CLIMATE CHANCE
2020

GLOBAL OBSERVATORY
ON NON-STATE
CLIMATE ACTION

GLOBAL SYNTHESIS REPORT ON CLIMATE ACTION
BY SECTOR

PRESENTATION

Climate Chance

Since 2015, the Climate Chance Association has participating in the mobilisation against climate change. It is the only international organi-sation that aims to bring together all the non-state actors recognized by the UN (the 9 groups of actors: local authorities, companies, NGOs, trade unions, scientific community, agricultural, youth, indigenous peoples and women organisations), to develop common priorities and proposals and to strengthen stakeholders dynamics through networking (thematic coa-litions, summits, action portal).

The Observatory and the "Sector-based Synthesis Report"

In order to strengthen the action of non-state actors and give credibility to climate stabilisation scenarios, the Climate Chance Association launched in 2018 a Global Observatory of Non-State Climate Action, which aims to explain the evolution of greenhouse gas emissions, by crossing national public policies, with sectoral dynamics, strategies of private actors, local public policies, and all the actions undertaken by non-state actors at the local level.

In this report, we propose a synthesis of the recent literature and the ongoing trends of actions, to explain the evolution of GHG emissions in the following sectors : energy production, transports, buildings, industry, waste, and land uses.

The Climate Chance Association and its Observatory are supported by

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2020, an unusual year shaking up all observed trends from 2019

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The IPCC had set 2020 as the target year for emissions to peak and still have a chance of keeping to the pathway stipulated in the Paris Agreement. 2019 was therefore intended to be the last year in which greenhouse gas (GHG) emissions would increase.

In 2019, GHG emissions rose by 0.6% to 43.1 gigatonnes of CO_2 equivalent (GtCO_2e), including land use change. This is a smaller increase than the previous two years (+2.1% in 2018 and +1.5% in 2017), after a levelling-off between 2015 and 2016, which still brings the global increase in emissions to 4% since the signing of the Paris Agreement, and the concentration of CO_2 in the atmosphere to record levels: 410 ppm on average in 2019, whereas humanity had never exceeded 300 ppm before the Industrial Revolution (Global Carbon Project, 2019). With average temperatures 1.1°C higher than in the pre-industrial era, the year 2019 proved to be the warmest ever recorded in Europe and the second warmest on a global scale (WMO, 2020).

The year 2020 started with a mixed situation, but with focused on the opportunity for States to present their progress and renew their Nationally Determined Contributions (NDC) at the COP26. However, the Covid-19 pandemic spread across the planet in early 2020 and inevitably disrupted the dynamics observed until now. The recession experienced in 2020 has been much more severe than that following ther 2009 financial crisis. Global GDP could fall by 4.5 per cent, according to estimations by Enerdata and OECD (Enerdata, 2020). However, the most industrialised countries have proved the most resilient, particularly China, which has already made a massive economic recovery. While these figures are still uncertain, due to the second round of lockdown in the autumn of 2020, it is interesting to note that this recession could lead to a faster decline in energy consumption (-5.9%) and an even faster decline in CO_2 emissions (-8.6%). The International Energy Agency (IEA) remains cautious and expects a 5.3% drop in energy consumption and a reduction in CO_2 emissions of only 6.6% (IEA, 2020). As a reminder, the United Nations Environment Programme (UNEP) estimates that annual reductions of 7.6% in emissions of all GHGs through 2030 are necessary to achieve the objective of limiting global warming to 1.5°C, while reductions of 2.7% are needed to limit it to 2°C (UNEP, 2019).

FIGURE 1

CHANGES IN CO_2 EMISSIONS (FROM FUEL COMBUSTION) AND ENERGY CONSUMPTION - PROJECTION 2019/20
Source: Enerdata, 2020

● TOTAL PRIMARY ENERGY SUPPLY (TPES) ● CO_2 EMISSIONS (FROM FUEL COMBUSTION)
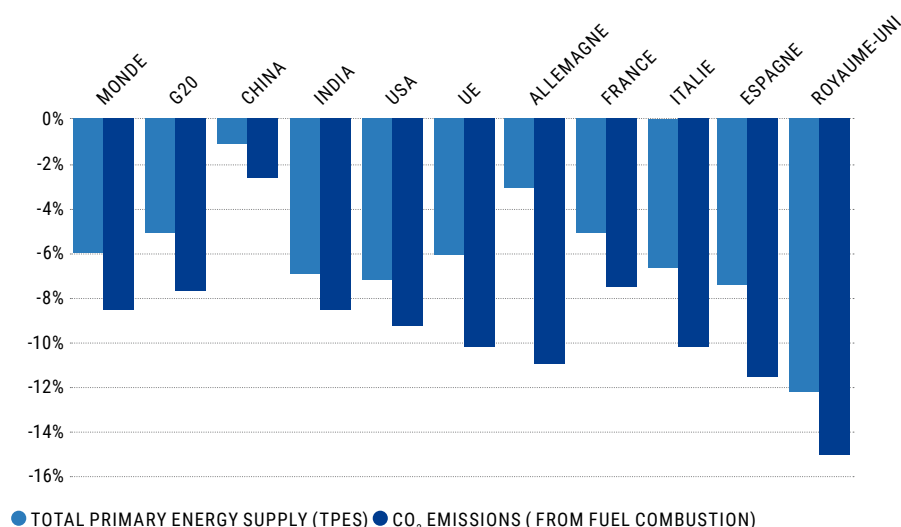
What broadlessons can be drawn from this Synthesis Report?

First and foremost, we observed that net reduction in demand and needs is a powerful factor in reducing GHG emissions.

The sectors related to energy production or use can be analysed according to the following triptych: decarbonisation, energy efficiency and net demand reduction. Though this observation may seem obvious in 2020 with the lockdown measures linked to the Covid-19 pandemic, it is nonetheless also relevant for observing trends from 2019. The first factor in the reduction of GHG emissions in electricity production in 2019 is the slowdown in economic growth and electricity consumption (p. 20). Conversely, this same observation explains the difficult decarbonisation of these sectors. In the building sector, the meagre efficiency gains in 2019 do not compensate for the growth in electricity demand for appliances, or even the demand for building space (p. 114). In the transport sector, sales of new vehicles continue to decline, although the trend towards higher-end vehicles and the success of heavier, more fuel-intensive SUVs undermines efficiency gains. Finally, our analyses of the steel and textile production sectors (pp.143 and 155, Industry section), show that the options for decarbonising these two sectors are limited. This observation calls for a reduction in the use of virgin materials, via either more circularity or by a net drop in demand.

Some positive signs of the transition accelerated with the health crisis.

In electricity production, the priority given to renewables on grids and the drop in oil demand both enabled renewables to maintain growth while amplifying the devaluation of fossil fuels, especially the Oil majors (p. 29). Cycling, at the crossroads of environmental and health challenges, has benefited from a sudden burst in popularity. Not only in Europe, but elsewhere in the world as well, this can now be considered a scaling-up process, and not just a simple surge limited to a few cities (p. 59). After the shock caused by the closure of China's borders to imports of recyclable waste in 2018, the reintegration of local recycling channels in industrialised countries has become all the more urgent as the pandemic has caused recycling rates to fall and pushed up the price of virgin plastics (p. 188).

At the same time, the crisis is reversing some encouraging trends observed in recent years.

There have been many impacts on access to clean electricity and households' ability to equip themselves with entry-level off-grid solutions in developing countries (pp. 26 and 41). Low oil prices have also enabled maritime freight companies to cushion the impact of the pandemic on their activities, while weakening some of their decarbonisation and depollution strategies (p. 82). The drop in cost of petrochemicals also benefits the producers of virgin plastics - at the expense of recycled plastics - with high demands for Personal Protective Equipment (PPE) equipment (p. 192).

Finally, the crisis has exacerbated some already worrying trends,

such as the weakening of controls to combat forest fires and deforestation in Brazil, and thwarted efforts in Indonesia, which had succeeded to curb the pace of its deforestation. Nevertheless, a positive effect of the pandemic could be how the role of forests and biodiversity as natural barriers to the circulation of pathogens, in addition to their role as carbon sinks, has recently been put in the spotlight and at the heart of public debates

Key takeaways

● The general decline in both energy use and production of goods and services constitutes a powerful factor in reducing GHG emissions. This was evident in 2019 and is so again 2020.

● The pandemic and its consequences have accelerated some progress made with regard to the transition, particularly electricity production, urban mobility and waste treatment.

● The crisis is also reversing some encouraging trends observed in recent years, such as access to off-grid energy in developing countries, efforts to reduce transport emissions, and efforts to protect forests.

● The shock of the plunge in demand and oil prices has ambivalent effects in the short term, but may well lead to structural changes in some sectors.

Socio-economic consequences of the Covid-19 crisis: a possible drawback for climate objectives

In addition to insufficient progress made in 2019 towards achieving the Sustainable Development Goals (SDGs) by 2030, most SDGs have been affected by the Covid-19 pandemic: "*the coronavirus epidemic has reversed some of the progress made in poverty, health care and education*" as highlighted in a report by the UN Department of Economic and Social Affairs (UNDESA) (United Nations, 2020). However, the Paris Agreement climate goals and those of Agenda 2030 are closely linked and feed off each other (Gonzalez-Zuñiga & al., 2018; Nerini, F. F., et al., 2019): indeed, this is what underpins calls to develop a "One Health" approach, integrating human health, animal health and environmental services, and to better align the Rio agendas on climate, biodiversity and desertification. From this perspective, the increasing localisation of SDGs observed this year by the Global Taskforce of Local and Regional Governments highlights increased trust in local governments, which have proven their legitimacy in managing the health crisis at the local level (CGLU, 2020).

As the most vulnerable have been the hardest hit, the pandemic has set back a number of key socio-economic indicators crucial to achieving the SDGs. After dropping since 2015, global poverty stalled this year. According to the World Bank's report on poverty and shared prosperity published in October 2020, "*The COVID-19 pandemic is estimated to push an additional 88 million to 115 million people into extreme poverty this year, with the total rising to as many as 150 million by 2021, depending on the severity of the economic contraction. Extreme poverty, defined as living on less than $1.90 a day, is likely to affect between 9.1% and 9.4% of the world's population in 2020, according to the biennial Poverty and Shared Prosperity Report. This would represent a regression to the rate of 9.2% in 2017.*" (World Bank, 2020). Since 2019, level of food insecurity have climbed (25% of the population) and are now likely to worsen due to additional threats to the global food systems (SDG 1; United Nations, 2020). Access to education has also been strongly affected, even as new generations need better training, and all the more so in less wealthy areas (SDG 4).

Some of the SDGs with the strongest causal links to the success of climate ambitions have been directly impacted. While energy demand has been satisfied by a more renewable mix during the lockdown period, there has been a decline in access to electricity and investment over the year (SDG 7), particularly in Africa (p. 26). Given the inevitable impact of Covid-19 in cities due to their population density, new urban planning initiatives were rushed into place, not all of them climate-compatible. Fear of public transport has led to a rebound in the use of private cars, threatening an increase in air pollution, which is harmful to human health and CO_2 emissions (SDG 3, p. 56). Similarly, one third of manufacturers and retailers of improved cookstoves temporarily ceased their activities in spring 2020. Due to financial difficulties, some households increased their reliance on wood for cooking. In 2018, 38% of the world's population still lacked access to electricity or gas for cooking (SDG 7, p. 117).

Key takeaways

● The health/economic crisis is reversing progressive trends that have been tracked for several years or even decades by socio-economic indicators such as food security, access to clean energy, health and education.

● The fall in household income could jeopardise climate objectives, as energy solutions retained may be more economical but also more emissions and pollution intensive. For example the decreased popularity of public transport exemplifies a trade-off between human health priorities and emissions reduction.

Can recovery plans and re-newed State commitments to the Paris Agreement be compatible ?

As citizens increasingly **make the link between environmental preservation, climate change and health consequences**, there has been an extraordinary surge in high-level political announcements. **In recent months, three of the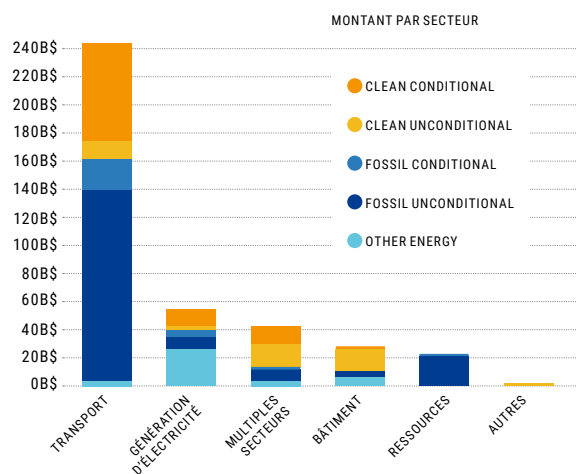 world's largest economies have made climate commitments**. To everyone's surprise, not only China, but also Japan and South Korea have announced a net zero target date, namely 2060 for China, and 2050 for the other two. This is a simple but significant commitment for countries whose economies are massively based on coal (China's energy mix is 62% coal). On another level, the election of Democrat Joe Biden as president of the United States of America means the USA will be rejoining the Paris Agreement, a good sign for multilateralism. And lastly the European Union is also ramping up its ambitions despite the brutal health crisis of 2020. President Ursula von der Leyen is advocating a 2030 target of reducing greenhouse gas emissions by 55% as compared to 1990, versus a goal of 40% currently, as part of the Green Deal proposal put forward by the Commission.

Despite encouraging signs, at this stage the pandemic's immediate impact on international climate negotiations has been negative. The weakened COP process is struggling to effectively integrate non-state actors in the implementation of the Paris Agreement (weighed down by the poor track record of the Talanoa Dialogue). On top of this, the pandemic has led many countries to postpone release of their renewed contributions to the Paris Agreement (NDC), and to announce recovery plans that are in some cases not compatible with decarbonisation of the economy.

Energy Policy Tracker, an initiative led by six international economic and climate research centres, analysed the distribution of public funds committed to the energy sector (production and use) by G20 countries in their recovery plans, by sector (**fig. 2**).

FIGURE 2

VOLUME AND COMPATIBILITY WITH THE PARIS
AGREEMENT OF AMOUNTS ALLOCATED BY THE G20
COUNTRIES' RECOVERY PLANS. *Source: Energy Policy Tracker,
2020*

renovation: the United Kingdom, Germany, France
and Canada. The shift towards hydrogen as an
alternative energy carrier also benefits from
significant funding.

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- CLEAN CONDITIONAL
- CLEAN UNCONDITIONAL
- FOSSIL CONDITIONAL
- FOSSIL UNCONDITIONAL
- OTHER ENERGY

There are the key sectors of the transition
at the heart of recovery plans, such as thermal
renovation, industrialisation of hydrogen pro-
duction (electricity storage, decarbonisation of
industry and transport), revival of the debate on
rail freight and relocation of economic activities.
Nonetheless, the need to transform the models of
certain sectors and mitigate their emissions has
yielded to economic urgency. Thus, the support
plans observed rarely include consideration for
either environmental or socio-economic issues:
this is particularly the case for car manufacturers
(p. 64), and stakeholders from maritime (p. 94)
and air transport (p. 96).

As of 21 October 2020, G20 members had
pledged $216 billion for investments linked to
fossil fuels, or 54% of all public funds committed to
the energy sector. Transport is by far the largest
sector with $243 billion dedicated to recovery
plans. $139 billion, or 57% of the sums promised
to this sector, support the consumption of fos-
sil fuels without any consideration for the cli-
mate. These sums are intended to save airline
companies. The building sector is receiving the
greenest investments, proportionally speaking,
with four countries' budgets allocated to energy

Local authorities were only slightly taken into
account in the preparation of these emergency
plans. In Europe, for example, the allocation of
the *Next Generation EU* recovery plan remains
very vertical and state-centred; the same applies
in the long term for the Green Deal, unless dis-
cussions of the European Climate Pact lead to
a stronger role for local authorities.

• Since the Paris Agreement, States have struggled to mobilise funding in line with what is required for the 2°C pathway. Recovery plans and emergency aid are redirecting considerable financial resources towards sectors deemed a priority by States, sometimes without any concessions including for high GHG emitters.

• Already at the heart of the climate agenda in the run-up to a review of contributions to the Paris Agreement, the recovery plans strengthen the role of States in the strategic, economic and financial steering of the ecological transition.

Trends among actors: diversifying climate action repertoires

In an era of carbon neutrality, actors reshape their climate strategies

Although international cooperation coalitions and initiatives seem to be losing momentum in light of disappointing results for 2020 objectives (the poor record on forest protection —New York Declaration, Bonn Challenge, etc—is a sobering example of this), players seem to be more ready to question their own scope of activity.

Firstly, **large companies across all sectors have massively seized the tools of carbon offsetting in order to present net-zero strategies for 2030 or 2050**. While in some cases these objectives show that they take into account the transition risks that threaten certain sectors (such as Oil & Gas), the criteria for assessing carbon neutrality are still too uneven to allow standardisation of GHG emissions reduction efforts prior to offsetting. This is also the case for cities, which are particularly numerous in joining the Race to Zero campaign, which brings together 452 cities, 45 investors, 22 regions and 549 universities alongside the 1,101 companies converging around a set of shared criteria for carbon neutrality in 2050 (UNFCCC, 2020).

Despite the crisis, communities are scaling up certain instruments and policies to achieve their climate and environmental objective. By 2019, 58 cities and regions had achieved 100% renewable electricity supplies, thanks in part to direct renewable energy purchase contracts and green energy certificates. The municipalisation of energy production could give rise to "guarantees of origins" to the benefit of citizen cooperatives and big energy companies (p. 35).

The proliferation of local and regional codes for new construction stands in stark contrast with the lack of regulation for existing buildings, although local integrated renovation services (e.g. one-stop shops) are becoming standardised (p. 121). As Asian borders close to recyclable waste, Canadian provinces have responded by operationalising producer responsibility, while Australian states are creating deposit-refund programs (p. 202).

At the individual level, new forms of deconsumerism also contribute to tightening the link between acts of production and consumption. Circularity and second-hand textile markets have been such a success that they are driving mass retailers to adopt this model. Meanwhile, the demand for the repair of electronic objects in Europe and the United States is prompting some companies to facilitate access to spare parts and offer repair services (p. 204). With air traffic at a standstill, *flygskam* has been out of the spotlight. Many changes have been noted in mobility behaviour, including growing interest in cycling and the necessary infrastructure for urban centres, accompanied also by the breakthrough of the market for electric micro-mobilities (p. 59). Finally, expansion of grid-connected residential solar installations in high-income countries does not seem to have been affected by the health crisis: on the contrary, their low cost makes them more competitive than ever with carbon-based electricity production (p. 23).

Legal action and the revival of certain struggles place climate at the heart of public debate and democratic expression.

Following on from past years, we have observed how climate action increasingly features in the legal sphere, as for example, the multiplication of "climate disputes", initiated by citizens, NGOs or even cities, against States or companies (Torre-Schaub, M., 2020). The *State of the Netherlands vs. Urgenda Foundation* case in December 2019 set a symbolic precedent. The Dutch State's lack of climate ambition to meet its 2020 emission reduction targets and refusal to take binding measures to achieve them were officially declared illegal by the country's Supreme Court. In France, the complaint filed by the commune of Grande-Synthe against the State for climate inaction led the Council of State in November 2020 to ask the government to demonstrate within 3 months that its efforts are in line with the low carbon national strategy and a 40% reduction in emissions by 2030, by undertaking an assessment of the public policies implemented. The State could then be obliged to take additional measures. Meanwhile, in the United States, a lawsuit filed by the State of New York against ExxonMobil for misleading its investors about its knowledge of the effects of climate change has resulted in a defeat for the plaintiffs (Harvard, 12/12/2019). The Colombian Supreme Court ruling ordering the state to stop deforestation in the Amazon has yet to result in policy, but the progress of the Leticia Pact, initiated by the Colombian president in late 2019 to protect the Amazon, is in line with the spirit of this decision.

The court annulment of an extension to London's Heathrow airport on the grounds that the project is not consistent with the Paris Agreement marks a turning point, however, by giving binding force to international climate targets (The Guardian, 27/02/2020). The UN Human Rights Committee, a UN monitoring body, issued a groundbreaking decision on the asylum rights of climate refugees, following an appeal by a Kiribati citizen whose asylum claim was rejected by New Zealand. The decision decrees that no country should deport a citizen facing conditions caused by climate change that endanger their life (IISD, 30/01/2020).

Alongside low-carbon commitments, **a growing number of companies are using "*corporate activism*" to support the climate cause**, of which encouraging employees to take part in climate protests is just one example. Companies are increasingly under pressure from their shareholders to deliver climate commitments and results, as shown by shareholder activism during the 2020 Annual General Meetings (Global Synthesis Report on Climate Finance 2020, Climate Chance).

In addition to the legal route and official processions of demonstrators, **industrial blockades or "occupations" of public spaces have now entered the collective action repertoire of climate activists, balanced at the frontier of law and civil disobedience.** In this area Extinction Rebellion is the organisation that receives the most media coverage. After four years of occupation and sabotage, two indigenous Ecuadorian groups, the Sapara and the Kitchwa, obtained a court decision to cancel a major oil drilling project in the middle of the Amazon rainforest (Energy Transition, 09/01/2020).

In response, **several states have turned to the law to penalise militant forms of activism**, as in the UK, where Extinction Rebellion is listed as an "extremist ideology" by the anti-terrorist police, or in the US, where the Department of Homeland Security listed "Valve Turners," a group of oil sands pipeline saboteurs, alongside mass murderers. Conversely, faced with growing awareness and civil society's growing commitment to social and climate justice, **several governments are trying to strengthen citizen participation in the drafting of public climate policies**. In France, a group of 150 randomly selected citizens wrote up 149 proposals submitted to the government. In the United Kingdom, 108 citizens were selected at random to formulate recommendations for achieving carbon neutrality (Carbon Brief, 10/09/2020) unveiled in early September 2020. These initiatives were inspired by the People's Climate Parliament

(*Klimatriksdagen*) meeting in Sweden in 2014, and will be replicated in Wallonia in January 2021 (La Libre, 30/09/2020), before perhaps finding their way to Spain, as Pedro Sanchez's government pledged in its Climate Emergency Declaration (MITECO, 19/02/2020). Separately, the integration of communal management practices into national or UN forest governance frameworks or timber trade agreements also stems from this trend, of institutions incorporating practices and experiences from the field (p. 232).

Key takeaways

● Although action coalitions and cooperation initiatives struggle to reach their objectives, a growing understanding and awareness coalescing around carbon neutrality over the past two years has influenced companies, cities and financial actors to take action on their emissions perimeters.

● Mass climate rallies, civil disobedience and legal actions are giving rise to a new arena to fight for climate justice. Outside institutional channels, this arena is taking over the climate language to challenge actors' behaviours, reverse economic sectors' trends and transform national and international action frameworks.

● Institutions have begun to respond by integrating the voices and skills of citizens into the formulation of climate policies. Examples include randomly selected citizen committees and experiments in community forest management, scaled up by national or international authorities.

GLOBAL SYNTHESIS REPORT ON CLIMATE ACTION BY SECTOR

ENERGY

Restructuring of electricity production players at a forced march

Restructuring of electricity production players at a forced march

Observatory Climate Chance: **Ghislain Favé** • consultant Energy-climate • **Amaury Parelle** • coordinator

The crisis seems to be accelerating the trends observed in 2019 in energy production: restructuring of major players in fossil fuel and electric power, historic decline in coal, renewable electricity supply by private and local players, etc. However, with 41% of CO_2 emissions linked to energy use in 2019, electricity production is demanding hardcore and long-term breakthrough strategies from its protagonists, given the rigidity of production systems. Demand is also set to increase with energy uses such as transport rapidly being turned over to electrification. Here we analyse recent developments in the roles and strategies of businesses, local authorities and citizens in electricity production, and how recent upheavals linked to the Covid-19 pandemic may have influenced them.

CONTENTS

ENERGY

1 Electricity production emissions fell by 1.3% in 2019, due firstly to a moderate increase in economic growth and consumption and secondly to the historic 3.1% decline of coal in the international mix, up to -19% in Europe and -15% in the United States. For the first time in the industrial era, low carbon energies (renewables and nuclear) have overtaken coal in the electricity mix (37% vs 36% respectively).

2 The Covid-19 pandemic has led to renewables gaining an increasing share of the global electricity mix due to their low operating cost and their priority access to the grid. Conversely, coal and gas generation is in sharp decline. However, electricity consumption is expected to decline by only 2% in 2020, with the drop in industrial consumption being offset by that of households. While recovery plans have a mixed record, with USD 13 billion being allocated to fossils compared with 14 billion for renewables, falling revenues are expected to reduce access to electricity in many developing countries.

3 Asset losses and impairments are accelerating in 2020 for major European and US groups in the oil and gas sector. Some are reorienting themselves more seriously towards renewables. Big public and private electricity companies are struggling to formulate and implement a fortiori long-term transition plans. On the consumption side, direct purchases of renewable energy by these companies picked up quickly in the second half of the year.

4 The actions of cities and regions demonstrate a growing ambition to mobilise their local players and their inhabitants in the energy transition. At the end of 2019, 58 cities or regions, including 44 in Europe, were being supplied with 100% renewable electricity through direct purchases and certificates, as well as through investments in their territory and elsewhere. More recently, they have become players in fossil fuel disinvestment through their public investment funds or their legal actions.

5 Citizens continue to transform into "prosumers", but the crisis has seriously impacted off-grid solar power and the capacity to equip lower-income households in developing countries. On the other hand, this is less the case in richer countries where solar electricity in the residential sector is driven by falling prices and local regulatory measures. Energy cooperatives are still marginal in capacity, but are increasing in number: 3,500 in 2019 in Europe. Finally, citizens are not slow to mobilise against certain wind projects deemed harmful to the environment and wildlife.

• **FALLING EMISSIONS IN 2019 DUE TO THE SLOWDOWN IN ECONOMIC GROWTH AND THE DECLINE OF COAL** • In 2019, global CO_2 emissions linked to electricity production amounted to 13.6 gigatonnes of CO_2 (Gt CO_2), down 1.3% from the 2018 level (**fig. 1**). This fall follows two consecutive years of increased emissions in this sector: +1.8% in 2017 and +2.5% in 2018 (IEA, 2020). The emissions changes are very different depending on the region (**fig. 2**): in the European Union, they have fallen for the seventh consecutive year and very markedly so (-13.9% in 2019). In Germany, the fall even reached -17.9%. Above all, while emissions for the sector had increased in the United States and India in 2018, there were falls of -8.4% and -2.3% respectively in 2019. In China, while emissions growth was 6.7% in 2018, it was no more than 2% in 2019.

FIGURE 1

GLOBAL CO_2 EMISSIONS LINKED TO ELECTRICITY PRODUCTION (IN BILLIONS OF TONNES OF CO_2)
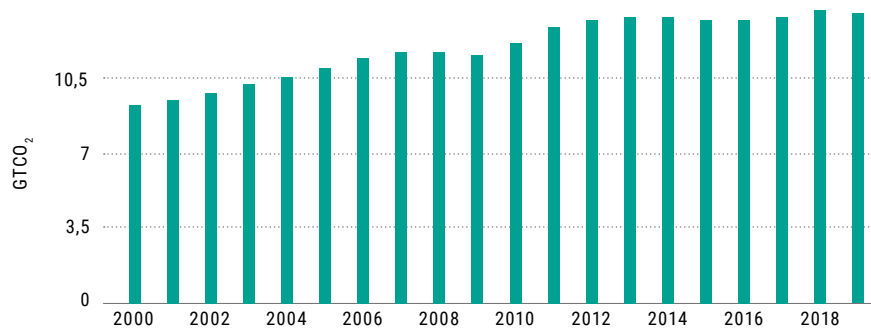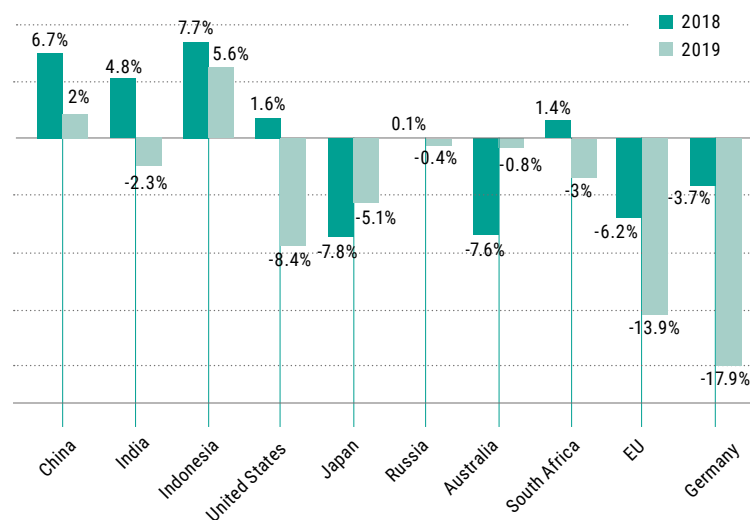*Source: IEA, 2020*

FIGURE 2

CHANGES IN ELECTRICITY AND HEAT PRODUCTION EMISSIONS FOR A SELECTION OF COUNTRIES
Source: Enerdata, 2020

1. Moderate growth in electricity consumption

This fall in emissions can be explained above all by a more moderate growth in electricity consumption than over the recent period, up 1.4% in 2019 (IEA, 2020). This demand for electricity follows global economic growth which shrank in 2019: +2.9% in 2019 compared to +3.7% in 2018. In the G20 countries, this growth was only 0.7% in 2019, whereas it stood at +3.8% in 2018 and at an annual average of +2.5% over the 2007-2017 period (Enerdata, 2020).

Climatic phenomena also explain this reduction in the demand for electricity: in 2018, the summer was particularly hot and the winter more severe than normal in North America, increasing the need for air conditioning and then heating. In 2019, in contrast, the summer was less hot in China and the United States, reducing the demand for electricity for air conditioning (IEA, 2020). In India, rainfall was high, which limited irrigation needs and their electricity requirements (Bloomberg, 2019). In total, climatic factors reduced the growth in global energy demand by 0.8 percentage points between 2018 and 2019.

2. A historic decline in coal

The reduced carbon intensity of electricity production is the second factor explaining the fall in emissions observed for the sector. In 2019, the carbon content of electricity was 463 gCO_2e/kWh, a reduction of 2.5% compared to 2018 (IEA, 2020); a rather more marked fall than the 1% of 2018. Significant progress was notably made in Germany (-12.9%), the European Union (-11.9%) and the United States (-6.9%). The decrease was 2.9% in China and 3.1% in India (**fig. 3**). However, this progress is still far from a 2°C trajectory: the IEA's *Sustainable Development Scenario* sets the required annual reduction in average carbon intensity at 5.6%.

FIGURE 3

CHANGES IN THE CARBON INTENSITY OF ELECTRICITY PRODUCED IN A SELECTION OF COUNTRIES
Source: Enerdata 2020
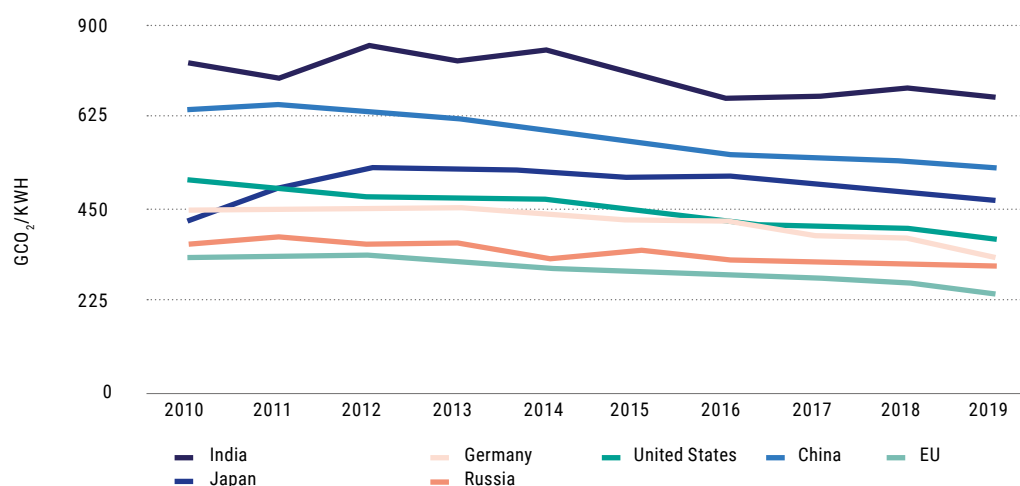
The reduction in the carbon intensity of electricity can be attributed to the decline of coal in the global mix in 2019. After three years of growth and a record 10,000 TWh in 2018, coal-fired electricity production fell by 3.1% in 2019. In Europe and the United States, coal production fell sharply: -19% and -15% respectively. In India, production dropped for the first time by 2%. In China, it increased by 2%, i.e. lower growth than in previous years and which does not compensate for the decline

observed in other countries (IEA, 2020). Over the past thirty years, coal-based electricity generation has declined on two occasions only: in 2009 following the financial crisis and in 2015 following the economic slowdown in China. The 3.1% decline in 2019 is greater than the previous two.

Despite this reduction in the contribution of coal, it remains the main source of electricity generation in the world, accounting for 36% of the electricity mix. In addition, the growth of coal has been so strong over the past two decades that 60% of coal-fired power plants are under 20 years old (IEA, 2020). Coal therefore remains firmly anchored as the main means of electricity production, especially in China, which produces and consumes half of the world's coal.

This decline in coal was largely offset by the growth of gas. Electricity generation from this fuel increased globally by 3% between 2018 and 2019, driven by 8% growth in the United States (IEA, 2020).

3. Installed capacities of renewables still leading the field

As was the case in 2018, renewable energy is the fastest growing source of electricity production. 184 GW of renewable non-hydro production capacity have been installed, i.e. 20 GW more than in 2018 (Frankfurt School). **Electricity production from renewable sources grew by 6% in 2019 with nearly 440 TWh of additional generation and renewable energy represented 27% of the global electricity matrix.** In 2018, they increased by 7%, so there has been a slight reduction in growth (IEA, 2020). For the fifth consecutive year, with 75% of the electricity production capacity deployed in 2019, renewable energy greatly exceed fossil and nuclear energy (REN21, 2020).

FIGURE 4

NEW RENEWABLE SOLAR AND WIND CAPACITIES INSTALLED
Source: Enerdata 2020
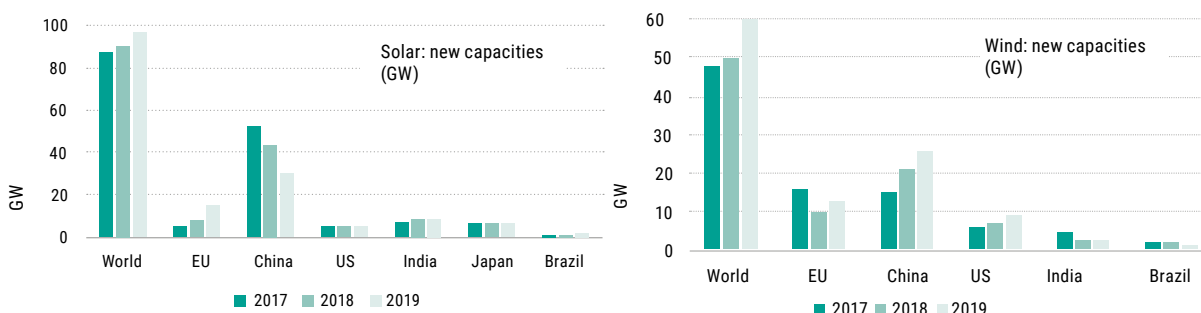
In 2019, 97 GW of new solar capacity was installed worldwide: 7% more than in 2018. Growth is strong in Europe with new installed capacity in 2019 doubling compared to 2018. Growth is stable in the United States, India and Japan. While China remains the leading country in terms of new capacity with 30 GW in 2019, the pace continues to slow (**fig. 4**).

New wind power capacities installed in 2019 total nearly 60 GW, up 24% compared to 2018. The rebound is strong in Europe and growth continues in China and the United States (**fig. 4**).

The share of low-carbon energy (renewable and nuclear) in the global electricity mix, an important energy transition indicator, has grown by one percentage point. For the first time in the industrial era, they have overtaken coal in the electricity mix by 37% to 36% (**fig. 5**).

FIGURE 5

CHANGES IN THE SHARE OF COAL AND LOW-CARBON SOURCES IN THE GLOBAL ELECTRICITY MIX

Source: IEA, 2020
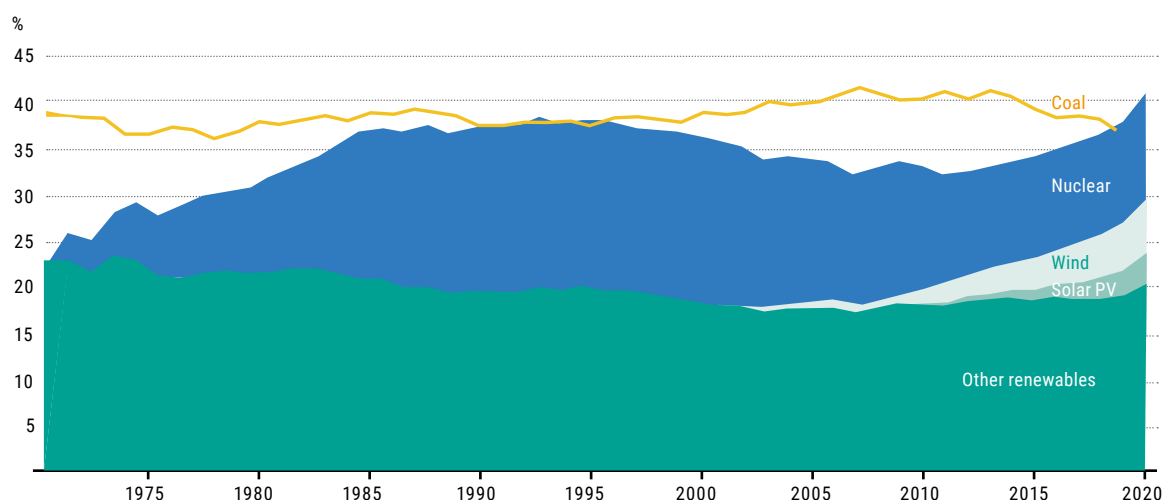
• THE HEALTH CRISIS REINFORCES 2019 TRENDS: A DECLINE IN COAL AND PRIORITY FOR RENEWABLES •

1. Subsidies for fossil fuel electricity already down in 2019, a slight rise for renewables

While 2018 saw an increase in fossil fuel subsidies, they fell in 2019, primarily because of lower oil prices. In the electricity sector, subsidies fell from 155 to 113 billion dollars, i.e. a fall of 27%. The countries that most subsidised fossil fuel electricity in 2019 were Iran ($52 Bn), Russia ($14 Bn) and China ($12 Bn) (IEA, 2020, **fig. 6**).

FIGURE 6

SUBSIDIES FOR FOSSIL FUEL ELECTRICITY - *Own compilation using IEA data*

BETWEEN $ 0 AND 1 BN

BETWEEN $ 1 AND 10 BN

BETWEEN $ 10 AND 50 BN

OVER $ 50 BN
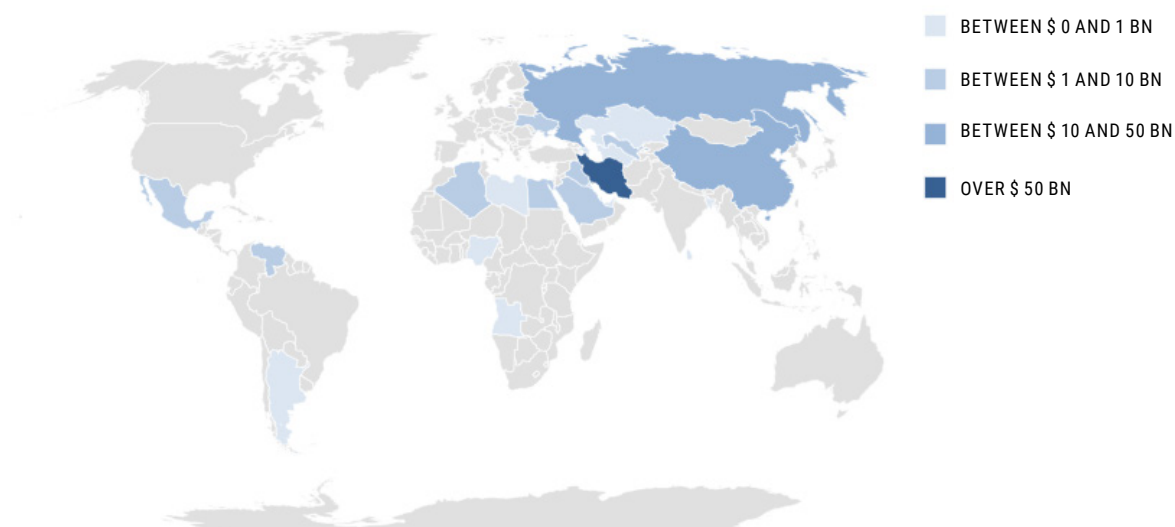
Investments in renewable energy including biofuel grew by 1% in 2019 to $282 Bn. These investments are still dominated by photovoltaic solar and wind power. For the first time since 2010, investments in wind power have exceeded those in solar and reached $142.7 Bn (+8% compared to 2018). Investments in solar totalled $141 Bn, down by 2%. As for investments in geothermal energy, they fell by 50% to 1.2 Bn dollars, a long way from 2011's 3.8 billion (REN21, 2020).

International public financial flows to developing countries for energy and renewable support reached $21.4 Bn in 2017, 13% more than in 2016 and double the 2010 level. But only 12% concerned the least developed countries (LDCs). By type of technology, hydroelectric power receives most of these funds (46%) followed by solar (19%) (IRENA, 2020).

Already observed in the 2018 and 2019 reports of the Climate Chance Observatory, the trend towards auction systems continues. According to REN21, at least 68 renewable energy auctions have taken place in 41 countries. This is seven fewer countries than in 2018, but the negotiated capacities were greater and the total number of countries using this mechanism increased. Nigeria thus issued a call for tenders for a 15 MW solar power plant connected to a 5 MW battery. These auctions resulted in strong pressure on prices and while the average bid price was around US$30/MWh, many auctions ended at US$20. The price record was reached in August 2020 in Portugal with a price of €11.14/MWh for a solar power plant (Reuters, 26/08/20).

EXPERIENCE FEEDBACK

CARBON CAPTURE IS PART OF ALL ENERGY SCENARIOS IN A 2°C TRAJECTORY, BUT STRUGGLES TO PROVE ITS WORTH

The 2018 Climate Chance Observatory Summary Statement reported difficulties in deploying Carbon Capture and Storage (CCS) with only 17 capture and storage projects in service worldwide in 2018. The technology remains too expensive and uncertain to really mobilise economic players (Climate Chance, 2018 Summary Statement p.120). Since then, progress has been very tentative and 21 CCS projects are operating in 2020. The sector is therefore very far from the objectives of the IEA roadmap which set a target of 100 projects to be in operation by 2020 to meet climate objectives. Current capacity is 40 MtCO$_2$e per year, or only 13% of the IEA's 400 Mt target (IEA, 2020). The finding is the same as in 2018: despite the technology being mature, the price of carbon is still insufficient for the development of large-scale projects.

The economic recession following the coronavirus crisis should have a negative impact on investments. Despite this climate of uncertainty, several announcements were made in 2020: in March, the United Kingdom confirmed investing £800 million in carbon capture infrastructure and announced that at least two industrial sites and a gas thermal power plant would be equipped with it. Over the year as a whole, the US government granted subsidies of $203 million to the sector (IEA, 2020). In September, the Norwegian government announced NOK 17.1 billion of support for the development of two capture and storage facilities (EnergyWatch, 21/09/20).

BOX 1

2. Covid and lockdown: coal and gas absorb the fall in demand

The lockdown measures adopted in most countries had an immediate impact on electricity consumption. In China, the first country impacted by the health crisis, demand for electricity fell by 13% in February 2020 compared to February 2019. In European countries demand fell, with

consumption sometimes 20% lower than in 2019 (**fig. 7**). With the gradual easing of the lockdowns, demand picked up but in July 2020 it was 5% lower in EU countries compared to July 2019 levels (IEA, 2020).
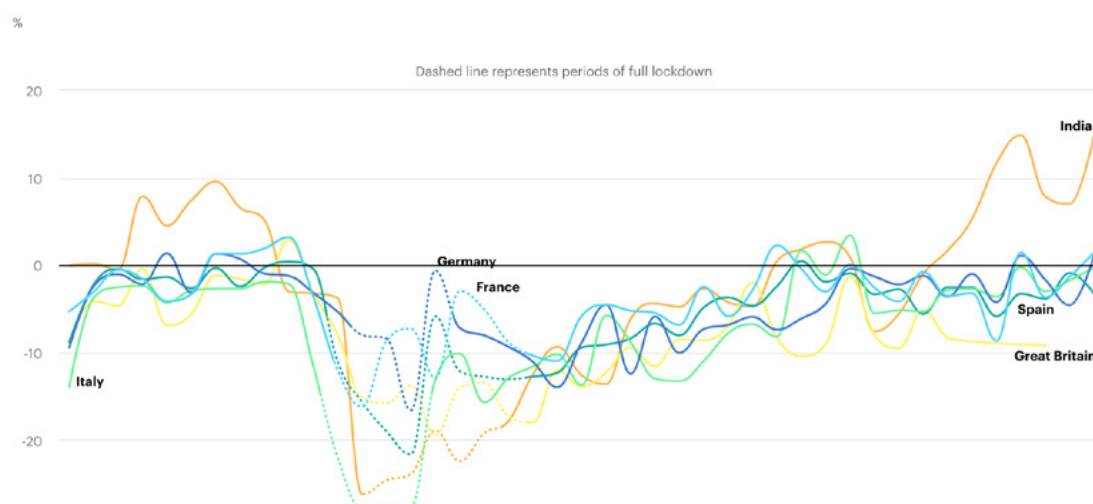
In all countries, the drop in demand for electricity during lockdowns had an impact on the electricity mix. **Due to their low operating cost and their priority access to the grid, renewable energy have seen their share in the energy mix of all regions go up.** The fall in energy consumption was thus absorbed by coal and gas. In Europe, while electricity demand fell by 7% in the first half of 2020, production from renewable energy sources grew by 11%, largely thanks to wind and solar installations, which produced a fifth of European electricity, a record figure. In Denmark, 64% of electricity was produced from wind and solar energy. During the lockdown and for the first time in Europe, electricity production from renewable energy (40%) exceeded fossil fuel electricity production (34%) (Climate Home News, 2020).

The first estimates published in October 2020 announced the impact of this unprecedented crisis, with a 4.5% fall in global GDP in 2020, resulting in a 5.9% reduction in energy consumption and an 8.6% reduction in CO_2 emissions linked to energy use. **Electricity consumption is expected to decline by only 2% in 2020, however, with the fall in industrial consumption being offset by that of households.** China is expected to be the only country not to see a fall in consumption in 2020 (Enerdata, 2020).

