

INFORMATION AND DEBATES

HOW COVID-19 IS CHANGING THE OUTLOOK FOR CLIMATE ACTION

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In the space of just a few weeks, the Covid-19 crisis has dramatically altered the prospects for climate action around the world. To stem the spread of the virus, governments are locking down populations, a measure that is resulting in a fall in production of a magnitude unknown in peacetime. In the short term, this health crisis could lead to a decline in global CO2 emissions of around 5 Gt, or ten times the amount observed in 2009, and could make 2019 the peak year for global emissions. Despite the rebound effect that will occur when the lockdown is eased, emissions will not return in the near future to their previous level. In the longer term, the pandemic will act as a catalyst for economic and societal changes that will provide new weapons to post-Covid-19 societies to combat climate risk. Depending on what they envisage, plans to restart the economy at the end of the lockdown may either speed up or slow down these structural transformations.



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Acknowledgements: the author would like to thank Jacques Percebois and Boris Solier for their careful reviewing of this article. Any inaccuracies that may remain are attributable to the author alone

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In a thought-provoking article, the philosopher Bruno Latour writes: "I hypothesize, like many other people, that the health crisis is preparing us, prompting us and encouraging us to get ready for climate change. This hypothesis still needs to be tested". A few lines later, he adds: "In terms of ecological change, the pathogen whose terrible virulence has changed the living conditions of all the inhabitants of the planet is not the virus at all, it is humans!" As a result, the hypothesis to be tested resists analysis. The health crisis is not preparing us directly for climate change.

Latour reminds us that the action of governments in response the pandemic cannot be directly transposed in any relevant way to what they are doing, or should be doing, in response to global warming.

Not only are the pathogens very different, but so too is the temporality of the "emergencies". In response to the health emergency, action is taken hour by hour: every day lost has an enormous impact on the eventual outcome. In response to the climate emergency, because of the relentless countdown of the climate clock, action must extend over decades. One of the major challenges for democratic societies will be to manage the time lag between the moment when action is taken and the moment when the population perceives the beneficial effects on the climate.ⁱⁱ

But refusing to take easy shortcuts does not mean that the management of the health crisis will have no impact on the management of the climate crisis. The impacts will simply be indirect, and often unexpected, and will elude the most well-informed predictions.

This edition of "Informations & Débats" tries nonetheless to foresee what the impacts might be, based on the information available on 26 March. It deepens the analysis in the initial article, written at the joint request of The Conversationⁱⁱⁱ and the blog ID4D^{iv}. However, it is organized in the same way as the earlier article, starting with the short-term impacts, and then moving on to the more structural, long-term impacts. The present article looks more closely at the economic recovery plans that will be put in place when the restrictions are lifted. These plans constitute an important strategic link connecting the different time horizons.

Assumptions about the lethality and duration of the pandemic

According to the work of the epidemiologist Antoine Flahault^v, the modern world has experienced three pandemics: "Spanish flu" of 1918-19 and the two outbreaks of influenza in 1957 and 1968. The impact of this fourth pandemic will depend on how dangerous it is, which in turn depends on its lethality and duration.

When historians look at the economic impacts of the most serious pandemics – the Black Death and Spanish flu –, a major parameter is the lasting loss of labour resources due to mortality (a quarter of the European population in the 14th century and at least 40-50 million deaths in 1918-19). Pandemics have a lasting effect on the labour supply^{vi}, but can also induce positive indirect effects through the reallocation of factors of production^{vii}.

It would be unwise to make any projections about the lethality of the current health crisis. The assumption is that its direct impact on the labour supply will remain invisible at the macroeconomic level. Unlike Spanish flu, in which more than 90% of the victims were under 65 years of age, viii Covid-

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19 mainly affects older people who have left the labour market. The generalisation of containment measures will also help to limit the mortality rate. In this analysis, it is the economic and environmental effects of the exceptional measures taken by the public authorities to contain the health crisis that are taken into account.

