in the second half of the 2010s.

Aside from investments by energy companies and governments, it is unclear whether banks and hedge and pension funds will still be interested, and have sufficient liquidity, to invest in gas projects. Their decision-making criteria in relation to risk and return may favour expansion of existing, rather than new greenfield, projects. But it is possible that price volatility and politicization may increase the risk profile of projects to the point where the sector is no longer seen as an attractive future investment.



The strategy of global LNG purchase and sale, which was highly successful in a market with significant regional price spreads, has far fewer commercial advantages in a market where regional prices are uniform and low. Until it can be anticipated that prices will increase significantly, and unless regional differentials then re-emerge, there will be very limited arbitrage gains from moving LNG around the world. This means that companies will need to 'trade smarter' using sophisticated financial instruments that are more usual in oil markets. However, it also suggests that the globalization of gas will slow down and international trade, particularly of LNG, will not increase to the extent anticipated before the crisis.

Longer-term energy transition impacts

Prior to the COVID-19 crisis, most models showed that under COP 21 targets, global gas demand would continue to increase into the 2030s, and then fall increasingly rapidly to 2050. For countries which adopt net-zero targets, the decline of natural gas, unless it can be decarbonized with carbon capture utilisation and storage (CCUS), would need to start in the 2020s. In both cases natural gas could be considered a transition fuel, but net-zero targets dictate that the transition should start soon and have a much shorter duration. The question now is whether the COVID-19 crisis has changed the longer-term outlook. As we have already indicated, answers will differ significantly between countries and regions, and depend not just on gas but also on the development of zero-carbon alternatives and technologies. But the COVID-19 crisis will only significantly change the post-2030 outlook for gas if government recovery packages are directed towards the development of hydrogen or electrification at the expense of gas, to a greater extent than was already anticipated.

In countries which already have a gas market, most studies find that a mix of electrification and gas will be a much lower-cost option to achieve decarbonization targets than electrification alone. Lowest cost will probably mean maintaining gas network infrastructure even if this needs to be converted to carry hydrogen, which will need to be available at scale for use in the industrial – and in some countries the residential, commercial, and electricity – sectors. In order to scale up rapidly, hydrogen will need to be derived from reformed natural gas with CCUS, with the anticipation that these will be replaced by large volumes of hydrogen from electrolysis of renewable energy after 2040.

A key question is when the global supply/demand balance will tighten and create signals for the next price cycle. With most new international gas and LNG projects having delivery costs of at least \$6/MMBtu (and a profitability comfort zone of closer to \$8/MMBtu), investments particularly in new greenfield projects will be a significant problem. In addition, with only 20–30 years before it needs to be phased out (depending on policy commitments), large new natural gas infrastructure may not be feasible unless it is hydrogen-ready. Initially this will be fossil-based hydrogen plus CCUS, but if it is to become a large-scale energy source, the majority of hydrogen will need to come from renewable electricity. This is particularly important for large-scale pipeline exporters to European countries committed to net zero emissions, where new infrastructure investments will need to be either amortized prior to phase-out or converted to decarbonized gas, a transition which needs to start by 2030. LNG exporters will have greater market flexibility, but those planning new projects need to be aware that an energy transition which meets even COP21 targets would mean that, by the 2040s, they would face similar demands from the majority of their customers.

ENERGY AFTER COVID-19: FINANCING A NEO-RENAISSANCE

Ahmed A. Attiga and Leila R. Benali

COVID-19 has compounded a series of crises – economic, health, and potentially financial – that were already changing the energy sector, accelerating some trends and undermining others. Like most other sectors, energy was immediately affected by sharp cuts in capital expenditures and by restrictions to supply chains and project delays and cancellations. On the financial front, the 2020 crisis brought a global slowdown in project finance and mergers and acquisitions, and a repricing of risk to the energy sector, particularly in emerging markets. Liquidity constraints, higher borrowing costs, and growing risks of defaults are pushing the sector to improve capital discipline.

A wider restructuring of the sector has been in the works. The post-COVID-19 energy sector will not see all-out 'creative destruction', as argued by some, where entire parts of the energy system will be replaced by new technologies and value chains. Rather, it will probably witness a 'Neo-Renaissance' in which most existing and new technologies will be needed, as each brings its intrinsic value, as long as these technologies keep evolving and investments continue flowing. Like the architectural style, the future energy mix will be a collection of incremental and eclectic evolutions borrowed from different technologies and sectors.



If energy technologies and players are expected to be increasingly electrified, digitalized, regionalized, and sustainable, the financing needs to be available for those technologies and players. But shorter-term, the current vicious circle of low revenue, low investment, and low output needs to be broken, and a virtuous cycle of investment in lower-cost, lower-carbon, sustainable assets needs to be induced.

Energy investment needs in the short to medium term

Many energy and energy-related commodities took an unprecedented hit in 2020, with more than 40 per cent of the global population locked down for many weeks, and more than 4 billion people were subjected to some form of confinement at the height of the lockdowns in April. Oil and coal were the fuels most affected by the crisis.

The good news is that 'clean' sources of generation are expected to increase with low operating costs and preferential access, and that 2020 global CO₂ emissions should decline by 8 per cent, to the levels of 10 years ago, the largest ever year-on-year reduction. However, it is already clear that the impact on investments has been larger and faster than in previous downturns. The International Energy Agency has reported a fall by one-fifth in 2020 of global energy investments. Oil and gas investments are expected to fall by 32 per cent in 2020 compared to 2019. Other sectors (power and energy use) are less affected. The crisis has also unveiled existing vulnerabilities, as is discussed in more detail below, and the sector is poised for a new wave of consolidations and mergers and acquisitions, particularly in oil and gas services and supply, possibly creating new types of players.

From a funding perspective, the energy sector faces two key problems: relatively low shareholders' returns, and squeezed margins across the value chain. The energy sector provided the lowest returns to shareholders during the last decade among the S&P 500, by a wide margin. Even if renewable energy is perceived by investors as a preferred infrastructure sector, it generally does not yet offer all the characteristics that conventional funding (bank loans, listing on public markets, etc.) is looking for in terms of market capitalization, dividends and liquidity. In fact, conventional funding is more available for well-rated large companies, leaving smaller players, typically testing new technologies, to tap into other forms of financing. These include tailored funding mechanisms such as mini-perms, green bonds, and aggregation of projects, as well as soft loans and crowdfunding.

The renewable industry has certainly benefited from these mechanisms, but the rest of the low-carbon value chain is lagging. The most extreme example is CO₂ capture, utilization, and storage (CCUS), one of the few proven technologies that can decarbonize both power generation and industrial sectors. According to the Intergovernmental Panel on Climate Change, achieving international climate goals would be significantly harder, if not impossible, without CCUS. But to achieve those goals, CCUS yearly investment must be scaled up 25-fold. The proposed Financing Principles for CCUS, established under the auspices of the Clean Energy Ministerial CCUS Initiative, offers a helpful guide to supporting this investment. It attempts to bring together banks and other financial institutions to explore the barriers to large-scale investment in CCUS, including the establishment of revenue streams from CCUS projects and of a CCUS industry driven by the private sector.

In the Middle East and North Africa (MENA), the same declining trend in investment is evident, but the dynamics in the different sectors are slightly different. The Arab Petroleum Investment Corporation (APICORP) projected that during 2020–2024 total committed and planned investments in MENA will be about \$792 billion, 18 per cent lower than its 2019 projection. The private sector's share in energy project investments, which had climbed to 22 per cent in last year's outlook, decreased to 19 per cent. The gas value chain registered the highest increase in planned investments compared to the 2019 outlook at \$28 billion, or 13 per cent, signalling the developing of unconventional gas and increasing production capacity in a few countries (e.g. Qatar).

As argued above, post-COVID-19, most existing fuels and technologies will be needed. However, they will require investment, including in research and development and supporting technologies. The key concern is that this time, unlike in previous downturns, energy investments might not be able to pick up again for two to three years.

Shorter term: the need for countercyclical financing

In the MENA region, the collapse of oil prices has had an adverse impact on all hydrocarbons producers and a destabilizing effect on the most vulnerable ones. Gas exporters were especially affected by a combination of weaker gas demand and falling gas prices. Most countries approached the financial markets in the last three months (April–June). The Gulf Corporation Council issued \$25 billion of four to six times oversubscribed bonds in April, while other MENA countries are generally struggling with increasing bond yields. However, there is a need for countercyclical financing – that is, financing arranged for countries or entities on the verge of a liquidity crisis that otherwise would not be available due to heightened risks.



Amongst the MENA hydrocarbons producers, Bahrain and Oman depend the most on hydrocarbon export revenues for their budget and external current balance and were already in a difficult situation on these two fronts. Oman has been trying to arrange a \$1.5 billion term facility and has started drawing on its revolving facilities – the last line of defence. With no access to a swap line, Oman only has \$7.4 billion of treasuries. After obtaining a bridge facility, primarily from local banks, Bahrain went to the bond market, successfully but at a high cost. The country sold \$1 billion in sukuk (Islamic financial instruments) at 6.25 per cent and \$1 billion in 10-year bonds at 7.375 per cent.

Also, companies that were operating on an open account basis have seen their international counterparts requiring letters of credit to be issued and confirmed by local banks. Working capital needs also increased, triggering the drawdown under existing revolving-credit facilities and the arrangement of new working-capital lines at high cost.

For hydrocarbon importing countries, support was provided by multilateral development banks and development financial institutions in the form of concessional facilities to fund basic needs (food, medical equipment, and commodities) and working capital needs (e.g. paying utility bills). One example is the European Bank for Reconstruction and Development's support for Jordan and Tunisia through concessional loans to the utility companies, given their cash shortfall due to the degradation of invoice collection.

APICORP announced a \$500 million stimulus package to be deployed over the next few months, extending funding for projects, trade flows, and working capital needs in sub-sectors including utilities, renewables, and petrochemicals. Some utilities projects, including renewables, experienced delays in completion, leading to cost escalation and a need for additional capital. Many of these businesses are attractively valued with limited merchant or commodity risk.

