

Our planet, our health, our priority!

By [Éloi Laurent](#)

“Are we able to reimagine a world where economies are focused on health and well-being?” With these words, the WHO issued a call to governments and citizens around the world on World Health Day, 7 April 2022, which marks the 74th anniversary of its founding and the coming into force of its [Constitution](#).

The theme of the WHO anniversary is “our planet, our health”, and it comes only a few weeks after the publication of three important articles that help to grasp the relevance and scope of this theme.

The first two articles demonstrate the progress in our knowledge about the emergence of SARS-CoV-2, the origin of the Covid-19 pandemic. The authors state that, first, it is [“very likely”](#) that the pandemic is the result of a zoonosis (i.e. transmission from animals to humans), as was the case with SARS-CoV-1 in 2002/2003, and that, second, it was at the [Wuhan live animal market](#) that this transmission first took place. This is a major breakthrough in a scientific debate that has been fiercely contested for the past two years and where all hypotheses have been seriously considered.

The [third article](#) looks at the consequences of the Covid-19 pandemic and measures the magnitude of the health shock it has caused. The authors estimate the excess mortality due to the global pandemic in 191 countries and territories from 1 January 2020 to 31 December 2021. They conclude that there is a discrepancy of one to three between their estimates and the official figures: taking into account errors and mistakes in

the Covid death toll, the number of deaths worldwide over this period was not 5,940,000, but rather 18,200,000 (a global excess mortality on the order of 16%).

For some countries, such as India, the gap is truly considerable: from 489,000 official deaths to an estimated 4,070,000. For France, the gap is still significant: [from 122,000](#) to 155,000, i.e. a difference equivalent to the number of official deaths during the first wave in spring 2020. Yet this global estimate is based on the figure of 17,900 Chinese deaths (almost four times more than officially announced), which is simply impossible to believe.

It is clear therefore that human health is [“inextricably linked”](#) to the health of ecosystems and biodiversity, which implies, as the WHO rightly points out, that the health-environment nexus must become the backbone of an [economy of well-being calibrated for the 21st century](#).

This backbone must be based on a “One Health” approach. In November 2020, a panel of high-level experts in this field (with [Serge Morand](#) being the only French member) was charged with consolidating and institutionalising this approach under the aegis of the World Organisation for Animal Health (OIE), the Food and Agriculture Organisation of the United Nations (FAO), the United Nations Environment Programme (UNEP) and the WHO. Human health, animal health, plant health and environmental health, these experts tell us, are complementary and interdependent.

The climate challenge similarly highlights the intersection of health and environmental issues. The [second installment of the IPCC Sixth Assessment Report](#), which deals with the impacts, adaptations and vulnerabilities associated with climate change, runs to 3,676 pages and contains no fewer than 4,853 occurrences of the word “health”.

Given all this, the WHO might want to update its own

definition of health, which dates from 1948: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". To update this definition, we may wish to define ["full health"](#) as "a continuous state of well-being: physical and psychological, individual and social, human and ecological". The important thing about this definition is to emphasise the holistic nature of the approach, the continuity of health, which links mental health to physiological health, individual health to collective health and human health to planetary health. Full health is therefore health based on interfaces, synergies and solidarities.

If the WHO member states were to adopt this redefinition of health, this would, for example, encourage health issues in France to be studied systematically from an environmental perspective, which is far from being the case today, as can be seen from examining the profusion of reports and proposals on the future of the French health system, and more broadly on health insurance and its financing. The common point in all these is to ignore the ecological issue almost completely. Yet if there is a "Great Social Security System" to be invented, it is social-ecological security.

The Covid-19 pandemic has shown how health is a collective matter that is blurred and distorted by calls for "individual responsibility", but the collectivity that we must take note of and become partners in goes far beyond the human race alone.

Climate: The urgency of justice

By [Éloi Laurent](#) and [Paul Malliet](#)

On the eve of the climate summit organized by the Biden administration on 22 and 23 April, which will be attended by 40 heads of state and government, we offer here some initial reflections on a critical issue facing international climate negotiations: how should the effort to reduce emissions be shared between countries within the framework of the United Nations?

The news on the climate emergency front at the start of 2021 is mixed, which might not be so bad: the new US administration's willingness to assume leadership on the climate agenda, within a multilateral framework, contrasts with the obscurantist obstructionism of the previous administration. Furthermore, 110 countries have announced their commitment to achieving carbon neutrality by 2050, with China sharing this goal, but by 2060^[1].

But in order to close the gap between the speed being attained by natural energy systems and the inertia inherent in today's economic and political systems, these encouraging geopolitical dynamics must pick up the

pace. In this respect, one key indicator is the gap between the status quo of current policies (“business as usual”) and the full implementation of the commitments made in the wake of the Paris Agreement: if all the commitments currently formulated and described in the States’ respective national contributions were really met, we would be heading towards 2.6° of warming by the end of the century; if everything continues as it is today, we are heading towards 2.9° of warming. As it stands today, the Paris Agreement (which has led to undeniable progress) is therefore worth only 0.3 degrees, or about a decade and a half of warming at the annual rate observed since 1981[\[3\]](#).

A new global climate strategy must therefore be developed and implemented, and it needs to bear fruit starting from the COP-26 meeting next November in Glasgow. The Biden administration is organizing a summit on 22 and 23 April, which will be attended by 40 heads of State and government. In line with the [American Jobs Plan](#), the [agenda for this meeting](#) emphasizes the economic gains expected from decisive climate action. But it fails to address the need for coordination: how should national efforts at emissions reduction be shared among the world’s countries? On the basis of what criteria? In other words, how can we map out the path towards the orientation indicated by the Paris Agreement?

We are proposing here an embryonic reflection (which we will elaborate on in the run-up to COP-26) on the

question which, in our view, is now the *raison d'être* of international climate negotiations: how to share the effort to reduce emissions between countries within the framework of the United Nations?

In the light of the IPCC's Special Report on 1.5° published in 2018, we determine a global carbon budget, which in 2019 amounted to 945 GtCO₂e; this corresponds to an intermediate target between the 1.5° and 2° budget associated with the 67th percentile of the Transient Climate Response to Emissions (TCRE), [\[4\]](#) in line with the goals set in Article 2 of the Paris Agreement.

The question of the fair distribution of this global carbon budget has been the subject of numerous studies (for a summary and proposals, see for example [Bourban, 2021](#)), but there is currently no work that integrates a complete vision of the three justice criteria identified in the academic literature – [equity, responsibility and capacity](#) – in order to determine an operational distribution of national efforts to avoid the climate catastrophe.