The global electricity mix has become less carbon-intensive as priority has temporarily been given to renewables, which have also benefited from favourable weather conditions in Europe. At the same time, we are seeing a drop in fossil fuel electricity generation (gas and coal) and the continuing phase-out of coal in Germany, the United Kingdom and the United States. In China, on the other hand, although coal-fired electricity generation fell by 80 TWh in the first half of the year, it bounced back immediately in the second quarter with a rise of 80 TWh (Enerdata). **Demand for coal and gas is expected to fall by 7.6% and 3.3% respectively in 2020. Renewables are the only source for which demand is increasing by 0.9% (Fig. 8).**

2020-2019 CHANGE IN GLOBAL INVESTMENTS BY TYPE OF TECHNOLOGY - *Source: IEA, 2020*
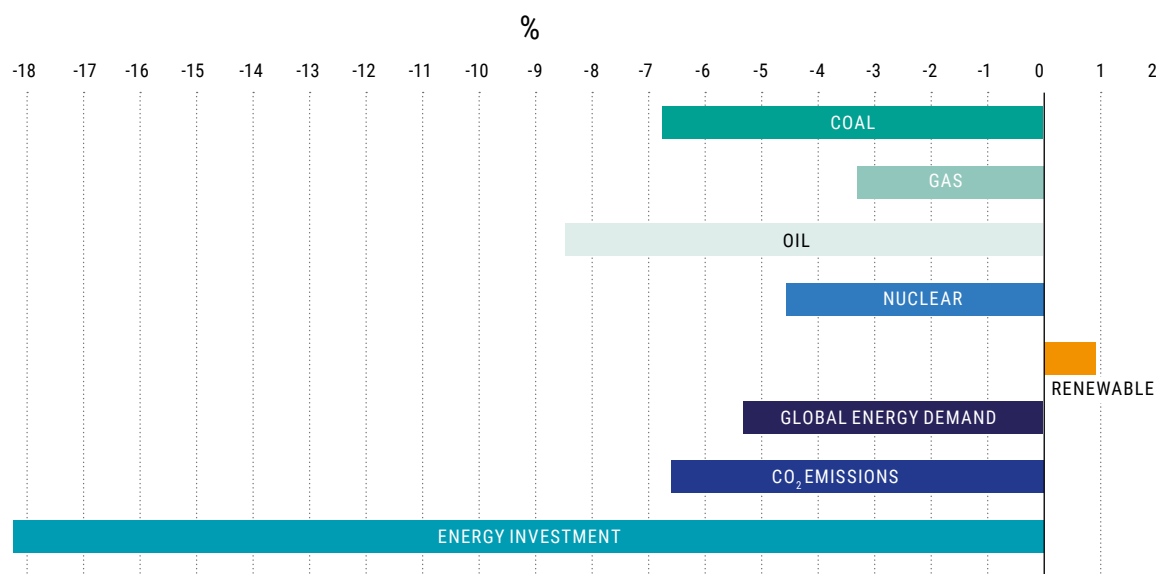
ACCESS TO ELECTRICITY WEAKENED BY THE PANDEMIC (SDG 7)

The share of the world's population with access to electricity has gone from 83% in 2010 to 90% in 2018. Taking into account population growth, over this same period more than a billion people gained access to electricity. In 2018, 789 million people still had no access to electricity, including 550 in Sub-Saharan Africa, and 1 in 4 hospitals had no electricity (IRENA, 2020). This progress is now threatened by the Covid-19 pandemic. The IEA estimates that the number of people without access to electricity in Sub-Saharan Africa will grow by 12 million in 2020. Rising poverty in 2020 is also expected to make electricity unaffordable for more than 100 million people, increasing energy poverty (IEA, 2020).

BOX 2

3. Post-Covid recovery: contradictory signals from one country to the next

To counter the economic and social shocks caused by the Covid-19 crisis, governments have committed to injecting billions of dollars into the economy. Although the primary objective of these investments is economic recovery, they also influence the energy transition, and the results of these recovery plans in conjunction with the announcements of certain countries send out conflicting signals.

China's rising renewable development ambitions are a positive signal (Bloomberg, 22/09/20), but its commitment to coal remains worrying and at odds with the global decline in production. It plans to increase the capacity of its coal plants by 21% in 2020 (205.9 GW, of which 97.8 GW is already under construction). The total capacity currently under development is greater than the total capacity of the United States. The policy of stimulating economic growth with mega-projects leads to the expansion of coal power. This expansion does not meet any energy imperative as China already has excess electricity production capacity: in 2019, power plants were operating at 49% of their capacity (CREA, 2020).

In India, 62 GW of coal-fired electricity production capacity was under construction in March 2020. However, according to the IEEFA, most of these projects are not viable, which would explain the cancellation of the equivalent of 46 GW of capacity in 2019 (IEEFA, 2020). However, the country is auctioning 41 coal deposits in order to stimulate the economy and reduce the country's dependence on coal imports (Le Monde, 18/07/20).

The Energy Policy Tracker (an initiative of six research organisations) analyses the distribution of public funds committed to the energy sector by the G20 countries as part of their recovery plans. As of 14 October 2020, the G20 had pledged $223 billion for fossil fuels: 52% of all of the public funds committed to the energy sectors (production and its uses) (**fig. 9**).

FIGURE 9

RECOVERY PACKAGE AMOUNTS IN THE ENERGY SECTOR BY COUNTRY IN BILLIONS OF DOLLARS[1]

Source: Compiled by the author using data from Energy Policy Tracker, 2020.
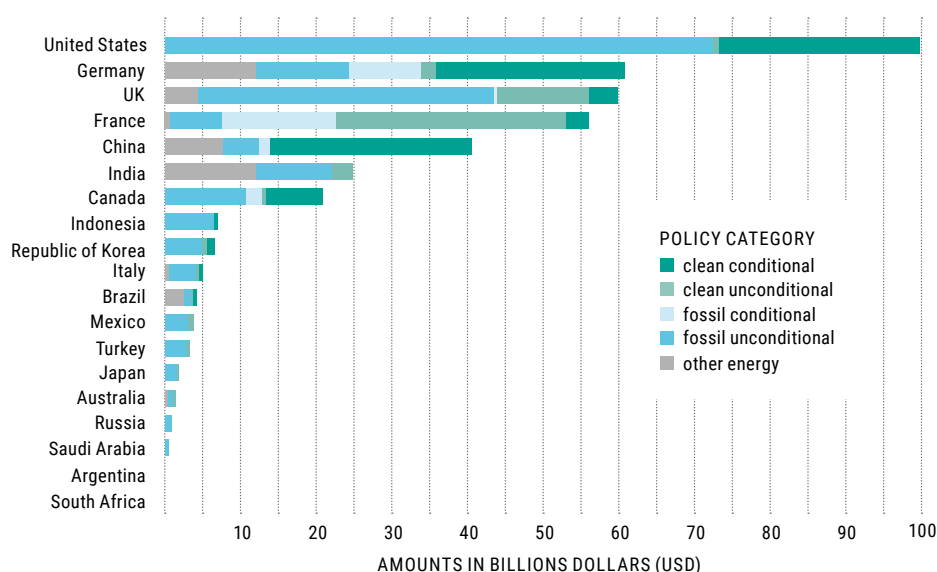
Regarding electricity production, 13 billion dollars were allocated to fossil fuels as opposed to 14 billion to renewables (**fig. 10**). This amount shows above all the importance of the public funding still allocated to fossil fuel electricity production. The share of renewables is partly explained by the maturity of certain technologies that no longer need direct financial support, but also by the fact that many policies to support renewables are more regulatory than financial.

Despite the many uncertainties regarding the duration of the pandemic and the response to it, in all of the IEA post-crisis scenarios solar energy becomes the primary source of energy over the period 2019-2040 while coal-fired electricity production continues to decline.

---

1 - Clean *unconditional* measures are strategies for energy efficiency and the production/consumption of renewable energy; *clean conditional*: strategies that support energy transition but without specifying environmental guarantees. *fossil fuel unconditional*: support the production or consumption of fossil fuels without climate compensation. *fossil fuel conditional*: support the production or consumption of fossil fuels but include climate targets or emission reduction requirements. *Other energy*: nuclear, hydrogen from unspecified sources, first generation biofuels.

FIGURE 10

AMOUNTS DEDICATED TO ELECTRICITY PRODUCTION IN RECOVERY PLANS, BY COUNTRY, IN BILLIONS OF DOLLARS - *Source: compiled by the author using data from Energy Policy Tracker, 2020.*

EXPERIENCE FEEDBACK

UNPRECEDENTED DYNAMICS FOR HYDROGEN

In 2018, global CO_2 emissions linked to hydrogen production were around 830 million tonnes, equivalent to the combined CO_2 emissions of the UK and Indonesia. Today, hydrogen is mainly used in industry for oil refining and the production of ammonia and steel (see industry section of this 2020 Report) and 95% of this hydrogen is produced from fossil fuels. There is therefore a strong potential for mitigation of emissions by producing "gr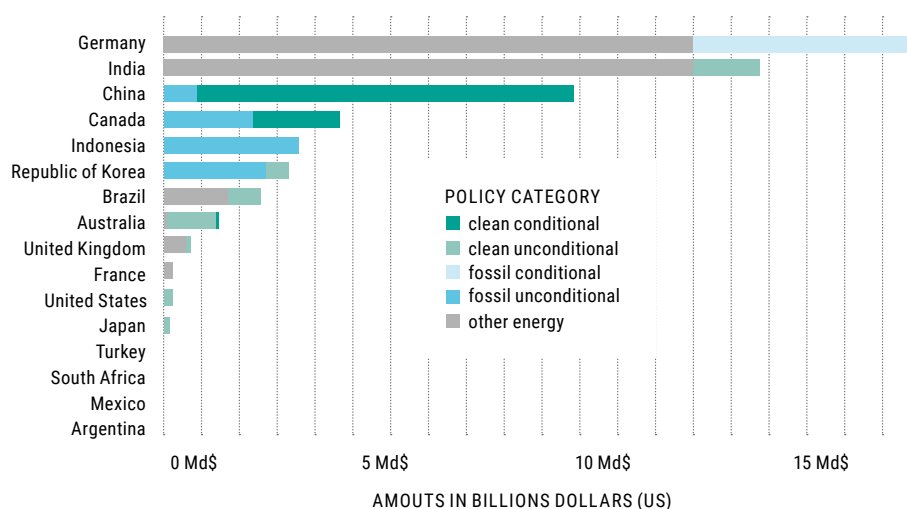een" hydrogen. Following the fall in the costs of solar PV and wind power, interest in electrolytic hydrogen is growing. The number of countries whose policies directly support investment in hydrogen technologies is growing, as well as the number of sectors they are targeting. In 2018, there were around fifty objectives, mandates and political incentives directly supporting hydrogen, the majority of which concerned the mobility sector (IEA, 2020).

Green hydrogen production capacities are experiencing exponential growth in 2020: in March 2020, the total capacity of new projects under development was 8.2 GW, i.e. 31 times the current installed capacity (Greentech Media, 09/04/20).

In July 2020, the European Commission announced a strategy to develop hydrogen production using wind and solar energy. The objective is to decarbonise the sectors which are the most difficult to electrify, including industry (European Commission, 2020). Some EU member states have also included hydrogen in their own recovery plans. This is notably the case of Germany and France, which respectively unlocked 9 and 7 billion euros to develop and structure a hydrogen sector. According to Energy Policy Tracker, G20 recovery plans dedicated to green hydrogen amount to 18 billion dollars as at 28 October 2020 (Energy Policy Tracker, 2020).

BOX 3

2. Private sector restructuring encouraging but without a long-term strategy

All over the world, solar and wind energy is becoming increasingly competitive and is today less expensive than electricity produced from fossil sources for two thirds of the world's population. In 2019, the prices of photovoltaic modules fell by 12%, reaching an average price of $0.36 per watt

(REN21, 2020). In the European Union, India, the United States and some parts of China, renewables produce energy that is cheaper than that of existing coal-fired power stations (REN21, 2020). In the rest of the world, where coal remains less expensive, energy parity should be reached within the next five years (Bloomberg)

The cost of lithium-ion batteries also fell by 85% between 2010 and 2018 and BloombergNEF predicts that it will halve again between now and 2030. According to the Energy Storage Outlook 2019 report, the energy storage market is expected to increase 122-fold between 2018 and 2040, from a capacity of only 9 Gw in 2018 to 1,095 Gw in 2040 (Bnef). These rapid changes are transforming the energy market and forcing companies to rethink themselves.

• RESTRUCTURING OF OIL COMPANIES IS ACCELERATING: DEVALUATIONS AND ASSET REDEMPTIONS •

1. Oil companies are now seeking positions that are pro renewables

As the world transforms into a low-carbon economy, investments in fossil fuels run into billions of dollars and are at risk of losing all their value to then become "stranded assets". The value of these assets running the risk of becoming stranded was evaluated in 2018 as being between USD 1,000 and 4,000 billion (Nature Climate Change, 2018). In a 2°C scenario, energy producers (mining companies included), would have to declare more than half of their fossil fuel reserves as stranded and therefore not burn them, while asset prices today remain correlated with their proven reserves (Financial Times, 2020). In this context of rising transition risks,, asset losses and impairments are accumulating for historical players (Finance Report 2020, Climate Chance).

The big fossil fuel production groups are the most affected. These companies are revising their long-term outlook on oil prices and demand and adjusting their values downwards. In Q4 2019, Chevron suffered losses of more than $10 billion and the group is ramping up its efforts to phase out unprofitable assets (Reuters, 2020); Shell was also hit in 2019 by asset impairment, in North American shale gas in particular; for US petroleum equipment maker Schlumberger, asset impairments reached $12.7 billion (Bloomberg, 2019).

The oil price war that began in March 2020 between Saudi Arabia and Russia is only accelerating the unprecedented drop in the price of oil, which has collapsed as a result of falling demand in China and then in the rest of the world. This decline weakens the profitability of extraction projects and accelerates the depreciation of the majors, which has reached record levels. In nine months, European Shell, BP, Total, Eni, Equinor and Repsol, as well as American Chevron, have collectively seen USD 87 billion of asset impairment (Climate Chance - Finance Report 2020). Among other things, this crisis precipitated the fall of Chesapeake, a shale gas pioneer in the United States which was forced to go into safeguard proceedings (Courrier International, 2020).

These losses in value also result in employment destruction, and several major players have already announced social plans: Schlumberger which intends to cut 21,000 jobs, Shell 9,000 and indeed Exxon 1,600 in Europe. The industry could lose up to 100,000 jobs according to the Oil & Gas Journal (OGJ, 2020).

On the other hand, electricity producers at the forefront of renewables see their market capitalisation grow rapidly. The stock market value of NextEra, based in Florida and the largest wind and solar power generator in North America, will exceed that of Exxon in the fall of 2020. In addition to the decline in oil consumption, it is also the growing share of renewables in the global mix and

investors' economic preference for stable returns that explain the parallel evolution of these two companies ([Finance Times](#), 2020). Indeed, most NextEra's revenues come from regulated electricity prices in Florida.

Faced with long-term uncertainties and price instability weighing heavily on the oil and gas sector, oil companies are slowly realigning their activities towards renewables and the electricity market. This trend, already observable in 2019 with more than 70 transactions in the renewables sector by oil companies ([Bloomberg](#), 2019), mainly concerns European companies, which are under more pressure from States and investors than in the United States, reflecting the strength of the political signals towards an energy transition ([The New York Times,](#) 17/08/2020). A study by the University of Petroleum in Saudi Arabia shows how oil companies are taking an increasing role in renewables and are being led to gradually position themselves as pro energy transition ([Pickl, J. Matthias](#), 2019). However, these investments still represent only 1% of their capital expenditure ([IEA](#), 2020). These movements are accelerating with the 2020 fall in oil demand, as shown by the data communicated to business intelligence company Rystad Energy on investments in solar or wind power made or planned by the oil and gas sector (**fig. 11**)

SHORT-TERM INVESTMENTS IN RENEWABLE ENERGY PROJECTS AMONG OIL COMPANIES IN MILLIONS OF US DOLLARS - *Source: [Rystad Energy](#), 2020*
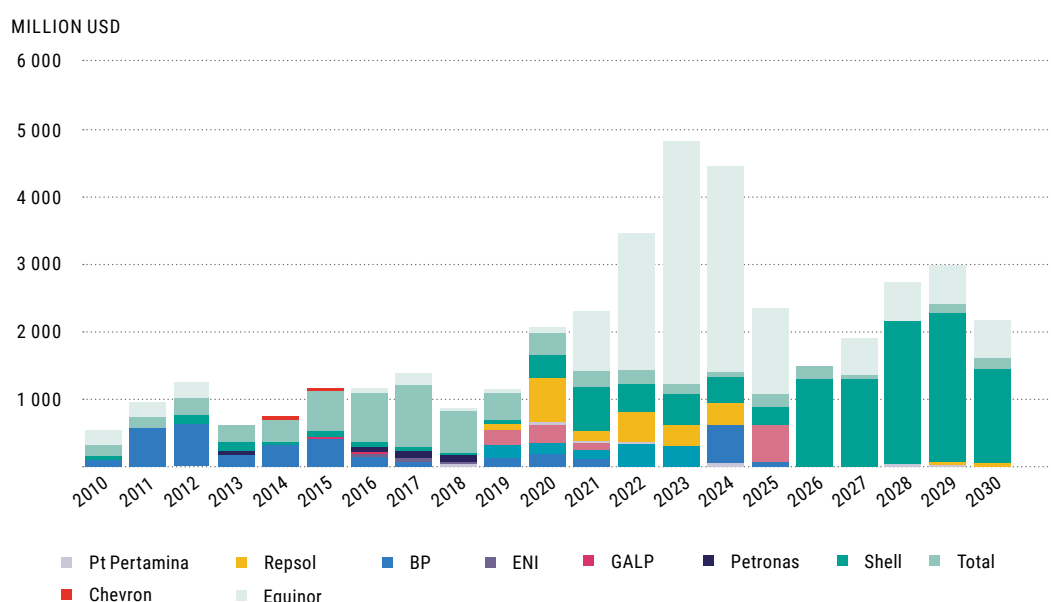
Some of these companies, especially the European ones, seem to be in competition, mainly through the purchasing of companies and assets in the renewables sector. BP invests in wind power in the United States in particular and recently published a 2030 plan including a 40% reduction in its oil and gas production and the production of 50 GW of renewable energy ([BP](#), 04/08/20). Equinor is banking on offshore wind and announced the "Dogger Bank project" in the United Kingdom in 2023, the world's biggest wind farm, in a joint venture with Scottish energy distributor SSE ([The Guardian](#), 10/09/20).

Shell wants to make a long-term investment of USD 1 to 2 billion per year in green energy, and thus acquired Eolfi in December 2019, a pioneer of floating wind power in charge of the pilot farm project in Brittany, France ([Shell](#), 05/11/20). Total, after having launched the construction in Dunkirk in 2019 of the biggest French battery electricity storage site ([Le Figaro](#), 10/03/20), in 2020 became a 20% shareholder in the floating Mediterranean wind power project EolMed by Quair, the

independent producer of exclusively renewable energy (Connaissance des énergies, 2020). **At the same time, Shell and Total continue to make 90% of their investments in fossil fuels** (IEEFA, 2020).

INDICATOR

1%

of investments by oil and gas sector companies are in low-carbon technologies, including renewables.

Exxon, on the other hand, constantly predicts that global energy demand will rise, driven by population growth and an expanding middle class. Exxon, therefore, considers that massive investments in oil and gas are necessary, even in the most restrictive low-carbon scenarios, and regularly increases its production targets in the Permian basin of Texas and New Mexico (Exxon).

2. Coal: a new adjustment variable for electricity mixes?

For big electricity groups, the poor competitiveness of coal and the Covid-19 crisis are accelerating the energy transition. **Thus, the number of coal-fired power stations worldwide decreased for the first time in history during the first six months of 2020, with more closures than commissionings, particularly in the United States and Europe (fig. 12)** (The Guardian, 03/08/20). Carbon Tracker estimates that 46% of the world's coal-fired power stations will experience negative cash flows in 2020 (Carbon Tracker, 2020).

FIGURE 12

ANNUAL VARIATION OF NEW COAL-FIRED ELECTRICITY PRODUCTION CAPACITIES
Source: Carbon Brief, 2020
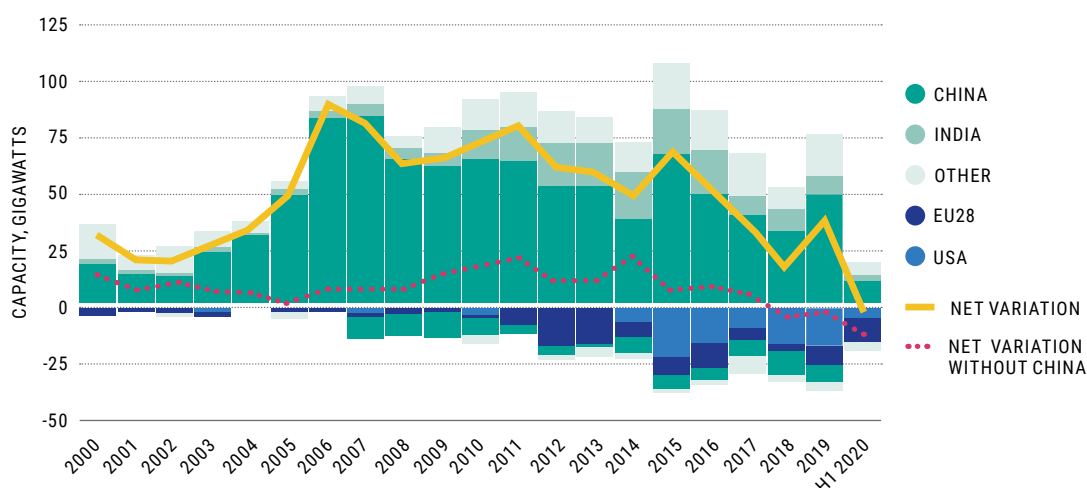
In the United States, electricity producers announced the closure of 13 coal-fired power stations in 2020 and the conversion of two power stations to gas. The Arizona Public Service company has announced its intention to put forward the closure of the Four Corners power station from 2038 to 2031 (Scientific American, 2020). Some American utilities are also shutting down gas power stations: in California, General Electric is decommissioning a gas-fired power station 20 years ahead of schedule (Reuters, 2020).

In Portugal, the production of electricity from coal fell by 95% in the first half of 2020 and the Energias De Portugal (EDP) group is moving shutdown of the coal-fired power station in Sines forward to 2022, two years ahead of schedule. Portugal will therefore finish with coal nine years ahead of schedule even though it still represented 24% of the country's electricity mix in 2017. The development of renewable energy in Portugal has been led in large part by EDP Renováveis (EDPR); created in 2007, it has reached fourth place in the world in terms of wind energy production in 10 years. Alongside this giant, a dynamic ecosystem of small businesses is multiplying wind and solar projects in the country (Portugal-Energy case study, Climate Chance, 2018).

KEYS TO UNDERSTANDING

FOSSIL FUEL DISINVESTMENT

A movement detailed in Climate Chance Observatory's 2020 Finance Report, companies continue to withdraw from fossil fuel investments. In October 2019, the Fossil Free coalition brought together more than 1,240 institutions managing $14.5 billion in financial assets that are disinvesting from coal, gas and oil (Go Fossil Free). The majority of the organisations that most frequently disinvest from coal are faith-based institutions, philanthropic foundations, educational organisations and pension funds.

"These practices can also be part of strategies for ramping up shareholder commitment policies as an ultimate means of putting pressure on companies. In fact, they are also the result of growing NGO campaigns targeting financial players and wishing to see access to capital in the fossil fuel sector become increasingly difficult and costly" (Finance Report 2020, Climate Chance).

Coal is the first target. The "Over 100 and Counting" initiative brings together more than 100 banking institutions, insurance and reinsurance companies that are putting an end to financing or insuring coal-fired power stations. The first half of 2020 was marked by the withdrawal of coal from Asian financial institutions. This is the case with the Japanese bank Mizuho, the largest financial player in the development of coal projects, which is stopping the financing of new power stations (IEEFA, 2020).

BOX 4

EDP is also planning the decommissioning of a coal-fired power station in Spain (EDP, 2020), where by May 2020 coal already represented only 1.4% of the country's electricity production even though the fuel still accounted for 15% of the electricity mix in 2018. Following this corporate-initiated collapse, seven of the 15 coal-fired power stations had shut by the end of June 2020 (Electrek, 2020). Spain-Energy case study by Climate Chance, due at the end of 2020.

• THE "ACT" TOOL SHOWS THE DIFFICULTIES FACED BY ELECTRICITY PRODUCERS IN TRANS-LATING THEIR CLIMATE STRATEGIES INTO TANGIBLE RESULTS • The international ACT initiative for Assessing Low-Carbon Transition is on the UNFCCC's Action Agenda and is supported by the French National Agency for Ecological Transition (Agence de l'Environnement et de la Maîtrise de l'Énergie - ADEME) and by the international organisation CDP. ACT gives guidance to companies to evaluate the alignment of their strategies with sectoral decarbonisation trajectories and to help them structure an appropriate climate strategy for their sector. For each company, the methodology proposes an evaluation comprising a performance score (from 0 to 20), an evaluation score (from A to E) and a trend score (positive, neutral or negative) (ACT).

A pilot project in 2016 made it possible to assess the strategies of a few volunteer electricity production companies. It concluded that the performance of electricity producers was good in

terms of strategy (objectives, desired business model, etc.), but less good in terms of indicators relating to investment choices, revealing difficulties in translating their strategy into tangible results (ACT, 2016). Since 2019, the *World Benchmarking Alliance* has been using the ACT methodology to conduct energy and climate benchmarking of electricity production and supply companies. The performance assessment is made up of six modules, each containing performance indicators.

4 electric utilities have climate objectives aligned with the Paris agreement

In terms of commitments, only four of the 50 companies assessed have climate objectives that are aligned with the Paris agreement: Enel, EDP, Ørsted and AES. Enel, EDP and Ørsted have shown that their trajectory is within a trajectory that is much lower than the 2°C global temperature increase thanks to the Science Based Target tool. AES, however, is not on track to achieve its 2030 objectives, with 68% of its installed electricity production capacity from fossil origin in 2018, this figure was 60% across all 50 companies. Only Orsted has made a clear commitment to completely disinvest from coal by 2023; nine other companies have formulated an exit date between 2040 and 2050. According to Climate Analytics, all OECD companies will have to get out of coal before 2031 anyway and before 2037 for the rest of the world (Climate Analytics, 2019).

However, overall, companies are not managing to follow their commitment to ambitious long-term financial strategies (the best rated provide mostly short-term information) and transparency regarding projected production and tested climate scenarios. About half use climate scenarios, but most fail to report quantitatively on the results of the analysis. Only AES reports the results its scenarios analysis on the financial impacts of a low-carbon transition in quantified financial terms (**fig. 13**).

Finally, more specifically on financial choices: 35 of them have made investment choices that will bring them to exceed their carbon budget between now and 2033; in most of them, executive salaries are still linked to the growth of fossil fuel equipment. Investments in low-carbon techno-logy R&D are less than 2% of capital expenditure in the case of 16 of the 24 companies declaring investment in such technologies. Fortum and Engie invest particularly heavily.

The "good pupils" will not be enough to save the class, because the 10 worst performing companies, most of which are located in Asia, account for 97% of the total production capacity of the 50 companies analysed.

FIGURE 13

NUMBER OF BUSINESSES THAT HAVE A TRANSITION PLAN AND HOW - *Source: World Benmarking Alliance*

42 companies have a
transition plan

21 include no
financial content

18 have high-level buy-in

1 company reports
scenario analysis
results in financial
terms
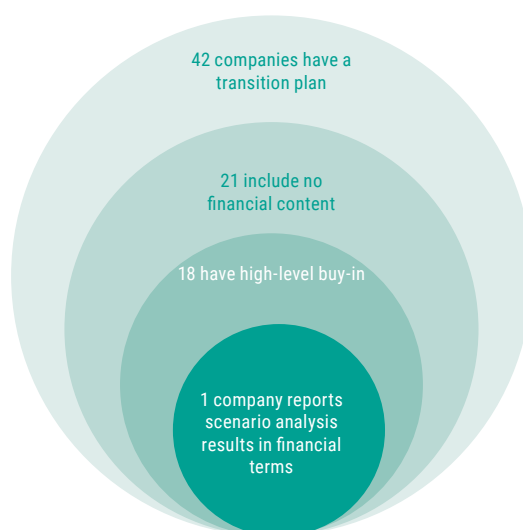
• DIRECT SALE OF ENERGY: BECOMING A FAVOURED TOOL FOR BUSINESS TRANSITION •

All sectors combined, companies incorporate renewable energy at the heart of their sustainable development strategies. The RE100 initiative thus brings together companies committed to 100% consumption of renewable energy: 263 multinationals are promising to supply themselves entirely with renewable energy in the shortest possible time periods (RE100, 2020). In 2019, a third of participating companies were being supplied with more than 75% renewables and 30 of them had already reached their goal of 100%. What is more, 44% of them are directly influencing their supplier to increase renewable generation capacities (The Climate Group).

INDICATOR

30
MEMBER
COMPANIES

30 members companies of the RE100 initiative have already achieved their goal of 100% renewable energy supply

Direct sales of electricity under "*Power Purchase Agreements*" (PPA) are becoming favoured tools for this transition These privately negotiated long-term contracts between renewable electricity producers and consumers, without going through an electricity supplier, make it possible to secure prices over time, reducing the risks associated with market prices. Used primarily by big electricity consumers, they also make it possible to finance the construction of renewable energy production facilities. PPAs could be particularly useful in countries where the development of renewable energy is not yet part of government policy and where subsidies are non-existent.

Today, they concern all sectors of activity: in 2019, 19.5 GW of PPAs were signed in 23 countries by more than 100 companies; 13.6 GW more than in 2018 and three times the level of 2017 (fig. 14). This total capacity is equivalent to 10% of renewable installed capacity in 2019 (BloombergNEF, 28/02/20). In Europe, it was mainly the work of the Nordic countries but the first contracts saw the light of day in Italy, Spain, France and Poland.

Many small projects are developing, but US digital technology companies are the first applicants (**fig. 14**). GAFAM[2], big consumers of energy to power and especially cool their data centres are the main buyers of these contracts: Facebook (1.1 GW), Amazon (0.9 GW) and Microsoft (0.8 GW). In September 2019, Google signed 18 PPAs for a total capacity of 1.6 GW and a sum total of $2 billion. For example, the company has signed agreements in Finland for the construction of a wind farm and in Chile where it will obtain electricity from a hybrid wind and solar power station (pv magazine, 23/09/19).

FIGURE 14

GLOBAL VOLUME OF DIRECT ELECTRICITY SALES BY BUSINESS SECTOR (IN GW)

Source: *IEA* based on data from *BloombergNEF*
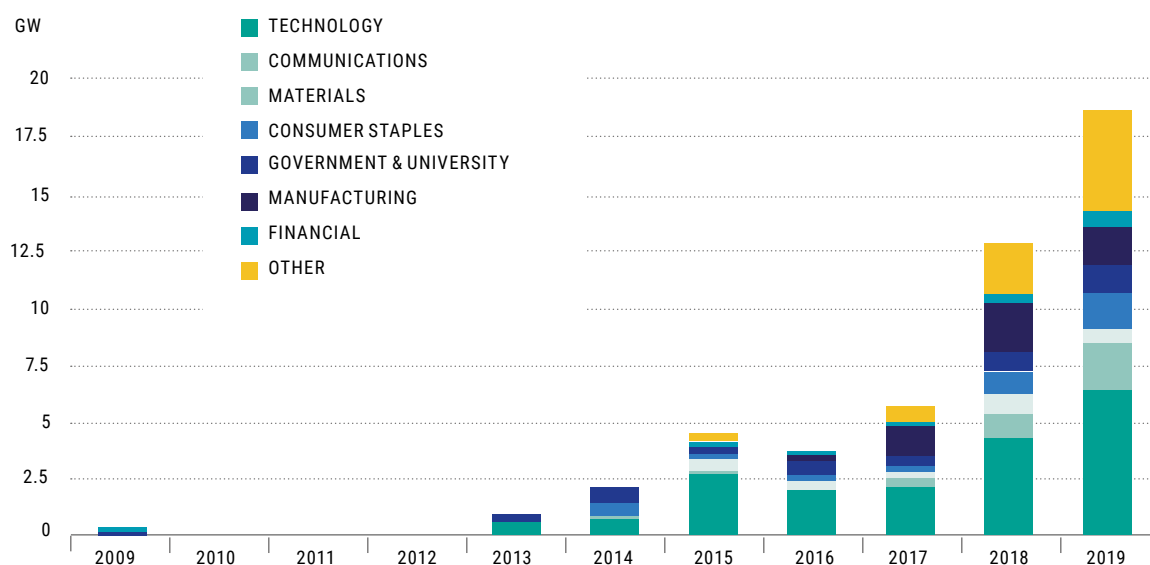
The Covid-19 pandemic and associated lockdown measures reduced demand for electricity by up to 20% in some countries and electricity prices fell. These impacts threatened to slow down the development rate of PPAs and therefore the development of renewable energy. The effects were ultimately more temporary than predicted and 8.9 GW of PPAs were signed in the first half of 2020, more than over the same period in the previous year (WBCSD, 2020). However, many companies are in financial difficulties and some have suffered a downgrading of their credit rating (Rolls Royce, Renault, etc.). This situation could have an impact on PPAs as project developers will face a reduction in the number of potential buyers. In response, in June 2020, more than 40 multinationals buying and supplying electricity (such as Enel and RWE) signed a letter to the EU requesting policies to support the deployment of PPAs and in particular the granting of public credit guarantees or risk sharing for the development of renewable energy projects (RE-Source, 2020).

3. Cities and regions: a growing driver of investment in renewables

• BETWEEN REMOTE PURCHASING AND LOCAL INVESTMENT TO ACHIEVE THEIR OBJECTIVES •

In the electricity production sector, more and more cities and regions are powered entirely by renewable electricity produced by various means. By 2019, 318 cities had committed to the goal of a 100% renewable electricity supply (**fig. 8**) at regional or municipal level, i.e. 38 more cities than in 2018 (IRENA). By the end of 2019, 58 cities or regions, including 44 in Europe, had achieved this goal of 100% renewables, for example Aspen (United States), whose electricity mix is almost entirely

2 - GAFAM is the acronym for the Web giants Google, Apple, Facebook, Amazon and Microsoft, which are the five big American firms that dominate the global digital market.

based on hydroelectricity and wind power ([City of Aspen](#)). Beyond a simple declaration of intent, these objectives signal the ambitions of cities and contribute to the mobilisation of local players and investment. To achieve their goals, local governments have an ever-widening range of supporting strategies and policies.

58
CITIES & REGIONS

58 cities & regions were powered by 100% renewable electricity in 2019

FIGURE 15

BREAKDOWN BY COUNTRY OF CITIES HAVING COMMITTED TO THE GOAL OF 100% RENEWABLES - *Source: [Irena](#)*

UNITED STATES	108
GERMANY	93
SWEDEN	18
FRANCE	16
AUSTRIA	13
CANADA	10
AUSTRALIA	9
REST OF THE WORLD	51
Total	**318**
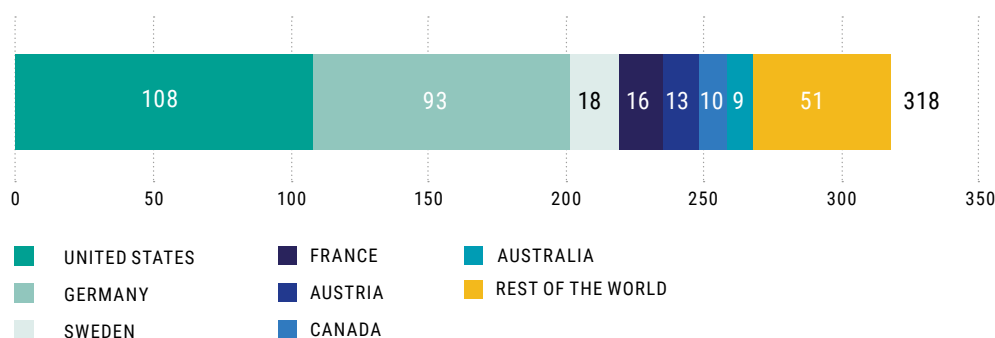
1. Power Purchase Agreements (PPAs): the flagship tool of big cities

A trend already noted in the private sector, *Power Purchase Agreements* (PPA) for the direct sale of energy are also concluded between municipalities and producer companies. The former are in fact major consumers of electricity whether for public buildings, schools or urban lighting. In September 2020, the city of Chicago launched a public tender of USD 200 million for a renewable electricity contract to supply all of the buildings owned by the city, as well as the public lighting, for five years. The city hopes to motivate the creation of new production units in the region and thereby job creation ([Chicago](#), 2020). Chicago, in parallel with its public contract and to achieve the goal of 100% renewable electricity for its buildings by 2025 and for the whole city by 2035, made a massive purchase of certificates in 2020 from *Midwest Wind farm*, a company located in the city ([Chicago](#), 2020).

The Australian capital Canberra (ACT), contrary to the choices made at the national level, has become the first local government of more than 100,000 inhabitants outside Europe to be powered 100% by renewable electricity, according to a report by the Australia Institute ([The Australia Institute](#), 2020). Only 5% of its electricity is produced locally, but the city directly finances wind and solar farms in different regions of Australia to supply the national electricity grid to the tune of 77% of the consumption of the inhabitants of Canberra ([abc.net.au](#), 2019). The rest of its consumption is to some extent compensated by the system of green energy certificates, but in 2020 the city is continuing its investments with an auction-type call to tender won by two wind power producers

(Neoen and Global Power Generation) for a total of 200 MW as well as a 60 MW electricity storage system (ACT, 2020).

Melbourne, for its part, has facilitated the signing of a second collective PPA with seven local players including universities and businesses. The *Melbourne Renewable Energy Project* (MREP 2) will supply 110 GWh of renewable electricity per year to the purchasing group over 10 years, i.e. 22 GWh more than the first PPA in 2017. This electricity will supply 14 shopping centres, nine office buildings, seven university campuses and four factories (City of Melbourne).

Cities can facilitate group purchasing for other players in their region by forming new entities known as *Community Choice Aggregations (CCA)*. A city or group of cities purchases wholesale electricity to meet the combined loads of residents and businesses in their region (IRENA, 2019). The latter then have the choice of remaining in the programme or reverting to their former supplier. This makes it possible to negotiate competitive prices with suppliers and to choose your electricity mix. This is mainly the case in the United States, where eight states have CCA legislation allowing local government to consolidate the electricity loads of residents, businesses and municipal facilities, but there are also programmes in several municipalities in the prefectures of Yamagata and Gunma in Japan (IRENA, 2019).

2. The strengths and weaknesses of green certificates as regulatory tools

Local governments also use "green" energy certificates to meet their renewable electricity targets[3]. This system is developing rapidly, particularly in Europe where more than 700 TWh were certified in 2019, compared to 650 in 2018. In the United States, 425 TWh were certified in 2018, i.e. +10% compared to 2017 (RECS, 2019). While no data seems available to indicate the share of cities in the purchase of these certificates, several examples show their rise. The certificates, which are issued by the competent authorities and traded between producers and consumers, are used by players in certain regions or federated states to fulfil the regulatory obligations imposed on them.

This is notably the case in the United States. Already mentioned in the 2019 Sector Report, the adoption of renewable energy quotas or *Renewable Portfolio Standards* by American cities and states continues in 2019 and 2020. According to the Berkeley Lab, about half of the growth in renewable energy production in the United States since the start of the 2000s can be attributed to these quotas, but their role has since diminished and they are believed to be responsible for only 30% of the new 2018 capacities (Berkeley Lab, 2020). Since 2018, its annual report also notes that 10 States have enacted higher quotas for renewables, in most cases equivalent to at least 50% of electricity sales.

In Europe, the different national systems and types of contracts have to meet the standards of the European Energy Certificate System (the EECS® Rules) to be able to be traded freely. They are therefore not regulatory except in a few countries such as Norway and Sweden, which jointly impose quotas on producers in their countries in a common market (Energy Facts Norway, 2019). In Belgium, the regions themselves define the quotas required of producers and the procedures (types of technology). There are several systems then, side-by-side: in the Brussels-Capital Region, quotas are calculated based on CO_2 emissions avoided, while the equation is more complex in the regions of Flanders and Wallonia (Res legal, 2020). If overall this system seems to have proved its worth, the measures taken to promote the deployment of low-power solar generated a surplus GC offer well above the quotas and therefore a significant drop in their price. This price was established at

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3 - A "green" or renewable energy certificate is a certificate that can be traded between producers and consumers or suppliers, proving that a certain amount of electricity is produced from renewable energy sources. Typically, a certificate represents the production of one megawatt hour of electricity.

the floor price, corresponding to the repurchase obligation of the transmission system operator. In the case of Wallonia, a 2019 study concluded that this imbalance between GC supply and demand transforms this market incentive mechanism into a support policy that is too generous for electricity suppliers and too costly for the local authority (Boccard, N. , Gautier, A., 2019). The Brussels regions are now planning to reduce the number of green certificates granted for new installations.

INDICATOR

50%

50% of the growth in renewable energy production in the United States since 2000 can be attributed to the quotas imposed by the states

EXPERIENCE FEEDBACK

TERRISTORY, IMPROVED AND SHARED GOVERNANCE OF ENERGY-CLIMATE DATA AT REGIONAL LEVEL

Last year we showed the role of cities in distributing information to residents, such as solar energy potential maps (Sector Report 2019, Climate Chance).

Year on year, the regions also improve the management of climate-energy data, making it possible to inform local decision-makers, and above all monitoring of the implementation of local authority objectives. Created in 2018 at the initiative of regional agency Auvergne-Rhône-Alpes Énergie Environnement, TerriSTORY was joined in January 2020 by the Occitanie and Nouvelle Aquitaine regions as well as by the energy network operators. A tool for piloting the regional energy transition, the TerriSTORY platform provides data at municipality level such as energy consumption, renewable energy production, GHG emissions and even energy poverty indicators. This energy-climate data is jointly built and managed by the regions and the platform is accessible to all free of charge (TerriStory).

BOX 5

3. Direct investment, but half-hearted remunicipalisation of energy production

Addressing the gaps in climate change and sustainability will require exploring possible alternative pathways suiting a country's specific needs and capacities. Energy supply decentralisation also offers a concrete opportunity to empower regions, cities, communities and other local entities.

The State of California has one of the most ambitious building codes with the obligation to install PV systems in new homes from January 2020. The state is the national leader in decentralised solar energy production with more than 1 million PV installations for a total capacity of 9,300 MW (California DG Statistics, 2020). In New Delhi the local building code was amended in 2020 with a relaxation of height standards in order to facilitate the installation of PV systems (Times of India, 14/07/20). South Delhi Municipal Corporation, one of the five municipalities in the territory of Delhi installed photovoltaic systems on 55 municipal buildings in 2018 and committed in 2019 to extending this measure to all of its buildings including municipal schools (REN21, 2019).

In 2019, the city of Edmonton (Canada) launched a financial aid programme aimed at developing renewable energy: the city offers an incentive rate of USD 0.40 per watt to homeowners wishing to

install solar panels, which would cover about 15% of the cost. Between 2018 and 2019, the number of photovoltaic systems increased from 677 to 1,188, a growth of 75% (Edmonton, undated).

EXPERIENCE FEEDBACK

HALF-HEARTED MUNICIPALISATION OF POWER PRODUCTION

After several examples of remunicipalisation of electricity production and supply by cities, in particular from a desire to promote renewable energy, this trend seems to be running out of steam or even being reversed.

This movement was particularly strong in Europe (Climate Chance, 2019): in Germany where the majority of remunicipalisations are concentrated, 90% of the 311 cases identified in 2017 according to the Transnational Institute (TNI, 2017), especially in Hamburg where a referendum with binding results ended in the remunicipalisation of electricity in 2014, gas in 2018 and long-distance heating in 2019 (EPSU, 2019); in the United Kingdom, in Nottingham, which created Robin Hood Energy in 2015, the first municipal energy company created by a local council in the United Kingdom in over 75 years (REN21, 2019); and in Spain, where the municipal company Barcelona Energía supplies electricity to city council buildings and facilities. Since 2019, it has also offered the service to the facilities of Barcelona's metropolitan area (AMB) and to the citizens and companies of Barcelona and the AMB, serving a maximum of 20,000 households (Barcelona Energía). Cadiz, Pamplona and Palma have launched similar initiatives. The European Union recognises the notion of "energy communities" in European legislation in the 2018 Energy-Climate Package. These communities can be understood as a way of organising collective energy actions around open and democratic participation and governance and providing benefits to their members or to the local community (Roberts et al., 2019). Of the 24 examples documented by a recent 2020 report, it appears that local and national public authorities seek above all to develop citizen-based energy projects or cooperatives. Poland even offers energy clusters: a civil law agreement (of cooperation and commercial partnership) between its participants, which may include individual natural persons, local authorities, entrepreneurs, research institutes, universities, etc (CRC, 2020).

Some cities are also going backwards. In the Netherlands, 44 municipalities including Rotterdam, The Hague, Dordrecht etc., which owned the Eneco company, which is very involved in the development of renewables, sold all the shares in March 2020 to the Japanese consortium made up of Mitsubishi (80%) and Chubu (20%). The transaction, which was valued at EUR 4.1 billion and was to the detriment of Royal Dutch Shell, which had long been positioning itself to acquire the public company as part of its renewable investment strategy, is one way for the Japanese group to develop its activities in Europe (Eneco, 2020). The sale is the direct result of the dismantling of Eneco and Stedin, the network operator, in February 2017. Following the liberalisation of the energy market in 2004, the government required energy companies to get rid of their electricity and gas networks. Eneco's 44 municipal shareholders found themselves with a trading company for energy products and services, which they do not regard as a government task (Newmobility, 2019).

Finally, municipal companies are sometimes not very involved in the energy transition, as is the case in Massachussets (United States), where the NGO Massachusetts Climate Action Network (MCAN) laments that municipal energy companies are not subject to the same requirements as private companies, particularly in terms of the share of renewables that they must inject into their public lighting system to achieve the State's objectives, as most of them do not inject any (MCAN, 2019).

BOX 6

• CITIES AND REGIONS AGAINST THE FOSSIL FUEL INDUSTRY: DISINVESTMENT AND JUDI-CIALISATION • In 2018, the mayors of London and New York created the Divest/Invest Forum, a partnership network intended to help municipalities accelerate fossil fuel disinvestment. In 2019, 158 public pension funds pledged to phase out fossil fuels. Among these were the pension funds of many cities, including Copenhagen, Dunedin and Sydney (REN21, 2020). In September 2020, the mayors of 12 cities including Berlin, Los Angeles and London launched a call to invest in green recovery and disinvest from fossil fuels. This declaration defends the exit from fossil fuels as an exit strategy for the crisis in "rebuilding equitable and sustainable urban economies" (C40, 22/09/20).

By initiating court action in January 2018 against five oil industry giants for their role in climate change, New York City (although unsuccessful) paved the way for a wave of lawsuits. In this way, the city of Richmond has taken legal action against no fewer than 29 international oil groups (Inside Climate News, 17/01/20). In November 2019, it was the mayor of Honolulu who announced the city's intention to sue the oil companies. The city is particularly exposed to climate change and has notably lost 25% of its beaches to the effects of erosion and rising sea levels (Ecowatch, 10/03/20). These initiatives were emulated in Europe and in June 2019, 13 French cities including Bayonne, Bègles, Grenoble and Nanterre urged Total to act to limit warming to 1.5°C. This team of cities brought the action to court in January 2020 (Banque des Territoires, 2020).

In India, following the government's decision in June 2020 to privatise and auction off coal deposits, the State of Jharkhand appealed to the Supreme Court, principally alleging irreparable damage to the environment (EconomicTimes).

4. Citizens: marginal capacities, but a voice in public decisions that cannot be ignored

• CITIZENS INVEST IN THE DECENTRALISATION OF ENERGY • Citizens continue to become "prosumers" (producer-consumers): between 2012 and 2018, 36 GW of residential solar equipment was installed, compared to 19 GW over the period 2007-2012 (IEA, 2020). This growth is explained by the falling costs of solar cells, the adoption of regulatory and incentive measures at national and local levels and easier access to finance in developing countries. In 2019, the total capacity of new decentralised solar installations, including residential as well as commercial and industrial sectors, reached 41.6 GW (Solar Power Europe, 2020).

While it is early to take stock, the health crisis does not seem to have impacted sectoral growth. On the contrary, the lockdown measures have given citizens time to carry out work on their homes, including the installation of solar panels. Thus, in Germany, the capacity of solar systems of less than 10 kW installed between January and August 2020 was already 22% higher than the total capacity installed in 2019. In the United States, solar photovoltaic power generation in the residential sector grew by 17% between August 2019 and 2020, reaching 2,550 GWh (IEA, 2020).