In addition to debt, equity investments have become more attractive, as the cyclical nature of the energy sector provides unique investment opportunities during downturns. Many 'deserving' investment opportunities exist at entities that may struggle to access critically required funding during periods of distress. These exist in almost every sector, including renewables, infrastructure, oil and gas companies, oil field services, and technology. It is critical to identify companies and assets which are in financial distress due not to an inherent weakness in their business models but to the crisis or to an overleveraged position.

Confidence in the energy sector and in energy entities is a minimum prerequisite for financing to play a true countercyclical role. Another prerequisite is the ability to extend 'patient capital', as it may take some time, and possibly another downturn in case of a W-shaped recovery, before value can be realized. In times like this, institutional investors with long-term visions and access to long-term funds can play a significant supporting and stabilizing role. APICORP is also expanding its unfunded support to its member countries in the form of issuance and confirmation of letters of credit, with the broader objective of lessening the fiscal and current-account pressures caused by market disruptions.

Longer term: financing the energy players of the future

As the world comes to grips with the longer-term implications of the 2020 global restructuring, some structural and interconnected changes could unfold in several areas including geopolitics, finance, trade, consumer behaviour, and technology. At a minimum, one can assume that energy business models will be pushed towards more vertical integration (e.g. refining, petrochemicals, and utilities) and less specialization to manage the rising commodity and carbon risks. BP is writing off \$17.5 billion in asset value after lowering its 30-year energy price assumptions by 30 per cent, to an average of \$55 a barrel for Brent and \$2.90 per MMBtu for Henry Hub gas. MENA national oil companies, with more limited diversification options, have generally been more conservative in their oil price planning scenarios. But all oil and gas companies have been sharing their long-term visions to transform into integrated low-carbon players, in some cases into electricity providers. As detailed in APICORP reports published in 2019, this trend was already happening, but it has now accelerated given the dilemma faced by the energy sector: relatively low shareholders' returns on the one hand, and squeezed margins across the value chain on the other.

For corporate strategies, a low-carbon world and a longer recovery means further integration, optimization, and scale. This transformation will require a more active role by institutional investors. US shale benefited partly from long-term commitments of private equities before undergoing multiple acquisitions by large players. The recent acquisitions by the Saudi Public Investment Fund in the shares of BP, Shell, Total, and others are just the tip of the iceberg. Consolidations are very much on the table in the troubled oilfield services sector. A few deals are also expected in the utilities sector, albeit with a more region-specific scope.



Moreover, the ongoing 2020 global restructuring has increased awareness that a serious transition towards a low-carbon energy system will require intensive deployment of existing and new technologies at a pace and scale far beyond anything previously experienced. In several large countries, even the confinement of half of the world's population and a deep and unprecedented recession could only decrease daily emissions by 20–30 per cent. The pace and scale needed for anything close to net zero emissions by 2050 will create enormous challenges for highly complex supply chains that do not now exist at scale in technologies such as batteries, solar, wind, and hydrogen. They will also require significant cost cutting and efficiency improvement, drawing on the technology improvements of the last decade – in sensors, software, digitalization, and artificial intelligence – specifically developed or adapted for hydrocarbons and electricity.

These two major transformations – more integration and an accelerated transition towards a low-carbon energy mix – will require not only continued investment in the energy value chain but also increased levels of funding that can only be deployed by a combination of institutional investors, sovereign wealth funds, multilateral development banks, development financial institutions, private equity funds, and commercial banks. Since the impact of the current crisis on investment has been larger and faster than in previous downturns, the 'patient capital' needs to be mobilized more than ever to enable the supply of sustainable, reliable, accessible energy and to finance the players contributing to the Neo-renaissance, to the new energy landscape.

POST-COVID-19 GREEN RECOVERY THROUGH THE LENS OF AN INVESTOR

Helena Viñes Fiestas

This crisis offers a unique chance for genuine transformation in the EU. Many of the hardest-hit sectors, such as oil and gas, automobiles, and aviation, have business models that were already under pressure before the crisis because of rapidly changing market dynamics and ever-tightening climate regulations. The generous recovery packages on offer, together with the particular circumstances of the crisis, provide them with the opportunity to launch bold and ambitious transformational plans that might otherwise be challenging to implement. How these companies respond to these packages, combined with their corporate strategies, will define their future profitability and long-term competitiveness.

The conditions attached to the EU stimulus will be a defining factor. Policymakers can implement recovery packages that may either act as a catalyst for change, setting these companies on the right transition pathway, or lock in their unsustainable business models and waste taxpayers' money.

More than ever, EU aid, and more globally all governmental aid, needs to have a long-term view with a strong environmental and social angle. Circumstances call for a responsible approach by policymakers, companies, and investors that prioritizes long-term returns to both society and the economy.

Oil and gas: an industry already at a crossroads

Over the past months, major European oil companies have announced their commitment to carbon neutrality by 2050 following pressure from investors (see www.climateaction100.org), regulators (the EU and UK's climate neutrality focus), and the demands of the market. The economics of oil for gasoline and diesel vehicles relative to wind- and solar-powered electric vehicles are now in relentless and irreversible decline. [Renewables, in tandem with electric vehicles, are economically and environmentally too attractive for investors, policymakers, and the oil majors to ignore](#). The latter have recognized that the future market is not that of oil but of electricity. The industry is facing 'major demand destruction' and 'even if prices recovered volumes could be significantly lower' (Shell's CEO, earnings call transcript published on [Seeking Alpha](#)).

Oil and gas companies know that they must adapt to declining long-term demand, especially in Europe. The crisis has seen demand collapsing and oil prices falling into negative territory, with comparatively little impact on demand for renewables. For the foreseeable future, the renewables market is so big that there is 'space for big competition without a major price or margin compression.' (Enel's CFO, earnings call transcript published on [Seeking Alpha](#)). The COVID-19 crisis has only accelerated the declining trend; it is a call for change.

Oil and gas companies have not reached the end of the road; they have myriad lucrative possibilities ahead of them to transform their businesses into major energy companies. The oil and gas sector is making investments in renewables – offshore wind, wave energy, solar, and geothermal – as well as in key technologies such as carbon capture, use and storage (CCUS),

plastics recycling, liquefied natural gas, green and blue hydrogen, waste-to-fuel, and biofuels. Green hydrogen, offshore wind, and CCUS alone offer trillion-dollar opportunities. While some of these are still in their infancy, and will take some time to become operational (assuming they do), others are ready for commercialization. Despite companies' flexibility in redeploying capital and leverage to undertake significant change, non-oil and -gas spending still represents a small portion of their capex. How the major international oil companies manage the transformation of their businesses to face the energy transition will define their future.

The [EU Taxonomy](#) provides these companies with a tool to guide the transformation of their businesses and to provide them with better access to green finance – arguably becoming the fastest-growing asset in European financial markets.

The role of the EU Taxonomy

The Taxonomy is a list of economic activities considered to be environmentally sustainable. It also specifies under which circumstances they are considered environmentally sustainable, by setting performance thresholds or technical screening criteria (both evidence- and science-based) that will be updated every five years. The performance thresholds help companies, project promoters, and issuers to access green financing, improve their environmental performance, and identify which activities are already environmentally friendly and which are not.

The approved [Taxonomy Regulation](#) governs the Taxonomy and makes it the official reference in Europe. For activities or financial products that are marketed as green or claim any environmental characteristics, companies and investors will soon be obliged to report how their activities and portfolios are aligned with the Taxonomy, using metrics including percentage of revenues, capital expenditure, and operating expenditure. The Taxonomy therefore sets the first-ever common measurement tool for green investments, providing clarity to the market, ending fears of greenwashing, and giving end investors the opportunity to make informed decisions regarding sustainable investments. It is the legal basis for the EU green bond standard and the first pan-European label for retail financial products, as well as for any label or standard that member states wish to develop for green financial products.

The [Taxonomy](#) supports companies, investors, project promoters, and other stakeholders, including policymakers, in navigating the transition to a low-carbon, resilient, and resource-efficient economy. Its uniqueness lies in the fact that it is consistent with EU environmental goals, including intermediate targets and a procurement plan for Europe to achieve carbon neutrality by 2050.

It is important to differentiate between improving the environmental performance of existing assets and ensuring that all future facilities make the maximum effort to be aligned with the low-carbon transition. The Taxonomy is particularly well suited to guiding new investments.

The current debate surrounding the Taxonomy centres on the role it should play in guiding public spending and green procurement at EU and member-state levels, especially in the recovery from COVID-19. The European Commission proposes that the Taxonomy guides investment in [Europe's recovery](#) to ensure alignment with the EU's long-term ambitions (what remains unclear is exactly how it will do so.)

Transition pathways and the need to strengthen company governance on sustainability

In parallel, there is growing pressure to strengthen the governance of companies in the area of sustainability (included in the [EU Action Plan on Sustainable Finance](#)). The recovery stimulus plan will reinforce this trend: this time around, public support from the EU and in many (but not all) other world regions will and should come with strings attached.

First, governmental aid in the EU will take the form not only of debt but also of equity. There will be different levels of state intervention, and a return to state ownership that will shake the ownership structure of more than a few companies. Society gains little from state interference in companies' daily operations, but the quid pro quo for government intervention could be to reinforce corporate governance requiring companies to pay heed to the interests of their stakeholders. Similar requirements could arguably be applied in exchange for public support in the form of debt.

In some countries, government aid is accompanied by conditionality in the form of disclosure requirements. Canada, for example, has mandated that companies with annual revenues of more than C\$300 million will have to commit to disclosing climate risks in line with the Taskforce on Climate-Related Financial Disclosure (TCFD) framework in order to receive government financial assistance. The International Monetary Fund (IMF) supports reporting conditionalities. In a recent [report](#), the IMF highlights how essential stress testing and mandatory climate risk disclosure lead to the better assessment of physical risks, and therefore how crucial they are in preserving financial stability.

This is a great step forward and is highly commendable, yet still not enough and probably not very practical in a European context. This is because the revision of the EU's [Non-Financial Reporting Directive](#) will almost certainly establish tangible climate-disclosure obligations, which will apply to all companies whether or not they have received state aid. New requirements will most likely integrate, partially or entirely, the non-binding guidelines on reporting climate-related information that the European Commission published in June 2019. Based on the work of the Technical Expert Group on Sustainable Finance, these guidelines integrate the TCFD recommendations into the EU's legislative reporting framework and supplement the Non-Financial Reporting Directive.