As Alain Trannoy^{ix} notes, the extent of the recession caused by the management of the health crisis will depend on the duration of the lockdown. The epidemic peak seems to have passed in China and Korea (which together account for 27% of the world's population). In Europe (with 7% of the world's population), the generalised use of containment measures has so far failed to prevent the spread of the virus. It is difficult to foresee the response capacity of the United States (with 4% of the world's population) due to the inadequacy of its public health system. The greatest uncertainty concerns South Asia and Africa, where 42% of the world's population has to cope with the virus on the basis of very fragile health care systems.

We have assumed a global peak by the end of June and a gradual return to the full mobilization of the factors of production from the summer onwards. An initial scenario assumes that Europe, the United States and then the rest of the world manage to contain the pandemic in a manner comparable to the first East Asian countries to be affected (China, Hong Kong, Singapore, Korea, Japan). A second scenario assumes less effective containment.

A decline in global CO₂ emissions at the upper end of the 1 to 5 Gt range

Recessions usually occur to correct previous imbalances, for example an initial over-indebtedness as in 2009, the last major economic crisis. The current situation is very different: economies are suddenly going into recession as a result of restrictions on people's mobility. Satellite imagery shows the extent of the change in China and Europe, where local pollution has fallen as a result of population lockdowns.

In China, these measures have led to an unprecedented decline in economic activity: a 20% drop in retail sales in the first two months of the year and a 16% drop in manufacturing output. By mid-March, with the worst of the health crisis seemingly over, the emphasis is on recovery. Yet

Covid 19's impact on the Chinese economy FT China Economic Activity Index (Jan 1 2020 = 100), last updated Mar 23 2020 100 2019* 80 Lunar new year Jan 25 2020 Jan Feb Mar *2019 values at same number of days before/after the lunar new year

Source: Financial Times (https://www.ft.com/coronavirus-latest)

despite the opening of the credit floodgates by the central bank, the economic turnaround appears to be sluggish. Confidence has yet to return, and household demand (consumption and housing) remains

depressed as a result. On the external front, exports are still weak due to the recession now impacting China's main customers.

During the 2009 recession, Chinese growth had simply slowed, with hardly any visible impact on CO_2 emissions. A completely different picture is emerging for 2020. According to a study^x by Lauri Myllyvirta based on very specific indicators such as thermal power generation, refinery activity and cement production, the present recession resulted in a 200 million tonne (Mt) or 25% fall in CO_2 emissions in February, the equivalent of two-thirds of what France emits in a year. Under these circumstances, China, with its 27% contribution to global emissions, should see its emissions fall by an unprecedented amount in 2020, in contrast to what happened in 2009.

In Europe and the United States, the onset of the health crisis was accompanied by exceptional measures, both monetary and budgetary, to cushion the economic shock. The aim is to prevent companies' cash flow problems from increasing the number of bankruptcies and causing unemployment to soar. While these measures will dampen the effects of the downturn, they will not create the conditions for an economic rebound. Furthermore, transport, a major source of CO_2 emissions, has also been badly affected in Europe and the USA. Hence the impact of the crisis on emissions will be all the greater.

Taking into account these geographical and sectoral characteristics, we have calculated two possible emission levels for 2020, corresponding to the two scenarios previously defined. In both scenarios, international transport sees a sharp fall in CO_2 emissions, by a quarter and a third respectively compared to 2019.

The impact of the health crisis on CO₂ emissions

	World	China	UE	USA	ROW	Transports int.	
Variation 2020/2019: "Short confinement" scenario							
Mt	-1 000	-200	-200	-300	0	-300	
%	-3%	-2%	-6%	-6%	0%	-24%	
Variation 2020/2019: "Long confinement" scenario							
Mt	-5 000	-850	-750	-900	-2 100	-400	
%	-14%	-8%	-22%	-17%	-13%	-32%	
Variation between 2008 and 2009							
Mt	-462	384	-337	-435	-28	-46	
%	-1,4%	5,2%	-8,1%	-7,3%	-0,2%	-4,4%	

Source of data used in the calculations: Global Carbon Budget (2019)

In the scenario of a rapid exit from lockdown, China limits the reduction in emissions to 200 Mt over the year. The European Union, the United States and the rest of the world experience a trend comparable to that observed during the 2009 recession. Overall, the world reduces its emissions by 1 Gt (3%), i.e. twice what was observed in 2009.