Australia now has more than 2.4 million decentralised solar PV systems giving a total capacity of 9.7 gigawatts. The Covid-19 pandemic has not slowed down installation. On the contrary, a greater number of people working from home, increased spending on renovation and low interest rates are all encouraging households to install solar panels. Right in the middle of the lockdown period, in the second quarter of 2020, installations of decentralised systems went up by 41% compared to the same period in 2019. About 29% of Australian households whose dwelling is suited to the installation of a photovoltaic system are now equipped (Bloomberg, 03/09/20).

KEYS TO UNDERSTANDING

OFF-GRID SOLAR HIT HARD BY THE HEALTH CRISIS

Off-grid solar plays a fundamental role in ensuring access to electricity anywhere in the world. These stand-alone solutions are the most cost-effective and the quickest to roll out in poorer regions with sparser populations. This is especially true in the Philippines where these off-grid solutions play a key role in providing access to electricity for the 10% of the population who live without electricity in rural and island areas (SEforALL, 2020). In its 2019 progress report, GOGLA, the world association for off-grid solar, reported a record year for the sector: more than 8.5 million off-grid solar lighting products sold during the year and almost 100 million people around the world benefiting from independent solar lighting (GOGLA, 2019).

The Covid-19 crisis hit the sector hard: all companies reported a fall-off in activity impacting their cash flow. Many companies have reduced their operations or are thinking of reducing them and some have gone bankrupt. In the first half of 2020, solar lighting sales fell by 26% compared to the results for the first half of 2019 and reached their lowest level since 2014. Entry-level products aimed at the lowest income households have been particularly hard hit, undermining the progress made within the framework of SDG 7 (GOGLA, 2019).

BOX 7

The reappropriation of energy by renewable electricity cooperatives is growing rapidly, but production is still marginal. There were approximately 3,500 such cooperatives in 2019, mainly in northern and western Europe, and their number is increasing (REScoop).

INDICATOR

3,500

3,500 citizen-based renewable energy cooperatives in Europe in 2019

The Netherlands thus had 582 cooperatives in 2019 compared to 485 in 2018. They are present in all regions and in 80% of municipalities and their membership is estimated at 85,000; 80% of cooperatives develop solar projects, 24% wind projects and a growing number are involved in district heating and other innovative projects (Hier Opgewelt, 2019). In the United Kingdom in 2019 there were 300 cooperatives. They installed 15.4 MW of new electricity production capacity in 2019, bringing their total capacity to 264.9 MW. The cooperatives also have 13.1 MW of heat production capacity (Community Energy England, 2020). In France, citizen-led projects have a collective capacity of 380.5 MW (Energie Partagee, undated). These projects often involve the participation of local communities, as in the case of Energ'Y Citoyennes, a citizen solar energy cooperative supported by the city of Grenoble, which buys shares in it and makes municipal building roof space available to it (Energy Citizens, 08/02/20).

• CITIZEN MOBILISATION AGAINST FOSSIL FUEL ELECTRICITY, BUT ALSO AGAINST WIND POWER • Despite the decline of coal in Germany's mix, citizens continue to demand that the government accelerate its transition and exit well before 2038. To this end, 3,000 activists from

several European countries and supported by Ende Gelände, one of the main civil disobedience movements, blocked and occupied a coal mine in western Germany on 26 September 2020. A study by Nature published shortly beforehand, however, on the opinions of a representative sample of German citizens, shows that most prefer to exit earlier than 2038, including in the main mining regions (Nature, 2020).

While most citizens support the deployment of renewable energy, these can also meet with vehement opposition regarding wind turbines. Many local resident's associations are opposed to new wind power projects for various reasons : fears of loss of personal comfort; devaluation of their land holding; questioning their relevance in the context of the energy transition and bemoaning the effects of turbines on the health of local residents, wildlife and landscapes.

In Norway, where wind power has experienced strong growth in recent years, citizen opposition triggered a moratorium on new projects in April 2019 and led to a regulatory overhaul (Reuters, 2019). The NVE, the government regulatory agency for the sector, proposed a new legal framework in June 2020: the approval conditions for onshore wind projects will be stricter with new require-ments for the height and distance of the turbines. The once-mooted introduction of new taxes will not now, however, see the light of day (Wind Power Monthly, 22/06/2020).

Opposition is particularly strong in Germany, where in 2019 onshore wind power had its biggest slowdown, with an 80% drop in new installed capacity. The introduction of calls for tender, the end of guaranteed income and red tape have led to a decline in the number of projects. The number of lawsuits brought by local residents and nature conservation groups has also exploded, slowing down proceedings. Pressure is also political and the far right AfD party has no intentions whatsoever of burying its anti-wind-turbine hatchet. It is estimated that between 30,000 and 40,000 jobs were lost in 2019 (Energytransition, 06/01/20). In September, the government proposed the introduction of a 1 km minimum distance from homes for any new wind power project, further penalising the sector and moving Germany away from its goal of 65% renewables by 2035. This measure will finally be abandoned in May 2020; however, the Länder are still able to decree minimum distances within a limit of 1 km (Windeurope, 19/05/2020).

CONCLUSION

The transformation of the electricity sector is accelerating and the health and economic crisis is accentuating trends observed in 2019. However, it is not impacting all players in the same way. Companies investing in fossil fuels are coming up against the economic reality and decline of coal, pushing some to position themselves increasingly favourably towards renewables with all-out investments. Although investment capacity seems to have been impacted for many businesses and local authorities, and households, the impacts seem to differ from one region to another. The deployment of decentralised production systems has weakened in developing countries, but continues to grow in the United States and in Australia, for example, where it is being endorsed by electricity producers who are turning to renewables. Therefore, energy poverty could increase, and access to electricity back up, for the first time in years in parallel with record investment in renewable electricity. Despite these advances, the fall in emissions observed in 2019 in the electricity sector is still far from meeting the objectives necessary for a 2°C trajectory, as illustrated by the lack of long-term strategies of the world's major utilities, as revealed by the World Benchmarking Alliance assessment.

Get in touch with us if you want to share any views, comments or piece of information to contribute to this report: contribution@climate-chance.org

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GLOBAL SYNTHESIS REPORT ON CLIMATE ACTION BY SECTOR

TRANSPORT

The pandemic has halted the continuous rise in emissions but undermines the long-term strategies of stakeholders

The pandemic has halted the continuous rise in emissions but undermines the long-term strategies of stakeholders

Observatoire Climate Chance: **Ghislain Fave** • consultant Climate Energy • **Antoine Gillod** • research officer • **Amaury Parelle** • coordinator

Global emissions from transport increased by less than 0.5% in 2019 (compared to 1.9% per year since 2000) due to efficiency improvements, electrification and greater use of biofuels. Nevertheless, transport still represents 24% of direct CO_2 emissions from the use of energy (IEA, 2020).

This year we are offering you, for each mode of transport (road, rail, sea and air), an analysis of the progression of emissions in 2019 and the factors driving this. The analysis also covers the impact of the Covid-19 pandemic on the strategies implemented by the stakeholders in these sectors. A summary of the main lessons learned can be found at the beginning of each mode of transport.

CONTENTS

TRANSPORT

1 Road: Economic losses due to the sharp drop in demand are putting the business models of public transport companies to the test. At the same time, cycling is emerging in cities as a solution that combines health and environmental benefits, and walking is also gaining ground, in developing countries as well. The growth in emissions from the road sector fell in 2019 thanks to the decline in sales of new vehicles. But SUVs stood their ground, even in the face of Covid-19, and their success continues to negate fuel efficiency gains. They overcome electric vehicles (EVs). Yet, EVs suffer less from the crisis than the rest of the global market (-14% vs. -28%). In general, reducing motorised mobility remains a blind spot in local and national policies. **Page 48**

2 Rail: The growth of the global rail network is struggling to align with climate objectives. It is mainly driven by Chinese investment in their domestic high-speed network and internationally to reach strategic resources in Africa and open up alternative or complementary land routes to maritime freight to boost trade with Europe. Competing with road freight, rail freight transport has proved its resilience in the face of the pandemic. In countries where the challenge is to shift demand to an existing rail network, urban densification policies and economic incentives have shown positive results. Although the electrification of lines continues, the emergence of hydrogen trains, particularly in Europe, lends credibility to more flexible and less costly alternatives. **Page 70**

3 Maritime: The stakeholders in international maritime freight have demonstrated a notable resilience to the health crisis, and have even come out stronger from a year marked by a fall in fuel prices and difficulties in the air sector to respond to the rise in e-commerce. However, the fall in energy demand and oil prices is likely to negatively impact the choices made by the players to meet the two objectives of reducing sulphur and greenhouse gas emissions, set by the IMO in recent years. On one hand, LNG, which has opened up new opportunities and decarbonisation solutions for maritime freight in recent years, is the energy product that has suffered most from the crisis. On the other, scrubbers, used to clean sulphur emissions from exhausts, are facing competition from alternative fuels that have become cheaper. **Page 82**

4 Air: The Covid-19 pandemic has put an end to the continued growth of aviation GHG emissions, which was at 2% in 2019. The fall in traffic in 2020 has led the International Civil Aviation Organisation to agree to consider only 2019 emissions as a benchmark for monitoring their progress. The industry predicts a return to normal in 2024 and a two-fold increase in traffic by 2050. Thus, analysts believe that these calmer years will not change the trajectory of the sector, which is still highly incompatible with the Paris agreement. Other trends illustrate the divergences and uncertainties concerning this trajectory: the drop in activity has put a brake on the States' desire to increase tax for aviation, while airport extension projects are increasingly being challenged by civil society in particular, where there is no longer any hesitation in bringing cases to court. **Page 96**

ROAD TRANSPORT AND URBAN MOBILITY

The pandemic is reshuffling the cards for mobility that has lost its inspiration

• KEY TAKEAWAYS •

❋ The economic model of municipal public transport is being strained by the pandemic, which is demonstrating that funding it from users' fares alone is a challenge. Meanwhile, cycling, a key solution bridging health and environmental challenges, but which has yet to be consolidated, has also boomed in cities where it was previously still marginal: There are nearly 2,400 km of additional bicycle paths under construction or announced in Europe, and nearly 900 emergency measures in favor of cycling and walking around the world. As for shared mobilities, a handful of dominant free-floating players should emerge stronger, thanks to the acceleration of merger-acquisition activity in 2019, but are still struggling to find a sustainable business model.

❋ The growth of emissions in the road sector slowed in 2019 as sales of new vehicles declined. In 2020, SUV and premium vehicles have been more resistant to the economic shock of the Covid-19 pandemic, and their success continues to cancel out the efficiency gains that have been recorded in recent years. Global sales of electric vehicles (EVs) in 2019 (-14%) suffered less than the rest of the market (-28%) in the first half of the year: Europe even became the leading continent in EV sales (+42% of sales), surpassing even China, which is reducing its subsidies for EV purchases. While attention is focused on electrification, EVs still account for only 3% of sales, compared with 41% for SUVs.

❋ Walking is making a tentative entrance in the mobility and urban development plans of cities like Paris and London but also in Brazil and various developing cities. However, apart from the widened popularity of teleworking, the reduction in the demand for motorised mobility, particularly due to the densification of living spaces, remains overlooked by municipal policies.

❋ Transportation figures prominently in economic stimulus packages. Although soft mobilities are supported, these plans still strongly promote individual motorised mobility, including internal combustion vehicles. Yet car manufacturers have fallen far short of the standards that have applied since early 2020 and are typified by their avoidance strategies. By contrast, restrictions on urban access for polluting vehicles are multiplying and are showing to be efficient.

1. Global trends: growth already limited in 2019, stopped by the pandemic

Road transport GHG emissions were 6.1 GtCO$_2$ in 2019, up 0.8% on 2018 (**fig. 1**). This growth is the lowest since 2011, with an average annual growth rate of 1.8% over the period 2011-2018 (Enerdata).

FIGURE 1

PROGRESSION OF ROAD TRANSPORT EMISSIONS IN GTCO$_2$ - *Source: Enerdata*
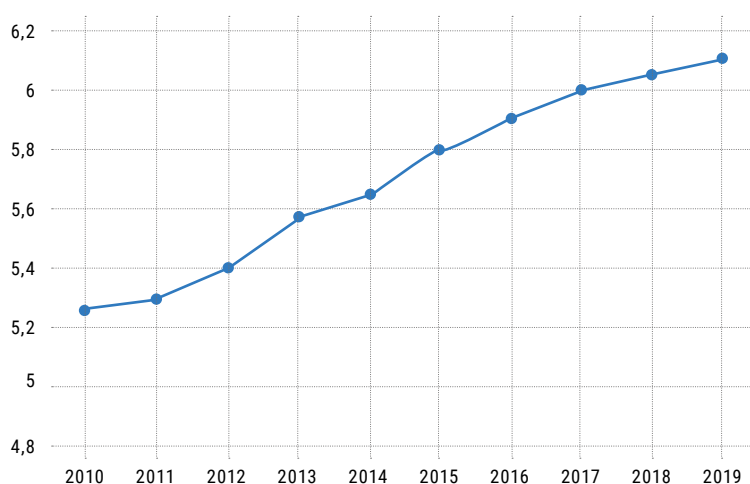
This more moderate increase can be explained by improved energy efficiency and electrification (IEA, 2020), although this is not sufficient to offset the rise in demand. As part of the follow-up to the Sustainable Development Goals (SDG), the United Nations Statistics Division (UNStats) has released data on transport demand for the first time, estimated in 2018 at 57,000 billion passenger-km for road passenger transport and 37,000 billion tonne-km for road freight (UNStats). This demand is very unevenly distributed: the United States, China and India, with 10,200, 6,200 and 2,300 billion passenger-km respectively are by far the countries with the highest demand (**fig. 2**).

This data on road transport demand differs significantly from the IEA data that we issued for 2018 in the Bilan Sectoriel 2019 [Sector Review 2019] (44,000 billion passenger-kilometres and 32,000 billion tonne-kilometres). Growth in global demand cannot be assessed due to the different methodologies used, but it correlates closely with the growth of economic activity. For example, in Europe, while GDP grew by 31% between 2000 and 2017, passenger road transport demand grew by 12% over the same period (EEA, 2019).

The majority of this travel takes place in urban areas, with urban transport GHG emissions totalling 2.3 GtCO$_2$e in 2010 or about one third of the overall transport sector emissions (ITF, 2019). Above all, by 2050 and in a scenario continuing the current trend, these emissions are expected to double under the effects of rapid urbanisation and economic growth in developing countries (Replogle, M. et Fulton, L., 2014): whereas around 55% of the world's population currently lives in urban areas, this rate of urbanisation is expected to reach 68% by 2050 (UNDESA, 2018). At the same time, urban GDP is expected to grow even more, from 60% of world GDP in 2015 to 81% in 2050 (ITF, 2019). Urban mobility therefore lies at the heart of the transport decarbonisation challenge.

FIGURE 2

DEMAND FOR ROAD PASSENGER TRANSPORT BY COUNTRY IN 2018 (IN THOUSANDS OF BILLIONS OF PASSENGER-KILOMETRES) - *Source: Made by the author based on data from UNStats*

The strong representation of energy-consuming and polluting modes of transport explains why the transport sector plays such a significant part in the GHG emissions of cities in particular. In the C40 cities, transport is responsible for one third of GHG emissions (C40, undated); the proportion is similar in the cities of the World Convention of Mayors initiative in Europe, where 26% of GHG emissions are attributable to transport (Covender, 2020).

However, the *Global High Shift Scenario* report produced by UC Davis University and the ITDP estimates that it is possible to reduce GHG emissions due to urban mobility by 40% by 2050 through a series of actions aimed at avoidance, change and improvement (Replogle, M. and Fulton, L., 2014). These various strategic actions aim to: a) avoid travel by means of urban planning that integrates land use and transport or by managing transport demand; b) change the way we travel, shifting users towards lower carbon modes of transport such as public transport or active modes; c) improve the carbon footprint of vehicles and fuels.

This year Climate Chance's Bilan sectoriel [Sector review] analyses recent progress made by non-state actors along these three lines with particular emphasis on the urban sector.

2. "Avoid": "demobility", the blind spot of mobility policies, revived by the pandemic

The demand for urban passenger transport in 2015 was 18,000 billion passenger-kilometres in 2015 (ITF, 2019). The combination of urban development and economic growth will result in increased demand for mobility and a doubling of demand in 2050. This increase will be largest in absolute terms in China and India, where demand for urban mobility is expected to grow by 7,000 billion passenger-kilometres between 2015 and 2050, with the movement of persons in the cities of these two countries in 2050 accounting for one third of the world's urban mobility in 2050. Relative growth will be strongest in urban areas of Africa, where walking is currently the main mode of travel and

GHG emissions from urban transport are therefore low. Demand for urban mobility will almost have quadrupled on the continent by 2050 (ITF, 2019).

The viewpoint of reducing demand in order to lower GHG emissions or to consider mobility is not yet the preferred angle for transport operators. The Covid-19 pandemic has brought more clarity to thoughts about "demobility", mainly involving teleworking, which is not without risks of rebound effects. More fundamental action to reduce urban transport demand is still under consideration, but some initiatives have emerged in recent years.

• THE COVID-19 PANDEMIC IS ACCELERATING REFLECTIONS ON "DEMOBILITY", STARTING WITH TELEWORKING • In April 2020, more than half of the world's population was at least partially locked down (Euronews, 2020). These measures have had an unprecedented impact on human mobility: road transport fell by between 50 and 75% in the affected regions. Globally, road transport demand fell to almost 50% of its 2019 level at the end of March (**fig. 3**).

Due to the travel restrictions, our ways of working, moving around, shopping and our relationship with towns and cities have been revolutionised. Teleworking was one of the responses that was quickly adopted into new sectors of activity and stakeholder operations.

FIGURE 3

DEVELOPMENTS IN ROAD TRANSPORT DEMAND IN SELECTED COUNTRIES AT THE BEGINNING OF 2020
Source: IEA, 2020
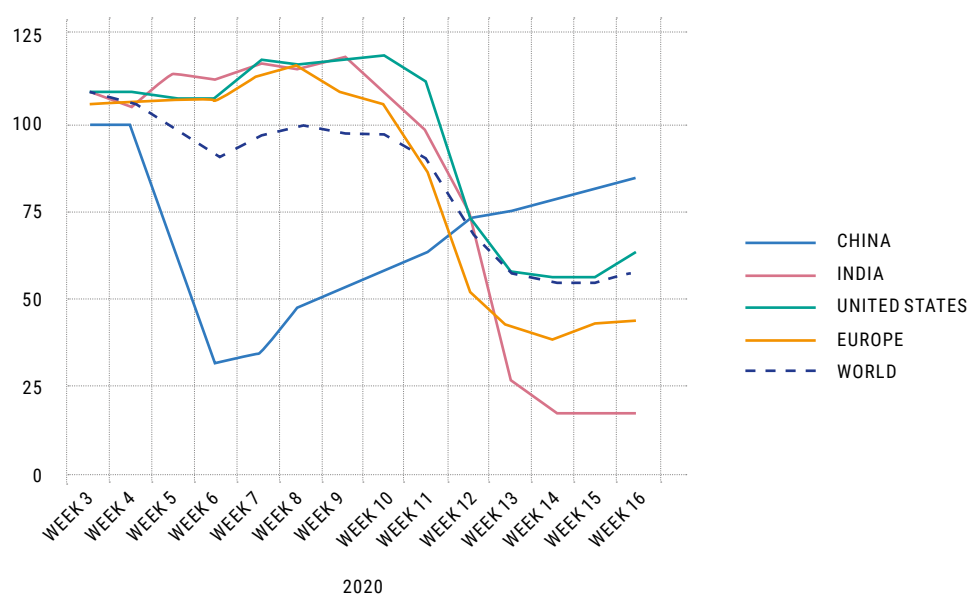
The practice had already been well-established in some countries for a long time, according to the *International Transport Forum* (ITF). In the United States, 10% of employees were already teleworking at least once a week in 2010. In northern European countries, such as Denmark and Finland, the figures for teleworkers were 34% and 32% respectively, in 2015. In southern European countries, only 10% of employees were involved in teleworking (ITF, 2019). **Two main factors explain these national variations regarding teleworking: varying degrees of advantageous legislation and social norms, with the culture of presenteeism being strong in some companies.**

The practice of teleworking reduces demand for transport, motorised journeys and thus GHG emissions from urban transport. The generalisation of teleworking could impact upon between

3% and 30% of urban travel by 2050, depending on the region, and reduce the sector's GHG emissions by 2% in 2050 (ITF, 2019). The study produced by the Agence de la transition écologique en France [French Agency for Ecological Transition] (ADEME) on lifestyles and teleworking in 2020 reaches a similar conclusion: while 41.6% of French workers teleworked during the lockdown, the generalisation of post-pandemic teleworking would significantly reduce travel. With 35% of workers teleworking, 3.3 million journeys totalling over 42.9 million km would be avoided on weekdays. The impact on GHG emissions would be significant with a 1.3% reduction in CO_2 emissions from cars in France (Ademe, 2020).

KEYS TO UNDERSTANDING

TELEWORKING, BE AWARE OF THE REBOUND EFFECTS ON GHG EMISSIONS

Recent studies on teleworking advise caution with regard to the possible rebound effects of this practice. Thus, according to the Ademe study, 45% of future teleworkers are poised to choose a new place to live further away from their employment, which would probably have consequences for urban sprawl and the development of motorised travel (Ademe, 2020). A study conducted in the UK also shows that the propensity for teleworking and the distance of the home-work journey are correlated; the causal link has not yet been established but the possibility of working remotely might encourage employees to decide to live further away from their workplace (Melo P., de Abreu e Silva J., 2017). Teleworking could have other indirect effects, such as increasing non-work-related travel or increasing energy consumption in homes (ITF, 2019).

Moreover, many cities have seen a shift in the housing market since the pandemic and a sharp rise in demand for out-of-town family houses. Following the lockdowns, city dwellers felt the desire to leave the city for more rural areas. Teleworking could amplify this trend (Le Monde, 27/04/20). For example, house sales grew 44% in suburban New York in July 2020 compared to July 2019, while home sales fell 56% over the same period in central Manhattan (New York Times, 30/08/20).

BOX 1

• DENSIFICATION OF PUBLIC OR PRIVATE SERVICES TO REDUCE THE NEED FOR MOBILITIES IS STILL UNDER CONSIDERATION • In July 2020, the C40 network of megacities issued a manifesto for an exit from the Covid-19 crisis: the creation of 15-minute cities is one of the strategies put forward to strengthen cities' resilience. The document points to the need to create a legal environment that encourages inclusive zoning and mixed-use urban development (C40, 2020). For the urban planner Carlos Moreno, who theorised about the concept of a "15-minute city", this crisis is an opportunity to think about the city in a different way, to create a *multi-centrality* conceived as having *"peaceful, green streets suitable for walking and cycling"* and the possibility of *"making one place have multiple uses, with each use offering a new area of possibility"* (Construction 21, 2020).

Several cities have adopted this concept in response to the Covid-19 crisis, such as the city of Milan, which is encouraging teleworking in companies, converting 35 km of roads into pedestrian and cycle zones and working with the Lombardy region to open medical centres in densely populated areas. It was also a major focus of the 2020 Paris municipal election campaign. According to a study conducted by the University of Florence on these two cities and their response to the crisis, **urban pandemic response strategies also respond to the need for sustainable reorganisation of cities: decentralisation of facilities, hierarchisation of the transport system and public services, and redundancy of public and semi-public services that encourage the multipurpose use of buildings** (Pisano, C., 2020).

At neighbourhood level, it is about improving urban design to diversify usage so that people can not only live and work there, but also enjoy themselves, eat and drink and have access to education, culture and health. In short, it is about going back to the urban design familiar to our cities before the advent of the car in the second half of the twentieth century. The city of Portland is one of the first to position the development of such neighbourhoods at the heart of its climate plan. In 2015, the city set a target of an 80% reduction in its GHG emissions by 2050, relative to 1990s levels, and one of the main strategies for achieving this is the creation of "complete neighbourhoods" for 80% of the population. The "complete neighbourhood" concept is defined as follows: "*a complete neighbourhood provides safe and convenient access to the goods and facilities needed for everyday life. It includes a variety of accommodation options, grocery stores and other shops, quality state schools, public green spaces and recreational facilities*" (Portland, 2015).

Other cities will then follow this example: in 2018, Melbourne unveiled the "*20-minute neighbourhood*" principle, whereby people should have access to all essential services within 20 minutes (Melbourne); in 2019, Minneapolis made a commitment to ensure that its entire population lives in "complete neighbourhoods" by 2040 (Minneapolis) and in the same year Ottawa launched its "*15-minute neighbourhood*" programme (CBC, 22/08/19).

• SUSTAINABLE MOBILITY PLANS: TRANSFORMING THE URBAN LANDSCAPE TO REDUCE DEMAND • The relationship between urban form and transport-related emissions has now been clearly established. A comparison of cities in North America, Europe and developing countries highlights the link between urban density and automobile dependence, and therefore GHG emissions. Thus, in general, the higher the urban density the lower the per capita emissions from urban transport (**fig. 4**). GHG emissions from urban transport often exceed 4 tCO_2e per capita in North American cities (5.2 tCO_2e in Houston and 5.1 tCO_2e in Tucson, for example) while they are less than 2 tCO_2e per capita in cities in the rest of the world (CODATU, 2015). These cities are now locked in an urban model dependent on the private car, from which it is difficult to escape: geographical dispersion makes the development of public transport offers complex, and active modes are not suited to the distances to be travelled.

FIGURE 4

URBAN DENSITY AND TRANSPORT EMISSIONS - *Source: Liu, Z., 2012*

1,017
European cities
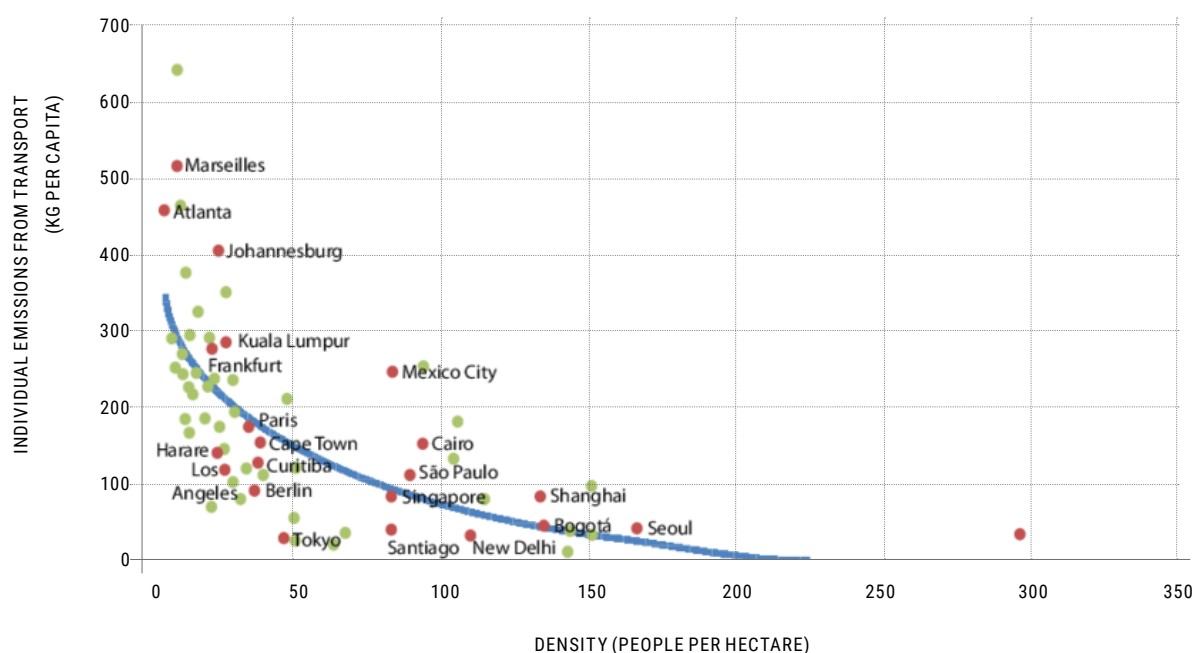
INDICATOR

1,017 european cities in 2017, had developed a SUMP, over half of them in Belgium, France and Spain

For cities, the challenge is therefore to manage land use in order to control urban development and organise urban growth around pivotal public transport networks. One community response to this challenge is the development of SUMPs *(Sustainable Urban Mobility Plans)*, which combine the organisation of sustainable urban development with mobility planning. In Europe, the development of SUMPs was driven by the EU-funded SUMPs-UP project, bringing together cities, researchers, environmental organisations and mobility experts. In 2017, 1,017 European cities had developed a SUMP, over half of them in Belgium, France and Spain (SUMPS-UP, 2018). While reducing transport-related GHG emissions and air pollution is one of the main reasons for developing a SUMP, the impact on the reduction of emissions is difficult to quantify (**Box 2**).

In Brazil, following the adoption in 2012 of the National Law on Urban Mobility, cities with over 20,000 inhabitants are obliged to acquire a *Plano de Mobilidad Urbana* (PMU, equivalent to the SUMP, cf. case study Transport-Brésil, 2018). This national legal framework is not sufficient and lack of awareness of the concept, failure to master methodologies and good practices and difficulty in funding projects are all holding back the implementation of sustainable urban mobility plans Although the initial deadline for implementing a PMU was initially set for 2015 and then pushed back several times, only 17% of cities with 20,000 to 60,000 inhabitants had produced such a plan

by early 2020. Consequently, in May 2020, the deadline was extended to 2023 by the Brazilian government (Ministério do Desenvolvimento Regional).

In Africa, where emissions from the transport sector increased by 84% between 2000 and 2016 alone (MobilizeYourCity, n.d.), urbanisation is even faster than elsewhere: some urban areas will have a 20-fold increase in surface area by 2030 compared to the 2000 level (Mahendra, A, 2019). One surprising factor is contributing to this explosion of urban sprawl on the continent: **the proliferation of cheap Chinese motorcycles is offsetting the lack of public transport, allowing people to move from city centres to the suburbs.** Agricultural areas are being transformed into residential space and public transport infrastructures cannot keep up with this rapid progress (Le Monde, 26/01/2017). Sustainable urban mobility policies are needed here as much as anywhere and the *Mobilize your City* initiative supports African cities in this endeavour. In 2019, SUMPs were drawn up for the cities of Douala and Yaoundé in partnership. The mobility plan for the city of Yaoundé sets out a specific action plan to streamline traffic and develop public transport, and establishes the target of reducing GHG emissions by 11% by 2035 relative to the ongoing scenario (MobilizeYourCity, n.d.).

However, measuring transport-related emissions remains a challenge in most cities as they are often estimated on the basis of national fuel consumption data and are difficult to transpose to local level. Some methodologies can be adapted to the context, such as the Global Protocol for Community-scale (GPC), which allows cities to select the type of travel that will be taken into account in the inventory. Some actors such as MobilizeYourCity propose innovative methodologies for the collection of locally available activity data (MobilizeYourCity, 2017).

3. "Change": accelerated implementation of soft mobilities against the background of difficulty with public transport

• URBAN MOBILITY IS STILL DOMINATED BY INDIVIDUAL MOTORISED TRANSPORT • Already put forward in Climate Chance's Bilan sectoriel 2019, urban mobility (in passenger-kilometres) is dominated by private transport: 67% for cars and motorcycles, 30% for public transport (buses), 1% for shared mobility (Uber, grab taxi, self-service bicycles, etc.) and 2% for active transport (**fig. 5**). Private transport accounts for about 75% of urban passenger demand in OECD countries and over 60% of demand in the rest of the world (ITF, 2019). These overall figures do not reflect the big differences between cities: while cars account for 39% of all trips in Madrid, 82% of Detroit workers use their cars to get to work. While the ITF's 2050 projections indicate a rebalancing of modal shares in favour of shared or active transport, the report also notes a significant increase in non-urban car use in recent decades, including in some OECD countries, and this is expected to continue.

FIGURE 5

MODAL SHARE IN URBAN AREAS- *Source: made by the author based on data from ITF*

- ● PRIVATE TRANSPORTS
- ● ACTIVE MODES
- ● PUBLIC TRANSPORTS
- ● SHARED MOBILITY
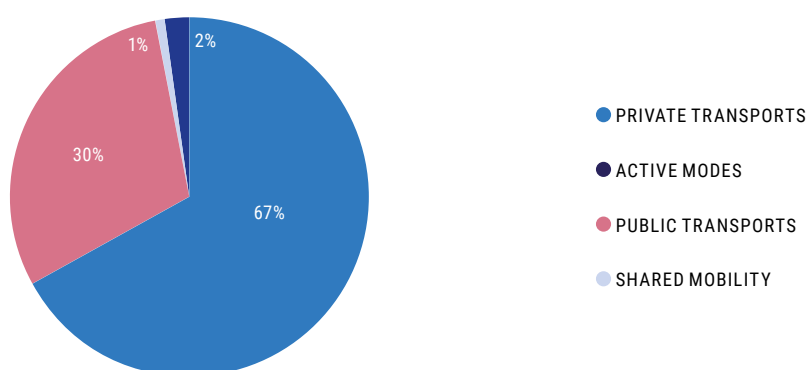
However, projections to 2050 indicate a significant decline in individual transport in favour of shared or soft mobilities. The challenge of the modal shift in modes of transport is thus to bring about modal transfer to the lowest-carbon modes of soft mobility and public transport. User deferral strategies can be divided into two categories: incentives to promote active modes and public transport; and coercive measures to deter car use.

• THE SLOW PROGRESSION OF PUBLIC TRANSPORT STOPPED BY THE COVID-19 PANDEMIC •

In 2019, only 50% of the world's urban population had easy access to a public transport network (UNStats, n.d.). There are wide disparities according to geographical area: while 75% of the urban population in Europe and North America has access to public transport, less than 40% of Asia's urban population and only one third of Africa's town and city dwellers do. This indicator is down three percentage points from 2018. Although methodological differences (**Box 2**) mean that it is too early to conclude that there is a downward trend, the lack of urban transport infrastructure can nevertheless be noted.

INDICATOR

50%

50% of the world's urban population have easy access to public transport in 2019: from 75% in Europe to 40% in Asia. This is a decrease of 3 points compared to 2018.
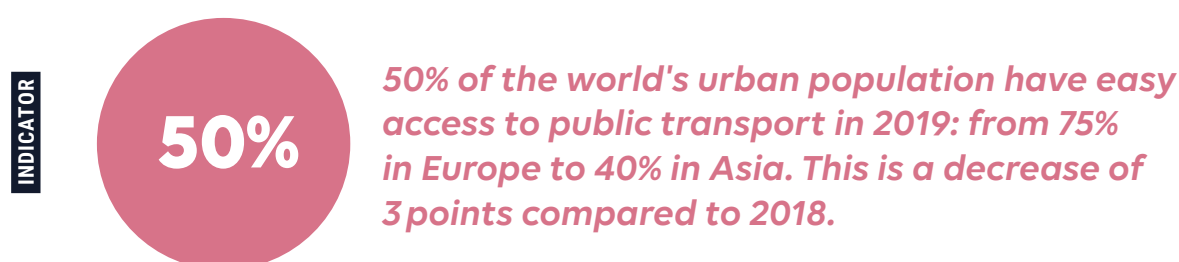
KEYS TO UNDERSTANDING

MEASURING ACCESS TO PUBLIC TRANSPORT

This indicator is measured as the fraction of the population that resides within 500 m of a bus/tram stop or within 1,000 m of a metro or train station. It responds to the need to measure progress towards Sustainable Development Goal 11 "Sustainable Cities and Communities" and more specifically target 11.2: "By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all." Measurement of this indicator is hampered by the lack of unified methodology and the lack of comprehensive data on public transport networks. Although data is available at transport operator level or at community level, it is absent at national level. Therefore, one has to work at the level of the municipalities operating the urban transport. In 2018, this indicator was calculated on the basis of information provided by 227 cities in 78 countries. In 2019, the sample was expanded to 610 cities in 95 countries (Indicators Report, n.d.).

BOX 2

2019 saw stronger growth in China's subway system. Lines were inaugurated in more than seven cities, including Xuzhou, Shenzhen and Wuhan (International Railway Journal, 11/10/2019). In 2019, the first underground lines were introduced in Jakarta, Sydney and Noida in India (Hindustan Times, 25/01/2019).

INDICATOR

174

Number of cities that have a High Level Service Bus in 2019. 4 additional cities only compared to 2018.

By contrast, the growth of the High Level Service Bus (HLSB) network has once again slowed: worldwide, the total network has grown marginally by less than 200 kilometres since 2018, from 5,059 km to 5,252 km today. 174 cities now have at least one HLSB line, four more than last year. Lines were also opened in Calgary, Nouméa, Los Angeles and Albuquerque in the United States in 2019 (BRT Data, n.d.). Once considered to be a model of its kind, the BRT of Pune (India, pop. six million) last year experienced setbacks that illustrate the difficulties encountered by this type of system. In November 2019, Pune Municipal Corporation (PMC), the BRT line operator, dismantled parts of the network by removing barricades to open the tracks to all traffic (Pune Mirror, 27/11/19), a decision that did not jeopardise the project according to local decision-makers, but one that followed many difficulties encountered by the network since its inception: a lack of buses to ensure a regular service, faulty infrastructure, frequent accidents, etc. (Citizen Matters, 25/07/19). Pundits attributed these implementation problems to population density to explain the contrast with successful models, notably in South America.

Transport networks were the first to be affected by the health crisis and the introduction of the first measures to curb the spread of the epidemic. With more than half the world's population in lockdown, the majority of urban public transport systems were hit hard by the crisis. Data from the *Mobility as a Service* Moovit application show the magnitude of the impact on urban public transport: a 93% drop in traffic in Lima, 85% in Bogota and 72% in Los Angeles (**fig. 6**). In China, the proportion of public transport users halved between December 2019 and February 2020. Over the same period the proportion of car users increased from 34% to 66% (IPSOS, 2020). In Ile de France, the share of Metros and RERs in circulation has been reduced to 30%. The impact on usage was even greater, with only 5% of the usual volume of passengers on the network at the heart of the lockdown and only between 20% and 45% in June 2020, even though supply had returned to 100% capacity (Le Monde, 13/07/2020). Moovit data illustrates that despite the gradual lifting of lockdown measures and the restoration of traffic on the transport systems, usage was still far from returning to normal in August 2020.

PUBLIC TRANSPORT USAGE BETWEEN 15 JANUARY AND 30 AUGUST 2020 IN A SELECTION OF CITIES - *Source: Moovit*
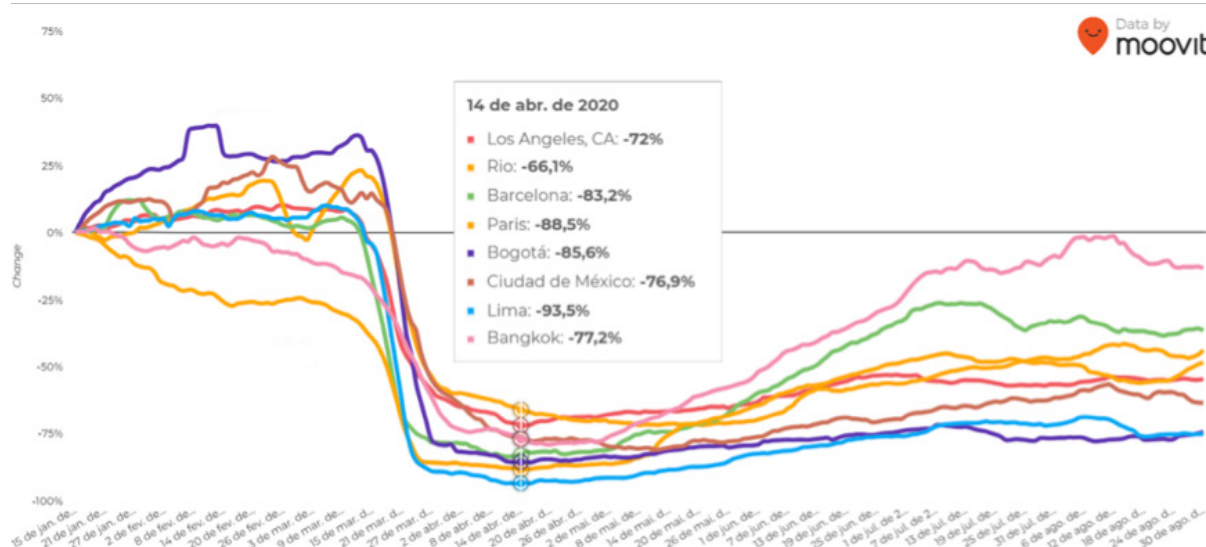
There has been widespread academic use of this data in studies attempting to rapidly estimate the impact of Covid-19 on GHG emissions. For example, *Forster & al. (2020),* after Le Quéré et al. (2020), relied on global mobility data collected by Google and Apple via their respective GPS applications to quickly propose, in a study published in early August 2020, an estimate of the cumulative effect of changes in emissions of various air pollutants and GHGs caused by lockdown measures. Result: this will only have a very slight cooling effect by 2030, but this could be as much as 0.3°C in scenarios where stimulus packages are fully targeted on eliminating fossil fuels.

• THE ECONOMIC MODEL OF MUNICIPAL PUBLIC TRANSPORT IN THE FACE OF THE HEALTH CRISIS • Maintaining social distancing rules reduces the capacity of public transport systems. A McKinsey study in June 2020 estimates that public transportation is operating at a fraction of between 15% and 35% of its pre-pandemic level (McKinsey, 2020) With a distance of two metres between passengers, Transport for London estimates that the London Underground could only operate at 15% of its normal capacity.

Following the drop in traffic, public transport systems are accumulating losses: the financial losses of the BART, the San Francisco Bay express train, are estimated at USD 975 million over the next three years (San Francisco Chronicle, 14/07/20); in April alone, at the heart of the crisis, the shortfall amounted to 1.4 billion Euros in operating revenue for the SNCF in France (Les Échos, 01/05/20). In Brazil, the sector receives little public aid and users fund the system almost entirely, which leads to overcrowded transport: a bus company's financial stability is based on six passengers per square metre. More than elsewhere, the health crisis and reduced demand are causing problems for the entire sector: operators in Salvador and SP have already gone bankrupt and half of the bus transport companies are threatening to file for bankruptcy by the end of 2021 according to the president of the NTU, the national association of urban transport companies (Folha, 09/07/20).

Several countries have already announced aid for the sector. In the United States, although 430,000 jobs depend on public transport, 25 billion dollars in emergency aid has been available (Reuters, 02/04/2020). In the UK, bus and tram operators received aid of £700 million (gov.uk, 2020). In France, the government allocated €1.2 billion to the development of public transport and cycling (Ministry of the Economy, 2020). This crisis shows that funding transport systems by from

users' fares alone is a challenge. In a context of economic crisis, it will be difficult for public aid to be feasible in the long term, particularly in developing countries. For the WRI, the current crisis is an opportunity to rethink the public transport funding model and any stimulus programmes should address new strategies such as congestion charges or car park management that would raise funds while reducing car use (WRI, 2020).

• CYCLING IS A KEY SOLUTION BRIDGING HEALTH AND ENVIRONMENTAL CHALLENGES •

While public transport has been hit hard by the pandemic, soft mobilities have experienced a real boom already seen in 2019 (Bilan sectoriel 2019, Climate Chance). In total, a public database from the *pedbikeinfo* site, run by Tabitha Combs of the University of North Carolina, has succeeded in identifying, as of 28 October 2020, 882 measures in favour of walking and cycling implemented in response to Covid-19 (pedbikeinfo, up. 28/10/20). Cycling is particularly suitable for physical distancing, as cyclists need to maintain distances to avoid collisions. Bloomberg recalls that cycling has often served as an emergency solution after crises such as the earthquake in Mexico City in 2017 and in Tokyo in 2011, but also after the oil shock in the United States in 1973 (Bloomberg, 25/03/20).

INDICATOR

882
mesures

Number of mesures that have been taken in favor of walking and biking and as a respond to Covid-19
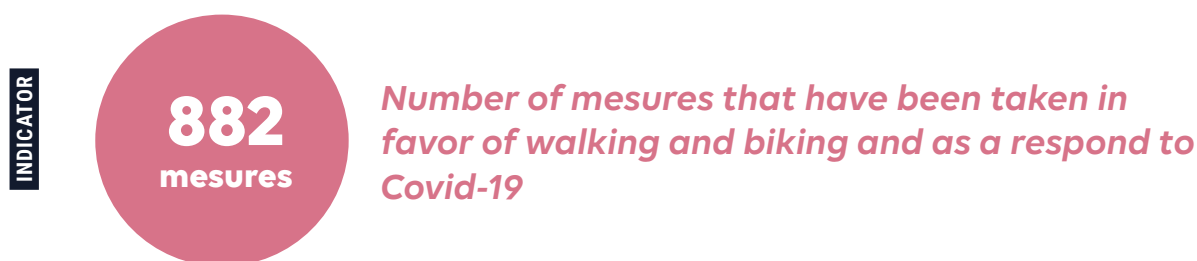
In order to enable essential workers to move around during lockdown and residents to take part in physical activity, temporary cycle arrangements have been established in many cities: Paris, Mexico City and Bogota, for example (The Guardian, 11/04/20; UCI, 04/06/20). In order to help communities, a multitude of practical guides to creating temporary bicycle infrastructure have been published (Mobycon; Cerema; Danish Cycling solutions, 2020).

Although cycle lanes were eliminated as soon as the lockdown was lifted, as was the case in Cambridge in Canada and in Saint-Étienne and Quimper in France, many cities are choosing to make the infrastructure permanent. Bogota has created 84 km of temporary cycle lanes and intends to expand the 280 km bicycle network over the next four years. In Lima, cycling is part of the city's response strategy to the Covid-19 crisis and 300 km of cycle routes are due to be developed soon (Bloomberg, 10/08/2020).

Public opinion is important in these decisions. In London, 56% of inhabitants would like the pavements to be permanently widened and 57% support the creation of new cycle lanes and the widening of existing lanes (inews, 04/06/20). In Australia, the 45,000 members of Bicycle Network are demanding the construction of 750 km of lanes in the country's main cities, which they believe would create numerous jobs (The Guardian, 25/05/2020). To date the European Cyclists' Federation has allocated budgets totalling over €1 billion to promote bicycles since the beginning of the pandemic and exactly 2,356.69 km of cycle paths have been announced, fewer than half of which have actually been completed to date. 75.2% of these measures relate to the creation of bicycle lanes, 19.5% to calming and reducing traffic and 4% to opening up pedestrian areas (ECF, 2020).

Some weak signals suggest that these rapid developments have increased the modal share of the bicycle. In Jakarta, cycling increased by 500% and by nearly 1,000% in some streets of the Indonesian capital (ITDP, 10/07/20). In New York, cycling had increased by 67% in June 2020 compared to June 2019 (Bloomberg, 25/03/20). Bicycle Network notes a 270% increase in bicycle use in some Australian cities The Guardian, 25/05/20). In Sydney, bicycle rentals jumped 60% during March and April, due to demand from citizens who began to offer delivery services to make their living (Sydney Morning Herald, 01/05/20). Everywhere, stories proliferate about the lengthening waiting lists in bike shops swamped with orders: in Germany, the Philippines, the United States and indeed in India, where the Hindustan Times even compared bicycle sales to the run on toilet paper that preceded the lockdown (Hindustan Times, 15/06/20).

This increased use of the bicycle in urban areas confirms two trends that began in 2019. On the one hand, the boom in electric bicycles has extended the practice to new groups of people: in the Netherlands, for example, sales of electric bicycles exceeded those of traditional bicycles after March 2019 (The Guardian, 01/03/19), with very positive trends in France and Germany (Bike Europe, 09/04/19). It is a booming market that benefits manufacturers and attracts investors; for example, the Dutch company VanMoof, which increased its profits by 220% in 2020, managed to raise some USD 73 million over the year to expand in North America, Europe and Japan (Bicycle Retailer, 16/09/20). On the other hand, electric bikes are expensive, and their success also depends on increasing the subsidy programmes available for purchasing electric models observed in recent years such as in Paris, Vienna, Guernsey, Lisbon, Madrid etc.