Second, while disclosures are extremely important and welcome everywhere, they are just a means to an end. This is a unique opportunity to enshrine long-termism in companies' modus operandi and to emphasize the importance of ensuring returns to long-term shareholders, while at the very least causing no adverse impacts to other stakeholders. During the pandemic recovery process, governments need to emphasize support that helps companies become sustainable from an economic, social, and environmental perspective. Priority should be given to setting companies on the right transition paths. Any firm within a carbon-intensive sector that receives a bespoke or large taxpayer bail-out should develop a detailed strategy to achieve carbon neutrality by 2050 at the latest. Transition plans should include short, medium, and long-term targets, and a social impact programme that addresses potential socially adverse impacts on employees – for example by retraining employees.

In Europe, the Taxonomy could form the basis of green transition plans, in combination with the governance and strategy principles of the TCFD, expressed in the Technical Expert Group's disclosure recommendations. It should also inform companies' future investments. These should be directed towards alignment with the Taxonomy, demonstrating a substantial contribution to climate change mitigation or adaptation (compatible with achieving carbon neutrality by 2050) while avoiding significant harm to other environmental objectives such as biodiversity or clean water. Oil and gas companies, for example, would be incentivized to prioritize their investments in renewables, CCUS, or green hydrogen, while reducing exposure to assets that risk being stranded.

Public support should be conditional on companies committing to assess their activities against the Taxonomy's significant-harm criteria and to modify activities assessed as harmful to make them neutral or low impact. Where activities (such as coal production and use) do not have the potential to transition, companies should establish plans for phasing out or winding down these activities while they diversify their portfolios.

In return for support, companies should also reinforce their governance structures in the following ways:

- Make alignment with Paris Agreement goals, or carbon neutrality by 2050 at the latest, in line with the EU Taxonomy, part of their articles of association.
- Place responsibility for their transition plans at board level.
- Link long-term and variable executive remuneration to progress made in their transition plans.
- Ensure alignment of lobbying and advertising activities.
- Report annually on progress made.

The role of shareholders

Investors – asset owners and asset managers – can play a role in supporting companies in their transition and recovery efforts. Investors need to understand the detailed impact that the crisis has had, or is expected to have, on businesses' prospects, strategies, capital allocation decisions, sustainability plans, employees, and broader stakeholders such as creditors or suppliers.

Companies' capital allocation decisions need to be underpinned by a solid strategy that reflects a balanced approach to the interests of their different stakeholders while ensuring the realization of their long-term plans, including the transition to a low-carbon business model. Long-term investors also understand that taxpayers would be entitled to be repaid ahead of investors if the company has benefited from public support.

More broadly, investors are starting to be scrutinized according to their investment decisions and their own efforts to align their portfolios to the goals of the Paris Agreement.

The new EU sustainable finance regulatory package will have far-reaching implications for asset owners and managers (worth noting that there is a [renewed strategy](#) on its way). New regulation obliges them to integrate sustainability risks into their investment decision-making processes and to disclose how they manage them in practice. As currently drafted, the EU

regulation includes the concept of double materiality as a fundamental part of fiduciary duties. In practice, such an amendment will oblige investors across Europe to take account of the material environmental and social risks to their investments, as well as any adverse impact that their investments may cause to society and the environment.

Investors will have to report on emissions, carbon and energy intensity, alignment to the goals of the Paris Agreement and the Taxonomy, exposure to coal, share of energy from non-renewable sources, and up to [32 social and environmental indicators](#), in relation to their portfolios and underlying investments, irrespective of their location. Similar obligations are expected to apply to credit institutions. Such obligations will impact all companies looking for access to European financial markets and services.

In parallel, [all financial advisers](#) will have to ask their clients about their environmental and social preferences, and present an offer based on their response. Environmental and social information, taxonomy alignment, and whether or not a fund has been labelled (e.g. with the EU Ecolabel) will be presented to clients, alongside financial performance data.

As demand for sustainable investments rises, investors will be motivated to increase the taxonomy alignment of their portfolios and decrease their exposure to high-carbon-intensive assets. This explains why European investors are becoming more demanding with regard to companies' efforts to tackle climate-related risks and why they are using their voting and financial leverage to influence EU and non-EU companies. The EU sustainable finance strategy will have an undeniable impact on the ability of companies to access finance in the EU and the cost of capital in the medium and long term, particularly in high-carbon-intensive industries.

This also helps to explain why a group of 109 investors responsible for managing assets totalling €11.9 trillion put their names to a proposal made to EU leaders [demanding a sustainable recovery](#) from COVID-19.

THE COVID-19 EXIT STRATEGY: FAST-TRACKING AND MAINSTREAMING NET ZERO AMIDST WICKED GEOPOLITICS

Lara Lázarou Touza and Gonzalo Escribano Francés

The COVID-19 exit strategy could resemble that of the 2008 global financial crisis, where only 16 per cent of the funds disbursed via stimulus packages were 'green'. Greenhouse gas (GHG) emissions experienced a strong rebound after the 2008 crisis despite increasingly ambitious climate commitments and temporary emission slowdowns. Alternatively, the COVID-19 exit strategy could accelerate the low-carbon transition by front-loading and mainstreaming net-zero roadmaps through green stimulus packages, greener budgets, and climate neutrality conditions in bailouts.

For a global green recovery to materialize, a coordinated and simultaneous response is needed. The geopolitical context is, however, fraught with difficulties. The US is not cooperating with the international community on a number of issues that require coordinated and simultaneous responses (e.g. the COVID-19 pandemic). In China, the pressure mounts to support jobs and growth even at the expense of environmental and climate goals, while US retrenchment offers China the opportunity to limit America's containment strategy by crafting a more strategic alliance with the EU. Europe will strive, once again, to lead by example through an unprecedented recovery package with green strings attached, a greener Multiannual Financial Framework (2021–2027), and the European Green Deal, Europe's 'man on the moon' project. In a fragmented leadership space, enhancing Sino–EU cooperation for a green COVID-19 exit strategy might be the way forward in fast-tracking and mainstreaming the low-carbon transition, although other alliances will arguably be needed.

This article analyses underlying trends regarding the low-carbon transition prior to the COVID-19 outbreak and offers a preliminary analysis of how these trends can be reinforced or altered in the current context. The article focuses on China, the EU, and the US, which together contribute just under 49 per cent of global GHG emissions, but does not analyse broader geopolitical implications of reaching net zero, or which countries stand to win or lose. Nor does it examine how energy geopolitics will be reconfigured as energy consumption is electrified and hydrogen-based technology develops further.

Global trends

Existing trends prior to the COVID-19 pandemic showed that the economics of transition were increasingly attractive, with renewables being the cheapest source of power in many locations around the world. The materiality of climate risks was being acknowledged by investors, with large-fund managers stressing the importance of climate-proofing portfolios. Companies were realizing that their ability to retain the social license to operate and access finance would benefit if they offered lower-carbon



goods and services. Furthermore, renewable-energy resources (RES) companies have fared better during the COVID-19 pandemic than their fossil-fuel counterparts, with [some analysts warning about an impending disruption to the fossil fuel regime](#). The climate and energy legislation *acquis* (*Acquis communautaire* or *acquis* are European Union laws) was never so comprehensive, having increased 20-fold since the 1990s, and society's concern about climate change was high.

Headwinds to fast-tracking and mainstreaming a Paris-compatible development model will, however, be significant after COVID-19. The world's track record in reducing emissions since 1990 is poor, with GHG emissions having increased approximately 50 per cent between 1990 and 2015. Per capita GHG emissions are more than three times those that would be compatible with the temperature goals enshrined in the Paris Agreement (i.e. limit global mean temperature increases to well-below 2°C (striving for 1.5°C) compared to pre-industrial levels). Current low fossil fuel prices can entice a high-carbon rebound, as was the case after the 2008 global financial crisis. Higher transaction costs for renewable projects and disruptions in the supply chain can stall short-term RES project deployment. Pressure mounts to rescue high-emitting sectors, despite calls for 'green' conditionality including net-zero roadmaps and evidence that investing in renewable infrastructure and clean research and development delivers not only significant climate-positive impacts but also higher long-term multipliers.

Sectoral plans for decarbonization are yet to be fully fleshed out. Globally, nationally determined contributions (NDCs) offer just headline climate action targets. Integrated Energy and Climate Change Plans in the EU provide more detailed indicative (i.e. not necessarily legally binding) decarbonization goals. The US is expected to pull out of the Paris Agreement in November 2020, largely rendering its NDCs unattainable at present. China has not clearly signalled that its second NDCs will be more ambitious. A gradual but inexorable decarbonization path is still resisted by fossil fuel producers who warn about the challenges of decarbonizing mass markets and high-emitting sectors. At the individual level, bridging the gap between concern and climate action will require awareness campaigns, clear information on low-carbon alternatives, internalizing externalities via price signals, competitive prices for low-carbon goods and services, and compensating losers, especially more vulnerable ones.

While COVID-19 might be sending us a postcard from a future in which renewables account for higher percentages of power, and oil and gas producers suffer from geopolitical power shifts, it seems as though the pandemic will enhance pre-existing trends rather than radically changing energy and climate geopolitics.

China

China's concern about economic growth has historically superseded environmental and low-carbon-transition concerns, and is expected to continue to be one of its top priorities in the aftermath of COVID-19. Nonetheless, China's stance towards decarbonization has changed compared to that of 2008. Its exposure to climate impacts, energy security concerns, changes in its economic structure, demands for better environmental quality domestically, and pressure from the international community have fostered increasingly ambitious commitments to a low-carbon transition.

Prior to COVID-19 the key drivers of Chinese climate action included: (1) severe impacts of climate change, including extreme weather events, increased water scarcity, soil erosion, and loss of crops; (2) China's energy use (representing 20.6 per cent of total final energy consumption globally in 2017) and energy dependence (being the largest importer of coal, oil, and natural gas); (3) environmental problems (especially air quality) that put pressure on the government to embrace an 'ecological civilization'; and (4) the changing structure of China's economy towards a more consumption-oriented model.