With this in mind, we focus our analysis on the top 20 emitting countries, [\[5\]](#) which accounted for 77% of emissions in 2019. We assume that the emissions reduction target will be shared by all countries by 2050 and that the carbon budget therefore covers the next 30 years, which translates into an average annual budget of around 30 GtCO₂e (for comparison, 36 GtCO₂e

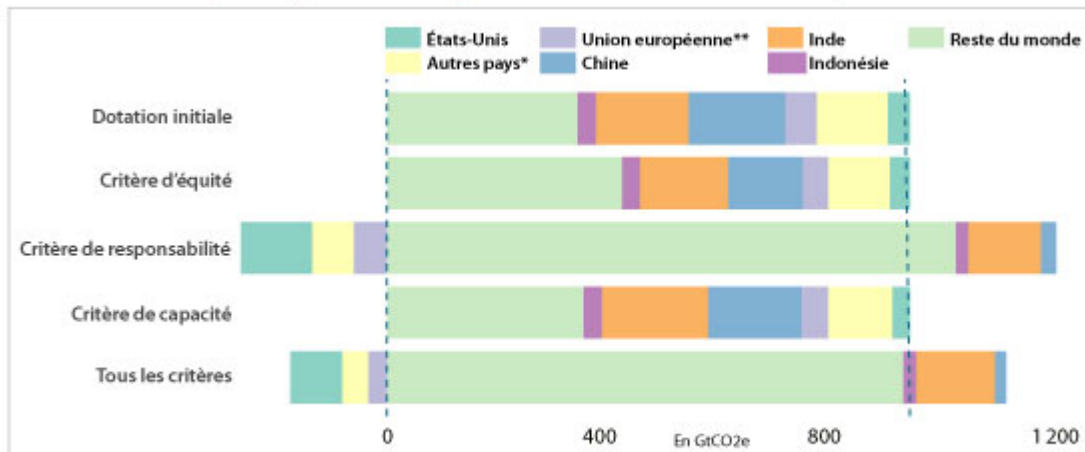
were emitted in 2019). We take as a starting point an equal distribution among all members of humanity in 2019, meaning an initial allocation of 122.5 tCO₂e up to 2050, i.e. about 4 tCO₂e per year (a country's budget being the aggregation of the individual allocations of its total population).

We interpret the equity criterion as meaning equal access of the world's citizens to the greenhouse gas (GHG) storage capacity of the atmosphere (this corresponds to a universal carbon endowment corrected for each major emitter for its population and for population growth by 2050).

Our responsibility criterion is the amount of GHGs already emitted since 1990 in consumption, thus combining a spatial justice criterion with a temporal criterion, reflecting the global as well as the historical responsibility of individual countries.

Finally, the capacity criterion is expressed here by the United Nations Human Development Index (HDI), which by construction ranges from 0 to 1, and which we relate for each country to the world average (which in 2019 was 0.737). Thus, countries whose HDI is lower than this world average would see their budget increase in proportion to their human underdevelopment, and vice versa for developed countries, i.e. they would see their budget decrease in the opposite direction (Figure 1).

Figure 1. Répartition du budget carbone mondial selon 3 critères de justice



* Canada, Arabie Saoudite, Australie, Japon, Royaume-Uni, Corée du Sud, Afrique du Sud, Iran, Mexique, Turquie, Brésil.

** Comprend les 27 États-membres.

Sources : Global Carbon Budget 2020, World UN Population, calcul des auteurs.

The equity criterion generally operates a reallocation from countries with a falling population to those with a rising population, which are almost entirely located in sub-Saharan Africa. In this respect, based on this criterion China undergoes a reduction in its budget of 44 GtCO₂e

(almost 25%), while the rest of the world benefits from an increase of 86 GtCO₂e.

The responsibility criterion appears to be the main determinant leading to a reallocation of the global budget between countries, with a transfer of nearly

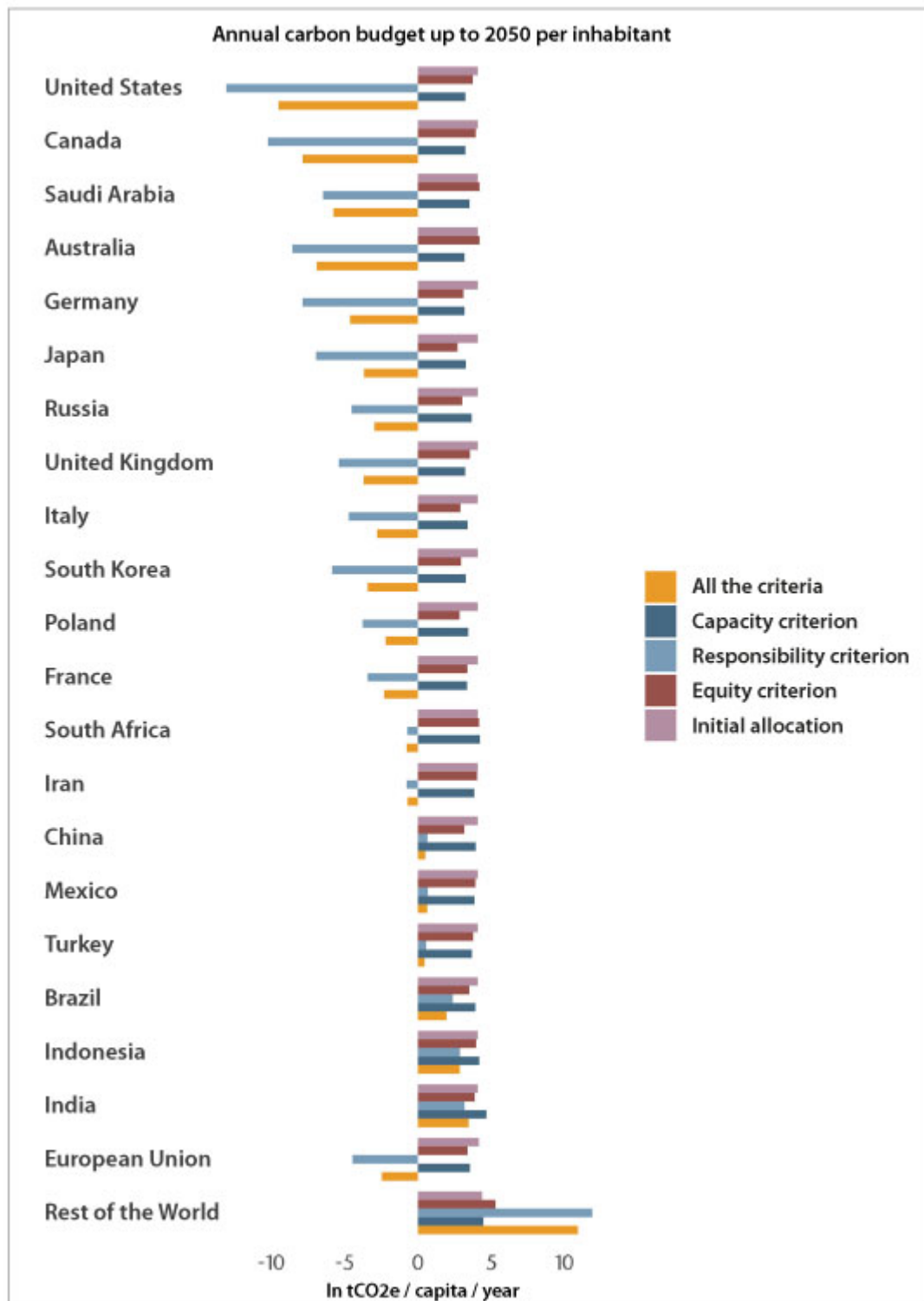
263 GtCO₂e from the OECD countries to the so-called developing countries. The capacity criterion also leads to a reallocation towards developing countries, but much less (almost 34 GtCO₂e in total) [6].

Thus each criterion plays out differently (either by the nature of the rebalancing or by its extent), suggesting that the

interplay of this relatively simple set of three criteria does indeed enable different understandings or conceptions of climate justice to be

translated into a distribution of the burden of the mitigation effort (Figure 2).

Figure 2. Distribution of the global carbon budget according to the 3 justice criteria for the 20 top emitters and the rest of the world



Sources: Global Carbon Budget 2020, World UN Population, authors' calculations.

Note: Each bar indicates the effect of each criterion, taken independently of the others, on the average annual carbon budget per country. For example, while each American citizen has an initial allocation of

4 tCO₂e, the equity criterion leads to this budget being reduced to 3.73 tCO₂e, the application of the responsibility principle leads to the initial allocation turning negative and corresponding to a debt of 13 tCO₂e, and the capacity criterion reduces the initial allocation to 3.25 tCO₂e. The aggregation of these different criteria results in a total negative budget^[7] of 9.5 tCO₂e per capita per year.