KEYS TO UNDERSTANDING

UNCERTAIN FUTURE FOR SHARED MICROMOBILITY ACTORS

Whereas shared micromobility initiatives (electric scooters, free-floating bicycles, etc.) have multiplied in recent years, and companies are competing in an ultra-competitive market (cf. Bilan Sectoriel - Transport 2019), the pandemic put a sudden end to these shared items that are not easily compatible with health measures. In March, Lime and Bird, two of the largest electric scooter operators, suspended operations in numerous American and European cities (Financial Times, 17/03/20).

These start-ups were already struggling with problems inherent to their economic model, based on bloated stock-market valuations, seasonal businesses (the use of scooters and bicycles is weather-sensitive) and fragile economic units. In fact, none of them had reached their profitability threshold; indeed, fleet deployment requires heavy investment and the breakage rate was higher than expected. In 2019, Lime's operating losses, the second largest on the market, amounted to 300 million dollars (The Information, 21/10/19). In early 2020, before the crisis, the company ceased operations in 12 cities and laid off 14% of its employees. The health crisis only exacerbated these difficulties and Bird, the market leader, in turn laid off 400 employees at the end of March 2020 (Bloomberg, 16/04/20). Since then, the use of scooters has bounced back and they seem to be being used for ever longer journeys (Bird, 29/06/20). In this highly competitive market, the pandemic is expected to accelerate the takeover and acquisition phenomena already observed in 2019 (Guidehouse Insights, 30/03/20). The American company Bird had already acquired its Berlin competitor Circ by January 2020 (Les Echos, 27/01/20). Later, during lockdown, it was the ridesharing giant Uber that participated in Lime's raising funds to the tune of 170 million dollars allowing Lime to acquire Jump, Uber's own shared bike and scooter service, strengthening integration of the two services on their reciprocal applications (Les Numériques, 12/05/20).

Electric scooters, already financially threatened, are now also under attack for their environmental footprint. Apart from the occupation of urban space, it is above all the lifespan of the

batteries and their recycling that raises concerns (Quartz, 01/03/19). When Bird announced in early June that Circ's activities in the Middle East would be "paused", the specialist online publisher "Tech Crunch" revealed that at least 10,000 electric scooters deemed obsolete had been sent to EnviroServe, an electronics recycling company in the United Arab Emirates (Tech Crunch, 03/06/20). After lockdown, Lime announced that it would provide the streets of Paris with 2,000 vehicles certified "Carbon Neutral" under the Carbon Neutral Protocol (Lime, 23/07/20), a certification body whose low requirements have been highlighted in the work of Net Zero Initiative on corporate carbon neutrality.

BOX 3

What effect might this breakthrough of individual bicycles in large cities have on the shared bicycle system? In April 2020, the Bike-sharing blog identified 2,102 municipal shared bicycle systems worldwide, compared to 1,600 last year (Bilan sectoriel 2019, Climate Chance). However, we note that the number of bicycles in use has not changed so it is difficult to tell whether this development is really the result of a spectacular new enthusiasm for these systems in municipalities or simply a more complete update of the database.

Firstly, the point should be made that there was already an upward trend in major European and American cities before the interruption caused by the epidemic. In the United States, shared micromobility journeys jumped 60% between 2018 and 2019, having already doubled between 2017 and 2018, largely due to the *free-floating* system. Public shared bicycle systems, less expansive by the nature of their infrastructure, remain stable (NACTO, 27/08/20). In Paris, the transport strikes in December 2019 pushed users towards bicycles even after the industrial action had ended: at the end of January 2020, the use of bicycle lanes had increased by 139% compared to January 2019 (Le Parisien, 04/02/20).

INDICATOR

2,102

Number of municipal bicycle sharing systems that are in place in 2020 according to the Bike-sharing blog

Few comprehensive studies to date estimate the post-Covid rebound effect on shared mobility. It would nevertheless appear that shared bicycle systems are, on the one hand, more resilient than other modes of transport, including self-service fleets (**box 3**). For example, usage of the eight largest systems fell by only 44% in the United States, compared to 70% for all modes of transport (NACTO, 27/08/20). On the other hand, there appears to have been an immediate rise in the use of bicycles and micromobility systems (public, private, or open access) after the lockdowns, at the expense of public transport. In Madrid, a representative of the municipal transport company (EMT) states that there has been a 10% increase in the use of BiciMAD since the lockdown (Polis, 22/06/20). As early as July, Citi Bike in New York was registering more users than in 2019, with evidence of a modal shift from the subway to the bicycle (Texeira et al., 2020). According to a survey by the Boston Consulting Group, micromobility was up 150% in China as it came out of lockdown (BCG, 16/06/20). However, in general, it is individual and private mobility that has emerged as the winner from the pandemic, including the use of cars.

• THE EMERGENCE OF WALKING IN TOWN AND CITY MOBILITY PLANS • Walking has long been the poor relation of urban mobility policies, often lacking any master plan. However this mode of mobility also requires investments in infrastructure to ensure safe and enjoyable usage (IFDT, undated). For example, a megalopolis like Paris only developed a strategy in 2017 when it launched its "pedestrian plan", the main objectives of which are to make journeys simpler and safer and to give space back to pedestrians: 50% of public space is currently occupied by cars (Ville de Paris, 2017). One of the challenges is also to defuse conflict between pedestrians, cyclists and scooter users and to improve relations between these different modes of transport. In 2018, the city of London unveiled its action plan to become "the most walkable city". The city aims to go from 6.4 million daily walks in 2018 to 7.5 million walks in 2024. The main measures adopted involve designing and adapting public space for pedestrians; increasing the number of pedestrian crossings, adopting intelligent traffic lights and prioritising pedestrians in all transport infrastructure (London, 2018).

In the cities of developing countries there are often more obstacles to walking: absent or poor-quality pavements, unsafe road infrastructure that requires long detours or the use of motor vehicles, and so on. In these urban centres where walking is an important means of transport, it is therefore mainly a matter of making pedestrian areas safe. *Bloomberg Philanthropies Initiative for Global Road Safety* is an initiative that helps 10 developing cities improve road safety particularly for pedestrians and cyclists. For example, in the Brazilian city of Fortaleza, traffic-calming measures have been adopted: the introduction of 30-zones, chicanes forcing vehicles to slow down, kerb extensions, raised pedestrian crossings, etc. have reduced road mortality by 40% between 2014 and 2018 (Vital Strategies, 2019).

Initiatives to promote active mobility are growing in Europe: Thriving Streets, launched in January 2020, brings together 10 European cities to redesign street usage by encouraging active modes and re-invigorating the local economy. Space4People began in 2019 and focuses on the place of the pedestrian in the city by re-imagining urban space. Ten medium-sized European cities are involved in this. In Spain, Barcelona's "superblocks" model is a success: demarcating areas smaller than a neighbourhood, in which space is dedicated to soft mobilities, has made the city more accessible to its inhabitants, promoting social cohesion and economic development. The concept is replicated in the cities of Vitoria, La Coruña, Ferrol and Viladecans (Energy Cities, n.d.). Brussels also drew on the Barcelona model when launching its mobility plan in 2019: the city will be divided into some 50 peaceful neighbourhoods in which traffic will be severely restricted (L'Echo, 04/04/19).

4. "Improve": the structure of the automobile market continues to annihilate progress made elsewhere

• OVERVIEW: IN 2019, THE AUTOMOTIVE MARKET CONTINUED ON ITS DOWNWARD TRAJECTORY THAT HAD BEGUN IN 2018 • Progress in improving the energy efficiency of private cars remains poor: between 2010 and 2018, the energy intensity of this mode decreased from 2.2 megajoules per passenger-km (MJ/pkm) to 1.9 MJ/pkm, a reduction of only 13.5% in energy consumption in 18 years (IEA, 2020). **While technological advances have led to the production of more efficient and less polluting engines, these gains are being offset by increased vehicle weights and rates of ownership.** Moreover, the share of electric cars is still low, representing 0.8% of the entire automotive fleet worldwide in 2019, an increase of 0.2 percentage points in one year (IEA, n.d.).

INDICATOR
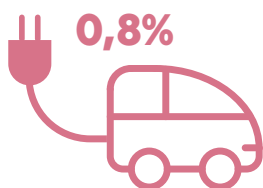
0,8%

0,8% of the global vehicle fleet in 2019 that was electric. + 0,2% compared to 2018

In 2019, global car sales fell for the second consecutive year. The decline was particularly marked in the United States (-11%) and China (-10%), while sales increased slightly in Europe (+1%). A total of 64.3 million cars were sold, 6.3% fewer than in 2018. In 2018, the market had already contracted by 2.9% (OICA). All vehicles combined, sales amounted to 91.4 million vehicles, a contraction of 4.5%. The health crisis and the imposition of travel restrictions in many countries has hit the automobile industry hard: in the first half of 2020, vehicle sales fell by 37% in Europe, 20% in China and 24% in the United States (EV-Volumes).

• CHINA BLOWS HOT AND COLD ON AN EV MARKET SLOWED DOWN BY THE HEALTH CRISIS •

In this depressed market, sales of electric vehicles (electric and plug-in hybrids) reached a new record in 2019 with 2.26 million cars sold, up from 1.96 million in 2018: an increase of 15%. Nevertheless, this increase is less significant than in previous years: growth was 70% between 2017 and 2018. There are wide variations across the regions with strong growth in Europe (+44%) and a decline in Japan (-16%) and the United States (-12%) for all electric vehicles, including hybrids (EV-Volumes). Despite market growth, sales of electric vehicles accounted for only 2.6% of total sales in 2019 (IEA).

In China, sales rose by 3% in 2019, but this annual reading must be tempered by the results for the second quarter of 2019: sales collapsed following the decline in purchase subsidies from 10,000 dollars to 3,607 (Forbes, 2019). The Chinese government's state purchasing support has proven to be the driving force behind the world's largest electric vehicle market, with 41% of new buyers expressing their desire to purchase an electric model (IPSOS, 2020). Initially planned to be discontinued in 2020, subsidies were eventually maintained and extended to 2022 to support the market during the Covid-19 pandemic. The new version of the programme, announced in July, is still limited to two million vehicles and limits technical criteria but has helped boost sales by 30% following a 42% fall in the first half of the year (BloombergNEF, 20/08/20). Major cities such as Changsha, Xiangtan, Foshan and Guangzhou have also introduced their own subsidies for electric vehicle purchase, since the fight against air pollution remains a local government priority (electrive, 17/03/20).

KEYS TO UNDERSTANDING

THE EXPANSION OF CHINESE MANUFACTURERS INTO EMERGING ELECTRICAL MARKETS

The Chinese State and its planning force have been central to the emergence of automotive champions at the forefront of electric power: first by subsidising R&D and then, as early as 2009, by introducing a system of purchase subsidies to support municipalities in the acquisition of electric fleets, which it then extended the following year to the purchase of individual passenger vehicles (MacroPolo, 08/07/20) A symbol of this success, the manufacturer BYD, based in Shenzhen, in the country's manufacturing heartland, was still the worlds's leading manufacturer of electric vehicles until December 2019, before being overtaken by Tesla (Clean Technica, 10/12/20).

Weary of the sector's dependence on government subsidies, China's policy now relies on two pillars: setting up foreign production lines in China, and exporting domestic models to emerging markets. The first goal is under way: in December 2019, Tesla launched its first *Gigafactory* not on American soil, in Shanghai. The same year also marked a real turning point in the penetration of Chinese manufacturers in Latin America. According to the latest data collected by the University of Rio's *E-Bus Radar* project, in April 2020 there were 1,229 electric buses operating in South American cities, 1,045 of which were sold by BYD in 2019 (Dialogo Chino, 29/06/20). These figures have not yet been updated with certain orders; for example, Bogota, which is to receive 379 new electric buses from BYD. According to Bloomberg, 99% of the world's electric buses are produced by Chinese manufacturers. And emerging manufacturers cannot do without Chinese technological know-how. In Uganda, for example, the state-owned company Kiira Motors Corp opened its first electric bus plant last June but is still dependent on batteries manufactured in China (Bloomberg, 11/08/20).

BOX 4

A number of other countries have included state aid for the purchase of electric vehicles in their post-lockdown stimulus plans: France, for example, where buyers receive € 7,000, or Germany (€ 9,000). Despite the unique circumstances, as a result of this aid, sales increased by 57% on the continent in the first half of 2020. Sales of the *Zoe* have reached 38,000 units, making it the best-selling model in Europe (Bloomberg, 24/07/20). In France, the market share of electric cars increased from 2.5% to 9.1% between the first half of 2019 and the first half of 2020 (CCFA, 2020), compared to 68% in Norway and 7.6% in Germany.

FIGURE 7

PROGRESSION OF SALES OF ELECTRIC CARS (HYBRID INCLUDED) IN THE FIRST HALF OF 2020

Source: EV-Volumes
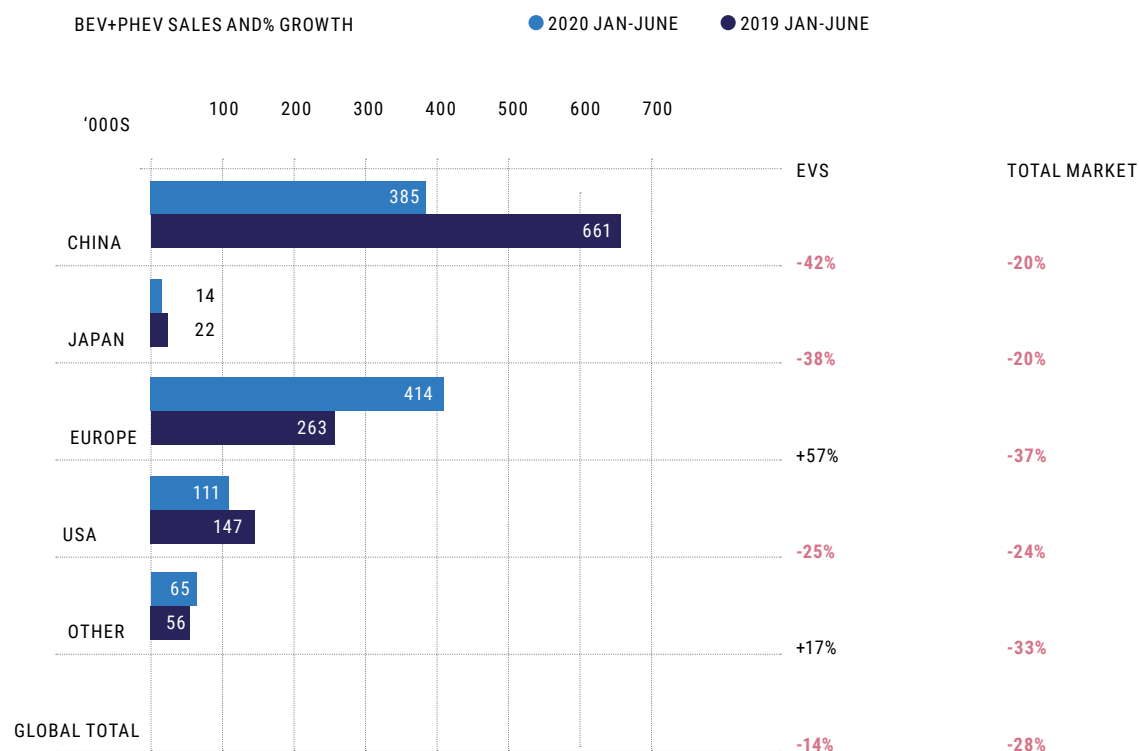
Electrification is also taking over with motorcycles, scooters and mopeds. Sales increased by 60% in the European Union between 2018 and 2019 but the market is still very limited: only 74,000

electric motorbikes were sold in 2019, representing a 5% market share ([Acem](#)). In India, the government unveiled the *National Clean Air Programme* in January 2019, and plans to ban motorcycles with combustion engines from 2025. India is the largest motorcycle market in the world, ahead of China, with over 20 million vehicles sold per year ([AsiaFundManagers](#), 01/07/20). While sales of electric motorcycles total 160,000 units annually, the manufacturer Okinawa Autotech is investing in a plant capable of producing one million electric scooters ([Asian Review](#), 25/10/19).

• RESTRICTING SUPPLY: NORMATIVE POWER BETWEEN THE LOOPHOLES AND THE EVASIVE STRATEGIES OF ACTORS • Electric vehicles have been a way for European manufacturers to anticipate the emissions standards that came into force in 2020. In 2019, car manufacturers were still far from the EU's target of 95 gCO_2/km. For the second consecutive year, average emissions increased by 1 gCO_2/km, reaching 122 gCO_2/km ([EEA](#), 13/08/20). In 2020, due to the increase in sales of electric models, emissions were reduced and manufacturers are on average 7 gCO_2/km above their targets ([ICCT](#), 02/09/20). In Europe, manufacturers have launched numerous electric models with the aim of getting average emissions below the 95 gCO_2/km threshold by the end of 2020 for all cars sold.

Adopted by the European Parliament in April 2019, the Regulation setting CO_2 emission performance standards for new passenger cars and new light commercial vehicles came into force on 1st January 2020 ([Regulation (EU) 2019/631](#)).

The regulation sets a new standard limiting the average emission of the EU fleet to 95gCO_2/km. This average applies to all vehicles sold by a manufacturer, so units exceeding this limit can be sold by offsetting them with sales of a model with much lower emissions. However, this value also takes into account the mass of the cars: the heavier the range, the higher the limit. Conversely the emissions limit is stricter for manufacturers of lighter cars.

For example, the limit is set at 92 gCO_2/km for manufacturers such as Renault or PSA-OPEL, whereas it is set at 103 gCO_2/km for BMW and even 109 gCO_2/km for Volvo ([ICCT](#), 02/09/20). This regulation therefore has the paradoxical effect of not encouraging any reduction in the weight of vehicles. Hence why in France the Citizen's Convention recommends introducing a larger penalty based on vehicle weight. A tax of this sort exists in Japan, for example and, together with other devices, helps to deter private car possession ([Case study Japan - Transport, 2019](#)).

KEYS TO UNDERSTANDING

CARBON CREDITS FOR DODGING EMISSIONS LIMITS

Tesla, the largest electric car manufacturer in the United States, has reportedly sold nearly [1.7 billion dollars](#) of carbon credits to its competitors General Motors and Fiat-Chrysler since 2012. These credits are awarded for each "zero emission" vehicle sold by Tesla through a multitude of federal and state programmes, such as the Zero Emission Vehicle programme in California, the National Highway Traffic Safety Administration (NHTSA) and the Corporate Average Fuel Economy (CAFE) standard. By purchasing credits, manufacturers not falling within the [standards](#) set by the environmental protection agency (EPA) offset their emissions at a lower cost than would be required to commit to genuinely converting their ranges to electric motorisation. However, the Obama administration's automobile sector energy efficiency goals had already been rolled back by the Trump administration in March 2020 ([Los Angeles Times](#), 31/03/20). Nevertheless, the potential return to the White House of the Democrats, who are calling for strengthening of these standards, is forcing manufacturers to envisage tightening the rules. For example, Tesla's sales of carbon credits had already reached 354 million USD in the first quarter of 2020, a record 64% increase over the same period in 2019 ([Car and Driver](#),

22/07/2020).

The same is true in Europe, where Fiat-Chrysler chose to "partner" Tesla, by paying 1.8 billion euros over three years to its competitor (Les Echos, 07/04/20), a possibility offered by the well-known European regulation on emissions standards, which allows manufacturers to form pools to combine their environmental performance and achieve their emissions targets (Regulation (EU) 2019/631, Art. 6). Fiat-Chrysler benefited from this by reducing its average emissions by 6gCO_2/km (ICCT, 2020).

Vehicle owners are not left out either. California's FairWarning NGO reveals the EPA's condemnation of several companies in the United States for selling "delete kits", devices that allow owners to trick the emissions tests and thus get around the *Clean Air Act* standards. These kits are available as software or in the form of a physical device. Approximately 500,000 diesel pick-ups have been fitted with these kits since 2009 (The Guardian, 09/09/20).

BOX 5

• VEHICLE EFFICIENCY HINDERED BY SHILLY-SHALLYING OVER PALM OILS AND THE DOMINATION OF SUVS • Transport & Environment have reported that the use of palm oils in biofuels increased by 7% in the EU in 2019, reaching 4.5 million tonnes, "*100 times more palm oil [...] than is in the 40 billion Oreo cookies consumed worldwide every year.*" (T&E, 02/07/20). Over the 10 years that have passed since the introduction of the renewable energy Directive, which encourages the development of biofuels, the consumption of rapeseed, soybean, sunflower and palm oil has increased by 46% in Europe from 8 million tonnes in 2009 to 11.7 million tonnes in 2019. According to the latest EU data, the 45% growth in imported palm oil since 2008 has caused deforestation. In early July, an NGO coalition relaunched the *#NotInMyTank* campaign to push the governments of France, Germany, Italy, Spain and the Netherlands to stop food-based biofuel subsidies next year (T&E, 23/07/20).

Indonesia, the world's largest producer of palm oil, also relies on its surpluses to increase its energy independence by subsidising the incorporation of palm oil into biodiesels. The programme is funded by a tax on exports of crude palm oil. Introduced in December 2019, biodiesel B30 (30% palm oil) was to be rapidly superseded by B40 (40%), but falling oil prices forced Indonesia to delay its introduction this year (S&P, 19/05/20) and to increase the export tax to support the programme in the face of the more competitive fossil-diesel (S&P, 19/08/20).

Globally, the main barrier to the shift to low carbon in the sector remains the ever-increasing success of SUVs (**fig. 8**). Although an IEA report pointed to SUVs as being the second most important cause of emission growth in 2018, their sales reached a new record with a 40% market share in 2019 (The Guardian, 01/09/20). Their success also continues in Europe with 38.3% of vehicles sold (Jato, 19/02/20) and a new record was reached in the United States, where one of every two new vehicles sold is an SUV (IHS Markit, 06/10/20). The Covid-19 crisis does not seem to be affecting this sector: in a March 2020 survey, 47% of new Chinese buyers wanted an SUV (IPSOS, 2020). This trend has continued, and the Chinese manufacturer Great Wall Motors saw its sales increase by 30% between June 2019 and June 2020 (China Daily, 09/07/20). In India, SUV sales increased by 87% from July 2019 to July 2020 and manufacturers are launching new models (carwale).

FIGURE 8

SUV SHARE OF TOTAL CAR SALES ON KEY MARKETS, 2010-2019 - *Source: IEA, 2020*

● UNITED STATES ● EUROPE ● CHINA ● INDIA ● SOUTH AFRICA ● WORLD
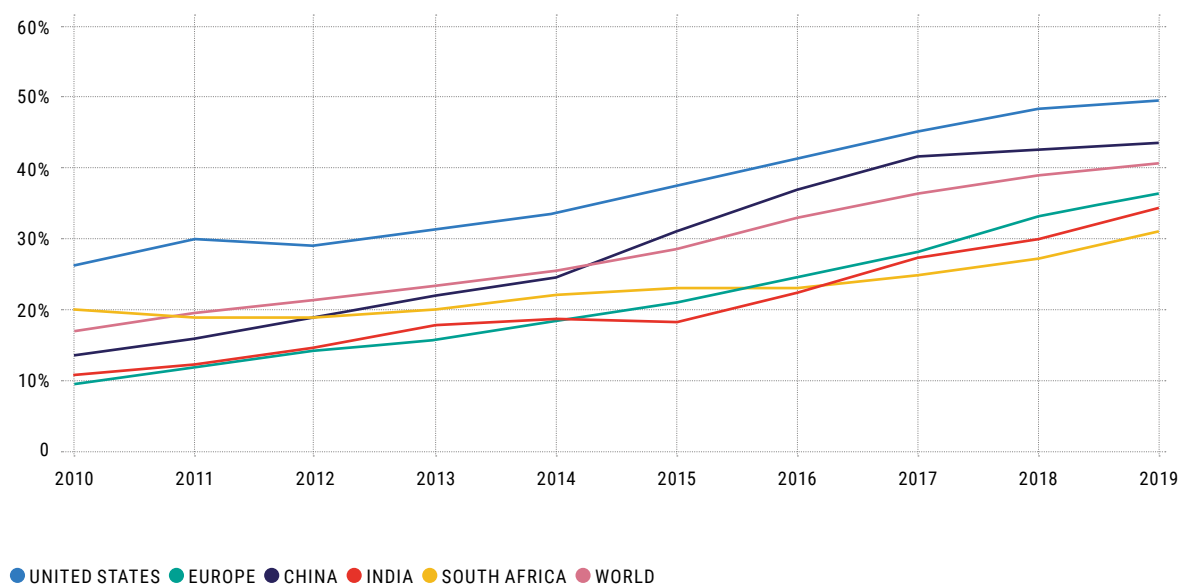
FIGURE 9

LOCALISATION OF URBAN ACCESS REGULATIONS IN EUROPE - *Source: Urban Access Regulation*

● LOW-EMISSION ZONES
● URBAN ROAD TOLLS
● OTHER ACCESS REGULATIONS
● POLLUTION EMERGENCY
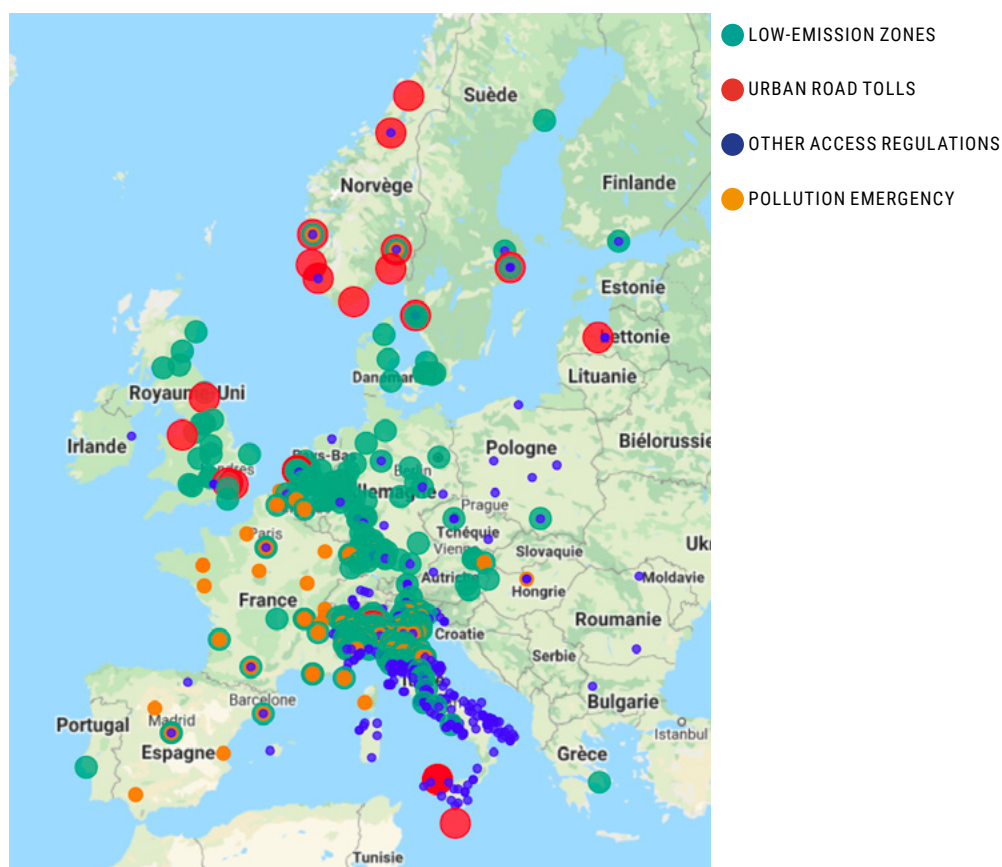
There are growing calls in civil society opposing these more polluting vehicles, which are also more dangerous and occupy more space in cities: in Germany, demonstrations have taken place in Berlin to ban them from the city (The Guardian, 07/10/19). In the United Kingdom, the think-tank New Weather Institute is calling for a ban on SUV advertising, drawing a parallel with the ban on cigarette advertising (The Guardian, 03/08/20). Cities are also taking steps to discourage the use of the most polluting vehicles. There are about 250 cities in Europe with low emission areas (**fig. 9**, Transport & Environment, 2019).

250 cities

Number of european cities that have established low emissions areas.

In London, residents have only one year left to get rid of their most polluting vehicles before the extension of the Ultra-Low Emissions Zone (ULEZ) in October 2021, when the zone will become 18 times larger than when it was introduced in 2019. Owners of vehicles not complying with the Euro 6 standard will be charged a tax of £12.50 per day within the zone, which could potentially affect almost 350,000 people (The Guardian, 04/10/20). The city of London has created special scrapping programmes to help the lowest-income households, charities and small businesses to finance the purchase of compliant vehicles to replace their old vehicles (Transport for London).

The system is beginning to prove its effectiveness in terms of air pollution alone. In August 2020, the City Council revealed that nitrogen dioxide (NO_2) emissions in central London had fallen five times faster than the national average since 2016, when Mayor Sadiq Khan began his term of office (London, 07/08/20). However, they still remain twice as high as in urban areas in the rest of the country.

Since the advent of Covid-19, we have observed that several cities ready to introduce traffic restrictions on the most polluting vehicles have postponed their projects. This is particularly the case in Scotland where the government has postponed introduction of the national scheme for low-emission zones in Glasgow, Edinburgh, Dundee and Aberdeen until 2022 (Evening Express, 26/08/20).

Many cities have also announced traffic bans of some kind in the longer term. Amsterdam, Austin, Berlin, Liverpool and Jakarta have brought the number of cities that have signed the C40 Fossil Fuel Free Streets Declaration to 34. One of them, the metropolis of Seoul, has since revealed its "No Diesel" plan, aimed at removing these vehicles from the city's public fleets by 2025 (Electrive, 06/08/20), in addition to subsidising the conversion of 700 taxis into electric vehicles (Electrive, 16/04/20). The State of California also announced a ban on petrol vehicle sales in 2035, with manufacturers being obliged to gradually increase the share of electric engines in their ranges to 100% (The New York Times, 23/09/20).

CONCLUSION

Emissions from road transport showed some signs of slowing down in recent years and seemed to be approaching a plateau. However, until this year, manufacturers' and consumers' appetite for ever heavier vehicles limited efficiency gains, and demand for mobility continued to grow. The intensity of the Covid-19 crisis has succeeded in placing the reduction of distances, the bringing together of services and the massive deployment of soft mobility (cycling, walking, etc.) at the heart of the debate. However, health fears have damaged public transport and highlighted the weaknesses of the free-floating economic models, whose leaders are being pushed towards concentration.

RAIL TRANSPORT

The climate is not yet conducive to the expansion and modernisation of the network

• KEY TAKEAWAYS •

☀ **The expansion of the global rail network in 2019 is more in line with the pursuit of economic growth and access to strategic resources than with a desire to decarbonise the mobility of passengers and goods. China is the sector's main investment force, internationally through the One Belt One Road initiative, and also through the expansion of its national network, which accounts for 2/3 of all high-speed lines in the world.**

☀ **The electrification of lines continues to expand globally: today, ¾ of the passenger network and half the freight network are electrified. In some places, such as India, the lockdown has made it possible to undertake massive track electrification works. Less costly in terms of infrastructure, hydrogen-powered trains are on the rise in Europe, their growth notably driven by Alstom, strengthened by the takeover of its competitor Bombardier Transport.**

☀ **Passenger transport by rail is still increasing (+3% between 2017 and 2018), but remains concentrated in a few countries and driven by the major Chinese high-speed line projects, climate and energy benefits of which are weakened by low demand. Where networks are already well developed, urban densification policies (Japan) and economic incentives (lower VAT on tickets in Germany) are proving effective in organizing a modal shift**

☀ **Rail freight remains closely linked to coal transport and access to strategic resources. In East Africa, it accompanies the major projects for the exploitation of ores and hydrocarbons (Kenya, Burundi and Rwanda), though some projects have been slowed by financial difficulties. On the rise in Asia, North America and Russia, but challenged globally by road freight, rail freight has proven to be resilient during the pandemic: for carrying health equipment from one country to another, but also for driving transcontinental freight activities along the OBOR network, which grew by 41% in the first half of 2020.**

1. Status of international rail emissions

In 2019, direct emissions from rail transport amounted to 101 $MtCO_2$, the same level as in 2018 (+0.4%) (Enerdata). This mode of transport is the most carbon-efficient of all engine-based modes of transport, with the average carbon intensity of non-urban rail being 14 gCO_2e per passenger-kilometre (pkm) (**fig. 10**). While it accounts for approximately 9% of global passenger transport and 7% of global freight transport (IEA, 2020), train only accounts for 1.3% of total direct CO_2 emissions of transport sector. This low impact can be explained by the high rate of electrification of the network: about three-quarters of rail passenger transport and almost half of rail freight are currently electrified. Europe and Japan have the most electrified networks (REN21, 2020).

FIGURE 10

EMISSIONS OF THE DIFFERENT MODES OF TRANSPORT IN GCO_2E/PKM. IN YELLOW, THE CARBON INTENSITY RANGE. IN GREEN AND BLUE, THE CARBON INTENSITY OF NON-URBAN AND URBAN TRANSPORT RESPECTIVELY
Source: IEA, 2020
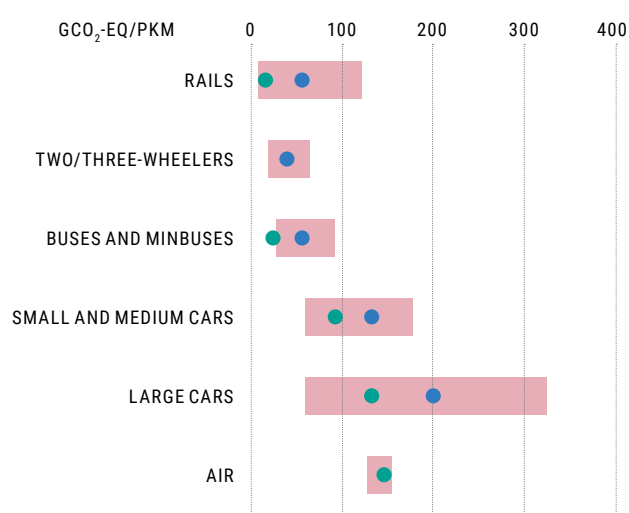
2. An expanding passenger network, but concentrated in China and on high-speed trains

Demand for rail transport continues to grow steadily. It amounted to 4,069 billion passenger-kilometres in 2018, an increase of 3% compared to 2017. The trend is very different depending on the region: while passenger transport fell between 2017 and 2018 on the African and American continents, it increased in Europe, Asia and Russia (+1.4%, +3.3% and +5.3% respectively). It is still concentrated in a few countries, with China, India, Japan, Russia and the European Union accounting for 90% of traffic in 2019. In the same year, demand reached 1,438 billion pkm in China and 1,157 billion pkm in India (UIC, 2020). These two countries therefore account for more than 60% of world passenger transport, i.e. almost five times the volume of passenger rail transport in Europe and almost 40 times that of the African continent.

FIGURE 11

EVOLUTION OF PASSENGER TRANSPORT DEMAND BETWEEN 2010 AND 2018 (MILLIONS OF PKM)

Source: UIC, 2019

- AFRICA
- AMERICA
- ASIA & OCEANIA
- EUROPE
- RUSSIA
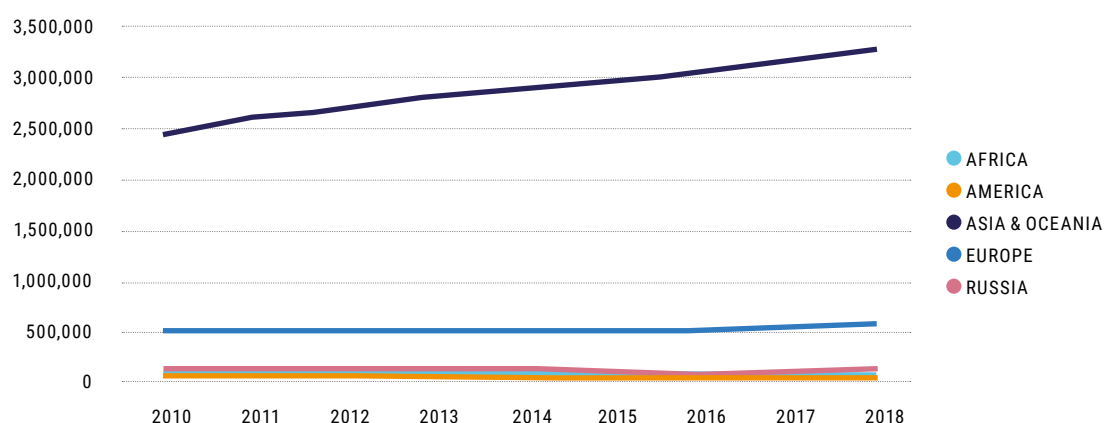
• DRIVEN BY CHINA, THE EXPANSION OF THE WORLD RAIL NETWORK IS DISCONNECTED FROM THE CLIMATE CHALLENGE • Between 2017 and 2018, the growth of the rail network amounted to 0.5%, with just over 5,000 km of additional lines (UIC). Most of this growth took place in Asia, while the network shrank on the European and American continents. The trend of previous years continues with the rapid expansion of the Chinese high-speed train network. In 2019, two new lines totalling 750km were opened (International Railway Journal, 27/12/19) and the China National Railway (CR) network now totals almost 30,000 km of high-speed lines (UIC, 2020). While China's high-speed rail network was non-existent ten years ago, China now accounts for more than two-thirds of the world's infrastructure (IEA, 2020). The speed of expansion of this network is unprecedented and the pace continues in 2020.

INDICATOR

2/3

Of high-speed lines are concentrated in China

In January, the world's fastest driverless train line was opened in preparation for the 2022 Winter Olympics. It makes it possible to travel the 174 km between Beijing and the ski resorts of Zhangjiakou in just 45 minutes (The Guardian, 09/01/20). However, the Covid-19 crisis has slowed down the expansion of the network, as China Railway (CR) is facing labour shortages as well as disruptions in the logistics chain. In the first quarter of 2020, CR's infrastructure investments fell by 21% compared to the first quarter of 2019. But this delay was made up for as soon as restrictions were lifted and by the first half of 2020 CR had opened 1,178 km of new track, including 605 km of high-speed lines, for an investment of $45.9 billion (an amount 1.2% higher than in the first half of 2019). CR's target for 2020 is to create 4,400 km of lines, including 2,300 km of high-speed lines (International Railway Journal, 17/08/20).

KEYS TO UNDERSTANDING

HIGH-SPEED LINES WITH HIGHER EMISSIONS

The expansion of this infrastructure produces high emissions and the production of steel and cement needed for construction has a direct impact on energy consumption. In China, these major projects have weighed on coal consumption, which grew by 1% in 2019 (Enerdata). In order to assess the climate impact of these new lines, it is also necessary to assess emissions during the operational phase. A life cycle analysis of the Beijing-Shanghai line (Lin et al., 2018) thus showed that the carbon footprint of this line is higher than that of other high-speed lines in other regions of the world. As the electricity is mainly produced using coal, it is highly car-bon intensive (see Sectoral Review 2020 - Energy, Climate Chance) and the operational phase accounts for 70% of emissions (**fig. 12**). The share of these emissions related to electricity consumption is expected to decline in the coming years with the growth of renewables in the electricity mix.

FIGURE 12

CO$_2$ EMISSIONS PER PASSENGER PER KM OF DIFFERENT HIGH-SPEED TRAINS
Source: Lin, J., et al. (2018)
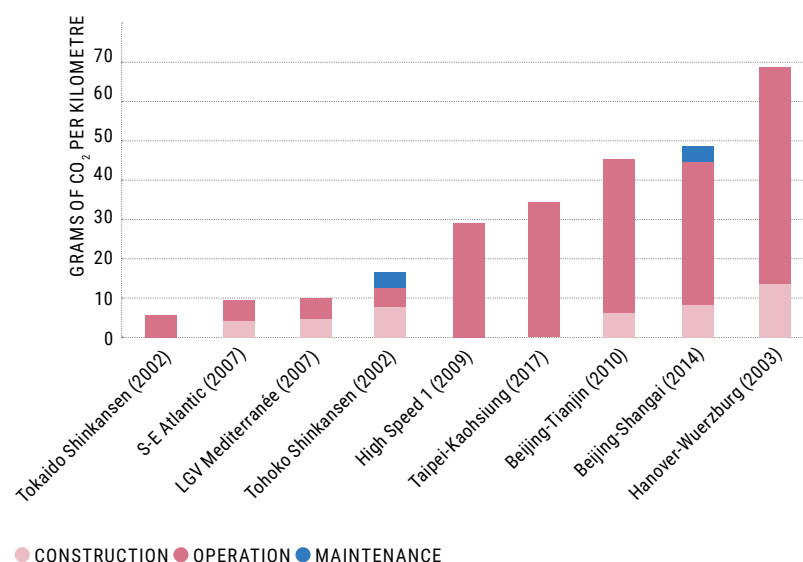
BOX 6

• PASSENGER MODAL SHIFT POLICY • The shifts from road and air transport to rail are key indi-cators in the climate impact assessment of a railway project. Thus, in January 2020, in order to encourage the modal shift to rail, the German government reduced VAT from 19% to 7% on train journeys of over 50 km. The operator, Deutsch Bahn, passed this reduction on to its fares, thereby reducing ticket prices by about 10% (T&E, 16/01/20). In France, the railways have not been forgotten in the recovery plan announced by the government in September 2020: 4.7 billion euros have been allocated to this sector with the aim of improving the quality of the network and increasing the range of trains available. The plan notably includes investment, at regional level, in the lines serving less densely populated areas as well as the redevelopment of night train lines (economie.gouv).

The inauguration of the Beijing-Shanghai line has enabled the demand for air transport on this route to be reduced by nearly 40% over the 2010-2012 period (China Dialogue, 05/04/19). Moreover, the annual growth in demand for high-speed rail transport is higher than that of domestic air transport in China, which reflects the ability of these major projects to achieve a modal shift from

air to rail (IEA, 2020). However, the current expansion of the high-speed network is moving towards less populous cities, where demand is lower. These lines currently operate at only a fraction of their capacity and are not financially profitable. The concept of network development responds more to a need to stimulate economic growth than to the imperatives of climate change (Bloomberg, 18/08/20).

REVITALISATION OF REGIONAL NETWORKS IN JAPAN FOR A MODAL SHIFT

With a modal share of 33%, one of the highest in the world, the Japanese railway network is extremely efficient. Strong national policies of rail-led urban densification and a set of laws penalising the use of private cars (vehicle weight tax, mandatory vehicle inspection programme, toll motorways and some of the most expensive tolls in the world) have driven the development of rail in this country. Above all, rail is at the heart of the State's regional revitalisation strategy and, since 2006, cities have been obliged to draw up low-carbon development plans that include public transport. The State also provides communities with the financial and legal means to rehabilitate rail transport networks. The "*Act on Revitalization and Rehabilitation of Local Public Transport Systems*" is a vertical separation mechanism that separates the ownership of railways from their operation. Local governments can thus revitalise lines that are no longer profitable with financial assistance from the state. The cities of Fukui, Sapporo and Kyoto have thus rehabilitated networks, notably by introducing tourist trains or trams. Japanese cities are among the best equipped in terms of urban train infrastructure with, in 2017, 4,000 km of metro and more than 20 million passenger-kilometres per kilometre of metro rail (see Case Study Transport-Japan, 2019).

BOX 7

• THE RAIL COMPANIES ARE ROLLING OUT RECHARGEABLE BATTERIES AND CONTINUING TO DEVELOP HYDROGEN • The electrification of passenger rail transport has grown strongly in recent years, rising from 60% of demand in 2000 to 75% in 2019 (IEA, 2020). This electrification continues, particularly in India where, in 2018, the government announced the complete electrification of the network by 2022. In 2019, this project had been delayed and despite the electrification of certain lines, the absence of electrical substations meant that diesel trains were still running on these lines. Between 2018 and 2019, diesel consumption in the railway sector therefore stagnated in India (Newsclick.in, 16/06/19). The Covid-19 pandemic, which led to passenger traffic on the entire Indian network coming to a halt, enabled Indian Railways to carry out major works on the network, including the construction of viaducts and the doubling and electrification of tracks (International Railway Journal, 29/06/20).

INDICATOR

75%

75% of passenger train lines that are electrified in the world

However, the electrification of lines is only really effective when they are powered by clean energy. For example, in Japan, where the electricity mix is still very carbon-intensive, Tokyu Corp. has started operation of the Setagaya line in Tokyo with electricity generated 100% from renewable energy (nippon.com, 25/03/19). In the United Kingdom, a pilot project for a line powered directly by a solar power plant was launched in August 2019. Similar projects have also started in Australia and Argentina (Railway Technology, 12/09/20).

The industrial development of trains equipped with rechargeable batteries or hydrogen fuel cells in the sector is beginning to attract the favour of more and more European territories and railway companies. These trains are less costly than infrastructure works and ensure a faster transition from diesel to electric since they can run on non-electrified lines. In the United Kingdom, where 58% of the network is not electrified, Hitachi Rail has signed an agreement with Hyperdrive Innovation to develop battery-powered trains, manufactured and assembled on British soil (Railway Technology, 07/07/20). In France, the Occitanie region, which is already committed to hydrogen trains, is going to experiment with Bombardier's rechargeable battery-powered trains to replace its diesel equipment (Région Occitanie, 07/02/20). But it is the French group Alstom, the historic railway construction company, that is currently doing well.

Two years ago, Alstom began operating its first hydrogen-powered train, the *Coradia iLint*, on a 100 km line in Lower Saxony, Germany. The train is equipped with combustion cells to generate electricity and lithium-ion batteries to store it. On the strength of this success, the company won a tender in 2019 to deploy 27 hydrogen trains in the Frankfurt-am-Main region, replacing diesel trains (International Railway Journal, 21/05/19). Since then, tests have been carried out in the province of Groningen in the Netherlands (Alstom, 06/03/20) and a trial run by the Austrian railway company ÖBB began in September 2020 (Alstom, 11/09/20). In June 2020, a five-year agreement was signed with the gas group Snam to develop hydrogen trains in Italy (Reuters, 04/06/20). Finally, Alstom is in the process of becoming the world's number two railway company by buying out its Canadian competitor Bombardier Transport, which is also investing in the development of battery-powered trains (La Tribune, 16/09/20).

EXPERIENCE FEEDBACK

IN FRANCE, THE OPENING UP OF THE RAILWAYS TO COMPETITION HAS LED TO THE EMERGENCE OF NEW PLAYERS TO REHABILITATE ABANDONED LINES

In France, the opening up of domestic passenger transport to competition, provided for in European law since 2012, did not become effective until December 2020: local authorities are now authorised to issue calls for tender for the operation of lines to companies other than the incumbent operator SNCF, which has had a monopoly since 1937. The first private trains will be running as early as 2021 and many French and foreign companies have already staked their claims in certain regions: Transdev, RATP, Italy's Trenitalia, Germany's Deutsche Bahn, the Netherlands' Abellio and Hong Kong's MTR. Social movements and the Covid-19 epidemic have already delayed the progress of some projects (Challenges, 07/07/20). Despite much resistance, as evidenced by the strikes by SNCF staff at the end of 2019, some unexpected players are seizing the opportunity offered by this opening up to competition to put forward projects to rehabilitate abandoned lines rather than compete with the SNCF on existing lines. To this end, Railcoop was born, a railway cooperative company founded in 2019 in the Lot region, which aims to take over regional lines, night trains and abandoned freight lines. Its statutes are based on the principles of the social and solidarity economy. Each individual member, whether a natural person or legal entity, thus receives one vote at the general meeting,

on an equal footing with any other member, regardless of their investment, and 57.5% of their profits must be reinvested in the company. Railcoop currently has 222 members registered on its website. In particular, the company wants to take over passenger transport activity on the Lyon-Bordeaux line, which was closed in 2014, and to run freight trains between Figeac and Toulouse. To do so, it must obtain a railway company safety certificate and achieve a share capital of €1.5 million (Reporterre, 02/07/20; L'Usine Nouvelle, 12/06/20).