The more likely scenario is now that of a gradual exit from lockdown. Emissions reductions in China, the United States and Europe would then lie in the range of 700 to 900 Mt. With a decline of more than 2 Gt, the rest of the world would be the largest contributor to the decline. In total, the world would be heading towards a fall in emissions of around 5 Gt (down 14%).

According to UNEP calculations, xi global emissions would need to be cut by 3% each year to get on a pathway limiting warming to 2°C, and by 7% for 1.5°C. A 14% reduction would therefore be equivalent to a gain of five and two years respectively. This is far from negligible. The key issue remains

the long-term effects of the health crisis. After this short-term crisis, will the world return to "business as usual"?

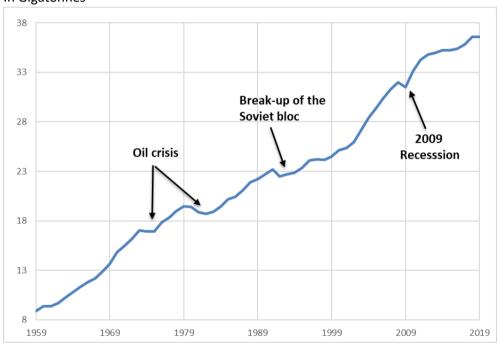
A much weaker rebound effect at the end of the current crisis than in 2009

Since 1959, global CO₂ emissions have fallen on three occasions, each time in response to an external shock. After each crisis, the global emissions curve rebounded. At first glance, this would suggest that short-term crises are merely blips and do not affect the long-term trend.

This picture is misleading. On each occasion, the crises left lasting effects through the reversal of emission pathways. But these effects were geographically circumscribed. Following the adjustment of oil prices in 1980, global emissions fell two years in a row for the first time. This was also the period when the future 28-member European Union reached its emission peak. The second decline in emissions, in the early 1990s, was superimposed on the emissions peak reached in 1990 by the various countries of the former Soviet bloc. The 2009 shock barely affected China's trajectory, but it was superimposed on the peak in CO₂ emissions from the United States, reached in 2007.

Global CO₂ emissions

In Gigatonnes



Source: author, from Global Carbon Budget (2019) data

The Covid-19 crisis of 2020 will also have lasting effects on emission pathways. It could even begin to reduce the overall pathway of greenhouse gas emissions. 2019 would then be the year when global emissions peaked.

Firstly, the crisis is of such magnitude that it will be it difficult to make up the difference when it is over, as happened in 2010 in the aftermath of the financial crisis. The end of the lockdown period will see a rebound in emissions. The low price of fossil fuels will stimulate demand for them and raise the relative costs of investment in green energy. The emphasis on reviving the economy risks taking over the entire realm of policy, to the detriment of governments' climate concerns. The desire to return to normal social life and the consumption patterns associated with it will be insatiable at the end of the period of confinement imposed by health considerations.

Despite these factors, it will be impossible to return in the space of a year or two to the emissions levels pertaining before 2020. In particular, there is little practical possibility for those services most affected by the fall in emissions – transport and tourism especially – to catch up. In contrast to industrial sectors, where the pattern of ending destocking and increasing the use of productive capacities traditionally observed at the end of a recession will apply, these activities are unlikely to suddenly rebound at the end of the crisis. Moreover, the financing of stimulus plans through energy taxation could counteract the incentives provided by low fossil fuel prices.