However, this representation does not tell us anything about the future emissions trajectories of the different countries, the instruments that will be implemented and the justice criteria specific to each country that will govern the deployment of these instruments. In a second stage of our analysis, we will propose possible distributions of the budget globally determined for France in order to appreciate the issues of climate justice, moving from the global to the national and finally to the individual. In any case, this first step informs us about what could be a fair distribution capable of more explicitly capturing the guiding principle of the international community since the Rio summit in 1992 of “shared but differentiated responsibility”.

In the light of this initial analysis, one point seems perfectly clear: if the new US administration does indeed intend to reassume global climate leadership, in association with the European Union, it will have no choice but to face the existence of a climate debt to the rest of the world. Given its level, it is illusory to believe that this can be offset by hypothetical negative emissions, and should therefore be subject to one form or another of compensation^[8]. This could for example mean much

more significant amounts than those currently paid into the Green Climate Fund, which is still largely underfunded in relation to the initial stated ambition of reaching a budget of \$100 billion in 2020.

A second point is that China can no longer claim to be a major emerging country in the climate negotiations, with an exploding emissions trajectory that is supposedly part of its right to development and economic growth. In 2020, and taking into account all the criteria adopted, its carbon budget, at 21 Gt, would be close to that of Indonesia, which has one-fifth of China's population.

It seems that the Biden administration wants to mark Earth Day on 22 April with two announcements: one concerning new 2030 climate ambitions for the United States and the other concerning further emissions reductions by the invited heads of State and government. These announcements will be fully credible only if the US manages to reconcile its national ambition with its global responsibility, and thereby convince China to do the same.

[1] This represents about 50% of the population as well as global GHG emissions.

[2] Climate Action Tracker, December 2020 projection <https://climateactiontracker.org/publications/global-update-pa>

[ris-agreement-turning-point/](#)

[3] Source: [NOOA](#).

[4] The TCRE translates the average variation of average temperature with the stock of carbon in the atmosphere with an associated probability. In our analysis this translates into the following:

There is a 67% chance that the carbon budget in question will lead to a temperature rise limited to 1.75°.

[5] The top 20 emitting countries in 2019 were: the United States, Canada, Saudi Arabia, Australia, Germany, Japan, Russia, the United Kingdom, Italy, South Korea, Poland, France, South Africa, Iran, China, Mexico, Turkey, Brazil, Indonesia, and India. We also include the 27-Member European Union to provide a basis for comparison.

[6] Note that among the countries we distinguish, only India would see its budget increase, but just by 3%.

[7] A negative budget here reflects the fact that the historical emissions taken into account via the responsibility criterion is higher than the current carbon budget allocated via the other criteria.

[8] The question of the monetary valuation of past emissions is a research topic in itself that we do not address in this text. As an illustration, a valuation of one tonne of CO₂ at \$1 would lead to a global amount of \$263 billion, and for a valuation at \$20, it would be \$5260 billion.

The essential, the useless and the harmful (part 3)

By [Éloi Laurent](#)

Is humanity a pest?

For the other beings of Nature who find it increasingly difficult to coexist with humans on the planet, the answer is unambiguous: without a doubt.

Life on earth, 3.5

billion years old, can be estimated in different ways. One way is to [assess the respective biomass of its components](#). It can then be seen that the total biomass on Earth weighs around 550 Gt C (giga tonnes of carbon), of which 450 Gt C (or 80%) are plants, 70 Gt C (or 15%) are bacteria and only 0.3% are animals.

Within this last category, humans represent only 0.06 Gt C. And yet, the 7.6 billion people accounting for only 0.01% of life on the globe are on their own responsible for the disappearance of more than 80% of all wild mammals and half of all plants.

This colossal crisis

in biodiversity caused by humanity, with [premises dating back to the extermination of megafauna in the prehistoric age](#)

(Pleistocene), started with the entry into the regime of

industrial growth in the 1950s, with the onset of the "[great acceleration](#)".

This is now well documented: while nearly 2.5 million species (1.9 million animals and 400,000 plants) have been identified and named, convergent studies suggest that their rate of extinction is currently 100 to 1000 times faster than the rhythms known on Earth during the last 500 million years. This could mean that, due to human expansion, biodiversity is on the brink of a sixth mass extinction. Whether we observe these dynamics [in section](#) or [longitudinally](#), at the level of [certain key species in certain regions](#) or by turning to more or less convincing hypotheses on the [total potential biodiversity sheltered by the Biosphere](#) (which could amount to 8 million species), the conclusion is obvious: while humans are thriving, the other species are withering away, with the exception of those that are directly useful to people.

But this destruction of biodiversity is of course also an existential problem for humans themselves. According to a causal chain formalized two decades ago during an [evaluation of ecosystems for the millennium](#), biodiversity underpins the proper functioning of ecosystems, which provide humans with "ecosystem services" that support their well-being (recent literature evokes in a broader and less instrumental way "the [contributions of Nature](#)"). This logic naturally also holds in

reverse: when humans destroy biodiversity, as they are massively doing today through their [agricultural systems](#), they degrade ecosystem services and, at the end of the chain, undermine their own living conditions. The case of mangroves is one of the most telling: these maritime ecosystems promote animal reproduction, store carbon and constitute powerful natural barriers against tidal waves. By destroying them, human communities are becoming poorer and weaker.

The start of the 2020 decade, the first three months of which were marked by huge fires in Australia and the Covid-19 pandemic, is clearly showing that destroying Nature is beyond our means. The most intuitive definition of the unsustainability of current economic systems can therefore be summed up in just a few words: human well-being destroys human well-being.

How do we get out of this vicious spiral as quickly as possible? One common sense solution, known since Malthus and constantly updated since then, is to suppress humanity, in whole or in part. Some commentators are taking note of how much the Biosphere, freed from the burden of humans, is doing better since they have been mostly confined. If we turn off the source of human greenhouse gas emissions, it is of course likely that they will fall sharply. Likewise, if the sources of local

pollution in urban spaces, for example in Paris, are turned off, the [air there will be restored to a remarkable quality](#). It is also likely that we will see an improvement in the lot of animal and plant species during this period, much as in areas like the [Chernobyl region that humans were forced to abandon](#). But what good is clean air when we are deprived of the right to breathe it for more than a few moments a day?

In reality, even if confinement has led to a constrained and temporary sobriety, its long-term impact is working fully against the ecological transition. All the mechanisms of social cooperation that are essential to transition policies are now at a standstill, except for market transactions. To take simply the example of climate policy, the very strategic COP 26 gathering has already been postponed to 2021, the [next IPCC Assessment Report has been slowed down](#), the full, comprehensive outcome of the efforts of the Citizen climate convention has been compromised, and so on. And a [heat wave under lockdown](#) cannot be excluded!

The point is that it is not a matter of neutralizing or even freezing social systems to “save” natural systems, but of working over the long-term on their [social-ecological articulation](#), which is still a blind spot in contemporary economic analysis.

The fact remains that the current social emergency is forcing governments around the world to work here and now to protect their populations, particularly the most vulnerable,

from the colossal shock that is simultaneously hitting economic systems around the world. The notion of essential well-being can rightly serve as a compass guiding these efforts, which could focus on sectors vital to the whole population in the months and years to come, subject to the imperative of not further accelerating the ecological crisis. Essential well-being and non-harmful well-being could converge to meet the present urgency and the needs of the future. How, precisely?