BOX 8

3. Rail freight, a rising power whose climate efficiency depends on its market services

Rail freight grew for the second consecutive year, up 4.6% between 2017 and 2018, while activity stagnated over the 2011-2016 period. In 2018, demand amounted to 11,190 billion tonne-kilometres (UIC, 2019), i.e. around 7% of freight transport (IEA, 2020). Freight activity increased mainly on the American and Asian continents and in Russia (+3.3%, +6.8% and +4.2% respectively between 2017 and 2018), while it stagnated in Africa and Europe (UIC, 2019). The structural trend of rail freight is declining, with a modal shift towards road freight. This shift is explained by the growing demand for rapid deliveries of lighter, high value-added goods. The flexibility and capillarity of the network are assets of road freight in this context.

• RAIL FREIGHT STILL MAINLY DEDICATED TO COAL • The history of rail freight is closely linked to that of coal and the development of the mining industry often goes hand in hand with that of the rail networks. Even today, the largest rail freight line opened in China in September 2019 is exclusively dedicated to coal transport. At a cost of US$27 billion, the 1,813 km Haoji line will carry 200 million tonnes of coal per year from the mines in the North to the thermal power stations in the South, which used to be transported mainly by sea (The Japan Times, 20/09/19). But in many regions, the decline of coal is a challenge for the sector.

INDICATOR

28%

28% of the global rail freight that is used for the transport of coal and fossil fuel

Globally, coal and fossil fuels account for 28% of rail freight (IEA, 2020) and are an important source of income for companies in the sector. In the United States, coal accounts for 30% of rail freight volume and 13% of its revenues (Association of American Railways, 2020). Coal production in the United States has declined sharply, from 1.17 billion tonnes in 2008 to 705 million tonnes in 2019, and this decline is expected to continue, with financial consequences for freight. By 2030, coal demand in the United States is projected to have fallen by 50%, resulting in losses of $5 billion for US railway companies (Moody's, 04/09/2020). The situation is similar in South Africa, where a third of rail freight is dedicated to coal. In 2019, the reduction in coal exports was one of the factors that led to a 4.9% drop in freight volume for the operator Transnet (Transnet, 2019)

PASSENGER TRANSPORT SUBSIDISED BY COAL FREIGHT

In India, the interconnection between the rail network and coal is even more pronounced: in 2017, 60% of the coal that was consumed in thermal power stations to generate electricity was transported by rail, and it accounted for 48% of the freight in tonnes carried by Indian Railways (IR) and 45% of its revenue.

With 1,157 billion pkm in 2019, IR is by far the largest passenger rail operator. Comparatively, this figure represents more than 12 times the volume of passengers carried by SNCF in 2019 (UIC, 2020). IR's passenger fares are among the lowest in the world and Indian Railways' business model is based on subsidising the price of the passenger ticket by charging a higher rate per tonne of goods transported. India thus has the lowest passenger to freight fare ratio in the world: 0.24, compared to 1.9 in Japan or 1.5 in Germany. While growth in passenger transport is higher than that of freight, the deficit in the passenger segment has widened and Indian Railways has increased freight tariffs sharply to support this pattern, especially since 2012.

FIGURE 13

GROWTH OF PASSENGER AND FREIGHT TARIFFS IN RS/PKM AND RS/TKM
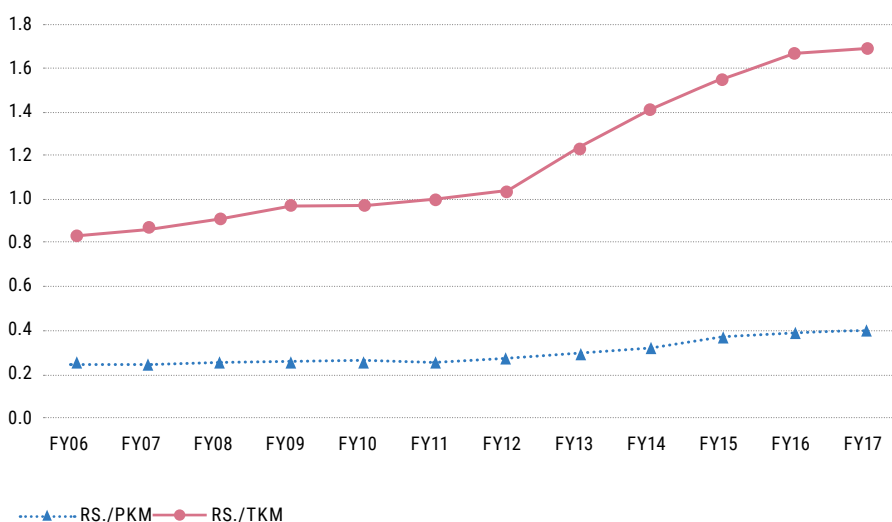
This strategy is unsustainable in the long term, as high prices risk causing a modal shift to road transport (Brookings, 2018). The increase in coal transport tariffs means that electricity tariffs have also risen. Moreover, maintaining this tariff system implies that coal demand will remain constant. Slower economic growth in India, improved efficiency of new thermal power plants and the deployment of renewables are holding back coal. In 2019, after about 50 years of growth, coal consumption declined for the first time in India (see Climate Chance, Sectoral Review - Energy 2020). IR, which depends on coal to subsidise passenger transport, will therefore have to reorganise.

BOX 9

British Rail freight, as elsewhere in Europe, has historically been dependent on the transport of raw materials for heavy industry. The sector therefore suffered successively from the closure of coal mines in the 1980s and the closure of coal-fired power stations as part of the transformation of the energy mix since 2015 (cf. Case study Energy - United Kingdom, 2019). From 8 billion tonne-kilometres in 2006, demand for coal transport was only 0.37 billion tkm in 2019, or 2% of total rail freight demand (**fig. 14**). Between 2018 and 2019, it fell by a staggering 68%.

GROWTH OF RAIL FREIGHT IN THE UNITED KINGDOM IN BILLION TONNE-KILOMETRES - *Source: Office of Rail and Road*
(2020). Freight Rail Usage and Performance 2019-20 Q4 Statistical Release
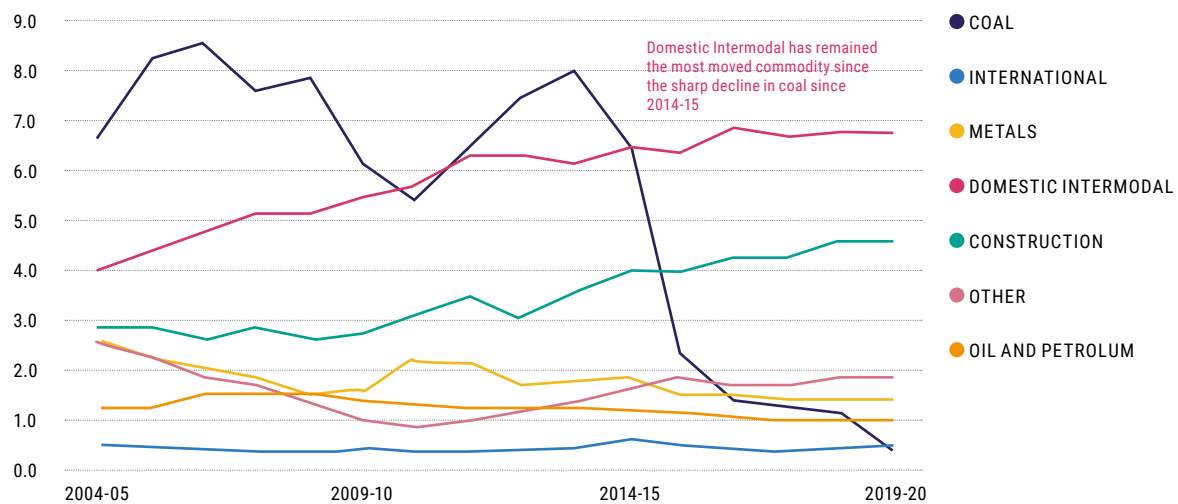
However, despite a slight decline in 2019-2020, the market share of rail freight has remained stable over the past five years. Indeed, the private companies that make up the free British freight market are struggling with their post-coal transition by redirecting their activities towards the transport of construction materials (28% of activities), with domestic intermodal freight accounting for 41% (Office of Rail and Road, 28/05/20). This means that the transport of manufactured and consumer goods from port and non-port terminals now dominates the sector. Nevertheless, rail's share of freight transport in Great Britain does not exceed 9% (in tonne-kilometres), compared with 79% by road.

In East Africa, the demand for rail infrastructure, whose buoyancy and financial obstacles we have highlighted, responds to a dual need to open up new markets for Chinese manufactured products by linking coastal ports to the hinterlands and Great Lakes ports on the one hand and to connect mining and hydrocarbon deposits to port terminals, particularly between landlocked countries (Democratic Republic of Congo, Rwanda, Burundi, etc.) and their neighbours (Mozambique, Tanzania, Kenya…) on the other hand. The deployment of rail freight lines coincides with the growing number of projects in recent years for the use of oil fields and production of liquefied natural gas (IFRI, 2019), and mineral deposits in the east of the African continent. At the end of September, the Tanzanian and Burundian presidents communicated an agreement on the construction of a narrow-gauge railway to transport nickel from the Gitega deposit in central Burundi to Uvinza in Tanzania (The East African, 29/09/20).

FIGURE 15

HIGH-COST RAILWAY PROJECTS IN EASTERN AFRICA

Source: Oxford Analytica, 2019. Based on data from Kenya Railways Corporation, Tanzania Railways Corporation, Uganda Railways

A planned regional standard-gauge rail network comes at huge cost, even as all states struggle with mounting debt
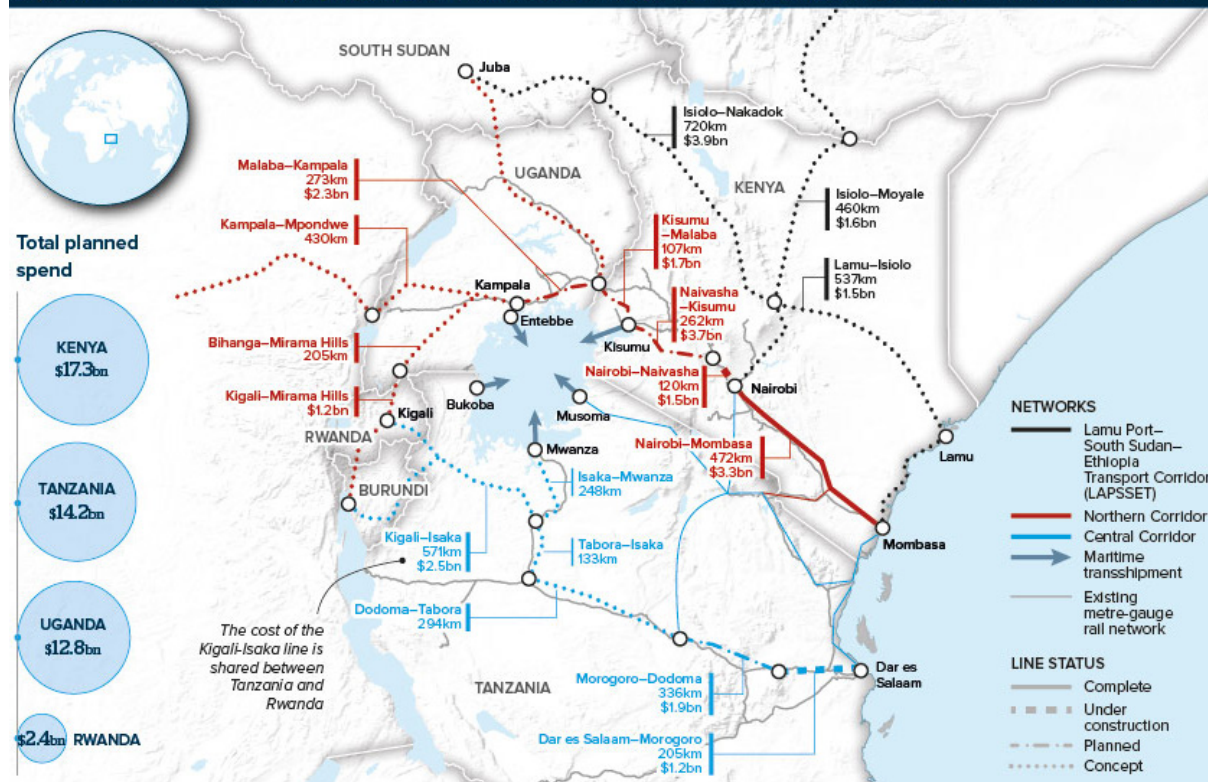
In addition, Chinese investment in the development of standard gauge railways (SGR) and the renovation of old lines, as part of the Belt and Road Initiative, would seem to herald a new momentum for railways on the continent. For the moment, many projects are being drawn up, but few have yet seen the light of day (Le Monde Diplomatique, 09/02/19).

The most iconic of these, the Nairobi-Mombasa-Naivasha line opened in 2017 in Kenya, is currently experiencing operational and financial difficulties that are likely to undermine its profitability. The 729 km-long SGR has doubled the share of rail freight on the Nairobi-Mombasa line since it opened, in a country where 90% of freight goes by road. Activity at the port of Mombasa also reached record levels in 2019 (Ecofin Agency, 02/01/20). But importers, disgruntled with the extra cost of rail freight compared to road haulage, have claimed to have been forced by the Mombasa port authority to use the railway line to transport their cargo (Reuters, 03/12/19). At the end of September 2020, after many months of non-payment, the transport committee of the Kenyan parliament finally asked the government to renegotiate the terms of its loan from the China Exim Bank, China's import-export bank, as well as the operating costs paid each month to Afristar, the line's operator and a subsidiary of the China Road and Bridge Corporation, which built the line (South China Morning Post, 03/10/20).

In the face of these difficulties, Chinese enthusiasm for financing projects in the region seems to be waning and is pushing governments to opt for the rehabilitation of old lines rather than the construction of new SGR. Last year, China Exim Bank twice turned down requests for loans from the state of Uganda for the construction of a new SGR, so the government is now turning to a project to rehabilitate the Kampala-Malaba line (Ecofin Agency, 11/06/20). Similarly, the stalemate in discussions with China on financing the extension of the SGR to Kisumu on the Ugandan border has

led Kenya to opt for the rehabilitation of a 100-year-old metric-gauge line between Nakuru and Kisumu (Ecofin Agency, 24/07/20). In contrast, work on phase 1 of Tanzania's SGR, operated by a Turkish-Portuguese consortium, are expected to be completed by the end of the year. This project is expected to extend over 2,500 km and connect Tanzania to Democratic Republic of Congo, Rwanda, Zambia, Uganda and Burundi, at an estimated total cost of US$14.2 billion (Ecofin Agency, 10/08/20).

• THE EFFICIENCY OF RAIL FREIGHT IS ASSERTING ITSELF AT THE HEART OF THE PANDEMIC •
Launched in 2013 by the Chinese government to strengthen international trade and stimulate economic growth, the Belt and Road Initiative (BRI) is a set of maritime and rail routes linking China to Europe via Africa and Central Asia. With 370,000 20-foot containers (CVPs) transported in 2018, rail freight represented only 1.6% of container flows between China and Europe, but this mode of freight grew by 38% between 2017 and 2018 (OVRSEA, 17/03/20). In 2019, new BRI freight lines were inaugurated and on the Chongqing-EU and Zhengzhou-EU lines, traffic almost doubled between the first half of 2018 and 2019 (Belt and Road News, 15/08/19).

INDICATOR

38%

38% is the growth rate of the rail fret in Europe and China between 2017 and 2018

At the height of the Covid-19 crisis, rail freight lines between China and Europe experienced a peak in demand, proving the resilience of rail freight compared to other modes. Less subject to the restrictions imposed on aviation and faster than sea freight, rail freight was favoured, particularly for transporting medical equipment. In June 2020, a 41-wagon train travelled 11,920 km to deliver 40 million surgical masks, gloves, gel dispensers, etc. to France (SNCF, 05/06/20). The volume of freight on the BRI broke records in 2020: in July, 1,232 trains had made the link between Chinese cities and Europe, a monthly record and an increase of 68% compared to July 2019. In the first seven months of 2020, growth was 41% (South China Morning Post, 17/08/20). Freight still accounts for only 1% of freight volumes from Europe to China and 2.5% from China to Europe: but the imbalance in the trade ratio narrowed during the epidemic in the first half of 2020, in favour of European exports. Exports consisted mainly of paper, plastic and pharmaceutical products in the EU-China direction, and machinery in the China-EU direction (Upply, 03/07/20).

Following these excellent results, the Chinese government has launched a plan to accelerate the growth of rail freight. In June 2020, China announced that it was boosting commercial exports (B2B) by simplifying administrative procedures and streamlining supply chains. Twelve cities have been designated as pilot e-commerce hubs and benefit from a tax system designed to support online trade. New transcontinental freight lines are on the rise: the Baltic Train opened in October 2019 to link China to the port of Gdansk in Poland (Maritime Executive, 25/11/2019), while the line between Shenzhen and Duisburg in Germany opened in August, (Courrier International, 12/09/20). In September, a first train dedicated exclusively to the delivery of goods ordered by European companies via e-commerce platforms travelled between Chongqing and Budapest (South China Morning Post, 09/09/20), which raises questions about the purpose of using the network.

Given the low emissions of rail transport, the modal shift from road to rail is a strategy with a high impact on reducing emissions. In June 2020 Germany announced that it wanted to increase

the share of rail freight to 25% of freight by 2030 ([International Railway Journal](#), 01/07/20). In France, players in the sector have joined forces within the 4F alliance, "Fret Ferroviaire Français du Futur" (French Rail Freight of the Future) and are championing a doubling of the share of rail freight by 2030 (from 9% to 18%), even though it is constantly falling. This coalition brings together the main rail transport companies such as Fret SNCF and DB Euro Cargo Rail, multimodal combined transport operators such as Novatrans and Naviland Cargo, as well as stakeholder associations (Association Française du Rail, Association des Utilisateurs de Transports de Fret, etc.). The French State has committed to supporting investment in freight lines to access production sites ([economie.gouv](#), 2020).

The 18 European rail operators who are members of the Rail Freight Forward coalition aim to increase the modal share of rail freight from the current 18% to 30% by 2030. Through with-the-flow growth, freight transport should increase by 30% by 2030, but this increase would mainly be in the road sector, triggering the addition of one million trucks per year. The goal of a 12-point increase in the share of rail freight would make it possible to avoid the emission of 290 million tonnes of CO_2. The initiative's roadmap includes improving traffic management, digitising services, improving infrastructure and simplifying administrative procedures ([Rail Freight Forward](#)).

CONCLUSION

Towed by the domestic and international investments of the Chinese locomotive, the international rail network is still struggling to fully serve the ecological transition of mobility. High-speed lines in China, if they are not adapted to the constraints and needs of demand, may even prove counter-productive, while offering alternatives to air travel between major cities. The gradual breakthrough in the use of fuel cells and batteries in Europe offers the prospect of more flexible alternatives to the electrification of infrastructures, which is still in progress. While rail freight has demonstrated its resilience during the pandemic and is opening up new routes across East Africa and the Eurasian space, the sector's dependence on coal and mineral transport raises questions about its uses in a decarbonised world..

MARITIME TRANSPORT

Climate strategies navigating through the fog

• KEY TAKEAWAYS •

☀ **The growth in international trade stalled in 2018, the latest year for which data is available. This, coupled with efficiency gains in international maritime freight, meant that GHG emissions from maritime transport actually decreased between 2017 and 2018 (-0.7%).**

☀ **Until now, the use and transport of LNG has proved to be both a market opportunity and a decarbonisation strategy for maritime freight, while the IMO is targeting -40% emissions in 2030 in its strategy adopted in 2018. To meet the new IMO 2020 standards on sulphur emissions, which came into force in January 2020, shipping companies have made a significant technological decision to use "scrubbers". This technology has already been adopted by more than 4,000 ships to purify exhausts without having to stop using traditional fuels.**

☀ **There is a clash between the depollution and decarbonisation strategies of shipping companies. Methane (+150%) and black carbon (+12%) emissions from the maritime sector have been rising sharply since 2012. This is due to the popularity of two alternative fuels: liquefied natural gas (LNG), which companies are betting on for their decarbonisation, and very low sulphur fuel oil (VLSFO), to reduce air pollution. The adoption of open-circuit models of scrubbers, the most popular model but one that contributes to ocean acidification, is also impeded by the numerous bans imposed by States and port authorities around the world.**

☀ **The restrictions in movement to combat Covid-19 have hit passenger shipping companies such as Brittany Ferries hard. But containerised freight (Maersk, Hapag Lloyd, HMM, etc.) has proved particularly resilient, despite the reduction in traffic, taking advantage of low oil prices and higher tariffs applied to containers and the difficulties experienced by the air transport industry in capturing the e-commerce market.**

☀ **Covid-19 is also undermining the strategic options chosen to respond to the challenges of climate change and air pollution. LNG was already in overproduction before 2020 and is the energy product most affected by the fall in energy demand. Hundreds of LNG tanker journeys have been cancelled in 2020, and low prices in the short term do not point to a solid recovery in the long term. The fall in oil prices is also lengthening the return on investment for scrubbers, which benefits VLSFO.**

1. State of play on emissions: the market efficiency of maritime transport has not stopped the growth in emissions

Greenhouse gas (GHG) emissions from the maritime sector increased by 9.6% between 2012 and 2018, according to the Fourth IMO Greenhouse Gas Study conducted by a consortium of consulting firms and research centres (IMO, 2020). After a 3.7% increase between 2016 and 2017, emissions from the sector decreased slightly by 0.75% between 2017 and 2018. In 2018, total emissions from the sector (including international transport, domestic transport and fisheries) amounted to just over 1.076 $GtCO_2e$, or 2.86% of global emissions from fuel combustion. 98% of these GHG emissions were carbon dioxide (CO_2). However, the study observes a particularly sharp increase (150%) in methane (CH_4) emissions over the period 2012-2018, which has a global warming potential (GWP) 86 times greater than CO_2 over 20 years. Three classes of ships alone are responsible for 55% of the maritime sector's CO_2 emissions: container ships (23%), bulk carriers (19%) and oil tankers (13%) (IMO, 2014).

At international level, the maritime sector is regulated by the International Maritime Organization (IMO), a United Nations specialised agency, which now unites nearly 140 member countries. Like international aviation, international maritime transport is not covered by the scope of the Paris Agreement. But in April 2018, more than 100 states met at the IMO headquarters in London and agreed to adopt a strategy to reduce emissions by at least 50% by 2050 compared to 2008. Specifically, the agreement calls for emissions from all international transport activities to be reduced by at least 40% by 2030 and up to 70% by 2050 (IMO, 2018).

Maritime transport has been making major gains in energy and carbon efficiency for years now, through various measures with exponential impact, such as reducing the cruising speed of ships. Indeed, the average carbon intensity of the whole sector is now 21-30% lower than in 2008 whether calculated in reference to vessels or routes, according to the IMO's Energy Efficiency Operational Indicator (EEOI) (IMO, 2020). The sector is also the most efficient in terms of the carbon emissions/goods/km ratio (**fig. 16**). It accounts for about 80% of the volume and 70% of the value of international trade, while only emitting 21% of total freight emissions (Sector report 2019 - Transport, Climate Chance). However, most of these efficiency gains were achieved before 2012, and the carbon intensity of operations has been declining by only 1-2% per year since 2015.

FIGURE 16

THE DECOUPLING OF THE GROWTH IN EMISSIONS FROM THE GROWTH IN INTERNATIONAL SHIPPING TRAFFIC

Source: made by the author using data from IEA, UNCTAD and World Bank data

—— CO_2 EMISSIONS FROM INTERNATIONAL MARITIME TRANSPORT ($MTCO_2$)

—— INTERNATIONAL TRADE IN GOODS (% OF PIB)

—— INTERNATIONAL MARITIME TRAFIC (MT LOADED)
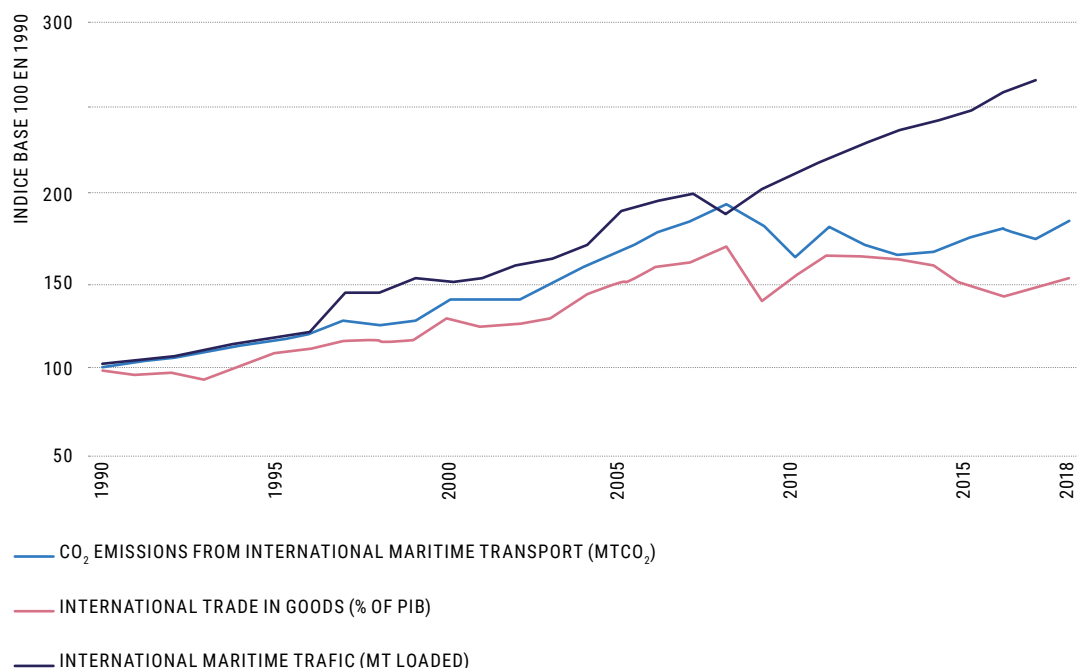
KEYS TO UNDERSTANDING

BLACK CARBON EMISSIONS FROM SHIPS

For the first time in the series, the IMO's Fourth Greenhouse Gas Study assesses black carbon emissions from the maritime sector, based on the work of the International Coalition on Clean Transportation (ICCT). It shows that these emissions increased by 12% between 2012 and 2018. Black carbon, like methane, is a "short-lived climate pollutant" and the molecules have a powerful radiative forcing power. Even though it only survives for 4 to 12 years in the atmosphere, the GWP of black carbon is between 460 and 1,500 times more powerful than CO_2 (CCAC, n.d). Its emission stems from the incomplete combustion of fuels. There is also evidence that short-lived climate pollutants have a long-term impact on the atmosphere (Fu, B. et al., 2020). A recent study, presented to the IMO by Germany and Finland, reveals that Very Low Sulphur Fuel Oil (VLSFO), an alternative fuel that allows companies to comply with the new IMO sulphur concentration standards (see below), contains aromatic compounds that increase black carbon emissions by 10-85% compared to the traditional fuel, Heavy Fuel Oil (HFO) (Safety4Sea, 21/01/2020). Four NGOs, Clean Shipping Coalition, Friends of the Earth International, Pacific Environment and WWF, are lobbying the Marine Environment Protection Committee (MEPC), the IMO's environmental decision-making body, to ban VLSFO (Lloyd's List, 16/01/2020). The IMO has already committed to proposing a regulation of black carbon emissions in 2021, and to ban the use of HFOs in the Arctic, where fishing vessels are the main emitters of black carbon.

BOX 10

2. Protectionism and environmental standards challenge maritime transport to make the transition

• GROWTH IN COMMERCIAL TRAFFIC HAS SLOWED SINCE 2018 • UNCTAD's latest *Review of Maritime Transport*, published in October 2019, noted a slowdown in the growth of global maritime traffic in 2018. The volumes transported grew in 2018 (+2.7%) at a lower rate than the average recorded over the period 1970-2017 (3%) and in 2017 (4.1%). Nevertheless, the total volume transported reached a record 11 billion tonnes in 2018. Approximately 80% of the volume of international freight is carried by sea. Variations in activity in this sector are therefore closely linked to fluctuations in international trade. And the growth of the latter is effectively following a similar dynamic, falling from 4.5% in 2017 to 2.8% in 2018. The growth of container port traffic has thus also lost two points, from 6.7% in 2017 to 4.7% in 2018 (UNCTAD, 2019).

The main dry bulk products (coal, iron ore, cereals) account for 40% of solid goods shipments. Tankers transporting oil and gas still occupy almost a third of total volumes, but their share has largely decreased since the 1970s. Conversely, containerized goods, the symbol of globalized trade, grew at an average annual rate of 8% between 1980 and 2018, and now account for a quarter of solid cargo volumes (24%) (UNCTAD, 2019).

Since 2012, developing countries have been unloading more goods than they load, reflecting their growing consumption capacity, but also their new role in international semi-manufactured product processing chains. Asia alone accounts for 41% of goods loaded and 61% of goods unloaded, while the share of developed countries has declined over the long term and now sits at around one third for both types of flow. The importance of the Asian continent explains the magnitude of the disruptions caused by the trade war between China and the United States between 2018 and 2019. The tariff increases applied between September 2018 and June 2019 affected nearly 2% of the volume of world maritime traffic, according to UNCTAD. Trade between the two powers is estimated to have declined by 15%, making it the main factor behind the slowdown in the growth of world trade and thus of maritime freight.

KEYS TO UNDERSTANDING

THE INTERNATIONAL WASTE CRISIS: CONTAINER SHIPS IN DISARRAY

We analyse this issue extensively in the chapter of the report on waste (see Waste section 2020, p. 178). The closure of China's borders to imports of recyclable waste, followed by similar decisions by its South-East Asian neighbours, has shaken the sector on a large scale. For decades, industrialised countries have relied on the recycling industries of third countries, particularly in Asia, to find outlets for recyclable waste sorted in their country. Thousands of tonnes of waste in containers are transported across the seas by cargo ships every year, to be unloaded in ports and then, in principle, recovered by the recycling industry. Except that, in the last two years, following China's example, the region has been closing itself off to these imports and returning the shipments to their senders. As such, at the beginning of 2020, 150 containers loaded with 3,737 tonnes of waste were sent back. This included 43 containers to France, 42 to the United Kingdom, 17 to the United States and 11 to Canada (Business Insider, 21/01/20). Sri Lanka, in turn, returned 21 containers of waste mixed with hazardous materials to the United Kingdom (BBC, 27/09/20).

As China is in the process of further tightening its rules, CMA-CGM, the world's fourth-largest container carrier, has announced that it will now refuse any further shipments of solid waste to China. This decision is in line with those of its competitors, APM-Maersk, Mediterranean Shipping Company (MSC) and Hapag-Lloyd, all of which have decided in recent months to refuse such shipments to China, effective from 1st September 2020 (Resource Recycling, 25/08/20).

BOX 11

• LNG, THE OVER-HYPED DRIVER OF GROWTH IN THE MARITIME SECTOR • One of the only sectors not to have been affected by this slowdown is gas transport, which is booming (+7.25% in 2018), driven by demand from Asian countries for Liquefied Natural Gas (LNG). Japan is the world's leading LNG importer, ahead of China, Korea and India (IEA, 2020), while Qatar, Australia and, to a lesser extent, the United States dominate production. Because it is liquefied, LNG reduces the density of natural gas, allowing it to be transported by sea, offering much greater flexibility than pipeline transport. This makes it a product of the future for the transport activities of LNG carriers, the specialised ships: in 2019, exports grew by a record 12.7%, driven by demand in China and Europe (BP, 2020). 42 new LNG carriers were launched in 2019 (+8.4%) (IGU, 2020).

But at the height of the trade war, Chinese LNG imports from the United States were halted for two quarters in 2019. Furthermore, the global slowdown in Asian demand (-7.5% in Japan, -4.6% in Korea) has put the market into a state of overproduction, causing a collapse in prices, while Australia, Argentina, Russia and especially the United States continue to increase supply capacity by building new liquefaction terminals (GIIGNL, 2020).

The sector should therefore welcome the "Phase 1 Agreement" signed in January 2020 by US President Donald Trump and Chinese Vice Premier Liu He to put an end to the confrontation between the two countries (Reuters, 15/01/2020). The agreement stated that China would buy nearly $200 billion worth of goods from the United States over two years, including $52 billion worth of energy products. However, after Chinese tariffs were lifted in April, LNG imports resumed in June 2020 but, slowed by Covid-19, at a pace that is not sufficient to meet China's commitments, analysts note (S&P, 12/06/20).

• 2020: PIVOTAL YEAR FOR THE REGULATION OF SULPHUR EMISSIONS FROM SHIPS • This is the key event for the sector in 2020. On 1 January, the IMO 2020 regulation on sulphur oxide (SOx) emissions came into force. SOx is a particulate matter emitted from the combustion of the fuel most commonly used by transport ships, HFO (heavy fuel-oil). In particular, sulphur dioxide (SO_2) is known for its deleterious effects on human respiratory health and for the role it plays in the formation of acid rain.

The IMO 2020 regulation has reduced the sulphur content limit for fuel oil used in ships from 3.5% m/m (mass per mass) to 0.5% m/m. This new standard applies to all ships outside Emission Control Areas (ECA). Where they exist, ECAs may impose even stricter standards (0.1% m/m), such as in the Baltic Sea, the North Sea and the Caribbean Sea Area of the United States (IMO, 2020). Voted in 2016 by the IMO's Marine Environment Protection Committee (MEPC), this new standard is an amendment to the International Convention for the Prevention of Pollution from Ships (MARPOL), adopted in 1973.

To prepare to meet these new standards, several options are available to the stakeholders in the sector: replacing HFO with a fuel with a lower sulphur content but more expensive, such as VLSFO (*Very Low Sulphur Fuel Oil,* **see Box 1**) or LNG, or equipping their ships with purification equipment while continuing to use HFO. **So far, the trend is clear: the shipping companies are converging towards a significant technological decision to equip their ships with "scrubbers", purification towers which clean the sulphur particles from the exhaust fumes.** In March 2020, some 4,000 ships were equipped with such devices, according to DNV GL data. The technology has been increasing exponentially since 2018 (**fig. 2**). An addition of the installations already completed and the orders in progress shows that the container ship sector is the most reliant on this system (31.6% of the fleet, in DWT[1]),

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1 - Deadweight tonnage (DWT). Refers to the maximum load that a ship can carry, apart from the weight of the ship. Deadweight includes goods, passengers, fuel, etc.

ahead of oil tankers (30.9%) and bulk carriers (23.5%) according to the latest calculations by BIMCO, the largest association of maritime transport professionals (BIMCO, 13/08/20).

4,000

Number of ships in the world that were equipped with scrubbers to reduce sulphur particules emissions in 2020
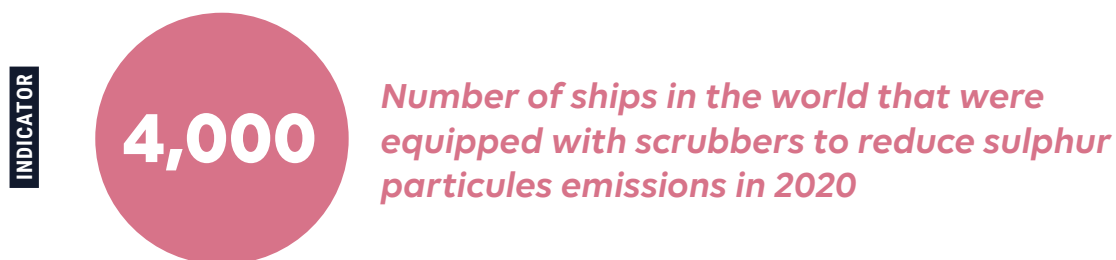
The downside to this craze is that the most economical version of these scrubbers, known as "open circuit" scrubbers, is also highly polluting. Indeed, open circuit scrubbers are simpler to put into action because they simply discharge the washing water into the sea, without treatment. Specifically, these waters present a risk of increasing the pH of the water and contributing further to the acidification of the seas and oceans (ICCT, 18/06/20). This has been argued by the Clean Shipping Alliance 2020, a coalition of shipping and cruise industry companies, based on a study commissioned from the environmental consulting firm CE Delft (CE Delft, 2019).

For the time being, many port authorities and states have imposed restrictions or even complete bans on the discharge of washing water in their ports. The list is long and extends across all continents. For example, the marine insurance company North maintains an up-to-date list of locations and restrictions (North, 14/10/20). Among the most recent regulations, the Saudi Ports Authority and Oman have banned the discharge of washing water in their territorial waters (Seatrade Maritime News, 20/08/20).

FIGURE 17

NUMBER OF SHIPS EQUIPPED WITH SCRUBBERS AROUND THE WORLD
Source: ICCT, using DNV GL data

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
12	22	44	117	255	325	400	736	3,103	4,047
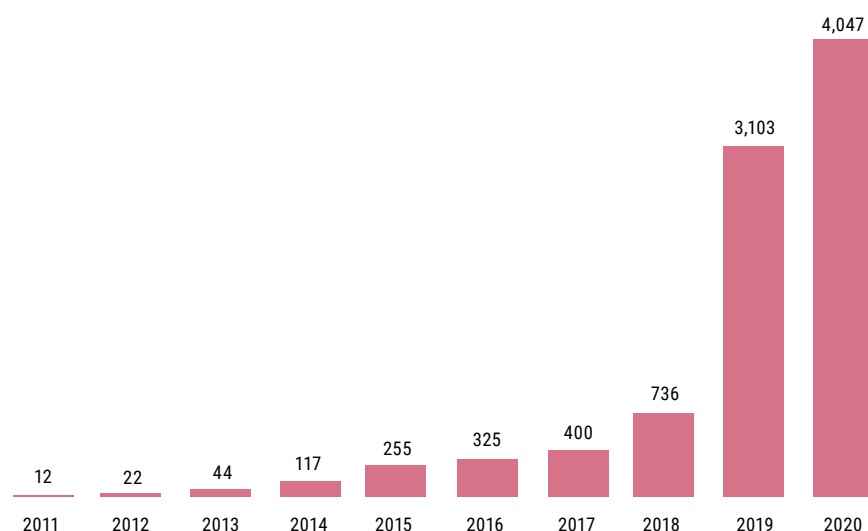
• SCALE-PROOF DECARBONISATION SOLUTIONS • According to modelling results recently published in the journal Climate Policy, the maritime sector, like aviation, road freight and industry, will only be able to comply with the 1.5°C or 2°C scenarios at the price of a reduction in demand (Sharmina, M. et al., 2020). Without this, emissions from the sector could reach between 90 and 130% of their 2008 level in 2050 (IMO, 2020). What decarbonisation pathways have the actors been exploring in recent years?

Unlike the air transport sector, there is not yet an international emissions trading market for the maritime sector. In its Emission Reduction Strategy, the IMO envisages four other types of medium-term measures: the development of low-carbon (or even zero-carbon) fuels, operational measures for ship energy efficiency, technical cooperation and capacity building activities, and feedback mechanisms for sharing good practices (IMO, 2018). Strategies will also differ according to the types of ships and the phases of navigation during which they emit the most GHGs.

In addition to providing an additional outlet for maritime transport activities, LNG is an increasingly popular alternative fuel for shipping in ECAs, in line with the IMO's new sulphur emission standards and its low-carbon strategy. In 2019, 756 ships worldwide were fuelled by LNG, notably ferries and supply ships (**fig. 18**). The use of LNG increased by 28-30% between 2012 and 2018 (IMO, 2020). The Bothnia Bulk Project, conducted in the Bay of Bothnia between Sweden and Finland, claims a 50% reduction in CO_2 emissions between 2016 and 2020 through the introduction of new LNG-powered bulk carriers (ESL Shipping, 04/11/20).

FIGURE 18

NUMBER OF LNG FUEL SHIPS IN OPERATION OR UNDER CONSTRUCTION IN MID-2018 AND PROJECTION FURTHER
Source: ICCT (2020) according to IHS Markit data (2019)
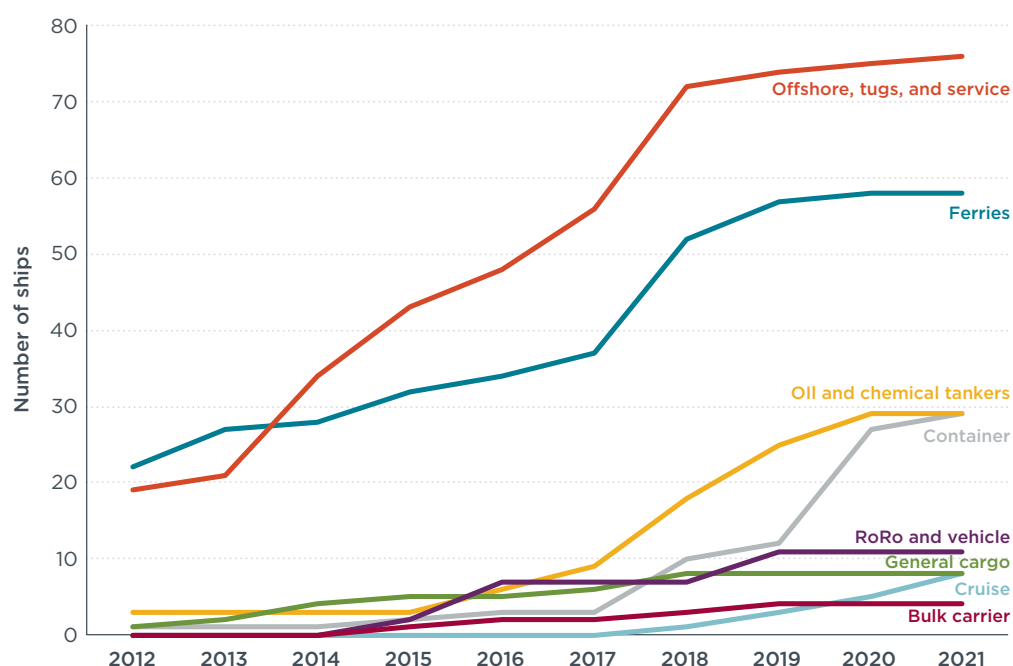
However, while LNG does indeed emit 25% less CO_2 than traditional marine fuels, it is still a gas, and its use is responsible for the increase in CH4 emissions observed in recent years (see above). These emissions are caused by LPDF (low-pressure dual fuel injection) engines, the most common technology for running ships on LNG, which emit large amounts of CH4, especially when ships are lightly loaded (Ushakov, S., et al., 2019). According to a life cycle analysis by ICCT, using LNG with

this technology produces 70-82% more GHG emissions than the other gas-based fuel, marine gas oil (MGO). At 100 years, and subject to the adoption of more efficient technology, the emissions gains from LNG could reach 15% compared to MGO; but at 20 years, closer to the urgency of climate action, the use of LNG would produce 4% more emissions (ICCT, 2020; IMO, 2020).

The numbers of electric-powered ships are still very marginal: moving a vessel the size of a container ship over the commercial distances travelled is currently out of reach of the existing batteries on the market (Wired, 19/03/20). However, a few large-scale projects for shorter distances and lower volumes can be found here and there. Norway has been particularly successful in this area, electrifying the ferry fleets operating in its UNESCO World Heritage fjords (see Transport Case Study - Norway, Climate Chance, 2019). Corvus Energy, an American company already involved in Norway's first electric ferry Ampere, has opened an electric battery factory in Bergen, for the European maritime market (Corvus, 06/06/20), and is currently introducing new production lines in Richmond, Canada (Corvus, 25/03/20). The Norwegian chemical company Yara, a producer of plant fertilisers, was expecting delivery this year of the world's first zero-emission self-contained container ship, the Yara Birkeland. The ship was built in Romania and has a capacity of 120 TEU (twenty-foot equivalent unit). According to the company, it is expected to eliminate the equivalent of 40,000 annual journeys made by diesel-powered heavy goods vehicles. But the work has been suspended for the time being, put on hold by the Covid-19 epidemic (Yara, n.d.).

The solution of reducing speeds would require fewer conversions on ships and port terminals, and this approach is known to successfully reduce emissions from maritime transport. It is now widely accepted that there is a cubic relationship between reducing a ship's speed and fuel consumption: reducing speed by 10% reduces the required engine power by 27%. Therefore over the same distance travelled more slowly, the energy required for the journey decreases by 19% (Faber et al., 2017).

TABLE 1

RELATIVE REDUCTIONS IN CO_2 EMISSIONS ACCORDING TO ALTERNATIVE SPEED REGIMES
Source: Faber et al., 2017

	10% Speed reduction	20% Speed reduction	30% Speed reduction
Container ship	13%	23%	32%
Dry bulk ships	15%	28%	28%
Oil tankers	10%	18%	24%
Total	13%	24%	33%

A report commissioned by Transport & Environment and Seas at Risk, presented to the IMO in autumn 2019, outlines the scientific knowledge on the environmental and climate benefits of reducing ship speed and calls for the IMO to make this measure mandatory to meet the goals of its emissions reduction strategy. The UN institution decided not to retain this proposal for the time being (T&E, 16/12/19). However, the shipping companies are very much in favour of this option, which also allows them to reduce their costs and fuel consumption. 100 companies, including Euronav, the largest oil tanker company, Louis Dreyfus Armateurs, Tsakos Shipping and Trading, Navios Maritime Holdings and Dynagas supported this proposal in a letter to the IMO (Safety4Sea, 30/04/19).

In general, the optimisation of navigation, mooring, undocking, loading and unloading operations offers significant potential for energy efficiency gains and emission reductions. A.P. Møller-Mærsk, the world's largest container ship company, claims to have reduced its CO_2 emissions between 2008 and 2018 by 41% through optimising its manoeuvres and processes, both at sea and at berth. In 2018, Mærsk set a target to reach carbon neutrality by 2050. Since then, the Danish company has

founded the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping, an independent research centre with a budget of 60 million USD and 100 employees, to study the different ways of decarbonising the sector (The Maritime Executive, 26/06/2020).

As transit infrastructures, ports are key players in the economic and logistical efficiency of passenger and freight transport chains. The World Port Sustainability Programme (WPSP) awards annual prizes to projects carried out by port authorities in areas related to the 17 Sustainable Development Goals. The winner in the "Climate and Energy" category in 2020 was the European LOOP-Ports project. Financed by Climate-KIC and coordinated by the Fundación Valenciaport, the project brings together 13 partners in 6 EU Member States and runs until December 2020. It aims to create a network of port authorities and associations to exchange good practices on the circular economy. 44 ports from 14 countries are already members of the new network. Also in the running were the port of Marseille for its industrial demonstrator of Power-to-Gas, Jupiter 1000, for energy storage, and the port of Helsinki for its carbon neutral 2035 strategy (WPSP, 17/06/2020).

KEYS TO UNDERSTANDING

SEA FREIGHT, RAIL FREIGHT: BALANCING COMPETITION AND COMPLEMENTARITY

As modal hubs, ports play an essential role in global supply chains by acting as an interface between sea routes and rail lines.

The development of rail freight links boosts port activities and provides land-based relays that complement the transport of goods by sea. In Sweden, for example, the port of Gothenburg increased the volume of containers transported by rail by 14% in 2019, enabling it to increase the total number of containers in transit by 3% over the same year. The port is a world leader in terms of container transit by rail. In 2019, the Port Authority announced a plan to reduce the port's CO_2 emissions by 70% by 2030 (Container News, 27/01/20). In Great Britain, rail freight lines have limited their decline by shifting to intermodal freight to handle goods unloaded in ports from container ships (see Sector Report 2020 - Rail, p. 70).

In both Europe and Africa, Chinese investments in large ports such as Piraeus or Djibouti under the Belt and Road Initiative are strengthening existing trade routes, but they are still struggling to create alternative routes (ITF, 2020). This is illustrated by the difficulties encountered by the railway projects in East Africa aiming to open new trade routes for the continent's mineral deposits (see Sector Report 2020 - Rail). The price-competitiveness of rail over sea for transcontinental freight between Europe and Asia is increasingly being discussed, as suggested by the Chairman of the Board of the United Transport and Logistics Company - Eurasian Rail Alliance (Container News, 07/11/20). For the time being, the existing documentation does not confirm any potential modal shift to rail at the expense of maritime routes.