Over the past decade a 'new normal' development model has emerged, increasing the weight of lower-emitting sectors such as new energies, energy savings, and new-energy vehicles, all of which are considered strategic. In fact, China has been the largest investor in RES over the past decade, investing \$785 billion from 2010 to the first half of 2019. China's domestic drivers of climate action reinforced its willingness to increase visibility and ambition in international climate negotiations. In 2010 China committed to reduce its carbon intensity, and in 2014 it fostered the entry into force of the Paris Agreement, along with the US – a pact that will have to be replicated, perhaps with the EU and others, in order to move the global climate action needle forward.

Despite its decarbonization drivers, the extent to which China's recovery will be green remains to be seen. Slower economic growth in 2019 compared to that indicated in the 13th five-year plan dampened the prospects of an ambitious second NDC to be submitted in 2020. Additionally, China is building coal power plants in 2020 faster than in 2019. However, the economic growth goal has been dropped for the first time in decades due to COVID-19, which could mean a greater focus on sustainability.

Government officials in China have provided mixed signals regarding their exit strategy. As a positive development, the latest Annual Economic and Policy Meeting indicated the government's intention to support technology infrastructure (5G, new-energy vehicles, smart manufacturing, and industrial upgrades). However, the messages regarding climate ambition in the near term



are more sombre. This could mean avoiding ambitious goals in China's second NDC, not considering absolute emission-reduction targets, not bringing forward the 2030 GHG peaking date, not including a net-zero commitment in its long-term strategy, and questioning the feasibility of increasing the percentage of non-fossil fuels in its primary energy consumption, all of which are key for the world to meet the Paris climate goals.

These mixed signals notwithstanding, the dialogue between China and the EU to develop a joint understanding of the impacts of and response to the COVID-19 pandemic is ongoing. This dialogue acknowledges the imperatives of an immediate response to the health, social, and economic crisis while being mindful of the importance of avoiding lock-in effects that would further endanger the low-carbon transition. In a broader context, China could be interested in reinforcing its engagement with the EU at the recently delayed EU–China summit as a way of counteracting the US containment policy towards China.

The European Union

The EU has been a leader by example, and a mediator, in climate action since the 1990s, a trend that will continue in the COVID-19 era. The EU's leadership has been shaped by many factors, including the following:

- concerns about security of supply and energy dependence (53 per cent of EU's energy comes from abroad, with Russia being a key supplier for the majority of member states);
- its increasingly ambitious climate commitments, domestically and internationally;
- its wide-reaching climate and energy *acquis*; and
- a solid track record of meeting climate and energy targets, despite asymmetry across member states.

The EU track record also shows that decoupling emissions and growth has been possible, with GHG emissions between 1990 and 2018 decreasing by 23 per cent and GDP increasing by 61 per cent. Past decoupling of emissions and growth strengthens the case for further action, including through the EU's New Industrial Strategy for Europe – which seeks to harness the opportunities of the twin digital and low-carbon transitions and provide the EU with a competitive edge and with strategic autonomy. However, the feasibility of further decoupling under deep decarbonization scenarios will have to be monitored.

The EU-27 COVID-19 exit strategy is yet to be fully agreed. However, at the time of writing, and after initial pushback from some member states, it seemed certain that both the stimulus package and the proposed Multiannual Financial Framework 2021–2027 of €1.1 trillion will be greener than those put forward after the global financial crisis of 2008. The Multiannual Financial Framework, for instance, is expected to allocate 25 per cent of its funds to climate change. The European Commission's COVID-19 exit proposal includes a new temporary recovery instrument called Next Generation EU of €750 billion (€500 billion in grants and €250 billion in loans to member states), which will be funded by borrowing from financial markets and repaid through the Emissions Trading System, a potential (though controversial) 'carbon border adjustment mechanism', a digital tax, and a tax on non-recycled plastics. Added to these is a first-response package amounting to €540 billion.

The EU's pandemic exit funds and the upcoming budget will be guided by the European Semester's priorities, the European Green Deal's key pillars (the digital and low-carbon transitions), and the recently adopted taxonomy under the action plan on financing sustainable growth, including the 'do no harm rule'. In contrast to 2008, member states have Integrated National Energy and Climate Programmes and Just Transition Strategies to guide policies. Low interest rates, recovery funds of an unprecedented scale and strong regulatory frameworks will bring opportunities for those with shovel-ready and Paris-aligned projects. Germany, for instance, has already announced that its support for the automotive sector will be limited to incentivizing non-fossil fuel/combustion cars, which will be an influential driver for other countries, like Spain, preparing recovery packages for the sector.

Internationally, the EU will strive to raise its ambition by committing to GHG emission reductions of 50–55 per cent below 1990 levels by 2030, which would be enshrined in its second NDC. Discussions with policy-makers in the EU and the UK indicated, however, a winding road to COP26 (the next global UN climate change conference). Health concerns due to COVID-19 have delayed the annual climate gathering twice (it is now scheduled for November 2021). Political capital and attention are rightly focused on the immediate response to the crisis. Hence, the hopes of an ambitious COP26 and a green COVID-19 exit strategy could arguably rest on the following steps.

1. Reach a joint understanding of the current situation with Chinese partners (Sino–EU ideational cooperation). Joint understanding could mean adjusting the negotiation agenda, arguably linking climate and investment negotiations, and



ensuring that stimulus packages avoid carbon lock-in. The establishment of a task force on green recovery within key multilateral institutions (e.g. the G20) could deepen cooperation and understanding. Cooperation could also be expanded to the Belt and Road Initiative, which has to date been high-carbon in nature, as well as to other climate-ambitious countries (e.g. in Latin America and in Africa and Asia).

2. Exploit the climate finance lever by supporting the work of the Coalition of Finance Ministers for Climate Action (encouraging China to join) and the Network for Greening the Financial System.
3. Broaden the scope for climate cooperation so that the EU contributes to the success of the 15th Conference of the Parties (COP) of the Convention of Biodiversity, which is a strategic event for the Chinese government.

The United States

The US stance on fast-tracking and mainstreaming the low-carbon transition after COVID-19 is bleak. Only a limited green recovery push by the US government is to be expected, despite its ability to decarbonize (for instance, [a 1 Gt GHG emissions reduction has been reported since 2000, the largest achieved by any country](#)).

This is not only due to the climate scepticism of the current administration. Reluctance to accelerate a low-carbon development model follows a long-term trend of political gridlock at the federal level. The US also has an abundance of cheap fossil fuels, especially after the shale revolution. It is the world's largest oil producer and the second-largest importer. The US is also the world's largest gas producer, the third-largest producer of coal, and the fourth-largest exporter of coal.

Additionally, there are strong vested interests opposing a low-carbon transition in key swing states that can determine the outcome of the presidential election. Among US citizens, a significant divide exists between Democrats and Republicans. Recent surveys show that Democrats and some moderate Republicans see climate action and economic growth mostly as reinforcing each other, while conservative Republicans generally believe the two goals are at odds.

All of the above led to a double climate default by the US. The first occurred in 2001 when, after having adopted the Kyoto Protocol, the US did not ratify it. The second is expected to occur after the upcoming presidential election, on 4 November 2020, when the US will have officially withdrawn from the Paris Agreement after having been one of its main architects, along with China and the EU, and having adopted and ratified it. The second default could be reversed in the event that Joe Biden, the Democratic candidate, is elected president.

US President Donald Trump's energy strategy, initially announced in his America First Energy Plan and his [Executive Order on Promoting Energy Independence and Economic Growth](#), has been reinforced in the COVID-19 era. The current administration's key goals have been ensuring access to energy at affordable prices and creating jobs while eliminating 'unnecessary' policies, including former President Barack Obama's Climate Action Plan and the Clean Power Plan. In the midst of the worst health crisis in over a century, Trump has continued rolling back environmental protections and undermining the role of science in policy-making. Regulations on vehicle emissions and fuel efficiency have been relaxed, as have regulations to curb pollutants emitted by power plants and standards limiting fine-particle air pollution. It is hence highly unlikely that any sizeable portion of the American stimulus package will be devoted to the low-carbon transition under the current administration, although this could change if the Democratic candidate wins the White House.

Conclusion

Despite the nearly universal reach of the Paris Agreement as the overarching framework guiding countries' energy and climate futures, it is unclear how the low-carbon transition will fare in the current context. Radical uncertainty caused by COVID-19, the global lockdown, and twin supply and demand shocks could either accelerate or slow decarbonization, depending on the response to the crisis. It is likely that pre-existing decarbonization trends will be reinforced by COVID-19. The chances of a green recovery are better than they were in 2008 in the EU; the US is unlikely to embrace a green recovery under the current administration; and China's plans are unclear.

The likelihood of fast-tracking and mainstreaming the low-carbon transition globally will only improve if stronger Sino–EU cooperation is forged by pressing ahead with a green recovery of unprecedented scale. However, despite the mutual interest in addressing climate change, uncertainty remains regarding a successful EU–China climate and energy transition binomial, within a wickedly complex geopolitical context.



Hence, it might be wise to explore ways in which existing ties can be strengthened in the current fragmented climate leadership space. This could mean reinforcing bonds with China, Canada, ambitious countries in Latin America, Asia, the Middle East and North Africa, and Africa more generally. Increased EU climate funds could help in this endeavour by enabling the achievement of conditional NDC commitments, helping fast-track the pathway to net zero.

ENERGY TRANSITION, COVID-19, COMPARATIVE ADVANTAGE, AND A WORLD OF UNCERTAINTY

Kenneth B. Medlock III

The world's economy has expanded considerably over the last three decades, underpinned by the rapid emergence of its most populous nations – China and India – as well as other developing economies. Such growth is critical for domestic prosperity, and it factors into international economic and geopolitical prowess. Environmental quality has increasingly become fundamental to political discourse, especially in the developed nations of the Organization of Economic Cooperation and Development (OECD), where policy proposals aimed at combating climate change – ranging from sweeping legislation to targeted policies directed at tax/fiscal incentives and nature-based solutions – are increasing rapidly.