Let us briefly return to the different dimensions of essential well-being outlined in the first post in this series. Public health and the care sector are clearly at the centre of essential well-being, understood as human well-being which works for its perpetuation rather than for its loss. The medical journal *The Lancet* has [highlighted in recent years](#) the increasingly tangible links between health and climate, health and various pollutants, health and biodiversity, and health and ecosystems. Care for ecosystems and care for humanity are two sides of the same coin. But the issue of environmental health must be fully integrated, including here in France, with the new priority on health. Investing in public services beyond the health system is also a guarantee that essential well-being is shared most equitably.

This temporal coherence is complicated by the necessary reinvestment in essential infrastructure. Food supply systems in France and beyond, from agricultural production to retail distribution, are today far too polluting and destructive to both human health and ecosystems. Food systems already engaged in the ecological transition should be given priority in order to promote their generalization. Likewise, the energy required for infrastructure, particularly urban infrastructure (water, electricity, waste, mobility, etc.) is still largely fossil-fuelled, even though in just five years a global metropolis like Copenhagen has given itself the means to obtain supplies from 100% renewable energy. We must therefore accelerate the move for energy and carbon sobriety – we have [all the means needed](#). Finally, the issue of the growing ecological footprint of digital networks can no longer be avoided, when essential infrastructures, such as heating networks and waste collection, work very well in a “low-tech” mode.

The notion of essential well-being can therefore be useful for the “end of the crisis”, provided that we remain faithful to the motto of those to whom we owe so much: first, do no harm.

The essential, the useless and the harmful (part 2)

By [Eloi Laurent](#)

How do we know what we can do without while continuing to live well? To clarify this sensitive issue, economic analysis offers a central criterion, that of the useful, which itself refers to two related notions: use and utility.

First of all, and faithfully to the etymology, what is useful is what actually serves people to meet their needs. From the human point of view, then, something is useless that doesn't serve to meet people's needs. Amazon [announced on March 17](#) that its warehouses would now store only "essential goods" until April 5, and defined these as follows in the context of the Covid-19 crisis: "household staples, medical supplies and other high-demand products". The ambiguity of the criterion for the useful is tangible in this definition, which conflates something of primary necessity and something that emerges from the interplay of supply and demand. While giving the appearance of civic behaviour, Amazon is also resolutely in line with a commercial perspective.

Furthermore, this first criterion of the useful leads into the oceanic variety of human preferences that punctuate market movements. As Aristotle recalls in the first chapter of the [Nicomachean ethics](#), the founding text of the economics of happiness written almost two and a half millennia ago, we find among individuals and groups a multiplicity of conceptions of what constitutes a good life. But contrary to the thoughts of Aristotle, who erected his own concept of happiness as well-being that is superior to others, it is not legitimate to prioritize the different conceptions of a happy life. Rather, a political regime based on liberty is about ensuring the possibility that the greatest number of “pursuits of happiness” are conceivable and attainable so long as none of them harms others.

But the Aristotelian conception of happiness, which emphasizes study and the culture of books, is no less worthy than any other. Are bookstores, as professionals in the sector argued at the start of the lockdown in France, essential businesses just like earthly food businesses? For some, yes. Can they be considered useless at a time when human existence is forced to retreat to its vital functions? Obviously not.

Hence the importance of the second criterion, that of utility, which not only measures the use of

different goods and services but the satisfaction that individuals derive from them. But this criterion turns out to be even more problematic than that of use from the point of view of public policy.

Classical analysis, as founded for example by John Stuart Mill following on from Jeremy Bentham, supposes a social welfare function, aggregating all individual utilities, which it is up to the public authorities to maximize in the name of collective efficiency, understood here as the optimization of the sum of all utilities. Being socially useful means maximizing the common well-being thus defined. But, as we know, from the beginning of the 20th century, neoclassical analysis called into question the validity of comparisons of interpersonal utility, favouring the ordinal over the cardinal and rendering the measure of collective utility largely ineffective, since, in the words of Lionel Robbins (1938), "every spirit is impenetrable for every other, and no common denominator of feelings is possible".

This difficulty with comparison, which necessitates the recourse to ethical judgment criteria to aggregate preferences, in particular greatly weakens the use of the statistical value of a human life ("value of statistical life", or VSL) in efforts to base collective choices on a cost-benefit monetary analysis, for

example in the area of environmental policy. Do we imagine that we could decently assess the “human cost” of the Covid-19 crisis for the different countries affected by crossing [the VSL values calculated, for example by the OECD](#), with [the mortality data compiled by John Hopkins University](#)? The economic analysis of environmental issues cannot in reality be limited to the criterion of efficiency, which is itself based on that of utility, and [must be able to be informed by considerations of justice](#).

Another substantial problem with the utilitarian approach is its treatment of natural resources, resources that have [never been as greatly consumed by economic systems](#) as they are today – far from the promise of the dematerialization of the digital transition underway for at least the last three decades.

The economic analysis of natural resources provides of course various criteria that allow us to understand [the plurality of values](#) of natural resources. But when it comes to decision-making, it is the instrumental value of these resources that prevails, because these are both more immediate in terms of human satisfaction and easier to calculate. This myopia leads to monumental errors in economic choices.

This is particularly the case for the trade in live animals in China, which was at the root of the Covid-19 health crisis. The economic utility of the bat or the pangolin can

certainly be assessed through the prism of food consumption alone. But it turns out both that bats serve as storehouses of coronavirus and that pangolins can act as intermediary hosts between bats and humans. So the disutility of the consumption of these animals (measured by the economic consequences of global or regional pandemics caused by coronaviruses) is infinitely greater than the utility provided by their ingestion. It is ironic that the bat is precisely the animal chosen by Thomas Nagel in a [classic article from 1974](#) aimed at tracing the human-animal border, which wondered what the effect was, from the point of view of the bat, of being a bat.

Finally, there appears, halfway between the useless and the harmful, a criterion other than the useful: that of “artificial” human needs, recently highlighted by the sociologist [Razmig Keucheyan](#). Artificial is understood here in the dual sense that these needs are created from scratch (especially by the digital industry) rather than spontaneously, and that they lead to the destruction of the natural world. They contrast with collectively defined “authentic” needs, with a concern for preserving the human habitat.

At the end of this brief exploration, while it may seem rather difficult to determine the question

of useful (and useless) well-being, it nevertheless seems... essential to better understand the issue of harmful well-being. This will be the subject of the last post in this series.

The essential, the useless and the harmful (part 1)

[Éloi Laurent](#)

The Covid-19 crisis is still in its infancy, but it seems difficult to imagine that it will lead to a “return to normal” economically. In fact, confinement-fuelled reflections are already multiplying about the new world that could emerge from the unprecedented conjunction of a global pandemic, the freezing of half of humanity, and the brutal drying up of global flows and the economic activity. Among these reflections, many of which were initiated well before this crisis, the need to define what is really essential to human well-being stands out: what do we really need? What can we actually do without?

Let us first reason by the absurd, as Saint-Simon invited us to do back in 1819.

“Suppose that France suddenly loses ... the essential French producers, those who are responsible for the most important products, those who direct the works most useful to the nation and who render the sciences, the fine arts and the crafts fruitful, they are really the flower of French society, they are of all the French the most useful to their country, those who procure the most glory, who add most to its civilization and its prosperity: the nation would become a lifeless corpse as it lost them... It would require at least a generation for France to repair this misfortune...”. It is in the mode of the parable that Saint-Simon thus tried to explain the hierarchical reversal that the new world of the industrial revolution implied for the country’s prosperity, which could henceforth do without the monarchical classes, in his view, whereas “Science and the arts and crafts” had become essential.