BOX 12

3. The pandemic reveals the resilience of the sector but weakens climate strategies

• THE ASTOUNDING RESILIENCE OF CONTAINER SHIPS IN THE FACE OF FALLING INTERNATIONAL TRADE • UNCTAD has managed to monitor the evolution of container ship calls in ports since the beginning of the year. This is a good indicator of the impact of Covid-19 on international trade given the scale of freight operations by sea (80%).

There was indeed a notably sharp decline in container ship arrivals between mid-March (week 12) and June (week 25), with a first very significant drop that reached a trough in January and February (**fig. 19**). This first episode of reduced port traffic, almost exclusively concentrated in China and Hong Kong, reflects the region's major share of the containerized goods traffic market (UNCTAD, 2020).

FIGURE 19

WEEKLY CONTAINER SHIP CALLS WORLDWIDE IN 2019 AND 2020, AVERAGE MOVEMENTS OVER FOUR WEEKS
Source: CNUCED, 2020
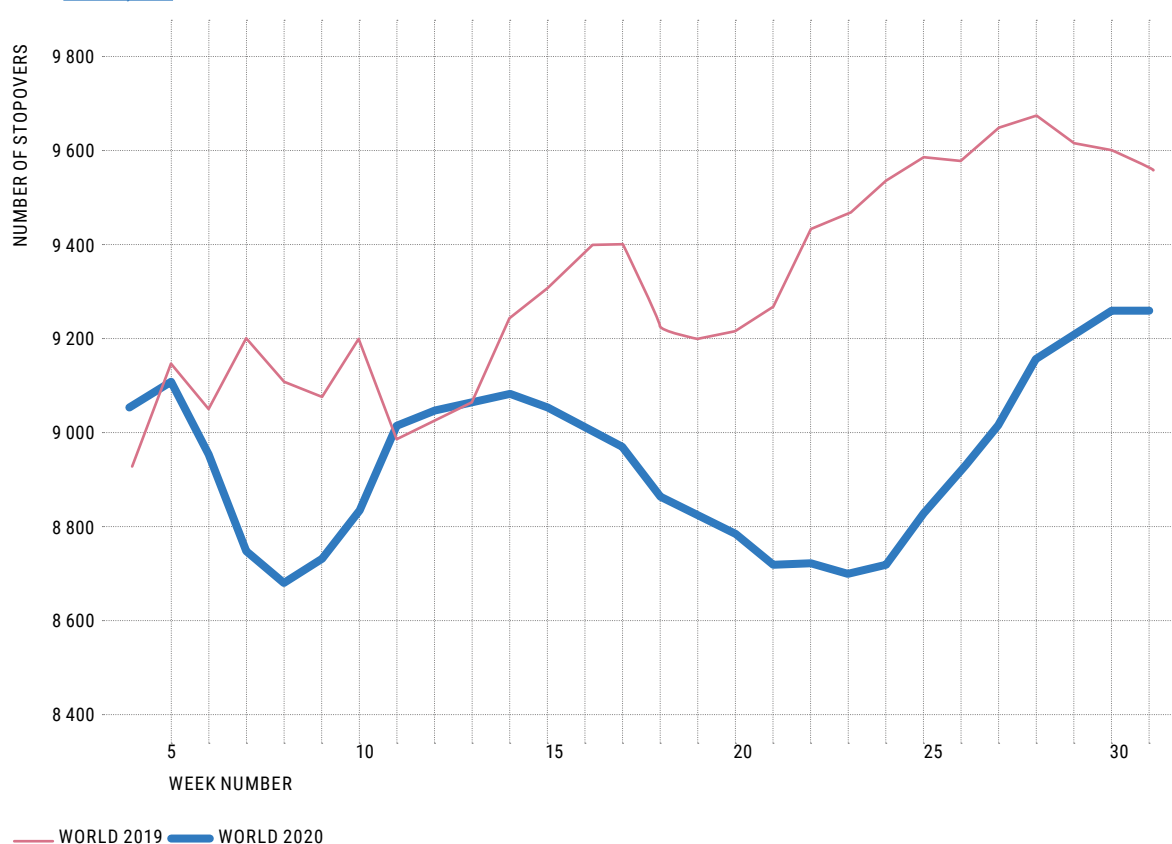
However, the container transport industry is proving to be particularly resilient to the downturn for the moment. In a market hyper-concentrated around three major alliances formed in 2017 (THE Alliance, Ocean Alliance and 2M Alliance represent 80% of the business in volume terms), the dominant companies in the sector could even conclude 2020 in better financial health than in 2019. For example, Mærsk reported a 26% increase in profits in the second quarter compared with the previous year, even though its business fell by 16% in volume terms. The company attributes this to an increase in transport rates (freight rates) since the beginning of the year, lower fuel prices as a result of falling oil prices, and effective management of network operations. The same goes for the German Hapag-Lloyd, whose results are on the rise, and the Chinese HMM, which is recording

profits for the first time in five years. Sea freight also enjoyed a favourable carry-over of goods ordered on e-commerce platforms, usually shipped by air ([Financial Times](#), 17/09/20).

In other sectors, some shipping companies have been hit hard by lockdown measures. Shipyards received half as many orders for new ships in the first half of 2020 compared to the first half of 2019, according to figures from Clarkson Research ([Offshore Energy](#), 13/07/20). In France, Britanny Ferries, the country's largest employer of seafarers, 87% of whose passengers are British, suffered from the quarantine imposed by the UK on passengers travelling from France. The company, which has suffered a drop of 75% in activity since March 2020, has had to close four of its five lines departing from France and now uses only six of its twelve ships ([Ouest France](#), 27/10/20). Under financial pressure, Brittany Ferries was also forced to cancel the order for its first LNG ship, the *Honfleur*, whose delivery had been postponed from spring 2019 to spring 2020 by the German shipyard FSG, which is currently in receivership ([Les Echos](#), 19/06/20).

KEYS TO UNDERSTANDING

CRUISE SHIPS, SIGNIFICANT CLUSTERS AT THE START OF THE EPIDEMIC

JUntil the Covid-19 crisis hit, the cruise industry was flourishing. An estimated 30 million people travelled on cruises in 2019, up 3.5% since 2018 and 68% since 2009 (17.8 million passengers) ([CLIA](#), 2019). Cruises are a symbol of mass tourism, although limited to a small portion of the world's population, and they contribute significantly to air pollution and GHG emissions. For example, the 47 luxury cruise ships owned by a single company, Carnival Corporation & PLC, emit ten times more sulphur dioxide than the 270 million passenger vehicles in circulation in Europe ([Transport & Environment](#), 2019).

However, since the emergence of the virus, activities have come to an abrupt halt. Worse still, cruise ships proved to be major clusters of contamination during the first months of the pandemic. For example, the Diamond Princess was kept in quarantine for several weeks off the coast of Japan, with 3,711 passengers and crew members on board, of which 697 tested positive for Covid-19 and 7 died on board. This became a major news story. A study published in the journal *PNAS* estimates that a single person carrying the virus on board was responsible for contaminating the ship ([Sekizuka, T., et al.](#), 2020). In late spring, a Japanese study concluded that the countries whose ports continued to allow cruise ships to dock until March 2020 were also those with higher rates of Covid-19 infection ([Ito, H. et al.](#), 2020).

BOX 13

• LNG, THE WORST PERFORMING ENERGY PRODUCT DURING THE PANDEMIC • Of all energy products, including coal and oil, LNG prices have suffered most from the consequences of the pandemic. The maritime sector's hopes for growth in LNG transport seem to be compromised in the medium term by the crisis of energy overproduction, coupled with the fall in demand caused by Covid-19, as well as the collapse of gas prices on the futures markets.

A rebound in China's LNG demand now depends only on lower prices for long-term delivery contracts to alleviate the financial losses accumulated in recent years by the main LNG importers (CNOOC, Sinopec and PetroChina). But such low prices would in turn prevent US players from amortising and recouping the investments already made in the construction of liquefaction lines ([IEEFA](#), 2020). Faced with so many uncertainties, buyers have therefore taken refuge in the short-term market (spot market) where prices are at their lowest, and are fleeing from long-term contracts, which are essential for stabilising the market. As a direct consequence of the fall in demand for maritime transport, dozens of ships due to export cargo from the United States were cancelled by

their sponsors during the summer (Reuters, 22/06/20). In total, world LNG trade is expected to fall by 3 to 3.5% in 2020 (S&P, 09/07/20).

However, the prospect of a colder winter in the northern hemisphere and the revival of the Chinese economy provide a more favourable market outlook for the end of the year (Reuters, 30/10/20). This is evidenced by the confidence shown by Qatar Petroleum, which has just completed the largest LNG carrier order in history from the "Big 3" of the South Korean shipyards, worth US$19 billion for 100 ships, to be delivered by 2027 (Reuters, 02/06/20).

• THE DECISION TO USE SCRUBBERS THREATENED BY THE COLLAPSE OF OIL PRICES • The collapse of oil prices jeopardises the future of scrubbers. Until now, the sector's preference for these exhaust scrubbers was justified by the lack of competitiveness of VLSFO compared to HFO, the traditional fuel. Affected firstly by a price war between producer countries and then by the fall in demand during the first half of the year, oil prices have stagnated at around $40 a barrel. This has reshuffled the deck by narrowing the price gap between HFO and VLSFO: between January and August, HFO prices fell by 12% and VLSFO prices by 50%. As a result, the price gap between the two fuels (the spread) decreased from an average of $150-200/mt to $50-60/mt. For the market, this means that the rate of return on investment in scrubbers could increase from two to five years, which weakens the profitability of the choices made by the whole sector (Le Journal de la Marine Marchande, 04/08/2020).

It is difficult to estimate whether this progression is liable to change the strategies of shipping companies to align with sulphur emission standards, but since the beginning of the year, the main scrubber manufacturers have reported drops in their orders. Indeed, the Finnish company Wärtsilä reported a 12% drop in its orders in the first quarter of 2020 (Le Journal de la Marine Marchande, 22/04/2020).

4. Emergency aid and faltering climate negotiations

• FERRIES, MAJOR BENEFICIARIES OF EMERGENCY SUPPORT PACKAGES WITH NO CONDITIO-NALITIES • In response to the difficulties encountered by companies, at least 13 countries with large maritime companies in their economies have offered emergency aid to the sector, according to the latest accounts of the International Transport Forum (**tab. 2**). As the ITF points out, a large proportion of these support packages are aimed at ferry and cruise companies and, like the air sector, are in the vast majority of cases devoid of economic, social or environmental constraints. Finland is an exception, imposing conditionalities on the firms to guarantee national security of supply.

TABLE 2

SUPPORT PACKAGES FOR COMPANIES IN THE MARITIME TRANSPORT SECTOR
Source: table produced by the International Transport Forum, 2020

Country	Beneficiary	Main measures	Amount (million EUR)
Singapore	Maritime, sea companies	Reduction in port duties	20
South Korea	HMM	Cash flow support	600
South Korea	Maritime companies	Cash flow support	1,000
United Kingdom	Cruise companies	Cash flow support from the Bank of England Covid Corporate Financing Facility (CCFF)	350
United Kingdom	Ferry operators	Support for ferry routes UK-Northern Ireland, and UK - Continental Europe	63
Germany	n.a.	Innovation, research, shore power, LNG refuelling, fleet renewal, cleaner ships	1000
France	CMA-CGM	State guarantee	1,050
France	MSC Croisière	Refinancing of loans by the public development bank SFIL	2,600
Finland	Shipping companies crucial to security of supply	State guarantee	600
Sweden	Eight ferry companies	Tax credit for 10 idle ships	10
Estonia	4 ferry companies	Subsidies to compensate for lost income	20
Croatia	Maritime companies	State guarantees	80
Ireland	3 ferry companies	Cost support for 5 ferry lines	15
Greece	Ferry companies	n.a.	35
Italy	Ferry and cruise companies	Tax exemptions, compensation for lost income	85
Hong Kong, China	Ferry and cruise companies	One-off grant (ferries), exemption from rent and fees, refund of deposit (cruises)	n.a.
Taiwan	Yang Ming, Evergreen	Facilitating loans and grants and interest subsidies	850

Other emergency measures have been taken since the publication. Namely, the French company Brittany Ferries, whose difficulties were mentioned above, has received €258 million in public aid from the State (€173.2 million) and the regions of Brittany and Normandy (€85 million) (Ouest-France, 27/10/2020). In the United States, a bill to this effect was tabled in the Congress of Representatives last July, but has not yet been voted on (Baker Donelson, 16/07/2020).

• CONTENTION OVER THE IMO STRATEGY • At the end of October, a group of 14 IMO member countries, including France, Norway, Japan, China and South Korea, agreed on a GHG emissions reduction proposition aimed at reducing the sector's carbon intensity by 40% in 2030 compared to 2008. This plan is supported by the International Chamber of Shipping and will be put to a vote at the next MEPC meeting in November. However, the proposal has already attracted criticism

from NGOs, including Transport & Environment, for not being aligned with the scientific recommendations of the 1.5 or 2°C scenarios (T&E, 30/10/2020). The associations contend that the plan's ambitions have been diluted by being based on the Energy Efficiency Existing Ship Index (EEXI), Japan's benchmark for ship energy efficiency. Yet Japan is one of those maritime powers hostile to overly strong ambitions on the part of the IMO, and whose standards are not very demanding (Climate Home News, 15/10/2020).

CONCLUSION

The maritime sector was set to go into 2020 with new and better ambitions to combat sulphur and greenhouse gas emissions. Encouraged by the energy efficiency gains made over the past 10 years through optimising shipping and quayside operations, the players in the sector were mainly counting on the use of LNG as a fuel to continue their decarbonisation efforts despite its methane emissions. While the outbreak of the Covid-19 pandemic has effectively slowed down international trade and shipping flows, sea freight has proven to be surprisingly resilient. However, the opportunity cost and cost-effectiveness of the decisions taken by shipping companies to meet the new IMO standards are being undermined by falling oil prices, while negotiations to give substance to the low-carbon strategy to reduce the sector's emissions by 40% by 2030 are faltering.

AIR TRANSPORT
Crashing ambitions?

• KEY TAKEAWAYS •

☀ **The continuous growth of GHG emissions from the commercial aviation sector over the last few years - 2% in 2019 and 29% since 2013 - has been halted by the Covid-19 pandemic. The air transport association IATA predicts a 68% drop in traffic over the year, which may not be recovered before 2024 due to the loss of household and business incomes.**

☀ **The industry and NGOs have very different views on the impact of the sector's long-term trajectory. In the industry's carbon-neutral scenarios published in September 2020, they make the assumption that traffic will double by 2050, whereas the NGOs believe that the temporary drop in air traffic does not call into question the sector's cumulative climate impact nor its current trajectory, which is highly inadequate to achieve a 2°C scenario compatible with the Paris Agreement.**

☀ **These two stakeholders are also disputing which figures to use. The International Coalition for Sustainable Aviation and other observers denounce the choice made by the International Civil Aviation Organisation (ICAO) to only take 2019 in consideration as the sole reference year for measuring the level of emissions beyond which airlines must offset their emissions from 2021 onwards, and instead of using the 2019-2020 average. In the United Kingdom, the Supreme Court ruled in favour of two NGOs and cancelled the project to expand London airport on the grounds that it did not take sufficient account of the Paris agreement as ratified by the British government.**

☀ **The Covid-19 pandemic and the collapse in transport demand have forced states to step back in terms of fiscal plans. Although many countries had planned to introduce a tax on passengers or freight, the governments postponed these measures in 2020 and invested heavily in their national firms. €110bn in the G20 countries and €33bn in the EU, in the form of guaranteed loans, public aid and even nationalisation. Very little of this aid has been made conditional on binding environmental and social measures.**

1. State of play of emissions and trends: strong turbulence throug the Covid-19 pandemic

Global CO_2 emissions from the aviation sector (passenger, cargo and combi aircraft) continued to increase in 2019 according to calculations by the International Council on Clean Transportation (ICCT), to reach 918 million tonnes of CO_2 ($MtCO_2$) compared to 903 $MtCO_2$ in 2018 (ICCT, 2020). This represents a total of almost 39 million flights in 2019 and a 29% increase in CO_2 emissions over the last five years.

The International Energy Agency (IEA) estimates that aviation was responsible for 2.8% of global CO_2 emissions in that year (IEA, 2020). The US, the EU and China accounted for more than half of these emissions, with 23%, 19% and 13% of the market share respectively. Finally, it should be noted that a quarter of these emissions come from the first and business classes.

Although carbon intensity per passenger decreased by 2% (90 gCO_2/passenger-kilometre) in 2019, and the industry is therefore meeting its target of improving fuel efficiency by 1.5% per year[2], commercial flights are growing in absolute terms four times faster than fuel efficiency (ICCT, 2020).

FIGURE 20

PROGRESSION OF AIR TRANSPORT GREENHOUSE GAS EMISSIONS, BY ACTIVITY, IN 2013, 2018 AND 2019
Source: ICCT, 2020
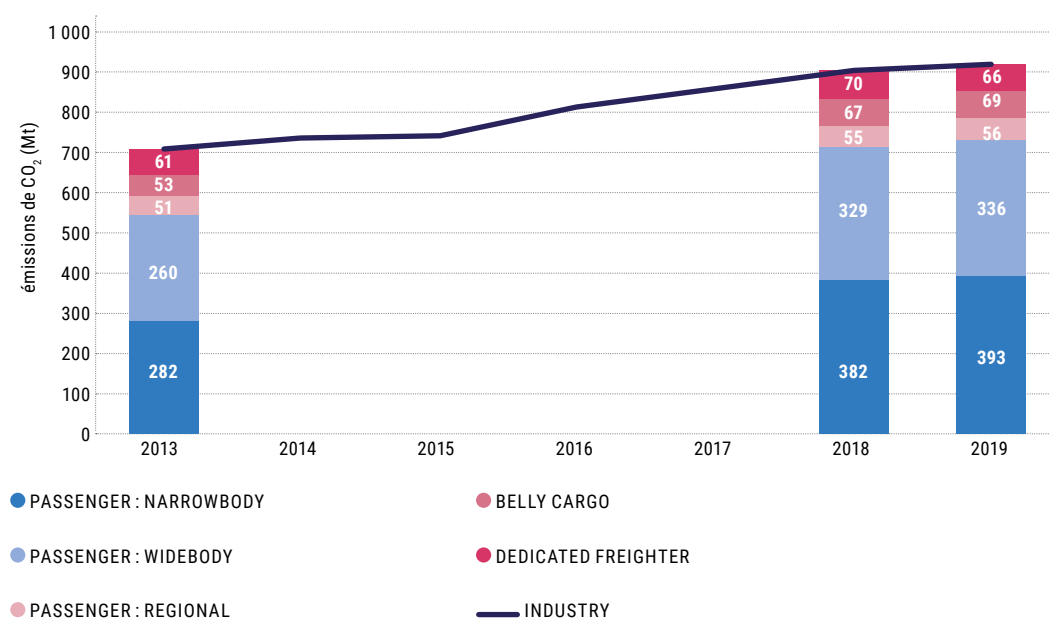
It should be noted that it is difficult to provide a clear picture of the real impact of the sector for two reasons. Firstly, the impact of aviation on the climate goes beyond CO_2 emissions, since this gas has complex interactions in the atmosphere that can deepen the impact of global warming (**Box 14**), and secondly, most of the data are produced by the industry itself (Climate Chance, Sector-Based Synthesis report, 2019).

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2 The International Air Transport Association (IATA) is the trade association for airlines across the world, representing some 290 airlines. It has set the following targets: +1.5%/year of fuel efficiency up to 2020, carbon-neutral growth from 2020 and halving emissions by 2050 compared to 2005. Sector report 2019, p 68.

NEW ESTIMATES OF THE "GLOBAL" CLIMATE IMPACT OF AVIATION AND THE CONCEPT OF "EFFECTIVE RADIATIVE FORCING"

A topical study from September 2020, published in Atmospheric Environment, reviewed several past works on the climate impact of CO_2 emissions and other aviation-related phenomena. The main conclusion is that, in total, aviation accounts for about 3.5% of the current radiative forcing. Therefore, although it accounts for about 2.8% of CO_2 emissions in 2019 (IEA, 2020), its impact on the climate is much greater (Carbon Brief, 21/09/20). In fact, the CO_2 emitted represents only 34% of the sector's overall climate impact or "effective radiative forcing" (Lee, D.S., et al., 2020). The remainder mainly comes from cirrus clouds and emissions of nitrogen oxides (NOx), which themselves cause a whole range of chemical reactions in the atmosphere (clouds of ice crystals, ozone, hydroxyl radicals, etc.).

Effective Radiative Forcing or ERF is measured in Watts/m², it is used as a measure of climate change to make comparisons possible between different greenhouse gases and other impacts that affect the climate system, because it has an approximately linear relationship with the change in the average global surface temperature (Carbon Brief).

BOX 14

All the emission development trajectories are now being called into question by the Covid-19 pandemic and the travel restrictions imposed by different countries in 2020. It is still difficult to estimate the impact of the Covid-19 pandemic. For example, the ICAO has not made its demand and emissions statistics public for the year 2019 because of the Covid-19 pandemic (ICAO, 2020).

In terms of traffic, aviation activity fell by 60% from March 2020 onwards (**fig. 21**), starting with China and then moving to Europe, India and the United States (IEA, 2020).

FIGURE 21

EVOLUTION OF AVIATION ACTIVITY IN SELECTED COUNTRIES AT THE BEGINNING OF 2020 - *Source: IEA, 2020*
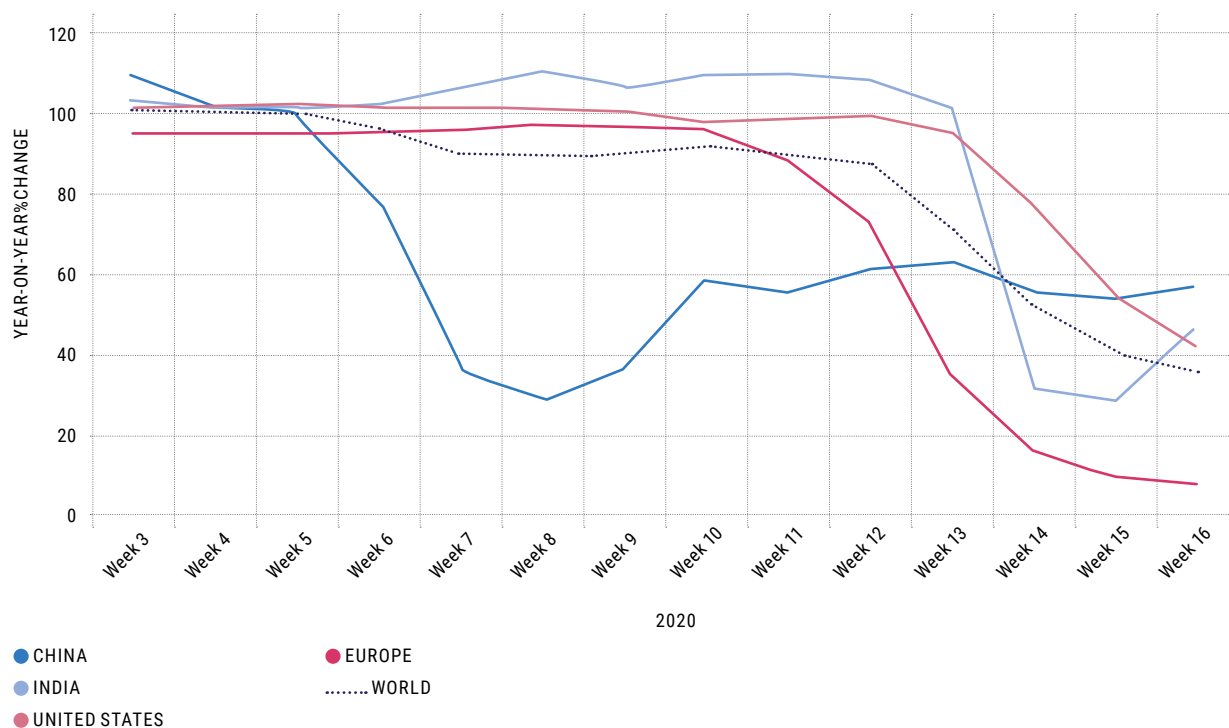
The end of lockdowns in China and Europe shortly before the summer did not permit a significant recovery of air traffic, since in June 2020 there was still an 86% drop in traffic compared with June 2019. The International Air Transport Association expects an overall decrease of 68% in passenger numbers over the whole year (IATA, 2020). According to ATAG[3], this drop in traffic could result in the loss of 4.8 million jobs in aviation, mainly in airlines and airports (ATAG, 2020).

The recovery of the sector could be further delayed by the fall in overall passenger incomes and the decline in confidence in the economic prospects of households and businesses. The industry estimates that passenger traffic will not return to its pre-Covid-19 level before 2024, unlike other crises easily overcome by the sector (**fig. 22**).

FIGURE 22

AIR TRANSPORT PASSENGERS AROUND THE WORLD 1914-2020 - *Source: ATAG, September 2020*
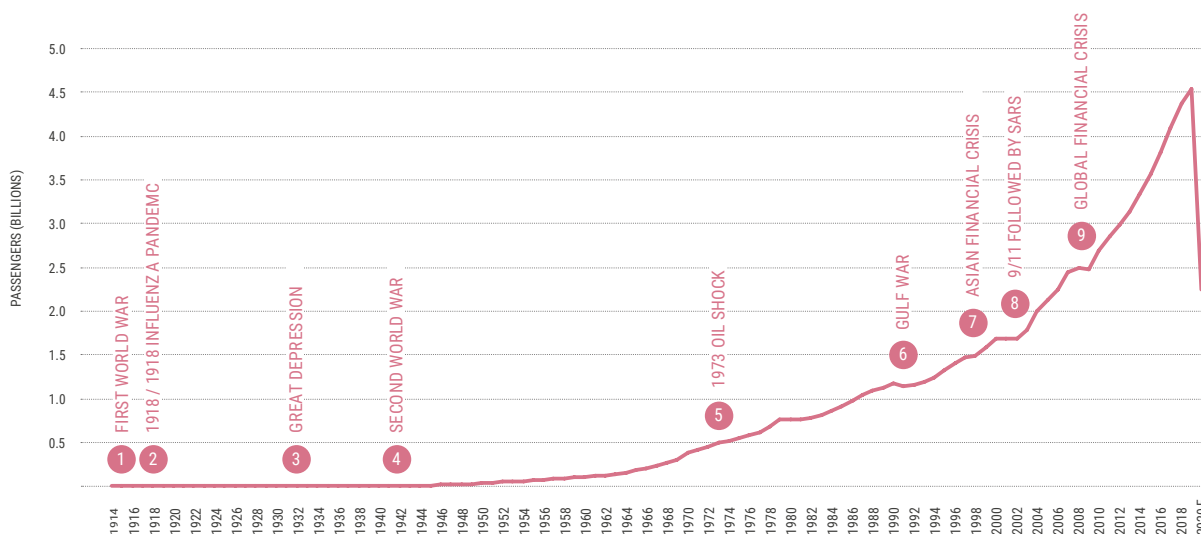
While this sharp drop in activity should enable the sector to achieve a trajectory compatible with international climate commitments, researchers point out that it is the cumulative impacts of CO_2 and other effects on the climate that matter, rather than the activity of a single year. The trajectories are therefore highly dependent on events of the coming months, the evolution of the epidemic in 2021 and pf demand (Carbon Brief, 21/09/20).

The same observation is made in the analyses of the think tank, Climate Action Tracker, which estimates that the recovery of the sector could bring the level of demand and emissions back relatively quickly to levels observed in recent years, and confirms the likelihood of a "critically insufficient" trajectory with emissions doubling by 2050 (**fig. 23**). Their analysis only covers the emissions from international aviation, which explains the lower historical emissions levels than the data mentioned above.

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3 - ATAG is a coalition of organisations and companies representing all sectors of the aviation industry worldwide.

FIGURE 23

HISTORICAL EMISSIONS AND 2050 EMISSIONS TRAJECTORY FROM INTERNATIONAL FLIGHTS IN RELATION TO THE OBJECTIVES OF THE PARIS AGREEMENT - *Source: Carbon Action Tracker, 2020*
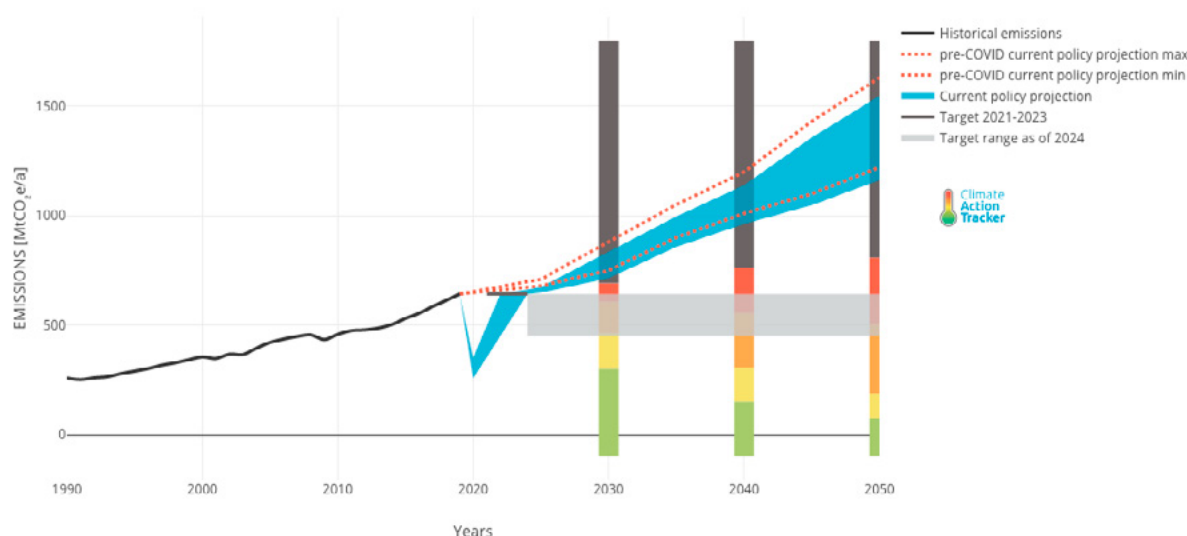
2. Aviation economic stakeholders renegotiating their international climate targets

However, this crash in demand in 2020 has a significant impact on the "Carbon Offset and Reduction Scheme for International Aviation" (CORSIA)[4], which regulates GHG emissions from international flights under the aegis of the International Civil Aviation Organisation (ICAO), a United Nations agency. Its objectives are defined in the resolution adopted by the ICAO Council in 2016, which provides for the stabilisation of the sector's emissions using the average CO_2 emissions of international aviation in 2019 and 2020 as a reference level. Above this level, airlines will have to offset their emissions.

However, in view of the crisis in the sector in 2020, its council accepted the request of the companies represented by IATA, made in April 2020, to change this reference date so as to only count 2019 emission levels, at least for the first 3 years, a decision notably supported by the European Union (European Council, 2020). The 193 members will decide whether to reverse this decision in 2022 and consider the 2019-2020 average as the reference level.

This decision has been denounced by many commentators, particularly the organisations of the International Coalition for Sustainable Aviation. They consider CORSIA to be already lacking in ambition in the face of the climate emergency (ICSA, 2020) and overly flexible with regard to the participation of Member States in this compensation scheme, since several countries have expressed reservations about their participation in the first pilot phases (Russia, Brazil, etc.), thus reducing the share of flights covered by CORSIA (Climate Tracker, 2020). This decision sets the reference level at its maximum, and will effectively exempt airlines from offsetting their emissions for several years, until 2027 according to Öko-Institut in Germany and the Environmental Defense Fund in the United States (Climate Homes, 26/05/20). The lack of obligations to offset their emissions could also weaken the incentives for the aviation sector to invest in carbon reduction measures, and result in an estimated revenue shortfall of US$15 billion (S&P Global, 2020).

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4 - International aviation is not included in the Paris Accord because it was considered difficult to attribute emissions to specific countries. However, international flights, which account for about 65% of the aviation sector's CO_2 emissions, are covered by ICAO's global programme, the Carbon Offset and Reduction Scheme for International Aviation (CORSIA). See Sector report 2019, p. 68

Back in late 2019 and early 2020, two ICAO decisions were already sparking a debate on the ambition of the CORSIA programme. The ICAO, as the secretariat of the Chicago Convention that regulates international civil aviation, decided in October 2019 that CORSIA would be the only system to regulate emissions from international aviation. This means that the industry will no longer be subject to the rules of the European Emissions Trading Scheme (EU ETS) which apply to all flights within the European Economic Area. This decision could result in an increase in aviation emissions in Europe by 2030 since CORSIA basically allows the industry to increase its emissions indefinitely as long as it offsets them by buying credits (T&E, 2019; CE Delft, 2016). Then, in March 2020, the ICAO Technical Advisory Board agreed on two important rules for the operation of CORSIA. On the one hand, credits from only six emission reduction certification bodies out of 14 applicants qualified for the programme. On the other hand, it introduces a "vintage restriction", restricting the credits that can be used for offsetting to those that started after 1 January 2016. These decisions reduce the risk of offsetting abuses on dated projects, but still maintain the supply of credits at a level well above the demand for the pilot phase (Carbon Market Watch, 16/03/20).

The industry does not believe that these measures will result in a lack of incentives. In September 2020, it published a report entitled Waypoint 2050 detailing the different scenarios for carbon neutrality by 2050, according to 5 evolution criteria (ATAG, 2020):

• traffic growth forecasts
• technological developments
• improvements in operations and infrastructure
• alternative fuels
• the role of compensation in filling the remaining gap

All the scenarios are based on a doubling of traffic by 2050 to 10 billion passengers per year. The scenarios thus differ according to the weight of the other four factors. The first scenario is the most balanced and relies on ambitious technological improvements, with hybrid/electric aircraft entering into service from 2035/2040 onwards (**fig. 24**). This possibility has been retained by Airbus, which seeks to be the first airline company to market a 100% electric aircraft by 2035, called ZERO-E (Airbus, 2020). For the moment, the American start-up ZeroAvia has managed to get the first 100% electric commercial aircraft powered by a fuel cell, with a capacity of only six seats, to take off over British soil (Euractiv, 24/06/20).

In all scenarios, alternative fuels represent the most promising decarbonisation option for the sector. Whereas carbon offsetting is considered to only marginally contribute to decarbonising the sector.

FIGURE 24

AVIATION SECTOR DECARBONISATION TRAJECTORY SCENARIO - *Source: ATAG, September 2020*
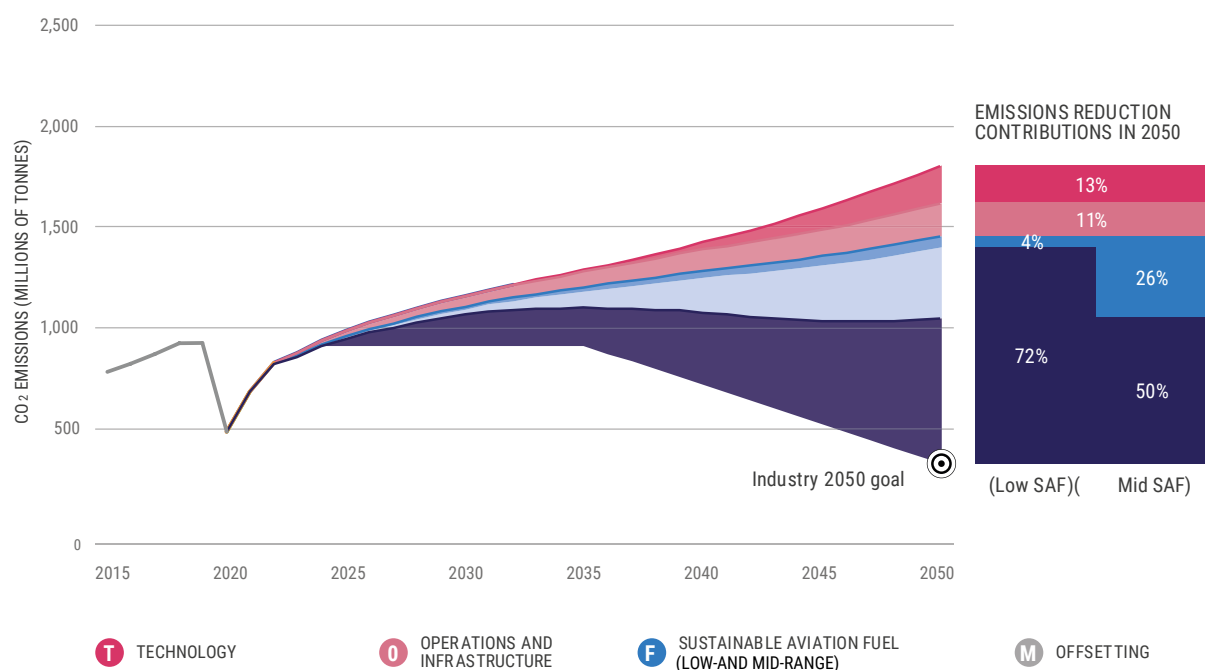
These changes are important in themselves, but their capacity to spread is the most decisive factor in whether the air sector will be able to massively decarbonise by 2050. According to modelling results recently published in the journal Climate Policy, the air sector, like the maritime, road freight and industrial sectors, will only be able to comply with the 1.5°C or 2°C scenarios at the price of a reduction in demand (Sharmina, M. et al., 2020).

3. Airline bailout plans replace tax contributions

In 2019, nine European Union Member States, including Germany, France, the Netherlands and Sweden, called for the introduction of an aviation tax throughout Europe. They believe that the sector is taxed less than others (exemptions from excise duties and VAT on international flights, etc.) and above all that the tax it pays does not reflect its contribution to GHG emissions.

Since then, the Covid-19 pandemic has shifted the sands, and the modification of the rules of the CORSIA offsetting scheme comes at the same time as a postponement of the taxes planned or applied to aviation and the rescue plans for the sector to protect jobs or the industrial skills of both manufacturers and airlines. The economic crisis in aviation has thus caused States to take two steps backwards in terms of taxation.

The first is backpedalling on planned taxes. The Netherlands was planning to introduce a passenger tax in 2021 in the absence of any prospect of a European tax at the end of 2020, as well as a tax on cargo flights. The latter was fiercely debated and strongly opposed by the industry in the autumn of 2020, particularly after a report by the SEO institute on the economic impacts on the sector and the risks of "leakage" of freight demand to other European airports (The Loadstar, 07/10/20).

After introducing an eco-tax of €1.50 to €18 on airlines departing from its airports in 2020, France announced in April 2020 the deferral of several taxes and charges (including civil aviation and solidarity taxes on airline tickets already in place), in order to support the cash flow of airlines. However, the Citizen's Convention for the Climate, in its 150 proposals published in June 2020, suggested increasing the eco-tax to €30 for flights of less than 2,000 km and €60 for those over 2,000 km, as well as a ban on opening new airports (CCC, 2020). The measure would then bring in 4 billion euros compared to just over 400 million today.

The airline companies see this tax proposal as the final straw for a sector already devastated by the crisis, and say it would lead to the loss of 150,000 jobs (Air Journal, 02/10/20).

The recent decision of the the UK Supreme Court to not allow the extension of Heathrow airport could encourage citizens to bring any such project to court in the future. The case was brought by the British NGO Plan B and the British branch of Friends of the Earth. The appellate judges agreed with the NGOs that the project owners had not taken sufficient account of the Paris Accord in the design of the project and requested that the UK government review the project in the light of its climate commitments. In the meantime, the owners have appealed again, but Friends of the Earth's lawyer considers the ruling unprecedented as it invalidates a massive infrastructure project based on the Paris Accord (Climate Home News, 08/10/20).

A court decision however was not necessary for the French government to cancel the extension of Charles de Gaulle airport, since the medium-term decline in traffic proved sufficient reason.

EXPERIENCE FEEDBACK

PASSENGER TAX IN GERMANY

Germany has already introduced a passenger tax. The tax depends on the distance between Frankfurt am Main airport in Germany and the largest airport in the country of destination, and is divided into three levels depending on the country concerned and the distance: €7.50, €23.43 and €42.18 per passenger. A 2019 study showed that most airports bordering Germany have gained a lot of passengers since the introduction of this air tax. This substitution implies that the air tax may not be effective in reducing overall emissions from air travel, while also leading to a loss of tax revenue due to passengers going instead to neighbouring countries (Borbely, D., 2019).

Germany announced an increase of this tax to almost twice the amount in 2019. Gains from this are to be used to subsidise train tickets by lowering VAT to 7% instead of the current 19%. Although the airline companies, as well as certain German airports were already opposed to this before the pandemic, the decrease in flights in 2020 has rallied the support of the aviation adviser of the CDU, Angela Merkel's party, who proposed postponing the tax for at least a year, believing that the pandemic had already served to reduce travel (Forbes, 06/03/20).

BOX 15

A second step backwards results from the aid given to airline companies in the framework of European and national recovery plans to help the economy recover from the pandemic. According to the Energy Policy Tracker database, aid to the airline sector totalled 110 billion USD in the G20 countries (Energy Policy Tracker, 2020). Half of this comes from the United States, which has earmarked 58 billion USD for airlines and 10 billion USD for airports.

Starting in April, the European Commission allowed Member States to help companies by putting in place a "temporary framework" that relaxes the restrictions on public intervention to support the economy, until 31 December 2020 (European Commission, 2020).

Most states have chosen to guarantee loans to companies, according to the assessment carried out by Transport & Environment in its "Bailout Tracker", for a total of €33 billion (T&E, 2020).

TYPE OF AID PROVIDED BY EUROPEAN STATES TO AIR COMPANIES

- LOANS AND LOAN GUARANTEES
- STATE AID
- RECAPITALISATION
- RENATIONALISATION
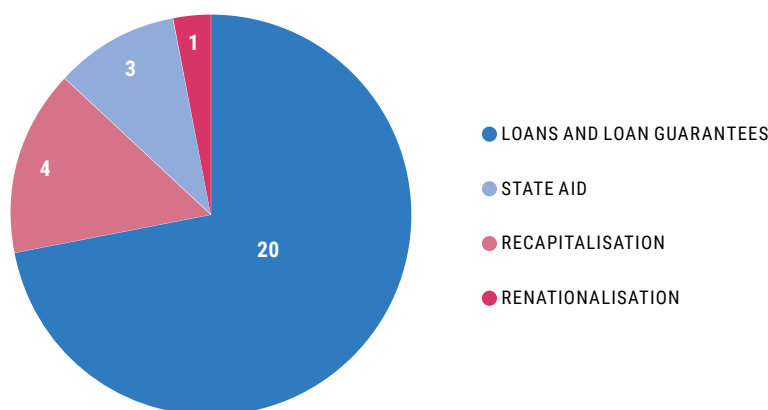
Sweden, for example, has released 455 million euros in public guarantees for loans to support airlines. In the United Kingdom, the aviation recovery plan announced for the end of 2020 would include the partial payment of the 55,000 employees in the sector, loans and 1.8 billion pounds of aid through COVID Corporate Financing, a Bank of England aid fund (UK Government, 19/10/20). Italy nationalised the company Alitalia with an initial contribution of 3 billion euros to save the already heavily indebted firm from bankruptcy.

In many countries, the public debate has centred around the issue of attaching environmental and social conditionalities. Some have come to agreements with companies on social or environmental conditionalities, however few of these are legally binding.

AirFrance KLM for example has benefited from a 90% revolving credit line of €2.4 billion guaranteed by the Dutch government and granted by 11 banks, and a direct state loan of €1 billion (KLM, 26/06/20). The State made these loans conditional on reducing the salaries of pilots employed by KLM (Aviation Journal, 04/11/20). On the environmental side, the agreement provides for a reduction in the number of night flights from Schiphol airport and the replacement by train for destinations such as Brussels and Düsseldorf. KLM has committed to reducing its emissions in 2030 to 2005 levels and to reducing emissions per passenger-kilometre by 50% over the same period (Simple Flying, 07/08/20). Greenpeace has threatened to take the Netherlands to court, claiming these conditions are insufficient and the targets weaker than in other sectors. The NGO is advocating for the introduction of an emissions cap on the airline and seeks to stop all short-haul flights.

In France, 7 billion euros of loans have been granted to Air France, which has committed to reduce GHG emissions from its domestic flights by 50% by 2024, to meet its commitments to reduce emissions per passenger and per km by 50% by 2030 and to reduce flights where an alternative by train in less than 2h30 is possible. These non-binding conditions have been denounced as insufficient by several NGOs, but also by the High Council for the Climate, a body attached to the Prime Minister and responsible for assessing the implementation of France's mitigation policies and measures. In its report, the HCC points out that aviation is the only sector subject to the EU ETS whose emissions continue to rise, by 5% in 2019 (HCC, 2020). *"This is not the time to support aviation at all costs, but to open up the debate on reducing air travel"* commented its president Corinne Le Quéré (Le Monde, 21/04/20).

As we enter a second wave of Covid-19 epidemics, airlines are urging governments to set up rapid testing systems so as to avoid collapsing their business a second time, but losses are nevertheless accelerating for most companies ([FT](#), 14/10/20).

CONCLUSION

While it enjoyed exponential growth in activity until the beginning of 2020, air transport found itself brutally constrained by the Covid-19 pandemic. With fleets stranded on the tarmac, GHG emissions from the aviation sector are set to reach historically low levels in 2020 in the absence of demand. Enough to call into question the offset mechanisms under the Corsia programme, whose pilot phase is due to start in 2021, and to push ICAO member states to adjust the rules. As more and more airlines are moving towards carbon neutrality, the sector is faced with the challenge of regaining a sufficient level of activity in the coming years to maintain the meaning of the offset programme, while at the same time embarking on an ambitious and uncertain technological transformation to align itself with the objectives of the Paris Agreement. The modal shift, which depends on many socio-economic factors, will depend on the deployment capacities of alternative modes and in particular on the support of recovery plans

Please do not hesitate to respond to this document, or to suggest any relevant additional reports or data by writing to the following address: contribution@climate-chance.org

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BUILDING

(Re)launching the climate strategies of actors in building and housing

(Re)launching the climate strategies of actors in building and housing

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Understanding emissions from the building sector and the trends in the actions put into practice by its protagonists, over the entire life cycle of a building, is a complex challenge. This is due to the dispersion of actors, difficulties in orchestrating their mitigation actions, and the diversity of climatic contexts and local issues linked to housing. Furthermore, as underlined in this analysis, the success of building renovation or sustainable construction policies does not depend only on technological solutions, but has much to do with the practices of occupants, both households and businesses. This context and these challenges are preventing the building sector from putting a check on increases in GHG emissions, which have risen again since 2016 and by 1.5% in 2019. Here we analyse the macroeconomic drivers of these changes, but above all we seek to illustrate the levers for action that can be used by companies, local authorities, research bodies and citizens, with the support of national policies, to speed up the pace of energy retrofits, improve the durability of new construction and, above all, ensure the sustainable and more sober use of buildings.

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BUILDING

1 Emissions from the building sector increased by 1.5% in 2019 (10.08 GtCO$_2$) due to a growth demand in electricity from household appliances and air conditioning. Energy efficiency gains (~1%/year) do not offset this growth, and investment in energy efficiency could decrease by 10% in 2020. The absence of energy codes in two thirds of the countries and obsolete appliance standards mean that more than 5 billion m² were built in 2019 without energy performance requirements. Only ~35% of buildings' consumption are covered by codes or standards.

2 The Covid-19 pandemic has led to a shift in consumption from industry and the tertiary sector to households, mitigating the expected decrease in overall electricity consumption in 2020. However, the pandemic's consequences threaten access to clean energy for cooking, of which 37% of the global population is deprived, and in a context where informal housing is again on the rise since 2018. In Europe, where 15 to 24% of construction companies could go bankrupt, local authorities and governments see the economic recovery as an opportunity to implement their renovation strategies.

3 Very few codes and requirements apply to the existing building stock. Some municipalities are showing interesting results thanks to mandatory reporting of energy performance (Tokyo, Columbus, Saint-Paul). Integrated renovation services at the local level (one-stop shops) are proving to be all the more relevant in overcoming the obstacles to renovation accentuated by the crisis, and are an instrument that the European Union wishes to disseminate widely.