In the wake of the COVID-19 pandemic and resultant economic crisis, governments in many regions are looking for ways to simultaneously address economic and environmental concerns in their recovery efforts. Whether this is fiscally prudent, or even feasible, remains to be seen, and it is likely that outcomes will differ from region to region. Regardless, it can be stated that economic growth and environmental sustainability are among the world's most pressing challenges. This was also true before COVID-19, but the crisis has made it even more salient.

The burden of this two-pronged challenge will not be distributed evenly around the world, with striking differences between developed and developing nations. Currently, the OECD represents about 1.3 billion people. This collection of nations has been at the centre of global discourse on economic growth, industrial activity, international trade, and geopolitics for over a century. Since the beginning of the 21st century, however, several large non-OECD countries have emerged as major global players. Developing countries in non-OECD Asia are home to roughly 3.4 billion people and have been the prime driver of this change over the last two decades. Non-OECD countries make up a large group of less-developed and developing nations that account for about 6.4 billion people, about five times the population of the OECD. As these countries develop, all matters related to energy, environment, health, and the economy will take on different dimensions in the global context. This is especially true for energy.

In many respects, the world of energy is a world of 'haves' (OECD) and 'have-nots' (non-OECD). While the paradigm is rapidly changing with the emergence of developing behemoths such as China and India, a large part of the global community remains mired in energy poverty, and the prospects for change are discouraging. According to the United Nations (UN) *World Population Prospects 2019*, by mid-century the global population will increase by more than 2 billion people, almost entirely in non-OECD countries. This will place added strain on energy, food, and water systems in those countries, and spotlight a feedback loop in which economic progress is vital to meeting new demands that will arise with continued population growth and economic expansion.

Uncertainty and the impact of COVID-19

The COVID-19 pandemic has exacted a massive human toll, and policy responses have unleashed a massive economic toll. The unexpected events that have transpired in 2020 have been devastating on many levels. Economies around the world are operating well below capacity, and policymakers are grappling with how to blunt the economic toll and restore public confidence. Both will prove to be difficult. 'Uncertainty' is rapidly becoming the word of the year for 2020.

Certain things have become part of a 'new normal' since March 2020. Working from home and meeting virtually have become common. Despite some protest, social distancing and mask wearing are now seen as positive, responsible steps to minimize the spread of the virus. Passenger mobility is down substantially, with air travel decimated and substantially reduced use of public and private transportation. Recent [National Bureau of Economic Research](#) working papers are drawing strong correlations between infection rates and the use of public transportation in the US, which opens an entirely new line of inquiry into future protocols for the use of mass transit and raises questions about the future of energy use in transportation. Altogether, this highlights why restoring public confidence is central to recovery from COVID-19.



It can be sobering to realize that, at the time of this writing, it has only been four months since societies were turned upside down and life was made uncertain by the pandemic. In a world of short attention spans and a social-media-dominated discourse, where thoughts and information flow freely and conversations turn frequently, the last four months have seemed to drag on for an eternity. That said, the last 4 months do *not* represent an eternity. Capital stocks have not turned over. Households have not completely overhauled their energy-using durable goods, and vehicle stocks have not been replaced. If anything, the rate of change has slowed. This raises a simple question: 'when the economy starts to move again, what will happen to energy use?'

Answers to this question cover a wide spectrum. At one end is the assertion that demand, particularly oil demand, has peaked. This has even been connected to the recent write-downs by BP and Shell, with claims that the write-downs are a realization that the associated assets are stranded due to the energy transition. However, those claims do not take into account the multiple reasons write-downs occur, including the requirement that a firm's financial statement accurately reflect the current revenue-generating capability of an asset relative to its costs, where revenue potential has been negatively impacted by lower prices in the wake of an unexpected event, COVID-19. Write-downs are prudent means of reducing tax liability and signaling to investors that there has been a positive balance sheet restructuring.

At the opposite end of the spectrum are statements that when public confidence is restored, capital stocks will be reactivated and energy use will rise in lockstep with the economy. Then, the discussions tend to focus on the pace of recovery and what the interim will look like. Of course, these discussions can often be rooted in the debatable supposition that consumer behaviors will revert to pre-crisis norms.

Interesting arguments can be made for and against each position, which only serves to heighten uncertainty.

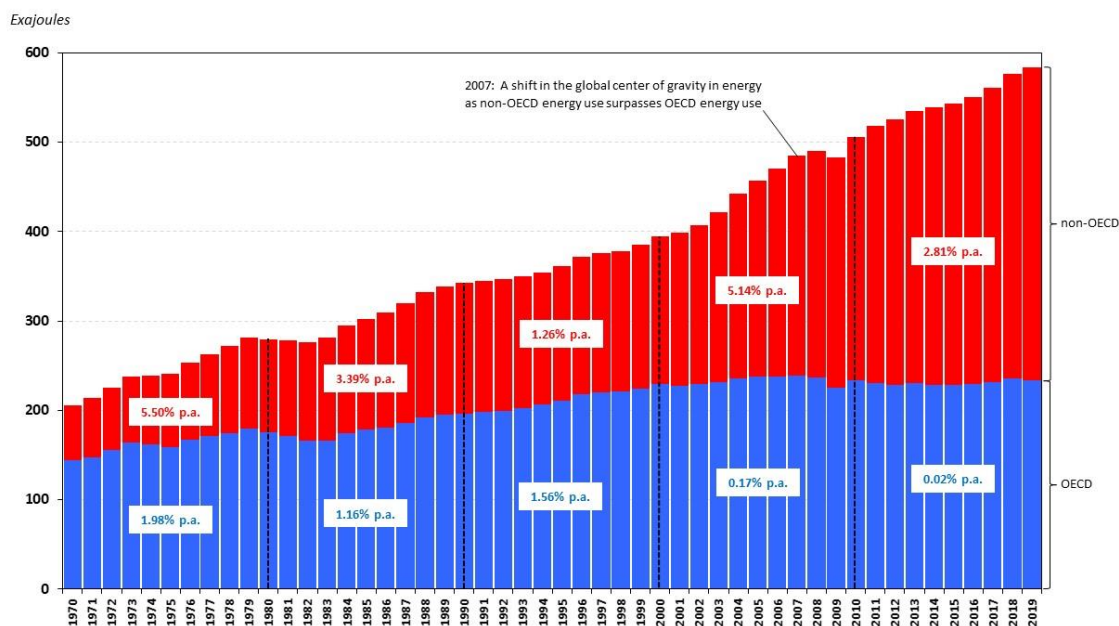
Finally, there is a growing chorus linking economic recovery with green energy infrastructure initiatives. Such calls are not without detractors, leading to active debate about the appropriateness of such policies in a broad economic stimulus. Regardless of outcomes, which will most likely vary by region, it is generally recognized that policy can have dramatic implications for local and regional energy markets, potentially even spilling into global markets depending on what is ultimately implemented. But future policy ambiguity only serves to complicate matters, layering greater uncertainty about the future of energy onto an already uncertain outlook.

Is the past prologue?

Examining the past can sometimes reveal both challenges and opportunities that may lie ahead, even in the wake of a dramatic turn of events such as the COVID-19 crisis. The figure below reveals global primary energy demand as well as per annum growth rates by decade since 1970 in OECD and non-OECD nations. OECD demand growth has generally fallen during that time, and has virtually stagnated over the last decade. By contrast, non-OECD demand growth has been strong and highly dependent on the emergence of various countries, with growth over the last 20 years driven by China and India. In fact, demand has grown so strongly in non-OECD countries that it eclipsed OECD demand in 2007, with no real prospect for reversal.

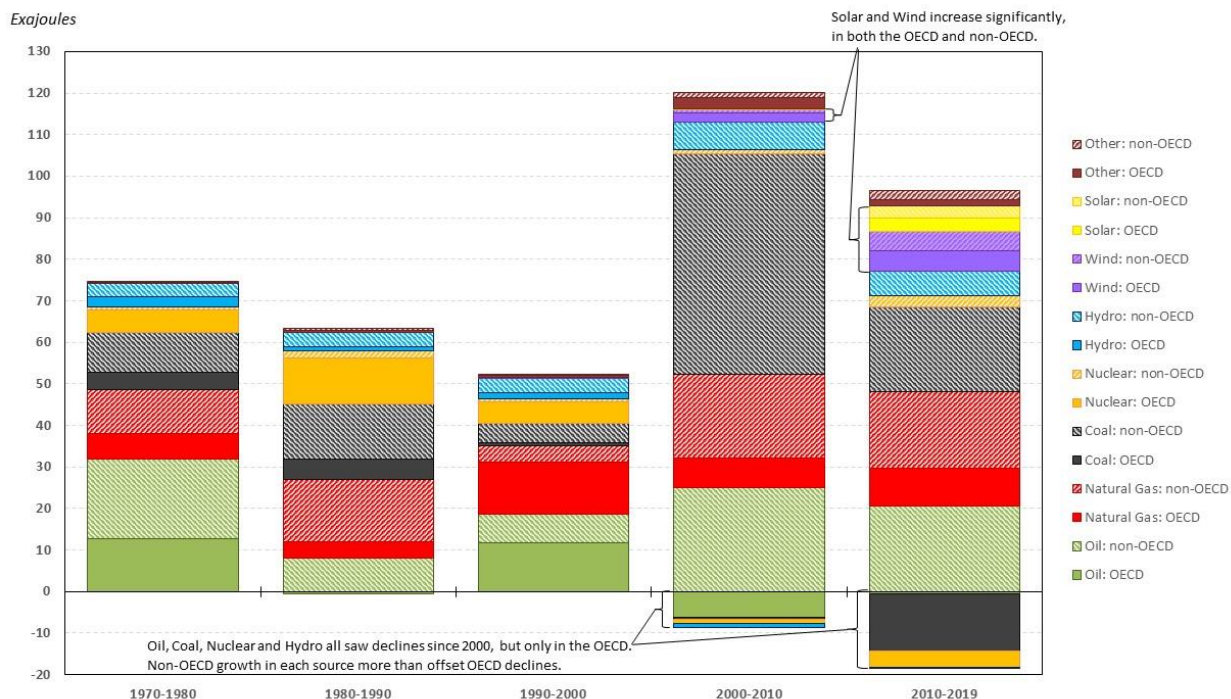
The evolution of fuel mix has also differed between OECD and non-OECD countries. The growth in coal use in developing Asia drove a large increase in non-OECD coal demand, which more than offset the declines in coal use in the OECD. In fact, non-OECD coal use increased 260 percent since 1990 and now accounts for almost 80 percent of global coal use. Similarly, non-OECD oil use more than doubled over the last three decades, and natural gas demand rose by about 220 percent. In the OECD, coal use fell by roughly 30 percent over the last three decades, with the majority of the decline occurring over the last ten years as an ageing legacy of coal-fired power generation has been replaced by newer, more efficient, less costly natural gas and renewables. By contrast, oil and natural gas use rose by about 10 percent and 80 percent, respectively, over the last three decades. In both the OECD and non-OECD, the use of wind and solar has expanded well over 100-fold since 1990, representing the fastest-growing energy sources by far, although each began from a very small base.