Secondly, the Covid-19 crisis comes at the end of a decade in which the rate of increase of global CO_2 emissions slowed significantly. This decline, temporarily masked by the oil counter-shock of 2015-2016, results from the fact that the low-carbon transition has begun in many countries, albeit at a painfully slow pace in view of the climate emergency. An underlying cause of this shift is the unprecedented fall in the costs of producing new renewable energies, electricity storage and smart grid management. These medium-term trends are unlikely be affected by the health crisis. The other cause of the slowdown in global emissions has been the reorientation of energy policies, partly in response to the urgency of the environmental situation.

These factors will contribute to weakening the potential for a rebound effect at the end of the crisis, particularly in China, where the situation is very different from that prevailing in 2009. At the end of the 2000s, China was on an upward emissions pathway of nearly 10% per year. The recovery plan had reactivated an economy that was emitting ever more CO₂. By 2019, this upward trend had fallen to less than a fifth of what it was at the beginning of the decade. According to various studies carried out before the health crisis, China was close to its emissions peak before the outbreak of the epidemic.^{xii} Barring a 10-year step back in time, it is difficult to see how the plan to end the health crisis could have effects comparable to those of 2009.

Nevertheless, in China as elsewhere, the substance of the recovery plans that accompany the end of lockdown will play a strategic role. Depending on the incentives they provide in the medium term, these plans may either accelerate or slow down the momentum of the low-carbon transition.

The strategic role of post-lockdown economic recovery plans

Spectacular though they are, the exceptional economic measures taken by governments to support containment are not stimulus measures. They are simply cushioning measures, designed to prevent the collapse of the economy that would result from a general cash-flow crisis and a halt in the payment of income to those whom lockdown prevents from producing. As the analysis by Christian Gollier and Stéphane Straub^{xiii} makes clear, governments act as providers of last resort, with access to unlimited short-term budgetary and monetary financing.

Following exit from lockdown, the economy will have to be restarted. Exceptional measures such as the distribution of "helicopter money" by central banks to inject purchasing power are not excluded. xiv One indispensable lever will be the launching of public investment plans.

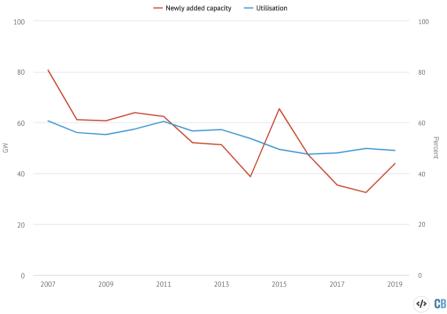
One very pro-active approach could involve governments deciding not to reactivate part of the capital stock immobilized by the Covid-19 crisis. Examples include grounded civil aviation fleets, idle thermal power plants, and oil refineries that suddenly far outnumber the demand for them. Decommissioning that part of this excess capital which emits the most CO_2 and investing massively in the conversion of the corresponding pools of employment would hugely speed up the transition. Such a choice would be tantamount to extending the rationing logic imposed on populations beyond the period of lockdown. It would, however, be a totally inconceivable option at a political level.

The aim of the recovery plans will be to revive the entire economic system. But not all recovery plans will be equivalent in terms of CO_2 emissions. Three criteria will determine whether or not they provide the right incentives in the medium term: the choice of how the funds invested are allocated; the way they are financed; and whether or not the environmental standards introduced before the health crisis have been relaxed or amended.

China was the first country to impose lockdown, and it is now gradually emerging from it. Exit from lockdown is not leading to an economic rebound, but to a relatively modest improvement that the government is seeking to consolidate by speeding up infrastructure projects. For the most part, it is the provinces whose bond issuance ceilings have been sharply raised that are in the driving seat. Health, telecommunications (5G) and transport infrastructure (new railway lines, airports and highways) are among the priorities, along with energy.