4 Local and regional codes for new buildings are more numerous: solar water-heating, solar cool roofs and rooftop gardens are among the most frequently imposed requirements. Subsidies, allowances and tax exemptions are also part of the incentives for such developments. Finally, some cities prefer to leave the choice of means to local players either through local emissions quota and trade systems (Tokyo, New York) or mandatory certifications (Singapore). Multi-stakeholder initiatives facilitate access to financing from local authorities or the development of a market dedicated to sustainable construction.

5 Multi-stakeholder initiatives are being developed to integrate building users' behavior and needs into renovation projects (data management systems, awareness-raising, etc.) and to develop building performance monitoring tools to this end (EPC, passports or notebooks, etc.). Reflections on the life cycle of buildings are leading to the integration of grey energy into certifications (NolICO$_2$ etc.), the creation of markets for more sustainable, biosourced or recoverable materials (2030 Palette, Madaster, etc.). Finally, a more "adaptive" approach towards recyclable or reversible buildings is emerging, which would make it possible to anticipate and adapt buildings to changes in usage, as in the case of teleworking accelerated by the Covid-19 pandemic.

1. Emissions still on the rise in 2020

• EMISSIONS PUSHED UP BY DEMAND FOR ELECTRICITY IN 2019 • Although the level of CO_2 emissions from energy consumption in the building sector plateaued between 2013 and 2016, it has since started climbing again. **In 2019, emissions went up to 10.08 gigatonnes of CO_2, up 1.5% from 2018.** In 2018, the growth in emissions was at 2%. While direct emissions[1] are down slightly, from 3.1 to 3.08 $GtCO_2$ between 2018 and 2019, this fall is offset by a 2.4% rise in indirect emissions linked to electricity consumption, which reached 7 $GtCO_2$ in 2019 compared to 6.83 $GtCO_2$ in 2018 (IEA, 2020, **fig.1**). Indirect emissions have seen the greatest increase in recent decades, going from 4.9 $GtCO_2$ in 2000 to 7 $GtCO_2$ in 2019, a rise of 43%.

FIGURE 1

CHANGES IN BUILDING SECTOR EMISSIONS - *Source: IEA*
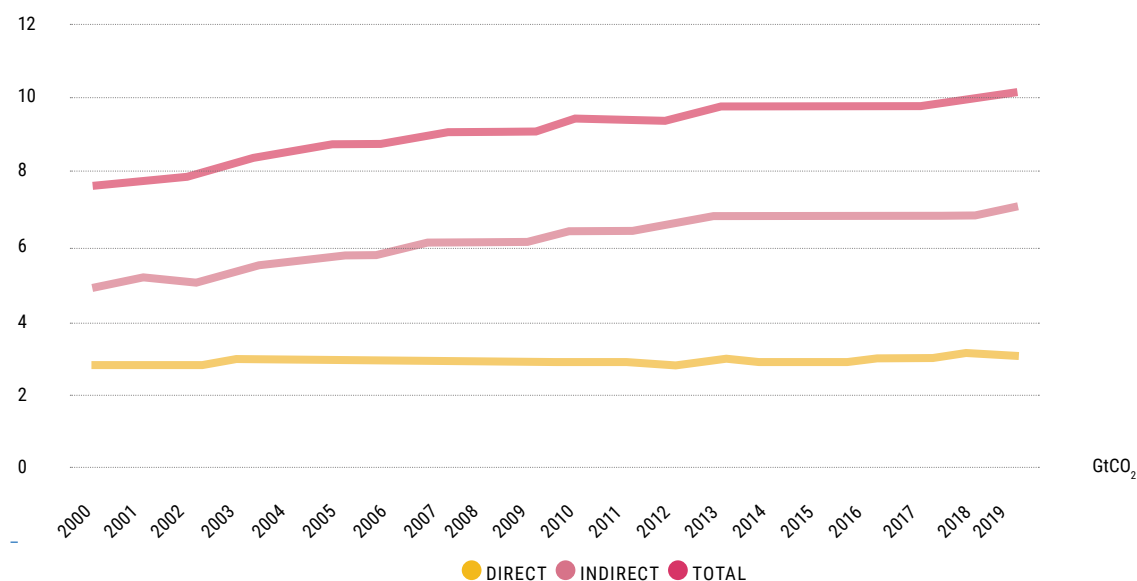
This increase is the result of a combination of factors. The primary cause however is the growth of the population and the built surface area (GABC, 2019) which rose to around 245 billion m² in 2019 (IEA, 2020). Overall, energy demand has increased since 2016 and reached 128 EJ in 2019 compared to 125 EJ in 2017. This rise in energy demand is driven by the electrification of uses and primarily by the growth in consumption of electricity for air conditioning and household appliances (IEA, 2020).

The demand for cooling was responsible for emissions of around 1 $GtCO_2$ and nearly 8.5% of total final electricity consumption in 2019. Between 2017 and 2018, the installed base for air conditioning systems worldwide went from 1.69 to 1.76 billion, a growth of 4.4% (IEA, 2019). Over the same period, electricity consumption for household appliances increased by 2.7% (from 3,129 to 3,222 TWh, IEA 2020). Climatic factors have also impacted the sector's electricity consumption in 2019. 2019 was the second warmest year on record and many countries experienced heat waves that resulted in higher energy demands for air conditioning.

The progress made in energy efficiency (~1%/year) is currently not sufficient to offset this growth in energy demand. The energy intensity of buildings (final energy consumption per m²) has been falling continuously by 0.5% to 1% per year since 2010, but a decrease of at least 2.5% per year is needed to meet the objectives of the Paris Agreement (IEA, 2020).

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1 - Direct emissions include the direct consumption of natural gas and oil for heating and cooking, while indirect emissions cover emissions related to the production of electricity and heat for household appliances, air conditioning etc.

• SLOW PROGRESS IN ENERGY STANDARDS AND CODES • The adoption of specific regulatory instruments promoting energy efficiency for buildings continues, but at a slow pace. National energy codes for buildings or energy standards, whether mandatory or voluntary, make it possible to establish standards for constructing buildings that offer better energy performance. They are one of the tools prioritised at national level to reduce the energy consumption and thus the greenhouse gas emissions of buildings.

According to the IEA, 69 countries had national energy codes in 2018. In 2019, less than 75 countries had or were in the process of developing such codes (**fig. 2**). Progress is therefore slow, all the more so since around 45% of these energy codes cover only a part of the building sector. A large part of the progress made between 2018 and 2019 consists of updating standards that are already in existence. Currently, two out of three countries apply no energy code nor regulation to the building sector. As such, the IEA estimates that more than 5 billion m² were built in 2019 without energy performance requirements (IEA, 2020).

FIGURE 2

STATUS OF ENERGY STANDARDS FOR BUILDINGS - *Source: IEA, 2020*

- Mandatory for entire sector
- Mandatory for part of sector
- Mandatory for part of sector in major city
- Voluntary for part of sector
- Code in development
- No known code

This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.
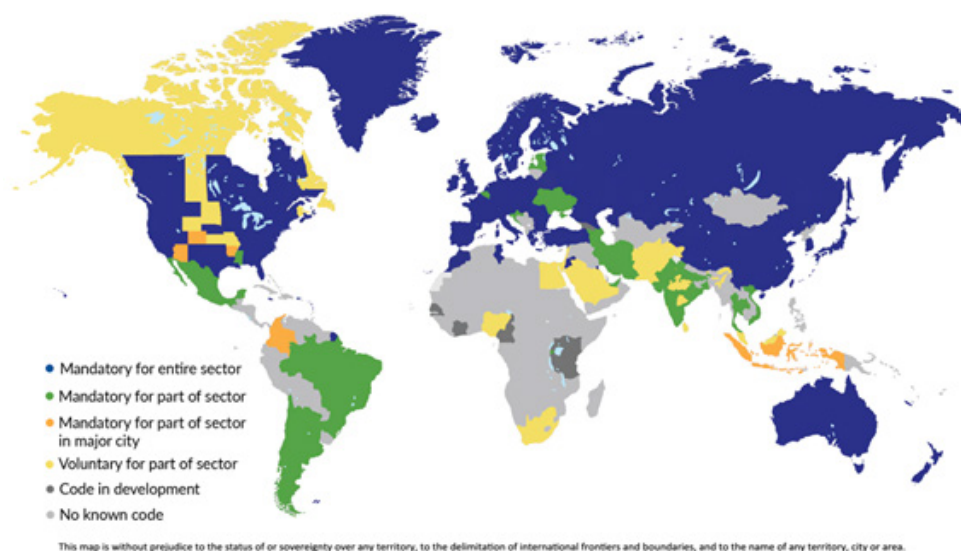
Energy standards for building uses are also progressing at a moderate rate, covering around 35% of the energy consumption of buildings in 2018 according to the IEA, compared to 34% in 2017. The most regulated sectors are lighting and cooling: 83% and 77% respectively of the energy consumption of these sectors is covered by energy efficiency standards. On the other hand, the proportion of household appliances subject to standards has fallen slightly, from 32% in 2017 to 31% in 2018 (**fig. 3**, IEA). The existence of a framework for energy uses does not necessarily guarantee that the energy criteria adopted for the equipment is rigorous. Indeed, many standards are now dated and have not always been updated to take account of technical progress. In many countries, for example, halogen lights are still authorised even though they are only 5% more efficient than incandescent bulbs (IEA, 2020).

COVERAGE BY ENERGY STANDARDS OF ENERGY USES IN% - *Source: IEA, 2020*

- ● SPACE COOLING ● LIGHTING ● WATER HEATING
- ● APPLIANCES ● SPACE HEATING ● TOTAL BUILDING
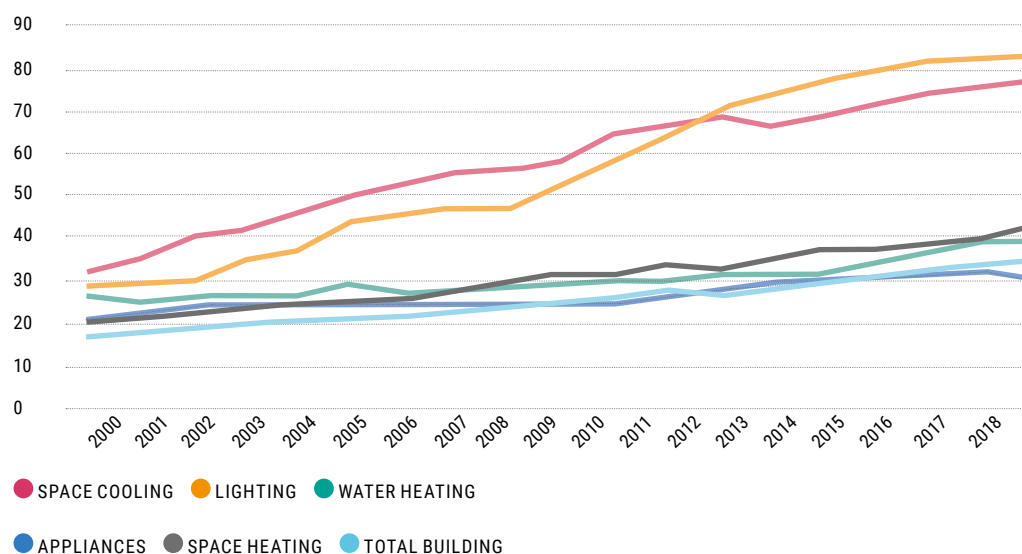
• THE CRISIS IS CHANGING THE WAY WE USE BUILDINGS • The effects of the Covid-19 pandemic are unprecedented and, according to the first estimates published in October 2020, the fall in global GDP for 2020 is expected to be 4.5%. The construction and building sector has been impacted like any other. Some projects have been delayed or even cancelled, because of health restrictions and impacts on businesses in the sector. Equipment and material supply chains have also been affected, especially steel and glass coming from Asia. In this context, subcontractors and SMEs are particularly vulnerable to bankruptcy, according to the firm PwC (PwC, 2020).

In Europe, construction activity fell by 25.7% between February and April 2020. Between April and August, activity increased by 30.5% and therefore returned to 97% of the pre-pandemic level (**fig. 4**). Although the construction sector seems to have recovered better than others, the number of B&PW companies in situations of bankruptcy on the European continent is set to increase from 15% to 24%, according to insurer Euler Hermes. The increases are predicted to be 24% in Spain, 19% in France and the Netherlands, and 15% in Italy and the United Kingdom (Le Moniteur, 19/06/20).

FIGURE 4

CONSTRUCTION ACTIVITY IN THE EU - *Source: ec.europa.eu*

EU-27, development of construction production, January - August 2020
2015 = 100
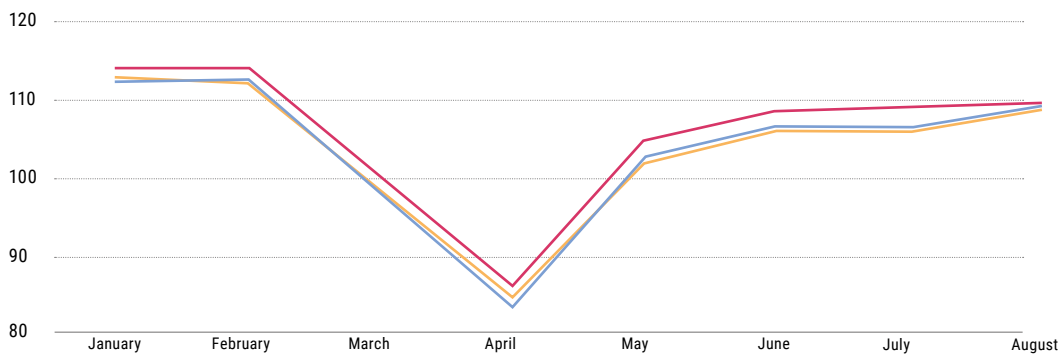
Source: Eurostat (online data code : sts_copr_m)

● TOTAL CONSTRUCTION   ● BUILDING   ● CIVIL ENGINEERING

The crisis is also having repercussions on how we use buildings, which has been modified by the pandemic. Lockdown measures have given impetus to working from home and e-learning, shifting a part of energy consumption to the residential sector (IEA, 2020). At a global level, electricity consumption should fall by 2% (Enerdata), but this is mainly attributable to the fall in industrial and tertiary consumption, while electric consumption remains stable and even increased in the residential sector. This decrease is partly offset by household consumption. In the United States for example, residential energy consumption has increased by 6 to 8% during the spring lockdown (Saadat et al., 2020). In France, according to RTE, although electricity consumption fell by 15% nationally at the height of the lockdown, it increased slightly in the residential sector, as a consequence of widespread working from home and people generally being at home more (RTE, 2020).

KEYS TO UNDERSTANDING

INADEQUATE PROGRESS IN ACCESSING CLEAN COOKING METHODS, DUE TO THE CRISIS

In 2018, only 63% of the world's population had access to "clean" means of cooking, meaning 2.8 billion people live without this basic provision. This proportion is not increasing fast enough and in some regions, such as in Sub-Saharan Africa, population growth is higher than the growth in the number of people gaining access to clean cooking solutions (Tracking SDG 7, 2020). The vast majority of people in sub-Saharan Africa therefore depend on collecting wood or biomass for cooking, especially in rural areas. The already inadequate efforts to reduce dependence on firewood for cooking risk being heavily impacted by the economic hardships caused by the pandemic. A survey by the Clean Cooking Alliance of manufacturers, distributors and other companies in the clean cooking sector found that a third of them had temporarily ceased operations. The other companies said that they faced "moderate to severe" difficulties (Clean Cooking Alliance, 30/04/20). Above all, as the crisis makes poverty worse, many households could once again take recourse to wood for cooking (IEA, 2020).

Additionally, access to electricity and particularly to off-grid photovoltaic systems has also deteriorated (see Energy section of the 2020 Sector Report).

BOX 1

The recovery plans are also an opportunity to advance the transition of the economy. In the building sector, the adoption of measures and targeted investments favouring new constructions with low energy consumption and energy renovations would make it possible to speed up the decarbonisation of the sector. Furthermore, the sector, particularly energy renovation, is very labour intensive, which fosters job creation (IEA, 2020).

Energy Policy Tracker analysed the recovery plans of G20 member countries. As of 25 October 2020, 60% of building sector investments - 17 billion out of 28 billion dollars - are "green" investments (**fig. 5**). Proportionally, the building sector is the sector with the greenest recovery plan. China, which has announced the renovation of 39,000 residential areas, is the country committing the largest sums. The spending includes general building reform and modernization work, but it also encourages improvements in the energy efficiency of the building envelope and the installation of charging stations for electric vehicles (Chinese Government, 21/07/20). In France, a budget of 6.7 billion Euros has been allocated to energy renovation for buildings, a sector which represents nearly 25% of the country's GHG emissions (French Government, 03/09/20).

In the UK, a programme worth 3 billion pounds sterling will be put in place for building insulation. Of this amount, 2 billion will be allocated to the "Green Home" subsidy program: vouchers worth up to £5,000 will be issued to British homeowners for energy renovations to their homes. 650,000 households are expected to benefit (Grantscheme.uk, 2020). Germany will increase the funding for various building renovation programs by 2 billion Euros, bringing the total budget to 5 billion Euros over the period 2020-2021 (IDDRI, 16/06/20).

FIGURE 5

AMOUNTS ALLOCATED TO BUILDING SECTOR RECOVERY PLANS AS OF 25 OCTOBER 2020 - *Source: Energy Policy Tracker*
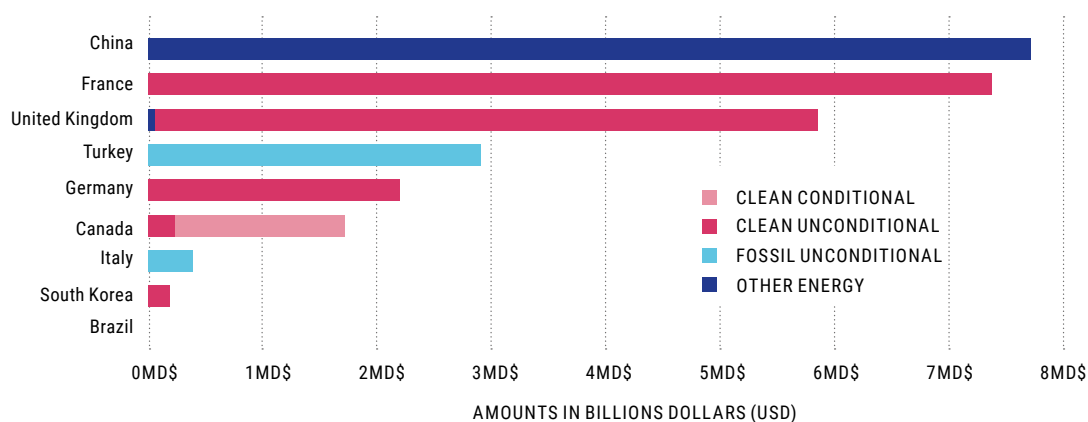
2. Existing buildings: Renovation and improvement of building operations

Almost two-thirds of the current built surface area will still exist in 2050 (Architecture 2030, 2018). In some countries, existing buildings are expected to represent up to 80% of the building stock by 2030. In most of the advanced economies, where the demand for heating is concentrated, the majority of buildings were constructed before the advent of energy performance standards. But currently, the annual rate of energy retrofits for the global building stock is less than 1% per year, well below the level required for alignment with the Paris Agreement (IEA, 2020).

here are many levers to increase energy efficiency: improving building design to make gains in heating, cooling, ventilation and lighting, replacing old and energy-consuming equipment, and even active energy management. However, investment in energy efficiency could decrease by 10% in 2020 (IEA, 2020).

• LOCAL AND REGIONAL GOVERNMENT REGULATORY POLICIES •

1. Regulatory obligations for renovation or reporting

The GlobalABC Roadmap shows that in 2020 very few countries have building codes that cover renovations of existing stock (GlobalABC, 2020). The findings are similar at regional and local levels - most of these codes in place concern new buildings (see part 3 below). There are a few exceptions like New York City's new energy conservation code which takes effect in 2020 and is one of the strictest in the United States. The envelopes and structures of buildings with a previous code must be modernised when the use of the building changes or when work is done that results in increased energy demand (Metropolis NY, 29/01/20).

In Europe, the obligations for local authorities come mainly from the European Union which, with the economic crisis linked to Covid-19, sees the implementation of its renovation strategy as a means of creating jobs and reviving the economy. With the amended Energy Performance of Buildings Directive (EPBD) and the Renovation Wave strategy of 2020 (EPBD) et la stratégie de vague de rénovation de 2020 (EUR-Lex, 2020), Member states are now bound to work on long-term renovation strategies to decarbonise national building stocks by 2050, with milestones every decade. The Commission's proposal includes an obligation to renovate all public buildings, including those belonging to local authorities. They will have to meet minimum energy performance standards, but details of the time period and performance level of the renovation are yet to be specified (Energy Cities, 19/10/20). For the Eurocities network, the European strategy must combine the programs adapted to each building segment and renovation methodology at the district level, to give cities flexibility to decide on the best approach (phased or one-shot renovation, etc.), based on local conditions and the financial support available (Eurocities, 2020).

Some cities and regions have also set up mandatory reporting systems for the energy performance of buildings to help develop renovation programs. These can give rise to an energy benchmark to compare the performance with that of other buildings on the market. They therefore involve regular energy audits. In the United States, a growing number of cities and states impose these benchmarks on large public and commercial buildings, as shown in the data collected by the Building Rating platform (**fig. 6**). They were joined in 2019 by Columbus in Ohio and Saint-Paul in Minnesota.

FIGURE 6

LOCAL AND REGIONAL OBLIGATIONS IN PLACE IN THE UNITED STATES - *Source: IMT & Building Rating updated 05/20*

U.S. City, County, and State Policies for Existing Buildings:
Benchmarking, Transparency, and Beyond
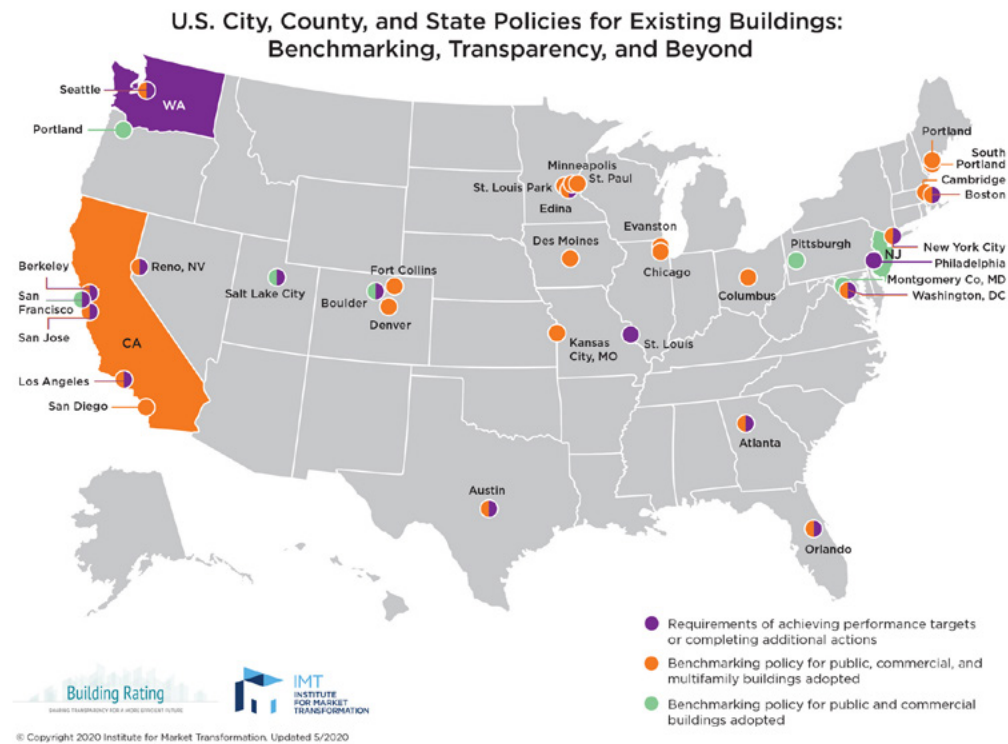
The energy performance of large public buildings have even been made public online in cities such as Tokyo, Philadelphia, New York and Seattle (C40, 2020). The Tokyo Carbon Reduction Reporting (CRR) program concerns the 660,000 small and medium-sized enterprises that represent 60% of emissions from the industrial and commercial sector but are not included in the carbon emissions trading market. Within this market however, the Japanese "Cap-and-Trade" program covers the GHG emissions of around 1,200 large company buildings and achieved a 27% reduction in CO_2 emissions in 2019 compared to the reference emissions, going from 16.5 $MtCO_2$ to 12.1 $MtCO_2$ in 2018 (Métropole de Tokyo, 26/03/20).

IN THE UNITED STATES, A MOVEMENT TO ELECTRIFY RESIDENTIAL AND COMMERCIAL BUILDINGS IS TAKING SHAPE

Some cities, particularly in California and Massachusetts, want to ban gas and promote completely electric homes, mainly for new buildings but also during major renovation works (Yale E360, 14/04/20). The state of Maine chose instead to pass a law aimed at installing 100,000 heat pumps in the state by 2025 (worth consideration when taking (the state has a total of about 500,000 households). The sudden drop in natural gas prices caused by the Covid-19 crisis should not undermine this trend, since in California for example 80% of the price of residential gas originates in network maintenance costs. Additionally, 70% of the citizens questioned in a survey prefer electrical appliances to gas appliances and electricity is also becoming more and more cost efficient compared to fossil fuels (GreenBiz, 03/04/20). However, in parallel, a Guardian investigation revealed the intense lobbying campaign carried out by gas companies in the United States to counter attempts by cities to exclude natural gas. The city of Seattle has thus abandoned its draft ban order, and some have themselves forbidden cities to issue orders banning gas (The Guardian 20/08/20, S&P Global 24/09/19).

BOX 2

2. One-stop shops: to be implemented by local authorities and scaled up by the European Union?

To encourage local businesses and households to renovate and modernise their buildings, a growing number of local authorities are offering one-stop shops to building owners, as we amply illustrated in the Sector Report 2019. These could be reinforced by the European Commission's "wave of renovation" strategy. This could help States and local authorities to set up standardised one-stop-shops to overcome obstacles linked to the paucity of information available to individuals or companies and the dispersed nature of renovation offers or funding opportunities. These challenges are regularly cited as being the main obstacle to renovations (France stratégie, 2020).

The introduction of integrated renovation programs, particularly at the local level, would make it possible to reduce the European Union's total energy consumption by 26%. These tools have proved particularly useful during Covid-19 to guide individuals, according to the European INNOVATE project which brings together 13 diverse local players from 11 European regions to deploy one-stop shops for renovation (Energy Cities, n.d.).

These shops are sometimes connected to the Energy Performance Certificate (EPC) databases, such as in Denmark or Scotland (BPIE, 2020). Some French regions are also taking the lead. Occitanie, for example, plans to roll out several one-stop shops throughout the region as part of their Building Recovery Plan approved in June 2020 (Occitanie, 2020). In France, building renovation is also taking the form of a national public service with the launch of the FAIRE support platform run by the Ecological Transition Agency (Ademe).

WARMER HOMES SCOTLAND A THERMAL RENOVATION PROGRAM FOR THE POOREST HOUSEHOLDS

Warmer Homes Scotland is a scheme under Home Energy Scotland, a network of regional advice centres throughout Scotland that provide all the information about home renovations, and the various financing options available (especially government grants and interest-free loans). Warmer Homes was launched in 2015, to help energy poor and fuel poor households to stay warm. Under the scheme, qualifying homeowners and private tenants can get assistance to get wall insulation, loft insulation, draught proofing, central heating (including new gas boilers), and even installing renewables. Since the launch of the scheme, over 17,000 households have benefitted from measures valued and saved an average of £300 per year on energy bills.

FIGURE 7

ENERGY PERFORMANCE OF BUILDINGS BEFORE THEIR RENOVATION
Source: WarmWorks Annual Report 2019
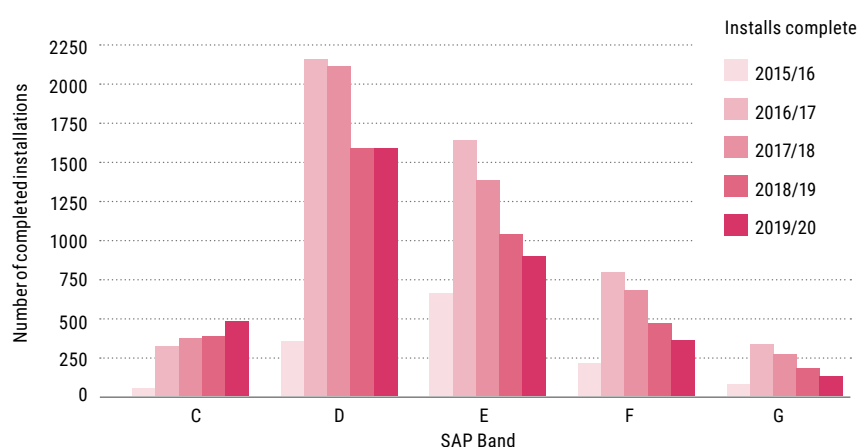
While many of these homes are rated C or D on paper, their actual performances were worse at the time of project installation (**fig. 7**). Post installations, these homes enjoyed an average of 20% increase in their energy efficiency. In the past one year, as per the 2019-2020 assessment, that has meant a saving of 5 000 tCO_2.

In addition to providing a One-Stop-Shop solution to heating-related renovations, the programme also serves to create apprenticeships for skill-formation along the entire supply chain. Out of the 22 registered subcontractors under the scheme, most of them are SMEs. In the 2020-21 period, an additional £6 million has been announced for the programme, to further the fight against fuel poverty and also create additional jobs.

Sources: Greener Scotland; Home Energy Scotland; WiredGov.

BOX 3

This need for coordination is even more important in the apartment blocks and condominiums in which 43% of the European population live, and whose energy performance is very often low (Energy Cities, n.d.). The owners of these buildings are often numerous and coordinating them for such projects can be a major obstacle. The European ACE (Accelerating Condominium Energy)-retrofitting project therefore provides support in this area, connecting the co-owners with the appropriate professionals. Local authorities provide the cornerstone in facilitating this project and the method and tools used are inspired by the work of the Paris Climate Agency (APC). Within this framework, Frankfurt, which is estimated to house around 200,000 residents in blocks of flats, has set up a platform inspired by that of the APC. This provides information on the different stages of

the process, key figures illustrating the economic and climate benefits, and specific recommenda-
tions (NWEurope, 27/03/19).

In total, the ACE programs have facilitated renovation for 371 condominiums, additional 241 reno-
vations are underway. These renovations allow for savings of more than 9,500 tonnes of CO_2 per
year (**tab. 1**).

TABLE 1

RÉSULTATS DU PROGRAMME ACCELERATING CONDOMINIUM ENERGY-RETROFITTING DANS LES VILLES PARTICIPANTES.
Source: ACE-meter, updated in July 2020.

	Co-owners coached	Professionnals coached	Retrofitting plans voted	Retrofitting in progress: condominiums/flats	Retrofitting finished: condominiums/flats	Annual decrease of CO_2 emissions in tonnes
Belgique	11,297	388	8		64/3,608	2,600
Allemagne	3,850	591	19	6/556	4/398,	35
Belgique	1,741	255	7	16/620	15/188	1,616
Pays-Bas	609	81	6	2/155	5/382	89
France	62,505	2,711	247	217/5,205	248/5,955	5,046
UK			69		35/284	178
TOTAL	**80,736**	**4,026**	**356**	**241/6,536**	**371/10,815**	**9,564**

• MONITORING THE ENERGY PERFORMANCE OF BUILDINGS AND BEYOND •

1. Energy performance certificates (EPCs) and energy passports

For the International Partnership for Energy Efficiency Cooperation (IPEEC), having energy
labels, codes and mandatory disclosure of building performance goes a long way as the first steps
encouraging energy-efficiency improving renovations (IPEEC, 2020).

Energy performance certificates (EPCs) were introduced in Europe in 2002 by the EPBD directive
(2002/91/EC). They aim to make an individual building's energy performance more transparent.
In 2010, the EPBD directive introduced an independent quality control for EPCs, sanctions for
non-compliance and the obligation to display the energy label in advertising and during sales
and rental transactions.

INDICATOR

6 millions

*6 millions of energy performance certificates (EPC) have
been deliver each year in the European Union including
United Kingdom*

The European X-tendo project recently carried out monitoring of EPCs Europe-wide. It estimates that around 6 million EPCs are issued each year in European countries. Slovakia, the Netherlands and Portugal have the biggest share of high-scoring EPCs (EPC A and B), which can be explained by housing stock performances and also by the building types included in the database, the compliance rate and calculation method (BPIE, 2020, **fig. 8**). In Scotland, the Covid-19 pandemic has led the government to postpone sin die the application of a new obligation that was due to come into force on 1st April 2020. This required all new rentals to have an EPC of at least E and all properties will have to have at least one E-Band EPC by 31 March 2022 (UK Government, 2020).

FIGURE 8

DISTRIBUTION OF ENERGY PERFORMANCE CERTIFICATES (EPC) BY SCORE IN% - *Source: X-tendo, mars 2020*

Distribution of EPC label ratings (%)

Share of dwellings with label A
Share of dwellings with label B
Share of dwellings with label C
Share of dwellings with label D
Share of dwellings with label >D
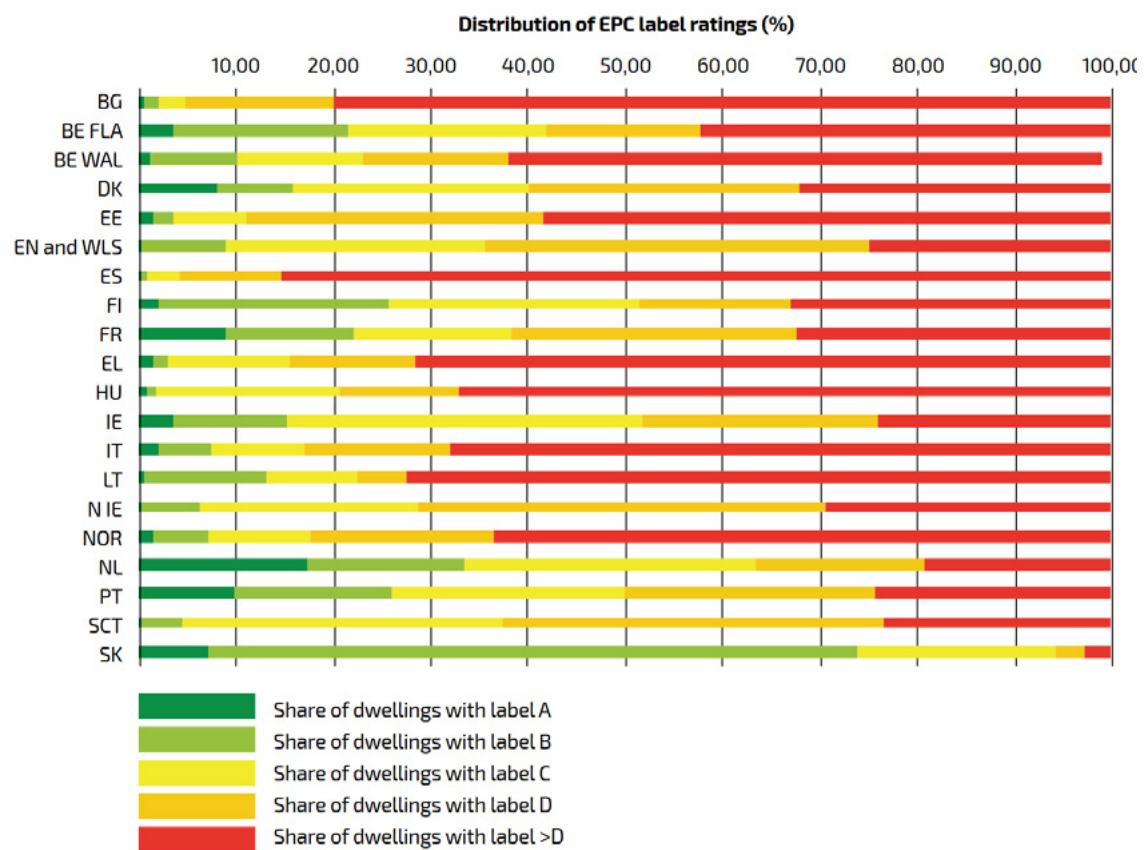
In Brazil, the PBE Edifica building energy labelling program applies to both existing and new buildings. Few buildings however actually have this label because of its voluntary nature, the cost (between 11,000 and 22,000 reais on average) and the difficulty of the certification process. This program has been compulsory for federal administration buildings since 2014 (See Building case study - Brazil).

Digital logs or building renovation passports (BRP) go even further in terms of the information given. They provide a long-term, building-specific renovation roadmap that home-owners can use to plan extensive renovations, including information on comfort levels (air quality, optimised brightness, etc.) and potential funding access. There is no common definition of BRPs in the EU and the existing schemes vary in their key characteristics, their main objectives and in the terminology used in each country (European Commission, 2019).

A study conducted on technical support and feasibility of building renovation passports (BRPs) across the EU has shown that there is a potential to reduce between 16 and 43 million tonnes of CO_2 emissions by 2050, depending on the extent of the policy package adopted. The study modelled 6 different scenarios, ranging from Policy Package 1, a scenario where the design and implementation of BRPs is entirely up to the member states, to Policy Package 6, where the EU makes BRPs compulsory alongside EPCs and makes supporting measures mandatory and far-reaching. 160 million BRPs would be created by 2050 in the latter scenario, compared with barely 60 million or less in the others (European Commission, 2019).

In practice, depending on the level of requirements, they can generate significant costs. For this reason, the French government abandoned an initial proposal for a digital log before adopting a lighter version which will be mandatory for any new construction or major renovation from 2022 onwards (Actu-envrionnement, 24/07/20).

2. Incorporating comfort and social sciences into available building data

According to a survey led in 2020 in Denmark, Greece, Poland, Portugal and Romania, owners and occupants were asked which improvements for the new generation of EPCs they believed to be the most important. The most popular options were information related to comfort, financial options and logs, alongside tailor-made recommendations and one-stop-shops (BPIE, 2020). Today only Greece and Portugal include the quality of the indoor environment in their EPC databases (X-tendo, 2020). Cercle Promodul/INEF4, the French endowment fund believes in adopting a "socio-technical" approach to comfort within the regulations in order to better perceive and reflect the expectations and needs of end users (Construction21, 19/12/19).

This survey corroborates the results of an enquiry by the Velux group, Healthy Habitat Barometer, conducted in 2016 among 14,000 Europeans. In answer to the question Why renovate? 80% said it would be to improve well-being and 81% to save energy (Batiactu, 21/04/16). The 2019 update of this survey further illustrates the urgency of renovations for the well-being of the fifth of poorest households in particular, who have a 25% greater risk of living in defective housing. 21 million European children live in so-called "unhealthy" buildings, leading to 2 million missed school days per year due to health problems resulting from inadequate housing (Groupe Velux, 10/10/19).

• HEATING, COOLING AND BEHAVIOUR CHANGES •

1. Heating and cooling: improving device efficiency

The IEA's Energy Efficiency Indicators 2020 show that in the residential sector, space heating is responsible for nearly half the energy consumption of IEA countries, with the largest shares coming from Europe and the smallest from Asia and Oeania. However, improvements have also occurred, due to better insulation of older buildings and improvement in heating equipment, with a 30% reduction in space heating intensity in France, Germany and UK since 2000 (IEA, 2020).

Improvements have been from the adoption of individual heat pumps, with the highest adoptions in Italy, Sweden and Finland; condensing boilers as seen in the Netherlands and UK; and pellet boilers and stoves in place of traditional wood heating, as seen in Italy, Austria, France and Germany (ODYSSEE-MURE, 2018). Globally, almost 20 million households purchased heat pumps in 2019 and their growth is evident in all the major heating markets - North America, Europe and Northern Asia. However, they only meet 5% of the global demand for heating buildings (IEA, 2020).

INDICATOR

20 millions

20 millions of households are equipped with heat pumps in 2019 and their growth is evident in all major heating markets.

In Canada, to replace gas heating, the Green Municipal Fund is preparing to replace fuel-fired heating appliances with high-efficiency biomass boilers in four New Brunswick communities, for an investment of 417,000 dollars (Electric Energy Online, 09/10/20). This use of forestry residue biomass for heating should be a viable example for Canada's other rural regions whose economies are linked to forestry, agriculture and related sectors.

Networks of district heating have been identified as a potential solution that can help to make heating more efficient. One of the best examples of this is Greater Copehnhagen, which has been developing district heating and cooling since the 1970's, and presently has a system that meets 98% of heating demand in the zones covered, through biomass-powered combined heat and power (CHP) and waste-to-energy (State of Green, n.d. ; CIBSE Journal, 2020.) The city of Saint-Paul, Minnesota, in the U.S. benefits from District Energy, a non-profit utility that provides heated and chilled water to the downtown and west side neighbourhoods, to meet all the heating and cooling needs, through CHP, and solar thermal. The system also makes use of thermal storage and high-efficiency distribution systems; and between 2000 and 2019, reduced carbon emissions for Saint-Paul's energy utility by 70% (District Energy, 2020).

While the demand for energy for heating has remained stable since 2010, the demand for cooling increases with rising incomes, urbanisation, expanding urbanisation and increasing mean temperatures, not only in terms of space cooling but also the need for refrigeration or freezing to maintain medical and nutritional security. In summers, air conditioning is responsible for around

50% of electricity-use in cities like Beijing and New Delhi, the situation being worse in cases of older buildings with outdated and inefficient air conditioners and refrigerators (Cool Coalition, 2020).

Sustainable Energy for All and the Kigali Cooling Efficiency Program identified 1.2 billion people across 54 high-impact countries who are at high risk due to their lack of access to cooling-- solving this would involve expanding access to cooling while simultaneously ensuring energy-efficient modes of cooling (K-CEP, 2020).

EXPERIENCE FEEDBACK

"COOLING AS A SERVICE" INITIATIVE

The Kigali Cooling Efficiency Program (K-CEP) is a programme funded to realize the Kigali Amendment of the Montreal Protocol. Together with the UNEP, the K-CEP instituted the Cool Coalition that brings together national and local governments, businesses, the finance sector and civil society, to a common platform for knowledge exchange, advocacy and joint action. As of 2020, the K-CEP works in 52 countries and has led to adoption of a dozen national policies. The Cooling as a Service (CaaS) initiative, which was launched in 2019 to bring together finance and technology companies to work with end-users, crossed the milestone of $50 million in investment (Cooling Post, 05/11/20). The CaaS model allows end-users to pay per use, over a 15-year contractual period where the cooling equipment remains owned by the manufacturer, saving 68GWh of electricity and avoiding 36,000 tonnes of CO_2 in a year.

BOX 4

By changing a dark roof to a white one, the temperature in the top floor can be reduced by 2-3 degrees, and by increasing solar reflectance of the roof from 10-20% to 60%, net annual energy use for a single-story, air-conditioned building can be reduced by 20% (Cool Roofs Challenge, 2020). The Million Cool Roofs Challenge, launched by K-CEP, SEforAll, the Global Cool Cities Alliance and Nesta, is providing $2 million in grants to proposals for cool and solar-reflective roofing in countries affected by heat stress and low access to cooling. In September 2020, winners were announced from Bangladesh, Côte d'Ivoire, Indonesia, Kenya, Mexico, Niger, Philippines, Rwanda, Senegal, and South Africa (Cool Roofs Challenge, 2020).

2. Building uses and behaviour changes

Improving the day-to-day operations of buildings, and behavioural change in the building users is the lowest-cost solution to improving energy efficiency of existing buildings. This includes simple steps like using more energy efficient fixtures and appliances, and more technology-integrating solutions like automation. A 2020 study by the Rocky Mountain Institute identified that older and smaller class B and C buildings in the USA could improve their energy performance and reduce energy expenditure by 15% by adopting low-to-no-cost measures related to building operations (Rocky Mountain Institute, 2020).

Fraunhofer ISE, a solar research institute, has developed a energy monitoring tool MONDAS, which helps to collect, save and visualize relevant time-series data related to building operations, in order to them optimise this through Building Automation Systems.

The US Department of Energy's Smart Energy Analytics Campaign, facilitated through Berkeley Labs, worked on energy management and information systems (EMIS) in commercial buildings. The campaign helped the participating institutions save over 1 trillion kWh annually - — enough to power more than 44,000 U.S. households for a year (Berkeley Lab, 20/10/20). **fig. 9** sums up how

EMIS work, by monitoring and analysing operations data and transferring actionable information to building engineers.

HOW EMIS, THE ENERGY MANAGEMENT AND INFORMATION SYSTEM, WORKS - *Source: Berkeley Lab, 2020*
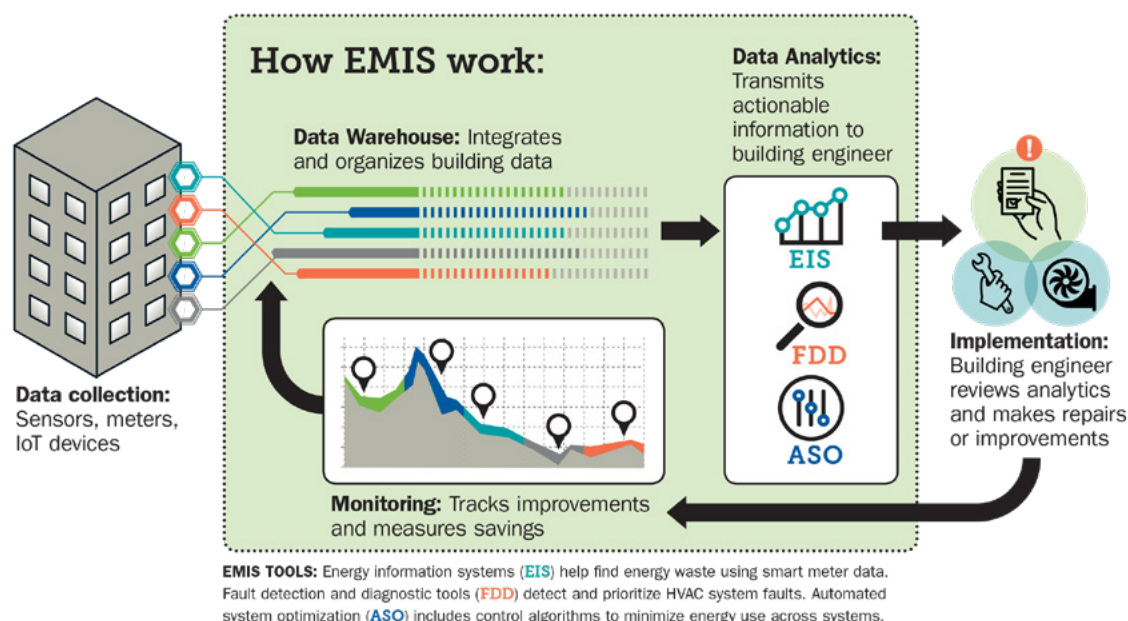
Behavioural policies, making use of certain levers and nudging, are key to overcoming adoption obstacles for more energy efficient behaviour or technologies, and behavioural insights may also explain why certain energy efficiency measures do not work as expected. Nudging often involves elements of choice architecture or presenting information in such a way that building users end up choosing the more energy efficient alternative. The EU's system of Energy labels, for instance, by assigning values, induce people to lean towards the higher ratings.

Community-level initiatives show that pre-existing social ties can also encourage energy saving, as can the idea of competition. The Energy Neighbourhood in Europe Program was deployed in several countries to test the ability of households to reduce their energy consumption themselves through the idea of a "bet" launched by participating cities (European Commission, n.d). The French have gone one further with the "Families Positive Energy Challenge" coordinated by the CLER network for energy transition. This has gathered more than 40,000 family or group participants in the Rhône-Alpes region, which co-finances the project. These groups have reduced their energy consumption by 12% on average, and were able to collectively avoid 1,400 tCO_2eq (CLER, s.d). The concept has since been taken up elsewhere, such as in Paris or in the Pays-de-la-Loire region.