Global primary energy use, OECD and non-OECD countries (1970–2019)



Data source: BP Statistical Review of World Energy, 2020.

Change in energy use by source, OECD and non-OECD countries (1970–2019)



Data source: BP Statistical Review of World Energy, 2020.

The figures above highlight just how massive an undertaking a shift away from fossil fuels will be, especially if a global goal of net zero by 2050 is to be achieved. In 2019, the share of fossil fuels in the global primary energy mix was 84.3 percent – with oil at 33.1 percent, natural gas at 24.2 percent, and coal at 27.0 percent. In 1990, the share of fossil fuels was 86.0 percent – with oil at 39.6 percent, natural gas at 21.6 percent, and coal at 24.8 percent. So, in the last 30 years the fossil share has declined slightly and the composition has shifted away from oil towards natural gas and coal. But focusing only on market share can be misleading, as overall use of all three fuels has increased with global energy demand growth.



Consider, for example, a modest outlook in which global energy demand rises by one-third between 2019 and 2050. Simply holding the use of fossil fuels to their 2019 levels in 2050 will require the fossil share to decline from 84.3 to 63.2 percent. While this may not be insurmountable, it requires other energy sources to increase their collective share from 15.7 to 36.8 percent, which translates to a more than three-fold increase in energy delivered from all non-fossil sources globally. If we assume all incremental demand will be met by wind and solar, a more than 10-fold increase in wind and solar energy must occur over the next three decades, just to keep fossil energy use flat. To achieve a much more ambitious carbon-free energy portfolio, the increase would have to be significantly larger.

Further complicating matters is the source of energy demand growth. The OECD has not accounted for any significant increase in energy demand over the last couple of decades. This is a symptom of relatively low economic growth, stagnant-to-declining populations, and gains in energy efficiency. By contrast, non-OECD countries have accounted for almost all global demand growth since 2000. Both trends are expected to continue, meaning the non-OECD countries must shoulder the majority of the shift to non-fossil energy sources, which would be a dramatic change relative to recent history.

The sheer size of non-OECD populations and economies presents a scale that will drive growth across multiple energy value chains. This has, in fact, already occurred with the astounding growth in the use of renewables alongside strong growth in the use of fossil fuels in non-OECD countries. Will this pattern continue? It is difficult to say, but given the magnitude of the infrastructure required to deliver energy services to the more than 6 billion people in non-OECD countries, one has to wonder how it could not.

Legacy, scale, technology, and the principle of comparative advantage

While the above arguments highlight the challenge, they are by no means meant to cast doubt on efforts to transition the global energy system. Rather, they are meant to establish the frame for a discussion about how to get to a desired outcome. To that end, any discussion of energy transitions must be able to reconcile legacy, scale, and technology. The *legacy* of infrastructure and energy delivery systems is the designator of change, where older infrastructures represent aging legacies that can be readily replaced, while the retirement of newer infrastructures would bear significant stranded costs. *Scale* matters because energy systems are large and must accommodate growth and expanding access, a point that is often under-appreciated in discussions about energy transitions. *Technology* signals how fuels will ultimately compete, working in multiple, sometimes competing, directions by raising the efficiency of use of existing fuels and by introducing new competitive energy sources.

Capital investment is the vehicle for technology deployment, which brings us full circle back to legacy and scale. Of course, economic viability also matters, because the cost-benefit ratio of any capital investment decision must be favourable for it to be sustainable. Meanwhile, policy and geopolitics shape, and are shaped by, all of the factors discussed above. Multiple factors influence the future of energy – but legacy, scale, and technology set the stage.

The principle of comparative advantage, which is intimately linked to all of the above, will ultimately define how transitions occur in different parts of the world. This simple point is too often unrecognized. There is a portfolio of options available for a lower-carbon energy future. But not every option in the portfolio is suitable everywhere. For instance, certain regions are favourable for a build-out of intermittent renewable resources that can leverage transmission connections to large hydropower resources for load stability. Some regions can leverage ample solar resources alongside low-cost natural gas to fuel economic activity; others have geologic advantages co-located with large industrial complexes that could make hydrogen with carbon capture and sequestration an attractive option; and still others have a wealth of renewable resources that could be leveraged to generate hydrogen through electrolysis. In either of the latter two cases, hydrogen could then be used to fuel transportation and/or store energy. Finally, there are some regions with very low-cost fossil energy resources that will continue to leverage their comparative advantage in those industries, even when fossil fuel use eventually declines, largely because the decline will not happen overnight.

Only by recognizing regionally distinct comparative advantages will least-cost outcomes be achieved. In turn, this will cause the energy transition to look different everywhere and to be resilient in providing economic opportunities. Absent this, the energy transition will occur in fits and starts, and will do little to change the global energy mix in the near to medium term.

In the end, the COVID-19 crisis will hopefully engender some focus and reinforce the importance of the principle of comparative advantage for piercing the veil of uncertainty, fostering energy transition, and driving economies. After all, the last 200-plus years of economic growth should have taught us something.

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CHINA'S CLIMATE COMMITMENTS AND ENERGY AMBITIONS BEYOND COVID-19

Sam Geall

After the UN climate talks in Paris in late 2015, there was little doubt that the People's Republic of China (PRC), the world's largest carbon dioxide emitter by volume, aimed to reposition itself as a global climate leader. But if China's commitment to ambitious climate policies was not entirely knocked off course by economic and geopolitical headwinds — particularly the election of US President Donald Trump and the ensuing trade tensions — it was certainly put under pressure.

Coal consumption began to tick upwards, even as it fell as a proportion of the energy mix, and China's commitment to climate policies at the UN became equivocal. COVID-19 injected a further element of uncertainty, which might cut both ways. On the one hand, it has increased international tensions, which could spur further retrenchment and a focus on energy security, boosting coal-fired power. On the other hand, it may lead to renewed calls from inside China for a deeper environmental commitment, with Beijing taking the opportunity to lead in the technologies of the future.

The pandemic came at a moment of flux. China's economic, energy, and climate goals in the 14th five year plan (FYP), covering 2021–2025, are currently being debated among policymakers and are scheduled to be unveiled in March 2021. There has also been a bureaucratic reshuffle. The 13th FYP period (2016–2020) saw the creation of two new super-ministries, with climate-change responsibilities moved out of the top economic planning agency, the National Development and Reform Commission, to the Ministry of Ecology and Environment (MEE). The MEE is under new, dual leadership: Minister Huang Runqiu is a well-regarded official who is not a member of the Chinese Communist Party (CCP), and Sun Jinlong is the new CCP secretary.

It appears that two approaches to a recovery, higher- and lower-carbon ('brown' and 'green') in emphasis, are being debated in elite circles, suggesting a renewed fragmentation and uncertainty regarding China's post-virus reconstruction. This article considers to what extent China might prioritize environmental and climate goals in its recovery, and what this implies for the country's energy transition and its participation in global climate and environmental cooperation.

Green hopes for 2020

In late 2015, China committed under the UN Paris Agreement to peak its greenhouse-gas emissions by 2030 or sooner, to cut carbon intensity (emissions per unit of GDP) by 60 to 65 per cent of 2005 levels by 2030, and to increase the share of non-fossil fuels in its primary energy mix to 20 per cent by the same date. Its domestic commitments were consistent with or exceeded these pledges.

In the 13th FYP (2016–2020), China set a goal of 15 per cent non-fossil-based energy in the country's primary energy mix by 2020, and set a cap on total energy consumption at 5 billion tonnes of standard coal equivalent by 2020, a 16.3 per cent increase in consumption from 2015 levels. This implied a reduction in the proportion of coal in the energy mix to below 58 per cent.

In the decade before signing the Paris Agreement, China's coal industry was already shedding jobs due to automation. Traditionally coal-dependent provinces, such as Shanxi and Inner Mongolia, have seen continued job losses due to air pollution regulations and an increasing share of renewables. Even after Trump's retreat from the global agreement on climate, CCP General Secretary Xi Jinping announced, in a 2017 speech to the CCP, that China was 'in the driver's seat' on climate cooperation. Xi made 'ecological civilization' and other green buzzwords a signature element of his rhetoric.

Yet ambitious climate policies had other dimensions, beyond environmental or altruistic motives. They clearly aligned with some of China's key political and economic ambitions, including the following:

- to restructure the domestic economy away from energy-intensive, polluting industries and towards innovation and services, as the leadership aimed to realize a 'new normal' of slower, higher-quality growth;
- to move up the value chain through state-led industrial policies, such as Made in China 2025, and position China as the leading supplier of low-carbon technology to the rest of the world;
- to increase energy security through diversification, exposing China to less of the geopolitical entanglements and price volatility associated with fossil-fuel imports;
- to reduce choking smog (seen in China's landmark Air Pollution Prevention and Control Action Plan in 2013, for example), in large part to maintain domestic CCP legitimacy, given rising public concerns about the health effects of air pollution;



- to increase China's standing in the international arena, by taking a lead in global environmental governance, as seen in China's decision to host the 15th Conference of the Parties (COP15) of the UN biodiversity talks (the Convention on Biological Diversity or CBD), postponed to 2021.