With regard to energy, the recovery plan is likely to herald the guidelines of the 14th Five-Year Plan (2021-2025). According to specialists, preliminary consultations are giving rise to heated debates. Incumbent operators under the umbrella of the China Electricity Council are campaigning to abandon the standards that have been capping total thermal generation capacity since the 12th Five-Year Plan. They are doing so despite the almost continuous decline in the use of installed capacity, which is adversely affecting producers' balance sheets (see Graph below). There are therefore strong economic arguments in addition to environmental pressure from public opinion to resist this type of backtracking. But unpleasant surprises are all too possible.

Thermal power generation capacity in China



Source: Carbon Brief, 24 March 2020

What a European "wartime Green Deal" should be like

In Europe, the exit from the lockdown period looks extremely complicated. The health crisis there has become considerably more serious than in China. Governments are responding in a piecemeal fashion. As with the Greek debt crisis, the only institution that still seems to be coordinating anything is the European Central Bank (and for the Eurozone alone).

Given this situation, there is reason to fear the recovery plans will be very weakly coordinated. Nevertheless, the European Union has many resources at its disposal to implement a plan that balances the rescue of productive assets and the acceleration of the energy transition.

Firstly, there is already a public investment programme in place. The Green Deal project,^{xvi} presented by the Commission in December 2019, comprises two instruments. The first aims at €1000 billion of green investment, slightly more than half of which will come from Community funds, to be implemented over ten years. The second consists of a €100 billion fund to finance the conversion of industrial areas dependent on fossil fuels. The timetable for these programmes in no way meets the needs of the health emergency and risks being repeatedly delayed if the Commission is asked to provide a basis for a new recovery plan.

In order to save time and increase efficiency in response to the health emergency, it would be better to change these existing programmes into a "wartime Green Deal", making the sums pledged over several years immediately available to countries and regions and drastically relaxing the conditions for their disbursement. In the current situation, it would be advisable to massively expand the fund's 100 billion allocation, and include under the eligibility criteria those economic areas most weakened by the health crisis.

In the case of France, the I4CE Institute has provided a detailed analysis of what such a public investment programme might be, while emphasizing the importance of not relaxing existing environmental standards. **xviii**

In view of the urgency of the situation, this injection of public funds will need initially to be financed in an unorthodox manner (public deficit + monetary creation). However, the question of continued financing will soon arise. Another aspect of the Green Deal should therefore be strengthened, namely carbon pricing. In its pre-crisis version, the Green Deal provided for a twofold extension of carbon pricing: a border inclusion mechanism that may not be operational in time; and strengthening this pricing and its possible extension to the transport and construction sectors.

Raising the price of carbon in this way would create an additional public resource in the order of several tens of billions of euros. As a non-sustainable resource, it would be well suited to finance part of the temporary increase in public investment. The other virtue of using this resource would be to send a strong incentive to economic actors of all kinds. By counteracting the perverse incentives of falling fossil fuel prices in international markets, it would help dissuade these actors from turning to fossil assets.

The third strand of the wartime Green Deal is the maintaining of existing environmental regulations. As in the case of China's electricity production, economic players weakened by the crisis will increasingly demand the relaxation of existing environmental standards. This is particularly true for transport, one of the sectors most strongly affected by Covid-19. In the context of the wartime Green Deal, this cascading relaxation of regulations should be resisted and indeed access to public funds should be made conditional on compliance with these standards. In particular, this must apply to CO₂ emission standards on new car sales.

At the international level, it will also be important to resist the many forms of pressure from airlines which will want to modify the CORSIA carbon offsetting scheme^{xviii} for civil aviation. The health crisis will make the CORSIA regulations much more restrictive than anticipated, as 2020 is taken as the reference year from which airlines will have to offset their future emissions. The right strategy would be to make the bailout of airlines with public money conditional on their continued adherence to the scheme.

The shockwave of the pandemic will impact the functioning of societies well beyond the timeframe of the recovery plans. In the long term, Covid-19 will be a catalyst for both economic and social transformations.