Adapting Saint-Simon’s parable to the current situation amounts to recognizing that we cannot do without those who provide the care, guarantee the food supply, maintain the rule of law and the supply of public services in times of crisis, and operate the infrastructure (water, electricity, digital networks). This implies that in normal times all these professions must be valued in line with their vital importance. The resulting definition of human well-being

resembles the dashboard formed by putting together the different boxes in the [pandemic travel certificates](#) that every French person must fill out in order to be able to move out of their confinement.

But it is possible to flesh out this basic reflection by using the numerous studies carried out over the decades on the [measurement of human well-being](#), work which has greatly accelerated in the last ten years in the wake of the “great recession”. We can start by considering what is essential in the eyes of those questioned about the sources of their well-being. Two priorities have emerged: [health](#) and [social connections](#). In this respect, the current situation offers a striking “well-being paradox”: drastic measures of confinement are sometimes being taken to preserve health, but they in turn lead to the deterioration of social connections due to the imposed isolation.

But how better to begin to positively identify the different factors in “essential well-being” that should now be the focus of public policy? Measuring poverty can help here in measuring wealth. The pioneering empirical work of Amartya Sen and Mahbub ul Haq in the late 1980s resulted in a definition of human development that the Human Development Indicator, [first published by the United Nations in 1990](#), reflects only in part: “Human development is a process of enlarging people’s choices. The most critical of

these wide-ranging choices are to live a long and healthy life, to be educated and to have access to resources needed for a decent standard of living. Additional choices include political freedom, guaranteed human rights and personal self-respect.”

More specifically, in the French case, the work undertaken in 2015 by the National Observatory of Poverty and Social Exclusion (Onpes) on [reference budgets](#), and extended in particular by INSEE with its “[indicator of poverty in living conditions](#)”, has led to defining the essential components of an “acceptable” life (we could also speak of “decency”).

But let’s suppose that these measurement instruments contribute, upon recovery from the crisis, to defining an essential well-being (which key workers would maintain in the crisis situations that are sure to be repeated under the impact of ecological shocks); expertise alone would not be enough to trace its contours. A citizens’ convention needs to take up the matter.

This is all the more so as the definition of essential well-being naturally evokes two other categories that are even more difficult to define, to which this blog will return in the coming days: useless (or artificial) well-being, that which can be dispensed with harmlessly; and harmful well-being, which we must do without

in the future because in addition to being ancillary it harms essential well-being, in particular because it undermines the foundations for well-being by leading to the worsening of ecosystems (this is the debate taking place in Europe on whether it is necessary to save the airlines). The debate over essential well-being has just begun...

Time for Climate Justice

By Eloi Laurent

On September 18th 2019, 16 years old climate activist Greta Thunberg appeared before the United States House of Representatives. When asked to submit a formal version of her inaugural statement, she replied that she would be giving lawmakers a copy of the IPCC special report on the impacts of global warming of 1.5 °C, the so-called "[SR 1.5](#)". "I am submitting this report as my testimony because I don't want you to listen to me, I want you to listen to the scientists", she said eloquently.

By the same token, when asked what words she wanted to be printed on the sails of the boat carrying her across the Atlantic Ocean from Sweden to the US, she asked for a blunt message urging citizens and policymakers to act upon climate knowledge: "Unite behind Science". Greta Thunberg deserves considerable praise for her intelligence, courage and

determination in the face of ignorance, skepticism and animosity. But she is wrong on one important point: nations and people around the world won't unite behind science. They will only unite behind justice.

Any meaningful conversation among humans about reform, change and progress starts with debating justice principles at play and imagining institutions able to embody these principles. This is especially true of the titanic shift in attitudes and behaviors required by the climate transition, which goal is nothing short of saving the hospitality of the planet for humans.

Climate injustice is obvious in our world. On the one hand, a handful of countries, about ten percent (and a handful of people and industries within these countries) are responsible for 80% of human greenhouse gas emissions, causing climate change that is increasingly destroying the well-being of a considerable part of humanity around the world, but mostly in poor and developing nations. On the other hand, the vast majority of the people most affected by climate change (in Africa and Asia), numbering in the billions, live in countries that represent almost nothing in terms of responsibility but are highly vulnerable to the disastrous consequences of climate change (heat waves, hurricanes, flooding) triggered by the lifestyle of others, thousands of miles away.

Why is climate change still not mitigated and actually worsening before our eyes, while we have all the science, technology, economics, and policy tools we need to fix it? Largely because [the most responsible are not the most vulnerable, and vice-versa](#).

And yet, the time may be ripe for climate justice to take center stage in international negotiations. Data compiled by the [Global Carbon Project](#) released last week show that top emitters are converging in terms of climate responsibility (table 1).

Table 1. Share in % for each country or region (responsibility in terms of emissions per capita is calculated in percentage of the world average)

	Emissions in 2018	Emissions per capita in 2018	Consumption emissions in 2017	Historical responsibility emissions (1870-2018)	Historical responsibility emissions (1990-2018)
United States	15	345	16	25	20
China	28	145	24	13	20
European Union	9	139	12	22	14
India	7	41	6	3	5
Russia	5	243	4	7	6
Japan	3	189	3	4	4

Source: Global Carbon Project.

Of course, China remains by far the first polluter: the country has emitted in 2018 roughly twice the volume of CO₂ than the US, thrice the amount of the EU, four times the amount of India, five times the amount of Russia. Consider the amount per capita, and the picture changes dramatically: a citizen of the United States emits more than twice CO₂ than a Chinese. And yet, for the first time, a European is (slightly) less responsible than a Chinese in terms of per capita emissions. Conversely, it is well established that historical responsibility for greenhouse gas emissions falls largely on the shoulders of Western countries, with the US and the EU jointly responsible for half of emissions since the industrial revolution, while China only accounts for less than 15%. And yet, for the first time, China is as responsible as the US when emissions are counted since 1990 onwards (both countries accounting for 20% each of emissions over the 1990-2018 period).

It is thus the right time to devise actionable equity criteria, commonly agreed upon top emitters, as to how distributing the remaining “carbon budget” (the overall amount of emissions remaining before the Earth’s climate reaches a catastrophic tipping point, approximately 1200 billion tons of carbon that remain to be emitted over the next three decades so as to limit the rise of ground temperatures to around 2 degrees by the end of the 21st century).

But as incredible as it may seem, the formal global

conversation has not yet started on climate justice: as the COP 25 ends in Madrid and all eyes turn to COP 26 for a renewed climate ambition, countries are still negotiating at the UN on volumes of emissions that do not take into account current and projected population, human development level, geographic basis (production vs. consumption emissions), historical responsibility, etc. By the same token, [The Paris Agreement](#) (2015) mentions the term “justice” only a single time, to affirm that signatories recognize “the importance for some of the concept of ‘climate justice’”. This is clearly a misinterpretation. The whole point of climate justice is precisely that it is not confined to a few nations or important for a few people: it should be the concern of all involved in climate negotiations.

It can be shown that the application of a hybrid but relatively simple model of climate justice based on five criteria would lead to substantially cutting global emissions in addition to the carbon budget (by 36%) over the next three decades which would ensure meeting the goal of 2 degrees, and even targeting 1.5 degrees, thereby enhancing the fairness of this common rule with respect to the most vulnerable countries and social groups (see table 2).