Globally, CBD COP15 in Kunming was expected to be one of the most important elements of the 2020 'super year for the environment', characterized by synergies across and between environmental negotiations – including the UN-led climate talks in the UK and the EU–China summit in Leipzig, Germany – with the prospect of renewed international cooperation enabling greater global environmental ambition.

The UN climate talks are at a critical juncture: the Intergovernmental Panel on Climate Change has warned that keeping the world's average temperature rise to 1.5°C 'can only be achieved if global carbon dioxide emissions start to decline well before 2030'. Reaching that crucial goal requires parties to the treaty to make significant increases in their commitment to reducing greenhouse gases – part of the crucial 'stocktake' process of ratcheting up national targets.

The impact of COVID-19

Given the US planned withdrawal from the talks, China is central to the future of not only the United Nations Framework Convention on Climate Change (UNFCCC) but also the outcome of the climate crisis itself. Yet it barely needs saying that 2020 has not turned out as planned, and the impacts of the COVID-19 crisis have been grave and myriad. These effects already include delays and cancellations of international environmental negotiations and government meetings in 2020, including the postponement of UNFCCC COP26, the Leipzig EU–China Summit, and CBD COP15.

It has also meant delays for domestic policymaking, including the opening of the annual legislative meetings in 2020, the submission of emissions pledges to the UN climate talks stocktake (known as nationally determined contributions, which are now not expected until the end of the year, after the US presidential election), and the hoped-for synergies between international meetings and engagements during the 'super year' (bilateral meetings have been delayed until after the "Twin Sessions" legislative meetings, which convened in late May 2020, instead of early March 2020).

Furthermore, the fallout from COVID-19 has created greater international tensions and the further deterioration of the US–China relationship (seen prominently in spats over the origin of the coronavirus and calls for an international inquiry), once a linchpin of climate cooperation, making protectionist and nationalist approaches to energy and the environment all the more likely.

Finally, there have been profound negative impacts on supply and demand in the global economy, and rising fears of a recession or depression – leading in some places, including the United States, to a further downgrade of climate change on the political agenda and calls for environmental regulation to be reduced. The federal bailout of industries affected by the pandemic in the United States, for example, looks to include billions of dollars of concessions to oil, gas, and coal companies — including US\$3.9 billion from the Paycheck Protection Program and \$1.9 billion in tax credits in the CARES Act passed by Congress.

Before COVID-19, there were signals in China that environmental concerns were in danger of slipping further down the political agenda. Some local governments pushed to expand coal power generation (just as others supported the transition away from coal), typically to ensure continued employment, short-term financial stability, and tax revenues. In the background loomed a number of growing stresses: the US–China trade war, ongoing protests in Hong Kong, distrust of China's practices and motives around the Belt and Road Initiative, and the pressure to meet highly symbolic poverty-alleviation targets: to eradicate poverty by 2021, the centenary of the CCP's founding, and to become a 'moderately prosperous' country by 2049, the centenary of the PRC's founding.

With the shock to the system posed by COVID-19 came a significant reduction in energy use, emissions, and pollution, but also bigger questions over what form the recovery might take and how it would impact energy and the environment. As the country continues to address a potential resurgence of infections and delays to policymaking, the shape of the post-pandemic stimulus, let alone an economic recovery, is still an open question. The most important questions for China's energy transition, climate, and environmental policy outlook, therefore, are being debated now in elite circles, in the context of the stimulus and recovery plans the government is formulating.

Signals for the recovery

To understand what type of recovery is being targeted, we need to look for signals not only to President Xi and the CCP's rhetorical commitments to the environment, but also to the futures targeted under the next FYP, stimulus packages, and other policy measures related to the post-virus recovery. Politburo statements have set out conceptual frameworks for this recovery, such as the 'six ensures': to ensure employment, basic livelihood, market entities, food and energy security, stability of the supply chain, and the 'functioning of grassroots institutions'.



But the moment is very different from the 2008 crisis, when China unveiled a huge central stimulus package that included its largest ever set of green measures (alongside high-carbon infrastructure investment). Chinese economists are divided about the risks of a post-virus recession in China; some caution against a large expansion in liquidity and warn that unrealistic targets could lead to ill-considered stimulus projects.

The 2020 Twin Sessions legislative meetings reflected this cautious stance. Premier Li Keqiang's flagship [Report on the Work of the Government](#) did not set a GDP growth target for 2020, the first such omission since 2002. A fiscal stimulus package was passed, but at 6.35 trillion yuan (US\$895 billion) it was far smaller than expected. In his press conference, Premier Li emphasized that spurring consumption, rather than infrastructure investment, was the priority for the government's recovery plan.

When it comes to coal, however, the signals are not so cautious. In February, the National Energy Administration lowered the risk ratings for coal-power overcapacity in many parts of the country for the third year running, opening the door for more regions to build coal power in 2021–2023. In theory, these risk ratings are used by central government to cool the expansion of coal-fired power, since approval powers have been devolved to the local level. It might be expected, too, that the risks are high: coal companies are losing money and utilization rates are low. A 2018–2019 report from the China Electricity Council found almost 50 per cent of Chinese thermal power generators lost money over the year.

However, the government's low risk rating – perhaps reflecting political concerns about unemployment or a future supply crunch – gave a green light to new coal: Global Energy Monitor reported that in just the first 18 days of March, China approved the construction of 7.96 GW of coal power – more than the 6.31 GW approved over the whole of 2019. In March, a [Carbon Tracker analysis](#) found that China has 99.7 GW of coal power capacity under construction, and 106.2 GW more in the planning pipeline – accounting for 40 per cent of global capacity under construction or in planning.

On the other side of the energy ledger, Carbon Tracker found that 70 per cent of the country's operating coal plants cost more to run than the cost of building new onshore wind or utility-scale solar photovoltaic. The new draft Energy Law, released on April 10, stipulates that 'energy exploration and development should be consistent with ecological civilization', but indications are that renewable-energy targets under China's 14th FYP will not rise above the 2030 target set in Paris. The direction of renewable energy policy has been towards the removal of subsidies in order to cool the market and prevent curtailment, where renewable power capacity outstrips the demands or even reach of the grid. Whether this might change is yet to be seen.

While there are indications that the 14th FYP could include a carbon emissions cap for the first time, there have also been proposals for a yet looser cap on coal-fired capacity – specifically, to expand it by 200 GW to 2030, and to 1,300 GW in total. At the same time, there are clear signals that 'new-infrastructure' – a catch-all term that includes 5G, ultra-high-voltage grid transmission, intercity rail, electric vehicle charging stations, big data centres, artificial intelligence, and more – will form a part of any such spending.

Conclusion

Any 'new-infrastructure' plan will need to be energy efficient and run on renewable power in order to be green and low carbon. But it is a signal that elite actors in China are considering investment in innovation, including electric vehicles and energy technologies, rather than merely bailing out incumbent industries. The MEE, under new leadership, has an opportunity to burnish its environmental credentials, and a resilient recovery that emphasizes nature, climate, and health is an appealing message for China to advance on the world stage.

There is a significant opportunity to advance such an agenda in the run-up to COP26 in Glasgow, postponed to late 2021. On the road to Glasgow, there are a number of meetings at which China, by signalling its interest in raising climate commitments, could help to spur further coordination to promote a resilient recovery. These include the postponed EU–China summit, which should reflect Europe's comprehensive effort to mainstream a 2050 carbon neutrality target in budgets, plans, and industrial strategies across the bloc; the G20, hosted by Italy, a COP26 co-host; and CBD COP15.

The 'super year' for the environment may have been postponed, but the climate crisis can't be, and a resumption of environmental negotiations in 2021 will see higher awareness than before of the centrality of biodiversity and wildlife protection in the preservation of public health and prevention of zoonotic disease transmission. China can take this opportunity not only to showcase new legislative and enforcement action against wildlife consumption and trade – seen also in the Twin Sessions in 2020 – but also to demonstrate particular synergies with the COP26 climate talks, since climate change is one of the largest identified drivers of biodiversity loss, particularly around the theme of 'nature-based solutions', which China chairs under the UNFCCC.

However, the uncertainties are many, not least associated with the sharpening geopolitics of COVID-19 and the results of the US elections in 2020. The opportunity exists for a renewed commitment to industrial and energy transformation – much as the Green Deal is being mainstreamed into economic recovery and energy planning in Europe – and signals that ‘new-infrastructure’ will form a pillar of that recovery suggest some commitment to that pathway. Government-connected figures are arguing, in private at least, against any further expansion in coal-fired power capacity under the 14th FYP. If coal continues to receive a boost this year, it will call into question China’s claim to the ‘driver’s seat’ on climate.

GREENING THE COVID-19 RECOVERY: FEASIBILITY AND IMPLEMENTATION ISSUES IN THE EUROPEAN UNION

Jean-Michel Glachant

The COVID-19 crisis and climate change are both serious issues, and addressing them in a single policy is a serious challenge. In Western countries, the COVID-19 outbreak has left intact most of the supply-side capabilities and a large part of the consumption potential. Climate change, in contrast, is an increasing long-term threat, which requires changing most supply-side fundamentals and consumption habits.

This article first explores the question: after the COVID-19 crisis, what will the ‘new normal’ be for the energy sector? It then discusses the feasibility of a green recovery, as a general public policy issue and as a particular challenge for the EU’s weak central authority. Next, it reviews likely implementation challenges, focusing on two energy supply-side options: renewables and carbon-neutral hydrogen. While a European green recovery policy seems much more feasible than it did even a few months ago, both the launch and the implementation of such a policy are likely to be challenging.

After the COVID-19 crisis, what will the ‘new normal’ be for the EU energy sector?

The COVID-19 crisis has temporarily but sharply reduced demand from companies for electricity, and from both companies and households for fossil fuels. At its lowest, electricity demand was down by as much as 25–28 per cent in France and Italy and 10–20 per cent in Germany and Belgium. Electricity wholesale prices fell by much more than half, with many negative price episodes. The EU price of carbon also went down to 15 euros a ton, calling into question whether the expected intervention by the EU Market Stability Reserve will be able to put it back to the pre-crisis level.