Covid-19 as a catalyst for economic transformation

The health crisis reveals the extreme vulnerability of development methods based on the incessant increase in the mobility of people, capital and goods. The speed at which the virus is spreading reflects this "hypermobility" (Yves Crozet's term^{xix}), which has invaded all areas of economic and social life.

In this context, curbing the spread of the pathogen soon becomes impossible unless exceptional measures are taken, as China was the first to discover. Rapidly mobilizing health resources such as respiratory equipment, protective masks or even paracetamol is hampered by the hyperspecialisation of value chains. In Europe as in the United States, health authorities are discovering with amazement the new forms of dependency resulting from this situation.

The health crisis is not only an indicator of vulnerability. But because of how drastically it is being controlled, it also entails experimenting with new and innovative modes of organization that prefigure changes in forms of production in the future.

Large-scale teleworking is an important component of this shift, and has developed everywhere at a speed totally unimaginable before the crisis. In education, for example, teleworking has emerged as an urgently needed alternative to traditional teaching methods, from kindergarten to university, including vocational or specialised courses (for children in difficulty). In many productive sectors, its applications make it possible to reconcile the restrictions with the maintenance of a minimum of economic activity. Telework is thus playing a key role in preventing the total collapse of economies as a result of lockdown.

Once the lockdown phase is over, teleworking will open up many possibilities for reducing the many forms of constrained mobility. Given that mobility unnecessarily increases the overall carbon footprint for little economic benefit, its reduction will therefore be beneficial for the climate.

With regard to goods, economic actors are being obliged to test the diversification of their sources of supply and the shortening of their supply chains. In the battle against the epidemic there has been a dramatic shift in the supply of basic necessities, such as masks, respiratory equipment and antibacterial gels, some production lines of which have been relocated to Europe as a matter of urgency. Here again, it involves experimenting with new forms of productive organization based on proximity, which not only limit the risk of epidemics but also help reduce greenhouse gas emissions.

The Covid-19 pandemic is calling into question the hypermobility on which the unbridled globalisation of the last few decades has been built and is fast leading to the testing of alternative types of organization. The health crisis will result in a speeding-up of the relocation of production, the first signs of which were already evident in the preceding decade.

It is difficult to foresee how far this "deglobalization" will go. Like previous pandemics,^{xx} the current crisis is fuelling the search for scapegoats, preferably located abroad. It is intensifying pressure for a systematic closure of economies, in a kind of breakneck deglobalization. Such a cure would be worse than the disease. In a well-known essay, Jared Diamond highlights the role of trade disruptions in the collapse of past societies and equally the contribution of trade to the resilience of other societies.^{xxi} The right response to global risks is certainly not a return to autarky.

Covid-19 as a catalyst for societal change

At the time of writing, more than three billion people are confined to their homes, or at least have been told to drastically limit their movements. This unprecedented situation will leave its mark on social functioning once the spread of the virus has been brought under control.

To get an idea of what changes Covid-19 may bring to the organization of societies, it is instructive to consider the analysis by the historian Charles Rosenberg. For Rosenberg, the way in which societies respond to the risk of epidemics can be represented as a three-stage process.^{xxii}

- The first stage involves the "progressive revelation" of the existence of the risk, and is characterized by the recklessness of the majority despite the increasing number of warning signs. Denial plays a typical role, either by reducing awareness of the threat or by downplaying its extent. Denial may arise in response to the protection of immediate economic interests or as a form of psychological defence against a risk one is unable to cope with.

The first change to be expected from the Covid-19 crisis is the reassessment of global health risks. Whistle-blowers, starting with the World Health Organization, have for a number of decades been reporting on the resurgence of this type of risk. But society remained deaf to these alerts. The pandemic will play a forceful role in reminding people of the need for warnings. Public opinion will demand accountability.