Table 2. A simple model of fair and efficient climate justice

Top 20 CO ₂ emitters: 76% of global emissions	% of the global average of consumption emissions per capita, averaged over 1990-2012	% of the global average of HDI, averaged over 1990-2012	Average distance to 100 of (1) and (2)	Projected population increase until 2050	Equal distribution of 75% of 1200bn tons of CO ₂	Carbon budget per country : = (5) + or - (3) + or - (4)
			(in %)	(in %)	(in bn tons)	(in bn of tons)
	(1)	(2)	(3)	(4)	(5)	
India	27	75	49	24	45	78
Indonesia	30	95	38	22	45	72
Brazil	43	106	26	12	45	62
Thailand	70	102	14	-5	45	49
China	85	97	9	-2	45	48
Mexico	83	108	5	27	45	59
Turkey	96	104	0	20	45	54
Iran	123	103	-13	17	45	47
South Africa	137	94	-15	28	45	51
France	187	122	-55	9	45	24
Italy	210	121	-65	-8	45	12
UK	232	123	-78	14	45	16
South Korea	233	121	-77	0	45	10
Russia	253	112	-82	-8	45	5
Japan	249	123	-86	-16	45	-1
Germany	280	124	-102	-3	45	-2
Saudi Arabia	296	114	-105	36	45	14
Australia	319	127	-123	33	45	5
Canada	361	125	-143	22	45	-9
US	391	125	-158	20	45	-17
Total					900	576

Reading: The 1990-2012 average of per capita consumption emissions can be compared with the average level of the human development index for this period, relying on the idea of the carbon budget as a development budget. Two global average deviations are calculated for each of the twenty largest emitters: the emissions gap and the human development gap, the average of which determines the national carbon budget (either positive or negative) to be used until 2050 (countries with a negative carbon budget may have to pay by investing in carbon sinks or by transferring technology and / or financing to accelerate emission reductions in carbon positive carbon budget countries). Countries receive the same carbon endowment up to 2050 regardless of population size, this equal endowment corresponding to an equal sovereign right to develop. But this initial equal endowment is adjusted by the projected increase of population until 2050 for each country (notice that population size has already been taken into account with per capita emissions in column 1). India for instance has emitted 27% of the world average from 1990 to 2012 and reached 75% of the world average level of human development over the same period. Its population will increase by 24% until 2050, it is therefore allocated 78 billion tons of CO₂ to be emitted by 2050. In contrast, the United States owes 17 billion tons of CO₂ to the rest of the world. Applying these criteria (and justice principles) makes it possible to determine the carbon budget of each state, and leads to a reduction of 36% global emissions, from 900 billion tons to 576 billion tons.

Source: Laurent 2019.

As available data make clear, we are collectively missing the wrong targets on climate. Even if all countries fulfilled their pledges and reach their targets, the increase in temperatures would [still be of 3 degrees by the end of the 21st century](#) (or twice the target agreed upon at the Paris Agreement in 2015). In other words, what is lacking is not just the political will but also the imagination. Climate justice is the way out of this impasse. Climate justice is the key to understanding and eventually solving the urgent climate crisis. Climate justice is the solution to climate change.

The imperative of sustainability economic, social, environmental

OFCE[\[1\]](#), ECLM[\[2\]](#), IMK[\[3\]](#), AKW[\[4\]](#)

It was during the climax of the so-called Eurozone sovereign debt crisis that we engaged into the independent Annual Growth Survey – [the project](#) was first discussed at the end of the year 2011 and the [first report](#) was published in November 2011. Our aim, in collaboration with the [S&D group](#) at the European Parliament, has been to challenge and question the European Commission contribution to the European Semester, and to push it toward a more realistic macroeconomic policy, that is to say less focused on the short term reduction of public debt and more aware of the social consequences of the crisis and the austerity bias. For 7 years, we argued against a brutal austerity failing to deliver public debt control, we warned against the catastrophic risk of deflation. We also alerted on the social consequences of the deadly combination of economic crisis, increased labor market flexibility and austerity on inequalities, especially at the lower part of the income distribution. We cannot claim to have changed alone the policies of the Union, but we acknowledge some influence, although insufficient and too late to prevent the scars let by the crisis.

Today, there is a need to take this initiative a major step forward. The adoption of the [UNSDGs](#) calls for a new approach to economic governance and to economic growth. The measurement of economic performance needs to evolve into the measurement of well-being on all three accounts of sustainable development

– economic, social and environmental. A broad range of policies have to be mobilized coherently to this effect, which must move fiscal policy from a dominant to an enabling and supportive role. Moreover, those policies need to be anchored on a consistent and inclusive long-term strategy, and should be monitored closely to check that they deliver sustainability.

So far, the EU has not properly embraced this agenda, and the still prevailing European Semester process is an inadequate process to lead the EU towards achieving the UNSDGs. In the same way as the iAGS challenged the dominant orthodoxy in the macroeconomic field, the [iASES 2019 – independent Annual Sustainable Economy Survey](#), the new name of the iAGS – is our contribution to support a strategy towards sustainability and show the way.

The iASES 2019 scrutinizes the general outlook of the EU economy. The coming slowdown largely results from the gradual attenuation of the post-Great Recession recovery momentum and the convergence of growth rates towards a lower potential growth path. The slowdown of growth coincides with a revival of political turmoil – *Brexit*, Italy's public finances, the trade war and turbulences in some emerging countries. [The upturn will come to an end at some point, and the euro area is not yet prepared for that, as imbalances persist and the institutional framework remains incomplete](#)[5]. The euro area has moved into a large trade surplus, which may not be sustainable. Nominal convergence remains an important issue that should be addressed by political willingness to coordinate wage development more actively, beginning with surplus countries. Moreover, the incomplete adoption of a Banking Union may be insufficient to ensure banking stability in case of adverse shocks. The ECB could have to come to the rescue with extended unconventional policies, complemented with automatic stabilisation measures working across borders within EMU.

The social situation has slightly improved in the EU since the worse of the crisis and, on average, the unemployment rates across European countries are back at their pre-crisis levels. However, differences across countries and sections of the population are still huge. [Policy makers need to be aware of possible trade-offs and synergies between economic, social and environmental goals in general and the Sustainable Development Goals \(SDGs\) in particular\[6\]](#). In line with the SDGs and intended goals of the European Pillar of Social rights iASES aims at promoting policies – expanding social investments, pro-active industrial policies, reducing working time, increasing collective bargaining to limit primary formation of inequalities – that address these goals and overcome the direct and indirect negative consequences of unemployment.

Climate change is arguably the most serious challenge that we collectively face. Computing carbon budgets can be useful to warn policy-makers about the effort to be delivered in order to put society on the road to environmental sustainability. The iASES evaluates the “climate debt” which is the amount of money that will have to be invested or paid by countries for them not to exceed their carbon budget, leading to three key policy insights. There are few years left for major European countries before exhausting their carbon budget under the +2°C target. [Consequently, the carbon debt should be considered as one of the major issues of the decades to come since in the baseline scenario it represents about 50% of the EU GDP to stay below +2°C\[7\]](#). Framing the climate question in the words of debt is deliberate as the concept of excessive deficit applies today totally to the procrastination we demonstrate there.

[\[1\]](#) Directed by Xavier Timbeau with Guillaume Allègre, Christophe Blot, Jérôme Creel, Magali Dauvin, Bruno Ducoudré, Adeline Gueret, Lorenzo Kaaks, Paul Malliet, Hélène Périvier, Raul Sampognaro, Aurélien Saussay, Xavier Timbeau.

[\[2\]](#) Jon Nielsen, Andreas Gorud Christiansen.

[3] Peter Hohlfeld, Andrew Watt.

[4] Michael Ertl, Georg Feigl, Pia Kranawetter, Markus Marterbauer, Sepp Zuckerstätter.