The world reduction in demand for fossil fuels put their prices at very low levels, triggering a wave of reduction in investments and of cost cutting by oil and gas majors. For the first time, world investment in renewables also reduced sharply. However, as low as fossil fuel prices are, they cannot beat wind and solar short-term costs in the generation merit order; they only call into question the relative order between lignite and coal versus gas in the residual demand left by renewables.

Another question regards the new EU post-crisis trend in renewable generation investment. As electricity demand and electricity generation investment are unlikely to grow above the pre-COVID-19 crisis level for a while, the electricity sector should probably evolve between its low level of March and April and its pre-COVID-19 level, with no other major change for a year or two. The low levels of prices and demand in the EU energy sector should impact all energy companies, whether they are regulated or not, raising questions about the viability of grids recovering fixed costs through volumetric charges under their revenue cap.

The feasibility of a green EU recovery

At the beginning of the COVID-19 crisis in March and April, the EU support for member countries supposedly mimicked what had been done after the 2008 financial crisis: an intervention by the EU central bank centred on a short-term rescue package framed by an ad hoc conditionality mechanism embedded in political governance driven by the ‘frugal northern’ states. At that point, a ‘green recovery’ policy was only an issue for intellectual debate. However, it became an EU policy-making issue on 18 May when Chancellor Merkel and President Macron allied in favour of a €500 billion recovery plan embedded in the European Commission budget for 2021–2027, a plan that the Commission expanded to a €750 billion recovery proposal: Next Generation EU. What the EU actually agrees to do will be detailed in the second semester of 2020 under the German EU presidency, but it is already a real policy-making debate, not only a hypothesis.

The first issue to discuss is whether a green agenda can reasonably be considered a good enough recovery tool to place it at the centre of the EU’s strategy. Any medium-term escape from the COVID-19 crisis (with a 5- to 10-year horizon) is indeed a serious matter beyond the fate of short-term rescue plans (with a 1- to 18-month horizon). A key empirical proof of seriousness is provided by an Oxford University study led by Cameron Hepburn and co-authored by Nick Stern and Jo Stiglitz in May 2020.

Researchers interviewed 231 experts from 53 countries (including all G20 countries) to rank 25 typical public-policy programmes (identified among hundreds of actual public policies implemented after the 2008 financial crisis). The study ranked these programmes according to their properties as economic policy tools (such as their speed of implementation as short-term 'rescue' packages and their long-term economic multipliers for medium-term 'recovery,' multiplying the initial public spending up to two or three times) plus their climate impacts and policy attractiveness. The study identified five policy programmes with a strong enough potential for recovery due to their economic multipliers and guaranteed climate impacts. Three are classic public support programmes: clean research and development (R&D), clean physical assets, and building efficiency retrofits. The other two are education and training, and investment in natural capital.

The second issue to address is the EU itself. It does not have a strong central government like the US and China, or even an acting political majority, as even troubled Spain and Italy have. Undertaking new policies in new areas which are not already entrusted to the European Commission by EU treaties is difficult, sometimes extremely so, as is illustrated by a decade of European crises over the eurozone, Ukraine, and migrants. However, if an EU recovery plan concentrates on public spending and state aid financed by debt, and does not so deeply hurt EU competitiveness as to necessitate a strong border adjustment mechanism, there should be less difficulty in reaching a European agreement. The difficulty might drop to the level of a 'normal' fierce fight about an expanded European budget for 2021–2027.

A typically fierce EU fight has two general dimensions. The first is an alliance of 'frugal' countries opposing any new budget transfer to other countries. However, with Germany defecting from the alliance of the frugal and occupying the EU presidency until the end of 2020, a way to a European compromise is open. The second critical dimension is an alliance of eastern countries opposing transfers that only occur among the western countries. There is already a solid basis for significant transfers to the east among the several classic recovery tools identified in the Oxford University study cited above. Moreover, the creation of a European fund for a 'just energy transition' should also attract support from many eastern coal regions. There was therefore reason for optimism that such a policy would only face a traditional fierce EU fight over a seven-year expanded budget. As we have seen on Tuesday 21 July, at 6am, after the longest ever EU marathon since Nice Summit in year 2000.

Implementing a green EU recovery: two scenarios

While the launch of an EU 'green recovery' policy is become feasible, implementation will likely face its own challenges. While all five of the potential green programmes described above deserve serious examination, this article focuses on two – clean physical assets and clean R&D – and specifically on efforts to incorporate more renewables and carbon-neutral hydrogen in the energy mix.

Massive renewables as a 'clean physical assets' recovery programme

With a 40 per cent reduction target for EU greenhouse gas emissions, the share of renewable energy sources (RES) in the EU electricity mix in 2030 has been evaluated at 54 per cent. With the suggested further increase of the greenhouse gas target to 50–55 per cent, the RES share might go up to 63 or 67 per cent. One can compare this with the actual RES share in Germany during lockdown of roughly 30 per cent. In addition, wholesale market prices then went down by around 2.5 times, to only €16 per MWh, also undergoing many negative price episodes. What might happen with from half to two times more renewables in the electricity mix? Massive renewables mean a massive number of generation units characterized by fixed costs, zero variable costs, and intermittent output. How could they efficiently work in a market design which was conceived for dependable generation units with significant variable costs? Might the market design evolve to give a scarcity value to flexible operation and other flexibility services? How can the arrangements for balancing and reserve procurement be redefined? How can generation adequacy and security of supply be guaranteed? What about capacity markets? What role will storage have? What role will there be for new long-term contracts incentivizing investments? And what multi-sector adequacy planning can provide a framework that ensures a multi-energy security for the whole EU?

The second aspect of massive renewable assets concerns the grids hosting them.

Consider only the distribution grids hosting both photovoltaic panels and onshore wind, and the many decentralized storage units and electric vehicle charging stations. The 2016 Massachusetts Institute of Technology report *Utilities of the Future* already showed that the former fit-and-forget approach can no longer lead to efficient expansion of distribution grids, and that distribution grids have to move to a very granular analysis of the costs (and benefits) of the different uses by their various users. What type of connected asset scenarios and usages should be envisaged? What time horizon should be used for calculation: one year, 10 years, several decades? What time granularity should be used to define system stress and network requirements: the critical day or days, or hour, or 10 minutes? What is the proper spatial granularity: the entire grid company portfolio, a single



grid zone or branch, or a single grid node? What incentives, short-term and long-term, should be used to attract the connection of flexible assets to each network unit in the grid? How will distribution grid operation schemes then interact with the transmission grid schemes? How should their respective scarcity values for flexibility combine at the whole-system level to reduce the need for further grid investments, or to substitute copper with local storage and fibre data cable? There are many questions but not much validated practice feedback yet. The need for innovative planning and tariffs for distribution grids in a massive-renewables world is obvious, but no robust practice has yet been developed. We still need to define a much more robust and efficient frame for investment and operation by the grid operators; as well as or for investment, behaviour and uses by the grid users.

Carbon-neutral hydrogen as a 'clean R&D' and 'clean physical assets' recovery programme

For more than a decade, a key component of EU green energy has been renewable electricity. However green electricity can also expand to new uses, such as electrification of mobility (e.g. bikes, motorbikes, cars, and buses). However, other energy uses might require green molecules instead of green electrons, particularly for their proper energy density. Certain uses will depend on their chemical nature as feedstock. Here carbon-neutral hydrogen is a candidate. Having been debated and written about since 2002, it became a major public policy objective in June 2020 with the German government establishing a national hydrogen strategy, with the following justification and features:

1. An industrial country the size of Germany needs to have a carbon-neutral hydrogen future.
2. All the various potentials of hydrogen need to be addressed: as an energy carrier, for energy storage, for sector coupling as Power2X, and as feedstock.
3. The strategy will cover the entire value chain: technologies, generation, storage, infrastructure, and use, including all logistics.
4. Germany will only focus on green hydrogen (produced from renewable energy), while it acknowledges that other countries might prefer blue (from fossil fuels plus carbon capture and storage) or yellow (from nuclear).
5. Germany also acknowledges that it will not have enough renewable resources nationally to supply all its hydrogen needs and it will have to import from non-EU countries, which will become close industrial partners. The national target is limited to 5 GW of capacity in 2030 and 10 GW in 2040.
6. Germany plans to spend €2 billion on research and primary applications, €1 billion on pilot industrial facilities, €7 billion on launching a German market, and €2 billion on building international partnerships.

The question now is how this can enter into a European policy framework. Can the EU choose green hydrogen only and ignore the other carbon-neutral hydrogen generation technologies? If EU funding is given to R&D, who will own the rights to the resulting technologies? If EU pilots are built, who will calibrate their testing and evaluate the results? If a national market is created, what will be the market-opening regime for non-national European players? If hydrogen only circulates in closed pipelines, who will decide their location, connections, operational rules, and access regime? Will hydrogen grids be designed and regulated at the EU level? If hydrogen is to be imported into a market inside the EU, it becomes a commodity submitted to the EU common trade regime and, presumably, the EU framework recently created for external gas supply connection facilities. If hydrogen is converted into another fuel (e.g. ammonia, methanol, or methane), how will this be measured, tracked, and guaranteed? There are many questions that Germany cannot solve on its own and that the European Commission started tackling in its first communication 8 July 2020.

Conclusion: a green EU recovery as a two-step challenge

A European green recovery policy looks both sensible and feasible – something that, as recently as March 2020, appeared to be only a dream; an idealistic French aspiration for an EU that is more likely to engage only in pragmatic political horse-trading, and even that not easily. It seems that the extent of the COVID-19 crisis and the seriousness of the ongoing climate threat, at a time of self-destruction of the formerly US-led multilateral world, have created an unexpected political defining moment, making a real EU 'green recovery' policy possible.

However, while its final adoption by EU institutions (both the Council and the Parliament) is not yet a given, the next key challenge is in sight. Without a proper implementation framework, a green EU recovery might lose its muscles and teeth: both



its economic multiplier effect and its climate mitigation effectiveness. The EU does not have a strong Weberian executive bureaucracy pushed by an effective political power. Implementing new policies in the EU is just as difficult as establishing them: a 27-country crowd game where three EU institutions have to align to make any new journey a success.

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