- As the spread of the virus accelerated, the recklessness that was still evident in most large European cities prior to the lockdown disappeared within a few days. Its evanescence signalled the start of stage 2, which Rosenberg defines as the stage in which a common representation of the causes and mechanisms of transmission of the disease is necessary in the face of the multiplicity of existing beliefs, often based on the stigmatisation of certain groups (foreigners, Jews, the poor, etc.) or certain practices (sexuality, alcoholism, drugs, etc.). Until the 20th century, religion and morality played as important a role as medical knowledge in forging this common representation. In the framework of Covid-19, powerful epidemiological information networks, relayed by major health institutions (WHO, national alert centres, etc.) or scientists (Johns Hopkins University, the Pasteur Institute, etc.) have rapidly overturned existing beliefs by informing as many people as possible about the basic mechanisms of Covid-19 transmission and the measures to limit its spread.

The second change to be expected from the Covid-19 crisis is a better understanding by society of the links between the health crisis and the deterioration of the environmental situation. Since pandemics are no longer considered to be divine punishment, it is important to understand their causes and the vectors of their spread. Both of these reveal interactions between the health crisis and the environmental crisis. The transmission to humans of viruses endemically present in the natural environment relates to the destruction of forms of wild biodiversity that have historically protected the human species. The vectors for the spread of the virus point to our environmentally destructive lifestyles. Everyone has been able to see satellite images revealing the spectacular improvement in air quality after only a few days of determined action against the spread of the virus.

- Stage 3 is the "collective response" imposed by the public authorities that manages to contain and then reverse the pandemic. In the absence of a proven treatment to cure the disease or a vaccine to prevent it, this response took a unique form in the case of Covid-19: population lockdown. Depending on how societies were organized and on the rate of spread of the virus, this lockdown has been either total or selective.

As the sociologist François Dubet points out, "the virus is relatively democratic in not choosing its targets. It is also relatively democratic because the protection of all depends on the protection and responsibility of each and every one of us." With the constraints of lockdown, the management of the health crisis has led to the emergence of many innovations in terms of solidarity. Every day, we see illustrations of this, both with regard to the elderly, the most vulnerable, and to health care personnel, who are the most exposed in combatting the virus. These innovations contribute to a re-evaluation of individualism and consumerism, both of which are obstacles to the implementation of a response to the climate challenge.

But lockdown also reveals the extent of inequalities and exacerbates them the longer it lasts. The constraints of confinement are very different depending on housing conditions and access to digital networks. Dubet thus warns us of the impact that lockdown will have on inequalities within the social body, especially if it has to be prolonged. At the end of lockdown, society risks being damaged by the deepening of these inequalities. Multifaceted solidarity initiatives will not be enough to restore harmonious social functioning. It will be necessary to restore the inescapable role of the state in this area. The Covid-19 crisis heralds a fairly fundamental rebalancing within our societies between market values and values pertaining to the general interest.

Conclusion: the risk of collective amnesia

Through its short-term impacts as well as the structural changes it heralds, the Covid-19 crisis is profoundly changing the outlook for climate action. It makes it likely that global emissions will reach their peak in 2019 and should make it possible to gain a few years, through the resulting emissions reductions, in relation to the inexorable countdown of the climate clock.

But reaching that peak does not mean that the battle against climate change will have been won. Once the peak has been passed, action will need to be stepped up to bring cumulative emissions down to a level compatible with warming of less than 2°C or even 1.5°C. The structural changes that the health crisis will bring about, both in productive organizations and in societal expectations, should better equip post-Covid-19 societies to manage the climate crisis. But these changes are neither guaranteed nor irreversible.