[5] See « [Some Challenges Ahead for the EU](#) », *OFCE Policy Brief*, n°49, February 5, 2019.

[6] See « [Social Sustainability: From SDGs to Policies](#) », *OFCE Policy Brief*, n° 50, February 5, 2019.

[7] See “[An explorative evaluation of climate debt](#)”, *OFCE Policy Brief*, n° 45, December 11, 2018.

Climate: Trump blows hot and cold

By [Aurélien Saussay](#)

Donald Trump has thus once again respected one of his campaign promises. Nevertheless, the withdrawal of the United States from the Paris climate agreement is still not certain.

Some key figures in the US oil lobby, such as the Secretary of State, Rex Tillerson, who was former boss of Exxon-Mobil, along with its current CEO Darren Woods and the Governor of Texas, the leading oil producing state in the United States, are advising the President to keep the United States in the agreement – if only to influence the way it's applied.

This withdrawal is certainly not good news. But it does not constitute the catastrophe that some seem to fear.

At the international level, China immediately renewed its

commitment by replacing the former Sino-US axis with a new Sino-European climate alliance.

Despite the importance of coal in China's energy mix, it has become the world's leading solar power producer, both in installed capacity as well as in the capacity to produce photovoltaic cells. China's leaders have no intention of turning their back on this technological shift, which places their country in an enviable position of technological and industrial leadership.

Moreover, beyond the global problem of climate change, for China the reduction of coal consumption is a critical issue in its local policy.

The fine particles emitted by the country's power stations are smothering its cities and significantly degrading the inhabitants' quality of life. With environmental demands rising among the populace, it would be unthinkable to forego further efforts to reduce coal consumption.

The combined leadership of China and Europe should be enough to isolate Trump's position on the international stage and not jeopardize the participation of the other major emitting countries in the agreement. But the United States alone does still account for 15% of global emissions (compared with 30% for China and 9% for the European Union).

A complete renunciation of any climate policy at the domestic level would have a significant impact on the future trajectory of emissions.

The announcement by the governors of the states of California, New York and Washington of the creation of an Alliance for the Climate in the aftermath of the US withdrawal is in this respect rich in lessons.

First of all, it confirms that a large part of American climate policy is decided at the local level (state, even

municipality).

It also reveals the great divergence between the American states in the face of climate change: other coastal states that are heavily involved in the energy transition like Massachusetts and Oregon could join this Alliance, which already accounts for more than one-third of US GDP.

Finally, it highlights how sharply divided the country is on the subject: a recent Pew Research Center survey indicates that nearly 60% of Americans want their country to stay in the Paris Agreement. Trump is actually almost as isolated within the United States as he is internationally.

The withdrawal from the Paris Agreement in the main represents a domestic policy decision for Trump. His announcement, which focused on the coal industry, is aimed primarily at his voters in Appalachia's mining country, who believe their survival is threatened by the energy transition.

In the short term, however, it is much more the competition from shale gas that is threatening the US coal industry.

The new competitiveness of renewable energies, even without subsidies, condemns coal over the longer term: the leading producer of wind power in the United States is for instance Texas, which does not exactly arouse suspicion for its environmental sympathies.

Donald Trump has thus taken a risk in breaking the international process centred on the Paris agreement in an effort to revive a dying industry – with little hope of success. Fortunately, his international and domestic isolation should limit the scope of his decision.

Measuring well-being and sustainability: A special issue of the Revue de l'OFCE

By [Eloi Laurent](#)

This issue of the [Revue de l'OFCE \(no. 145, February 2016\)](#) presents some of the best works that are being produced at a rapid clip on indicators of well-being and sustainability.

Why want to measure well-being? Because the idea that economic growth represents human development, in the sense that growth represents a good summary of its various dimensions, is simply false. GDP growth is not a prerequisite for human development; on the contrary, it is now often an impediment (as is illustrated by the exorbitant health costs of air pollution in India and China, two countries that concentrate one-third of the human population).

Achieving growth is not therefore sufficient in itself for human development; there is a need for specific policies that deal directly with education, health, environmental conditions and democratic quality. If the multiple dimensions of well-being are not taken into account, one dimension, typically the economic dimension, is imposed on and crushes the others, mutilating the human development of both individuals and groups (the example of health in the United States is particularly striking in this regard).

Why want to measure sustainability? Because today's global growth rate of 5% is of little importance if the climate, the ecosystems, the water and air that underpin our well-being have irrevocably deteriorated in two or three decades due to

the means deployed to achieve that growth. Or to put it in the words of the Chinese Minister of the Environment, Zhou Shengxian, in 2011: "If our land is ravaged and our health destroyed, what benefit does our growth bring?" We need to update our understanding of well-being so that it is not a mirage. Our economic and political systems exist only because they are underpinned by a set of resources that make up the biosphere, whose vitality is the condition for the perpetuation of these systems. To put it bluntly, if ecological crises are not measured and controlled, they will eventually do away with human welfare.

Indicators of well-being and sustainability must therefore enter a new, performative age: after measuring in order to understand, we now need to measure in order to make change – to evaluate in order to evolve. Because the change called for by these new visions of the global economy is considerable. This time of action invariably involves choices and trade-offs that are far from simple. This underscores the dual purpose of this issue of the *Revue de l'OFCE*: to show that indicators of well-being and sustainability have reached maturity and that they now can change not only our vision of the economic world but also the economic world itself; they can make clear the types of choices available to public and private decision-makers so as to carry out the change needed. In this respect the two sections of this special issue clearly highlight the issue of the relevant scale for measuring well-being and sustainability.

The first part of this issue is devoted to the relatively new topic of measuring regional well-being in France. Measuring well-being where it is actually lived presupposes moving down the scale to the local level: the need to measure and improve human well-being as close as possible to people's lived reality, along with the scale of spatial inequalities in contemporary France, demands a territorial perspective. There are at least two good reasons why territories (regions,

cities, *départements*, towns), more than nation-states, are the vectors of choice for the transition towards well-being and sustainability. The first is that they have grown in importance due to the impact of globalization and urbanization. The second is their capacity for social innovation. Following on from the late Elinor Ostrom, we talk about a “polycentric transition” to mean that each level of government can seize on the well-being and sustainability transition without waiting for a push from the top.

Monica Brezzi Luiz de Mello and Eloi Laurent (“Beyond GDP, beneath GDP: Measuring regional well-being in the OECD” – *all OFCE Revue articles in French*) gives the initial results of the theoretical and empirical work currently underway in the OECD framework (interactive access on the site <http://www.oecdregionalwellbeing.org/>) that measures certain dimensions of well-being at the regional level and applies these new indicators to the French case in order to draw useful lessons for public policy.

Robert Reynard (“Quality of life in the French regions”) provides an overview of recent findings by the INSEE using regional quality-of-life indicators. These can be used to develop a new typology of French spaces, highlighting eight major types of territories, which are distinguished both by the living conditions of their inhabitants (employment, income, health, education, etc.) and the amenities that these areas provide for their people (living environment, access to services, transport, etc.). The new representation of France that emerges constitutes a valuable decision-making tool for those in charge of policies aimed at promoting equality between the regions.

Kim Antunez, Louise Haran and Vivien Roussez (“Diagnoses of quality of life: Taking into account people’s preferences”) looks back at the approach developed by France’s regional monitoring body (*Observatoire des territoires*) and highlights indicators, offered at appropriate geographical scales, that

can be used to account for the multidimensional character of quality of life in France. Here too, regional typologies explore the link between the diverse amenities in people's environments and the diverse aspirations of the people who live in them, so as to highlight the imbalances that exist and the public policy levers that can be used to reduce these.