Over time, there is still a risk that the post-Covid-19 world will lower its guard, that it will develop a kind of collective amnesia. To Rosenberg's analysis of the three stages of the epidemic, it might be appropriate to add a fourth, that is, how society functions once the traces of the epidemic have been eradicated. In this fourth stage it is vital that collective amnesia does not infect the social body, for that would be a mirror image of the recklessness through which society reassured itself at the beginning of stage 1.

https://www.vox.com/coronavirus-covid19/2020/3/20/21184887/coronavirus-covid-19-spanish-flu-pandemic-john-barry

- ^{ix} Alain Trannoy, Le freinage volontaire de l'économie française ne peut être poursuivi sans danger audelà d'un mois, Le Monde, 21 March 2020.
- ^x Lauri Myllyvirta, Analysis: Coronavirus has temporarily reduced China's CO2 emissions by a quarter, *Carbon Brief*, 4 mars 2020.
 - xi UNEP, Emission Gap Report, December 2019, p.26.
- xii Wang, H., Lu, X., Deng, Y. et al., China's CO₂ peak before 2030 implied from characteristics and growth of cities, *Nature Sustainability* 2, 748–754 (2019)
- xiii Christian Gollier & Stéphane Straub, *L'économie du coronavirus: quelques éclairages*, Toulouse School of Economics, 21 March 2020 (https://www.tse-fr.eu/fr/leconomie-du-coronavirus-quelques-eclairages)
- xiv The Economist, *How to pay for covid-19?* 25 March 2020 (https://www.economist.com/finance-and-economics/2020/03/25/how-to-pay-for-the-pandemic)
- ^{xv} Lauri Myllyvirta, Shuwei Zhang & Xinyi Shen, *Will China build hundreds of new coal plants in the 2020s?* Carbon Brief, 24 March 2020.
 - xvi European Commission, The Green Deal, COM(2019) 640 final, 11-12-2019.
- xvii Hadrien Hainaut, Maxime Ledez, Quentin Perrier, Benoît Leguet & Patrice Geoffron, *Investir en faveur du climat contribuera à la sortie de crise*, I4CE, Etude Climat, April 2019.
- xviii Shahbano Soomro, *ICAO's global offset mechanism draws worldwide attention to international aviation emissions*, Climate Economics Chair, Policy Brief, 14 October 2016.
 - xix Yves Crozet, Hyper-Mobilité et Politiques Publiques, Economica, 2016, p88-105.
- xx David S Jones, History in a Crisis Lessons for Covid-19, *The New England Journal of Medicine*, March 12. 2020.
 - xxi Jared Diamond, Effondrement, Gallimard 2006, p.26-35.
- ^{xxii} Charles E. Rosenberg: "What Is an Epidemic? AIDS in Historical Perspective." Daedalus, vol. 118, no. 2, 1989, pp. 1–17.
- xxiii François Dubet, Le confinement accroît la violence des "petites inégalités", Le Monde, 25 March 2020.

ⁱ Bruno Latour, "La crise sanitaire incite à se préparer à la crise écologique", Le Monde, 25 March 2020, https://www.lemonde.fr/idees/article/2020/03/25/la-crise-sanitaire-incite-a-se-preparer-a-la-mutation-climatique_6034312_3232.html

ii Christian de Perthuis, Le tic-tac de l'horloge climatique, De Boeck, 2019, p 205 and following.

iii https://theconversation.com/avec-le-covid-19-une-decrue-historique-des-emissions-mondiales-de-co-est-amorcee-133975

iv https://ideas4development.org/en/coronavirus-crisis-impacts-economy-co2-emissions/ (Version anglaise de l'article)

^v Antoine Flahault, Epidémiologie des pandémies grippales, Séminaire de l'Ecole des Hautes Etudes de la Santé Publique, *Revues des Maladies Respiratoires*, 2008; 25: 492-6.

vi John M Barry, The Great Influenza: The Epic Story of the Greatest Plague in History, Penguin, 2004.

vii Nico Voigtländer & Hans-Joachim Voth, The Three Horsemen of Riches: Plague, War, and Urbanization in Early Modern Europe, *Review of Economic Studies* (2012) 0, 1–38.

viii Interview wiht John M Barry:



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The Climate Economics Chair is a joint initiative by Paris-Dauphine University, CDC, TOTAL and EDF, under the aegis of the European Institute of Finance.