Finally, Florence Jany-Catrice ("Measuring regional well-being: Working *on* or *with* the regions?") discusses a fundamental aspect of the debate about measuring well-being in the French regions: the participation of citizens in defining their own well-being. She shows in particular that the impact of the indicators depends on whether those who develop them work on the regions or with them – it is only in the latter case that the region and its inhabitants become active players in the development of a common vision.

But, in contrast to these localized approaches, the measurement of sustainability requires moving up the geographical scale to the national or even global level. This is the subject of the articles in the second part of this issue, which deal with a subject whose importance has been emphasized by the recent law on the energy transition: the circular economy. Here there is a crucial difference to be made between a seemingly circular economy, which concerns a product or business, and genuine economic circularity, which can be understood only by enlarging the loop to develop a systemic vision.

This is what Christian Arnsperger and Dominique Bourg aim to demonstrate ("Towards a truly circular economy: Reflections on the foundations of an indicator of circularity") by examining the main issues and questions that designers of an indicator of a truly circular economy would need to take into account, if it were ever to be developed formally and technically. They conclude in particular that without a systemic vision oriented towards the reduction, rationing and stationarity intrinsic to the permaculture approach, the notion of the circular economy

will forever remain vulnerable to misuse that, however well intentioned, is ultimately short-sighted.

Vincent Aurez and Laurent Georgeault (“Indicators of the circular economy in China”) attempt to assess the relevance and the actual scope of the assessment tools developed in recent years by China to flesh out an integrated circular economy policy that aims at ensuring the transition to a low-carbon model with a restrained use of resources. These instruments, which in many respects are unique, but still inadequate, are distinguished by their systemic and multidimensional character, and therefore constitute an original contribution to the field of sustainability indicators.

Finally, Stephan Kampelmann (“Measuring the circular economy at the regional level: A systemic analysis of the management of organic matter in Brussels”) draws on the theory of social-ecological systems to carry out a particularly innovative exercise. He uses a battery of indicators to compare the economic, social and environmental impact of two possible pathways for the municipal management of flows of organic matter in Brussels: a centralized treatment using anaerobic digestion, and a process based on decentralized composting.

Thus while well-being is best measured at the local level, to assess sustainability properly, including at the regional level, the impact felt beyond local and national borders has to be taken into account. The trade-offs between these dimensions, including the exploration and possible transformation into synergies at regional and national levels, then turn out to be the most promising projects opened up by the welfare and sustainability transition.

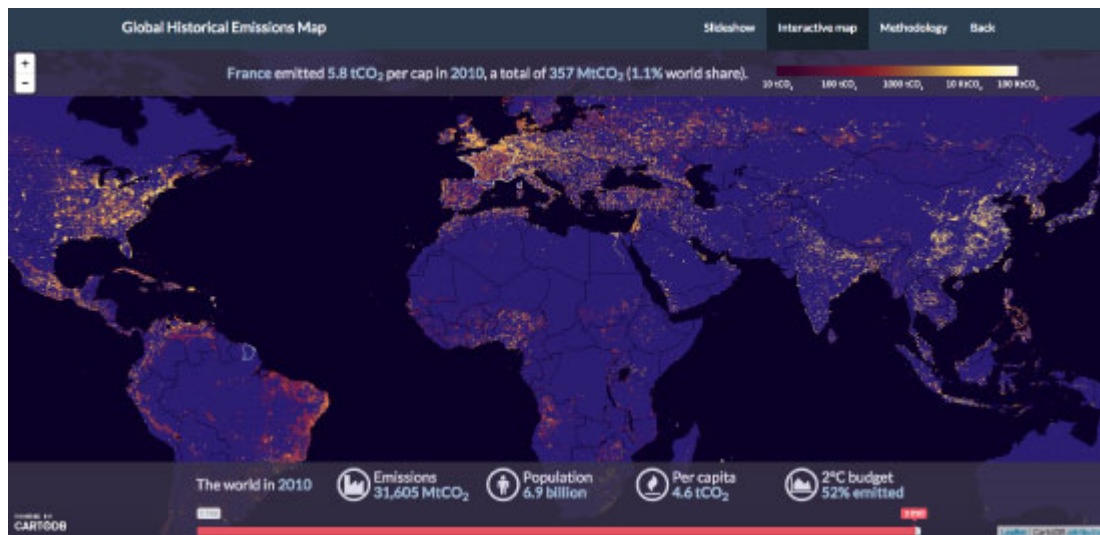
From the suburbs of London to global conflagration: a brief history of emissions

By [Aurélien Saussay](#)

A [new interactive map](#) of global CO2 emissions from 1750 to 2010 is helpful in understanding the historical responsibilities of the world's different regions for the climate crisis.

The 21st Conference of Parties (COP 21) ended on 12 December 2015 with a historic agreement. As 195 countries come to an accord on the need to limit global warming to 2 degrees by the end of the century, it is a good time to review the history of CO2 emissions since the beginning of the Industrial Revolution. Right to the end of the negotiations, the question of the historical responsibility of the different countries has remained one of the main obstacles blocking the path to a global climate agreement. The recently industrialized emerging countries and the developing countries that are just beginning their economic take-off rightly refuse to provide efforts comparable to those of the developed countries.

This feeling is confirmed by a [new interactive map](#) retracing 260 years of CO2 emissions from fossil fuel combustion and cement production on the surface of the planet^[1]. This map can be used interactively to explore the emissions of each country and their distribution in space over the last two centuries, both in their entirety and per capita. It can also be used to follow trends in global emissions and the gradual consumption of the total carbon budget for holding global warming to below 2 degrees.



By combining historical data on emissions per country issued by the [CDIAC](#) (from 1750-2010) with decadal data on population density produced by the European [HYDE](#) project (also 1750-2010), it is possible to estimate the distribution of emissions over space and time around the planet's surface – on a grid with a resolution of 5' of arc (5' being equal to 1/12th of a degree, i.e. about 10 km by 10 km at the equator).

This interactive map shows the contribution of each of the world's regions since the mid-18th century – while at the same time offering a gripping account of the gradual spread of the industrial revolution over the last two centuries.

These data illustrate several key points that help to understand the debate about differentiated historical responsibilities:

- Up to the mid-20th century, only Europe and the United States (and to a lesser extent Japan) contributed significantly to global emissions.
- It was only in the last 30 years that, led by China, the rest of the world “turned on”.
- Driven by rapid economic growth in the emerging countries, emissions have taken off in the last fifteen years.
- When weighted by distribution of the world population, emissions are highly concentrated spatially. This conclusion

is bolstered when using even finer data, notably the location of power stations and the most energy-consuming manufacturing plants (cement, aluminium, and paper, for example).

This brief history of CO₂ emissions across the globe reminds us of the West's special responsibility in the fight against global warming. The precocity of the Industrial Revolution in the West allowed the economy to take-off much earlier than in the rest of the world, but it also led to the emission of a disproportionate share of the total emissions budget that we are entitled to if we are not to exceed the target of two degrees of warming.

This differentiated historical responsibility, which was recognized by the Paris Agreement, requires Western countries to make a special effort in the fight against global warming. This responsibility must thus be reflected in a greater effort in terms of financial and technological transfers so as to ensure that the emergence of the developing countries minimizes the use of fossil fuels, without hindering their economic take-off.

[\[1\]](#) These emissions do not include emissions from changes in land use (LUCLUF) or fertilizer use. Unfortunately, it is very difficult to reconstruct these emissions for the period under consideration.