KEYS TO UNDERSTANDING

LEVERAGING OCCUPANT BEHAVIOUR IS INCREASINGLY GAINING ATTENTION

Occupant Behaviour (OB) is one of the main factors of uncertainty when forecasting the energy consumption of buildings. Default behaviour assumptions in energy regulation often result in inadequate choices of building envelope, technologies, design and systems operation. A better understanding of the real behaviour of occupants would make it possible to overcome

this bias and make more behaviour-orientated technological choices (Hua, S. et al, 2020). A study of 500 renovated buildings in Milan also concluded that incorporating the social dimension and practices can help maximise the impact of the intervention and limit the energy performance gap (Salvia, G. et al, 2020). Their studies made it possible to identify a series of context-specific variables that can be used as levers to align behaviour with the renovation procedures in social housing (DellaValle, N. et al., 2018).

A behavioural bias can be understood as an observed deviation from expected "rational" behaviour in a human. When it comes to energy consumption, two types of behaviour are prone to behaviour biases. On one hand, energy consumption itself is a routine behaviour, which is more or less automatic, and not so dependent on deliberate choices. On the other hand, investing in energy efficiency improvement, be it smaller measures or large-scale renovations, is less frequent and thus preceded by a longer and more deliberate decision-making process (OECD, 2017; Interreg Europe, 2018).

The first step to overcoming these biases is providing building users with information about their actions. For example, energy audits can help to establish currents consumption and efficiency levels, which can then be used to identify energy and cost-saving actions. Raising awareness and training can also change biases and habits in the long-run. A study by the Sustainable Energy Authority of Ireland showed that providing feedback on home energy usage through in-home displays and more detailed energy bills, along with free audits and providing a summary of energy saving measures seem to encourage energy savings and energy efficiency measures (SEAI, 2018).

BOX 5

3. New construction, from energy efficiency to climatic efficiency

• LOCAL POLICIES AND BUILDING CODES • More and more cities are putting forward local regulation to encourage high energy performance buildings, primarily for new constructions and public buildings. These standards, often stricter than national or regional regulations, allow for the creation of an environment that stimulates innovation and job creation (REN21, 2019).

1. Regulatory obligations and local building codes

Also highlighted in the Energy section of the Sector Report 2020, many regions and cities require the installation of photovoltaic systems in all new constructions. The State of California is the most emblematic example, leading the way in decentralised solar energy production in the United States with more than 1 million PV installations for a total power of 9,300 MW. There, the installation of PV systems in new residences has been mandatory since January 2020 (California DG Statistics, 2020).

In Germany, the city of Tübingen introduced new legislation in 2018 requiring PV systems to be installed in new housing and commercial buildings (FORESIGHT, 14/09/18). In New York City, two new laws, adopted in 2019, give a major boost to the city's roofing policies. They now require the installation of solar panels or green roofs on all new constructions as well as on buildings under-going major roofing renovations. The solar reflectance index for roofs also increased within the framework of the law on "cool roofs", in order to increase thermal comfort and reduce air conditioning needs and the urban heat island effect (Urban Green Council, 12/19). In Denver, a citizens' initiative led to a ruling that makes it mandatory to install solar panels or green parts on the roof of new constructions of more than 25,000 square feet (Gouvernement Denver, 2018).

In Denver, a citizens' initiative led to a ruling that makes it mandatory to install solar panels or green parts on the roof of new constructions of more than 25,000 square feet (REN21, 2020). In the

Argentinian city of Rosario, the requirement applies to all new or renovated public buildings where half of the hot water consumed must be produced from solar installations. This measure is part of Rosario's sustainable construction and energy efficiency plan. Its aim is to increase the share of renewables in the municipal building stock. This local project has enabled the market for solar water heaters in Argentina to develop (IRENA, 06/05/19).

Rather than imposing technical choices, some cities adopt building codes, which leave more options open in the strategies to be adopted to reinforce the energy efficiency of buildings. This is the case in Tokyo, New York and also Singapore, where the Building Control Act stipulates that all new buildings over 2,000 m^2 must be awarded a local Green Mark Standard certification. A special category is provided for "zero energy buildings". Moreover, to guarantee that buildings continue to operate efficiently throughout their life cycle, property owners or managers are obliged to perform regular energy efficiency audits of the buildings' cooling systems and submit information on energy consumption (Singapore BCA, n.d.).

2. Tax incentives

Tax and financial incentives are one of the tools favoured by local governments to guide investment towards lower-emitting equipment. These measures take the form of subsidies and tax rebates or exemptions. The subsidies are thus used by many municipal governments to encourage the adoption of photovoltaic systems. The city of Edmonton in Canada launched a financial aid program in 2019 to develop renewable energies (see Energy section of the Sector Report 2020). In Japan, the cities of Aichi, Hiroshima, Itabashi, Kitakyushu and Sumida offer grants to residents to buy PV system (REN21, 2020). Such measures are also numerous in Brazilian cities (**box 6**).

EXPERIENCE FEEDBACK

IN BRAZIL, PROPERTY TAX REBATE FOR GREEN BUILDINGS

As highlighted in Climate Chance's Building-Brazil case study, Brazilian municipalities continue to adopt tax incentive measures. The first city to introduce an IPTU Verde (green property tax) was the city of São Carlos in 2008, which reduced the property tax for buildings with green roofs or energy efficiency improvement measures in place (ACR Arquitetura, 06/02/19). Many cities subsequently adopted this type of local legislation, the biggest being São Paulo and Salvador. In São Paulo, property tax is reduced according to the level of LEED or AQUA certification obtained. In Salvador, the reduction is applied based on the score obtained on the city's own scale, where one of the score criteria is completion of an inventory of the building's GHG emissions. In 2020, the city of Balneario Camboriu approved an IPTU Verde for buildings with PV systems installed (Camboriu News, 21/05/20).The cities of Ilheus and Muriaé also adopted the IPTU Verde in 2020. On the other hand, the city of Goias adopted the IPTU Verde in 2012, but went back on this policy after a change in the municipal council, using the unconstitutionality of this measure as a pretext. A constitutional amendment is currently being analysed by the Brazilian Senate in order to guarantee cities the possibility to adopt and apply such local legislation (Senado Federal, 2019).

BOX 6

Some cities have allocated funds towards research and development of less energy-consuming solutions to heating and cooling. For example, in 2019, the city of Helsinki launched a competition offering a prize of 1 million Euros to the company or person who found a way of replacing coal heating in the city and specifying that the solution should use biomass as little as possible. The Finnish capital has in fact pledged to stop using coal for heating by 2029 (YLE, 04/04/19).

3. Multi-player initiatives

The [Building Efficiency Accelerator](#) (BEA) platform facilitates local government implementation of building efficiency policies and programs. 13 cities joined the initiative in 2019, which now unites 50 municipalities (**fig. 10**). With help from BEA, the city of Eskişehir in Turkey has raised the minimum level for energy efficiency for new constructions, a move that is expected to save 32 GWh and 4.4 million dollars between 2019 and 2030 ([WRI](#), 15/02/19). The BEA helped the city of Bogota develop its municipal building code. The national legislation was not directly applicable in the local context of this municipality. With the support of the Pacific Northwest National Laboratory (PNNL), an American body that has already evaluated many countries' national energy codes, and by working with the national government, it was possible to adapt the legislation to suit the city ([The City Fix](#), 11/05/18).

FIGURE 10

THE CITIES PARTICIPATING IN THE BUILDING EFFICIENCY ACCELERATOR INITIATIVE IN 2020 - *Source: [BEA](#)*

The American network 2030 Districts promotes public-private collaboration in the creation of high-energy performing buildings, districts and cities. Within this network, building owners and managers, alongside local governments and companies in the sector, collaborate, share resources and good practice, and together implement low carbon strategies. Currently, the network includes 22 cities including Albuquerque, Cincinnati and Dallas, more than 1,100 organizations and more than 2,100 commercial buildings for an area totalling approximately 47 million m². The members of the network commit to reducing energy and water consumption, as well as emissions linked to urban transport by at least 50% by 2030. Amongst the tools made available, a market has been created to connect customers with service providers capable of offering high energy performance materials, equipment and projects ([2030 Districts](#), n.d.).

• INNOVATIONS IN BUILDINGS, DESIGN AND CONSTRUCTION •

1. The evolution of sustainable building certifications and labels towards neutral buildings
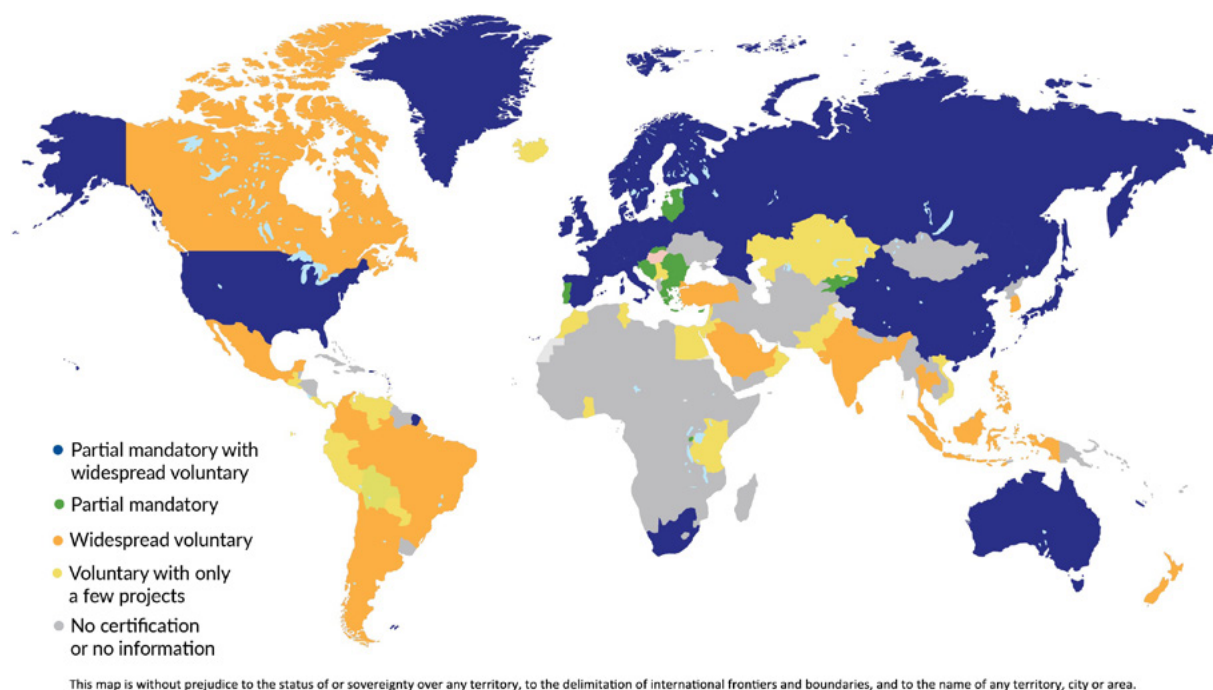
According to [IEA](#), data, about 85 countries had energy certification programs for buildings in 2019. 40 of these contain energy certification requirements for buildings. For the remaining countries, these programs are voluntary and some are more widespread than others (**fig. 11**). Amongst

these programs, many of the certifications were created by private or not-for-profit organisations to provide tools and advice to design and build more sustainable buildings. These sustainable building certificates are thus voluntary, they evaluate a building's environmental performance and encourage best practice.

FIGURE 11

ENERGY CERTIFICATIONS AROUND THE WORLD

Source: IEA, 2020

- Partial mandatory with widespread voluntary
- Partial mandatory
- Widespread voluntary
- Voluntary with only a few projects
- No certification or no information

This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

The LEED (Leadership in Energy and Environmental Design) certification is the best known of the voluntary benchmarks. It is now used in 167 countries, and more than 69,000 projects have been LEED-certified, for a built area of over 130 million m², or 16,000 m² per day (IEA, 2020). In the United States, LEED's country of origin, 2,209 projects were certified in 2019 (USBGC, 22/01/20). This standard testifies to a high degree of dynamism in emerging countries since, after the United States, the greatest number of certifications are in China, India and Brazil (USBGC, 13/02/19). Amongst the other most widespread certifications, we can cite the British BREEAM, certification, the French HQE and the German DGNB and PassivHaus.

The levels of requirement vary between these different certifications, and the required energy efficiency levels are not always sufficient to create a trend of buildings with a low energy footprint. The LEED certification, for example, was not quick enough in keeping up-to-date with the technical and financial developments enabling the reduction of the carbon impact of buildings. Notably, it did not react sufficiently to the sharp fall in the cost of renewable energies which now makes them one of the least expensive sources of electricity, nor the ease of off-site energy purchasing under an electricity purchase contract (see Energy section). In 2018, it was estimated that many buildings receiving the highest levels of LEED certification achieved reductions in energy consumption and CO_2 emissions of only 15% to 20%, compared to standard constructions (GreenBiz, 24/05/2018). In 2019, LEED launched its new version which now provides a framework for project teams. It also now takes GHG emissions into account and gives a greater weight to renewable energies, to better reflect the various supply methods and changes in the market (USGBC, 09/09/19).

The World Green Building Council has launched the Net Zero Carbon Buildings initiative and advocates that all buildings be "net zero carbon[2]" by 2050. The companies, cities and regions that are signatories to the initiative, also commit to ensuring that all uses of their buildings are carbon neutral by 2030. In its 2020 report on the progress made towards this goal, WGBC announced that 17 Green Building Councils have adapted their certifications to take this goal into account, that 418 buildings have been certified as "net zero carbon" and that the number of signatories is now 95. Amongst these feature cities and regions (Montreal, Helsinki, Yucatan amongst others), but especially many private companies, including property developers and property investment funds (WorldGBC, 2020). One of these Green Building Councils, the DGNB, published a benchmark for carbon neutral buildings in May 2018. Certified buildings must produce a carbon footprint report and demonstrate a trajectory towards net zero emission by 2050. Buildings whose actual consumption data show a carbon neutral are eligible for the Climate Positive award (DGNB, n.d.).

INDICATOR

418

418 buildings are certified "net zero carbone" in 2020, and 95 cities, regions and companies are signatories of the Net Zero Carbon Buildings Initiative

• SUSTAINABLE BUILDING MATERIALS • Building use represented 28% of global CO_2 emissions in 2018 and the largest share of emissions from buildings. The manufacture of building materials such as steel, cement and glass accounts for 11% of CO_2 emissions (GlobalABC, 2019). Unlike building use emissions which can be reduced over time through energy renovation and using renewable energies, this embodied energy or grey energy is fixed once the building is constructed. This incorporated carbon will be responsible for nearly 50% of total emissions for buildings constructed over the period 2020-2050 (**fig. 12** ; Architecture2030). Having minimised the issue for a long time, non-state actors are now gradually starting to take grey energy into account.

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2 - Building use must be carbon neutral, the energy used must be generated by renewables on site and any remaining emissions offset

FIGURE 12

EMISSIONS FROM NEW CONSTRUCTION FROM 2020 TO 2050 (BUSINESS-AS-USUAL SCENARIO)

Source: *Architecture2030*
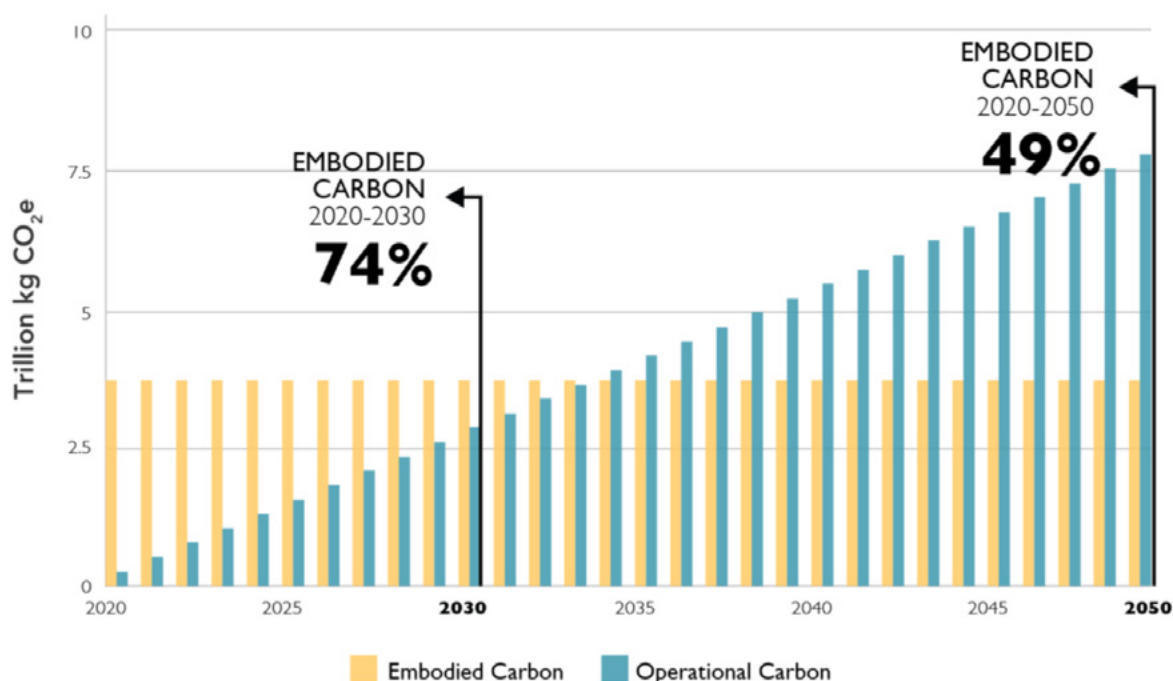
1. Life cycle analysis for buildings

Changes in equipment energy standards, thermal regulations and energy benchmarks have enabled improvements to the energy efficiency of buildings. But grey energy is often the blind spot of these regulations. As such, low-energy buildings can still have a large carbon footprint if the building's entire life cycle is taken into account, from its design to the end of its life.

In response to this ongoing concern, the voluntary energy benchmarks have been updated. In Canada for example, the Zero Carbon Standard label now takes the emissions of materials incorporated into the structure and the building envelope into account. The Swedish NollCO$_2$ certification goes further and imposes a limit on the carbon incorporated into construction and allows for the "offsetting" of these emissions through the production of renewable energy on site. In the Netherlands, Brazil and India, the respective Paris Proof Concept and Zero Energy Standard labels (same name in Brazil and India) are set to be updated soon in order to take life cycle analysis and embedded carbon into consideration in their criteria (WorldGBC, 2019).

In the construction sector, the cement and steel, at the base of reinforced concrete, emit large quantities of GHG during their manufacture (**fig. 13**, see Sector-Based Report 2019 for cement and Sector Report 2020 for steel).

FIGURE 13

DIRECT CO$_2$ EMISSIONS IN 2019 FROM 3 SECTORS (CEMENT, CHEMICALS, IRON & STEEL) - *Source: IEA, 2020*
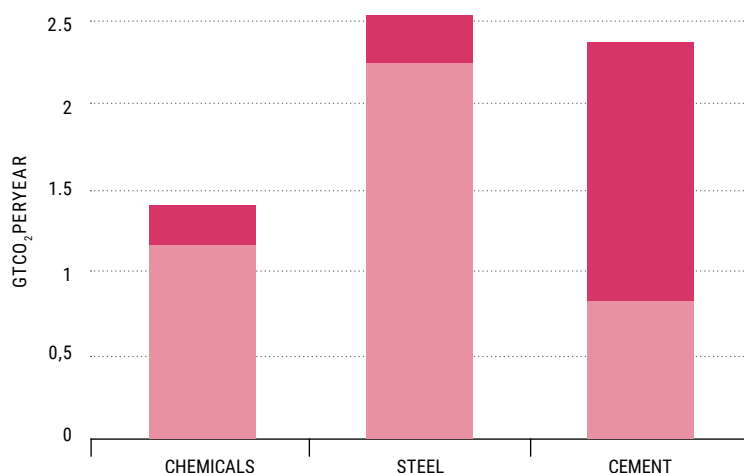
New trends are emerging and promoting the use of alternative construction materials. In particular, it is estimated that wood provides gains of 300 to 500 kg CO$_2$e/m^2 compared to a conventional building over its entire life cycle (Ollivier-Henry, 25/11/19). In the Ile-de-France region, which concentrates nearly 30% of the market share of the French building sector, the Pacte Bois Biosource (Bio-sourced Wood Pact) was signed in autumn 2020. The pact commits its signatories (developers, local authorities, etc.) to building at least 40% of their new buildings from wood or bio-sourced materials, with a carbon impact potentially 60% lower than a concrete building (FI Bois IdF, 30/10/2020).

For players in the sector, project developers, designers, architects and engineers, one of the challenges to access reliable data concerning the environmental impact of materials or equipment. Architecture 2030 has launched the 2030 Palette open access platform to support the construction industry in this area. This is an online database for the design of buildings with high environmental performance and resilience. It proposes sustainable low carbon strategies at the level of an individual building, and also at district and city level. In particular, it includes all the information relating to choice of materials (2030 Palette, n.d.). The Inies database gathers together data from materials manufacturers in France. In particular, it details the carbon and environmental impact of the materials throughout their life cycle (Inies, 29/04/20).

2. Recyclable / reversible buildings to avoid demolition and waste generation

The construction, renovation and demolition of buildings generate large amounts of waste. In Europe, it is estimated that waste from the B&PW sector represents between 25 and 30% of the total volume of waste. The recycling rate varies enormously within the European Union, from 10 to 90% depending on the Member State (European Commission, n.d.). There is a well-established market for reusing aggregate derived from construction waste in roads, and for direct reuse from site to site or even the backfilling of quarries. On the other hand, few materials are reused at their value and many are still thrown away because it is too expensive or even impossible to recover them. To avoid demolition and waste generation, there is an emerging trend towards reversible buildings.

Several initiatives have emerged recently to facilitate the recovery and reuse of building components and materials, and to activate the circular economy in the building sector. The BAMB (Building

As Material Banks) European consortium is developing tools to design easily reversible buildings. One of these tools is a materials passport platform in which information is recorded on the potential for reusing the various materials. It lists their characteristics and how they are incorporated into construction in order to determine their degree of recoverability. Using this data, architects and designers can determine which components can be taken apart and reused.

In the Netherlands, the Madaster platform also functions as a materials passport library. The principle is to provide information on all the materials' characteristics so that a building can become a store of useful material. In early 2019, the Dutch government decided to stimulate the use of materials passports and further promote it through tax incentives. Promoters who register materials passports can benefit from investment-related tax deductions of up to 75% (Madaster, n.d.). Additionally, the new offices of the Triodos bank were finished in September 2019 on these principles. This wooden structure building is the first reconstructible office building: the materials are assembled with reversible screwing and interlocking systems and in an accessible manner so that the building can be dismantled (Archdaily, n.d.).

RE4 is a collaborative research project of 13 institutions including CETMA (European Research Centre for Technologies Design and Materials), the Research Institute of Sweden and Spanish B&PW company Acciona Construccion. Their goal is to develop a prefabricated energy-efficient building which can be assembled and dismantled, containing up to 65% recycled material by weight. In France, the Cycle-Up platform seeks to optimise reuse materials transactions by bringing together players in the sector. Since its creation, it has generated savings of nearly 3 million Euros and has avoided the emission of 3,400 tCO_2 (Cycle Up, n.d.).

This approach to construction makes it possible to anticipate changes and create adaptive buildings capable of responding to changes in regions and evolutions in society. In the Lyon Confluence district, 5,442 m^2 of offices are currently under construction. This project is planning ahead for a regional transformation and the future downgrading of a motorway. As such the office buildings under construction are designed to be reversible into housing (LeProgres, 19/10/18). Buildings with the potential to evolve also make it possible to follow changes in society. The pandemic has transformed the way we use buildings and demonstrated that our homes are currently not suited to teleworking. A study carried out by the Institute of Higher Studies in Housing following the first lockdown revealed that only 55% of respondents had a separate space to work in (IDHEAL, 2020).

4 . Access to sustainable housing

The proportion of the world's urban population who live in slums or inadequate housing fell significantly between 2000 and 2014, from 28% to 23%. But this trend has since reversed, and in 2018, 23.5% of people in urban areas were living in slums. The pace of population growth and urbanization now exceeds the pace of construction of adequate housing. More than 1 billion people worldwide have no access to this, including 370 million people in East and South East Asia, 238 million in sub-Saharan Africa and 227 million in Central and South Asia (UNstats, **fig. 14**). For more than 90% of countries, access to housing is a major ongoing concern and implementation of social housing programs is a necessity (UNHabitat, 2020).

FIGURE 14

URBAN POPULATION LIVING IN SLUMS OR INFORMAL HOUSING IN 2018 IN MILLIONS - *Source: UNstats, 2020.*

WORLD 1033

370

238

227

199

EASTERNANDSOUTH-EASTERNASIA

SUB-SAHARAN AFRICA

CENTRALANDSOUTHERNASIA

OTHER REGIONS
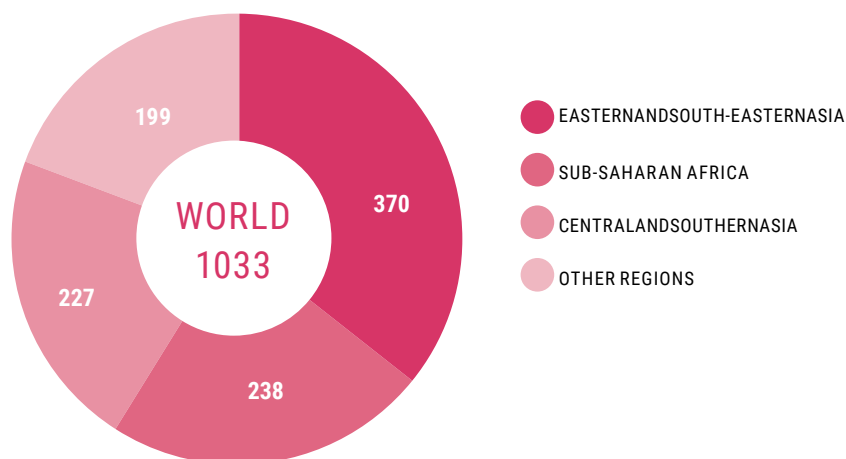
• SLUMS AND REHOUSING: LITTLE CONSIDERATION GIVEN TO ENVIRONMENTAL CRITERIA •

Simply eliminating the slums remains the foremost political response to the demands of those in need of decent housing. The response provided by national policies focuses mainly on constructing new housing. This approach provides a quality physical infrastructure quickly, but the community and social aspects are questionable (Teferi Z. A., 2017).

For example, in 2020 Brazil has more than 5.1 million informal housing units located in the favelas of 734 cities. Some cities such as Manaus actually have more informal than formal housing (Folha, 19/05/20). The 2009 "Minha Casa Minha Vida" (MCMV) social housing program enabled the construction of 4 million formal dwellings, but took little account of environmental aspects. The architectural projects are replicated almost identically across Brazil despite major climatic differences, and are not very energy efficient (see Building-Brazil case study). In addition, the houses in the MCMV program were built far from urban centres because of lower property prices. This contributes to urban sprawl and increases the need for transport (BBC, 04/06/18).

A draft law is currently under consideration which would strengthen the environmental criteria of the MCMV program. It plans to encourage solar energy production as well as multiple uses, thereby fostering economic activity within residential complexes (Senado.leg.br). Voluntary certification

mechanisms also exist for MCMV projects, including AQUA HQE which has a specific label for social housing, the AQUA Social label. The Amadis building owned by the property developer Tarjab was the first building to be certified, in 2019 (Vanzolini, 07/03/19).

In Buenos Aires, Argentina, an integrated urban development project is transforming the Villa 31 slum, home to more than 30,000 inhabitants. This project contains an energy efficiency component including modernization of insulation and heating and cooling systems. It also encourages the deployment of thermal and photovoltaic solar (WorldBank, 25/05/17).

In Brazil, since federal government investment is concentrated on creating social housing, it remains marginal in terms of improving housing and infrastructure in the favelas. These latter are home to countless community initiatives, through which the residents themselves tackle many challenges. The Sustainable Favela Network brings together 150 initiatives in the city of Rio de Janeiro. 62% of these are organised by favela residents and 38% by partner organizations, and 54% are led by women. For example, with the help of the local university PUC-Rio, the Vale Encantado community installed a biodigester to treat sewage to generate clean cooking gas for 25 homes. In the Santa Marta community, Insolar facilitates residents' access to solar energy (Catalytic Communities).

inally, slums will be particularly affected by the consequences of global warming: in urban areas with high population density where plant cover is scarce and buildings are of poor quality, the urban heat island effect is particularly marked, and temperatures can reach 11°C higher than in neighbouring regions. ESMAP is developing passive cooling solutions there (ESMAP, 2020). The ESMAP program, the fruit of a partnership between the World Bank and donors, helps low-income countries reduce energy poverty. It has provided 76.3 million people with access to electricity, and estimates that it has reduced CO_2 emissions by 650 million tonnes by installing 17.7 GW of renewable energy (ESMAP, 2020).

In West Africa (Burkina Faso, Mali, Senegal, Benin and Ghana), the Voûte Nubienne (Nubian Vault) association has been developing housing suited to the climate of the Sahel since 2000, integrating housing accessibility, vocational training, environment and climate. The architectural concept adapted to the climate of the Sahel dates back to ancestral times: there is neither wood nor sheet metal, and raw earth is used as the main material. The bio-climatic architectural process offers sustainability and thermal comfort to the inhabitants. In the extreme heat conditions common to the region, the thermal comfort is better than that of buildings with sheet metal or concrete roofs. The construction of a Nubian vault and its use over a period of 30 years reduces emissions by 0.8 tCO_2e per m². In 2019-2020, the association carried out 4,200 construction projects in 1,370 localities and estimates the emissions avoided to be 120,000 tCO_2e. Beyond this climate impact, the association is developing an entire professional sustainable building sector (La Voûte Nubienne).
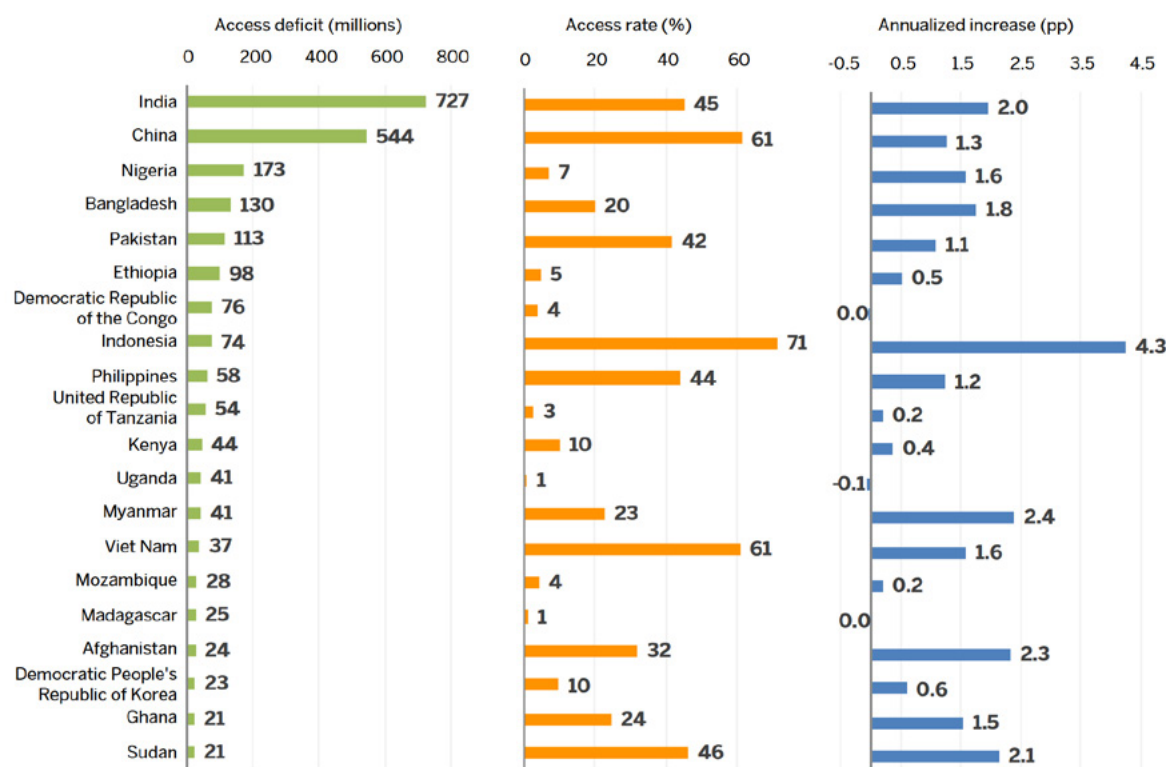
• ACCESS TO CLEAN COOKING TECHNOLOGIES •

In 2018, 2.6 billion people (37% of the world's population) did not have access to clean cooking methods and instead used wood, charcoal or kerosene. In absolute terms, most of this population is concentrated in Asia, where access to clean cooking is nevertheless slowly increasing. On the other hand, in many countries of sub-Saharan Africa, a large majority of the population does not have a clean means of cooking (**fig. 15**) and this share of the population is increasing with consequences for the health of populations and for deforestation (IEA, 2020). Since modern electric or gas stoves are often not available in the affected regions, traditional wood fires are often replaced by improved cooking stoves. These are designed to save firewood or charcoal by simple improvements to the combustion process. Replacing a traditional "three stone" fireplace with an improved stove makes it possible to avoid 7.5 tCO_2e of emissions over an entire life cycle (Wilson D.L., 2016). In view of the low investment, distributing these improved stoves constitutes an effective measure to reduce emissions at very low cost (RWI, 2015).

FIGURE 15

THE 20 COUNTRIES WITH THE HIGHEST POPULATIONS LACKING ACCESS TO CLEAN FUEL AND TECHNOLOGIES, 2014-18 AVERAGE - *Source: IRENA, 2020 p.52, WHO data*

The Clean Cooking Alliance is a global network of players in the sector (manufacturers, distributors and sellers of improved stoves and fuel) that aims to drive the development and market for clean cooking technologies. In 2020, the alliance launched The Cooking Industry Catalyst (CIC) initiative to accelerate the transition to clean stoves. The CIC's objectives, among others, are to consolidate the commercial viability of companies, facilitate their access to funding, and raise awareness among consumers (Clean Cooking Alliance, 2020).

CONCLUSION

The potential for reducing GHG emissions in the building sector remains largely untapped today. Indeed, the construction of new properties is still poorly covered at the global level by sufficiently restrictive energy standards. Additionally, the pace of renovation is hugely insufficient to compensate for the rise in energy consumption. Although the technical solutions are known, effective renovation is still hampered by a lack of access to information. This is gradually being solved by the introduction of one-stop shops. While it is still marginal, a transition can be observed, moving from a logic purely focussed on improving energy efficiency to a more systemic approach taking into account GHG emissions throughout the building's life cycle. Local authorities and private actors are thus updating the support mechanisms and technical benchmarks to take into account buildings' grey energy.

The Covid-19 pandemic is making access to clean energy harder in many countries, and could accentuate the already observed rise in informal housing. However, it does not seem to be having a significant impact on the renovation and sustainable construction strategies of local and private actors. It may even provide an opportunity for massive investment in energy renovation to revive the economy and create jobs, mobilizing both local authorities and private actors. Furthermore, it has accelerated the transformation of our building uses and encouraged us to think about buildings that can be adapted to our uses and needs, and then recycled at the end of their life.

Get in touch with us if you want to share any views, comments or piece of information to contribute to this report: contribution@climate-chance.org

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INDUSTRY

Carbon-free steel: a miracle solution and massive investment alloy

Carbon-free steel: a miracle solution and massive investment alloy

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Responsible for 7% of global CO_2 emissions, the steel industry emits more than the chemical and cement industries, our two previous focuses in 2019 (Sector-based Report 2019). Understanding the options that actors in this industry have for reducing their energy consumption and emissions requires looking at the various industrial processes involved in the steel production. Between reducing the carbon intensity of existing processes and the development of breakthrough technologies, can we expect sufficient progress to meet the objectives of the Paris agreement?

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INDUSTRY

STEEL

1 70% of steel is produced by coal-fired blast furnaces, mainly in China, a process that emits 1.8 tonnes of CO_2 per tonne of steel. The remaining 30% comes from electric furnaces, predominant in the United States and the European Union and whose emissions depend on the electricity used. In total, the iron and steel industry is responsible for about 7% of global CO2 emissions, mostly because of the considerable volumes involved (1,869 million tonnes of steel produced in 2019) rather than the carbon intensity of its production, which is among the lowest of the base metals.

2 The infrastructure used in steel production is heavy and has a long service life. Changes to manufacturing processes can therefore take several decades, and involve long-term thinking. Transformative investments are needed now to have a hope of a carbon-free sector before 2050.

3 In recent years, manufacturers have launched numerous pilot projects to explore technological solutions to reduce their emissions, projects that do not seem to have been too disrupted by the Covid-19 pandemic. The rapid increase in the production of pre-reduced iron ore since 2017 reflects the expansion of the electric route, which emits less CO_2 than blast furnaces. However, an ideal scenario for the development of the electric route and scrap recycling would lead to emissions only slightly lower than today's emissions in 2050 if production continues to increase.

4 One process in particular gives hope for decarbonisation of the sector in the distant future: the use of "green" hydrogen, obtained by water electrolysis, for the production of direct reduced iron. In fact, coupled with carbon-free electricity for the production of hydrogen and for supplying the electric furnace, this could lead to an almost carbon-neutral production.

1 . Steel manufacturing techniques

• DEFINITIONS, STATE OF PLAY • Steel is an alloy of iron and carbon, with a carbon content lying in the range between 0.3 and 2%. Beyond 2%, the alloy is called *cast iron*. Often, it is alloyed with other elements (nickel, chromium, molybdenum...) which give it useful physical properties depending on the end uses.

In 2019, global steel production amounted to 1,869 million tonnes (Mt), largely dominated by China (996Mt, or 53% of global production), followed by India (111.2Mt) and Japan (99.3Mt). Consumption is also predominantly Chinese: the country accounts for 51% of final consumption (World Steel Association, 2020). Production has increased considerably since the 1950s (around 200Mt in 1950) and continues to increase today: 2019 production depicts an increase of 3.4% compared to 2018 (**fig. 1**).

FIGURE 1

WORLD STEEL PRODUCTION AND GROWTH RATE FROM 1950 TO 2019 - *Source: World Steel Association, 2020*
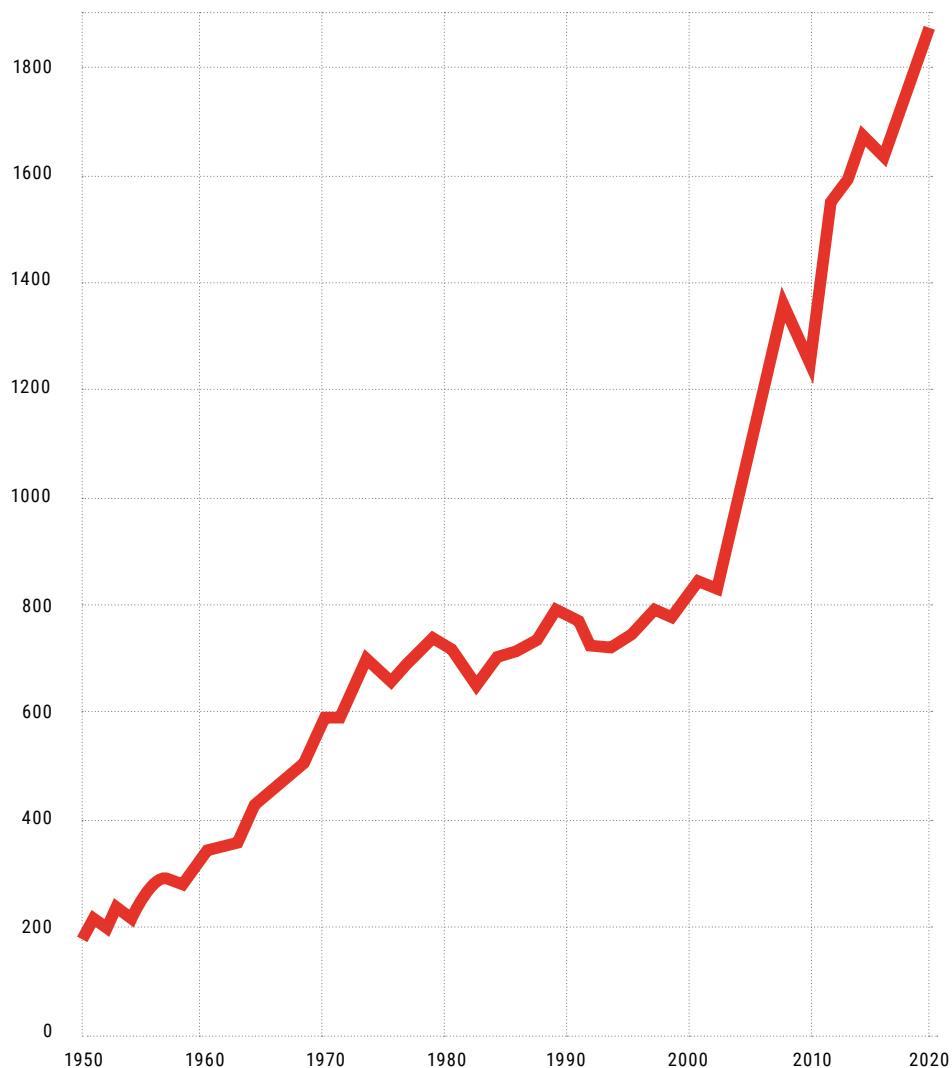
Steel is a material that is fundamental to our society: it is the basis of most of the buildings and equipment that make up our daily lives, and of the machines that provide for our economic activities. In 2019, 52% of the production is used in building and infrastructures, 16% in mechanical equipment and 12% in automotive (World Steel Association, 2020).

Two distinct chemical processes are involved in steel manufacturing. First, you need to extract iron (Fe) from iron ore, rocks that trap iron in the form of iron oxides (molecules made up of iron and oxygen atoms). It is then necessary to remove the iron from the oxygen atoms: this is called **reduction**, which is done by making the ore react with a **reducing agent** (carbon monoxide (CO) and/or hydrogen (H_2)). Once the iron is obtained, carbon must be incorporated (**carburization**).

There are 2 types of industrial processes for steel manufacturing:

• BLAST FURNACES • In a blast furnace, the reduction and the carburization take place during the same process and thanks to the same agent: coke, purified coal (the production of which creates carbon dioxide (CO_2) emissions). On burning, the coke produces CO_2 and carbon monoxide (CO)[1] and melts the ore. CO, a reducing agent, rips the iron away from the oxygen[2] (which emits CO_2). Simultaneously, the high temperature also enables a reaction[3] between the coke and the water vapour which forms, on the one hand, hydrogen, also a reducing agent for iron oxides (the reduction produces water[4]), and on the other hand carbon monoxide: in this way speeding up the process. Finally, the remaining coke that has not been consumed as fuel or reducing agent, provides the carbon necessary for carburization. The output product is cast iron which then passes through a converter where injected oxygen reacts with the carbon present in the cast iron which produces CO_2[5] and which lowers the carbon content to obtain steel.

This manufacturing process, therefore, embraces many sources of CO_2 emissions. In total, it is estimated that the production of one tonne of steel in a blast furnace emits on average 1.8 tonnes of CO_2 (tCO_2) (MTE, 2018), and that this route is used for nearly 70% of steel production ([World Steel Association](#), 2020).

• ELECTRIC ARC FURNACES • Electric furnaces consist of two large electrodes between which a very high voltage is applied, which is applied, which creates electric arcs that release very strong heat releases very strong heat capable of melting scrap (ferrous waste). Indeed, steel can be completely recycled without losing its carbon content, and its magnetism facilitates its collection: in total, between 80 and 90% of steel waste is recycled in an electric furnace ([IEA](#), 2020). In this case, the greenhouse gases GHG emissions come mainly from the electricity used for the furnace, i.e. on average 0.5 tCO_2 per tonne of steel ([MTE](#), 2018). They can even get down to 0.1 tCO_2 per tonne of steel when the electricity is completely carbon-free ([Material Economics](#), 2019). However, this method requires good quality scrap which is not always available, and can lead to "downcycling" phenomena since there is a mix of steels having undergone different treatments, associations or alloys. For example, it is estimated that a copper content of more than 0.15% significantly impairs steel quality and makes it unusable in many applications ([Energy Transition Commission](#), 2018). To overcome this problem, it is possible to add to the furnace "pure" steel produced in a blast furnace, but also direct reduced iron (DRI) ore, an iron ore obtained by "direct" reduction (without prior melting of the metal) by carbon monoxide and hydrogen. Here, these reducing agents are obtained for the most part from natural gas.

In total, the steel and iron industry is responsible for around 2.7 billion tonnes of CO_2 ($GtCO_2$) emissions per year, or 7% of global energy-related CO_2 emissions ([IEA](#), 2020) and 31% of the global

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1 $C + O_2 \rightarrow CO_2$ and $2C + O_2 \rightarrow 2CO$

2 $FeO + CO \rightarrow Fe + CO_2$. N.B.: All the chemical reactions shown in this report are merely indicative, to help the reader understand the processes involved in steel manufacturing and the stages responsible for CO_2 emissions. However, they do notCOver all the reactions at work in these processes.

3 $C + H_2O \rightarrow H_2 + CO$

4 $FeO + H_2 \rightarrow Fe + H_2O$

5 $O_2 + C \rightarrow CO_2$

industrial emissions ([Létard](#), 2019). This is more than the chemicals or cement sectors (fig. 2). It is the main CO_2 source for world metal production, while the carbon intensity of its production (carbon emissions during the production of one unit of steel, around 2 tCO_2/t) is among the lowest: in comparison, the production of one tonne of aluminium emits 17 tCO_2 and the production of one tonne of magnesium 36 tCO_2. It is therefore primarily because of the enormous production amount that steel is responsible for the emission of so much CO_2 ([France Stratégie](#), 2020).

2019 CO_2 EMISSIONS FROM THREE INDUSTRIAL SECTORS (CHEMICALS, STEEL, CEMENT) - *Source: [IEA](#), 2020.*
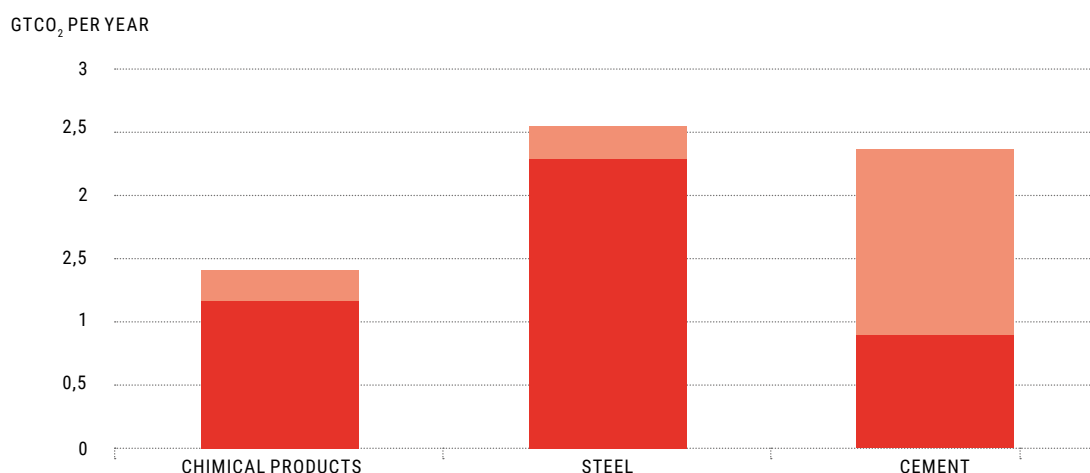
Carbon markets can help to force manufacturers to lower their emissions. Nonetheless, some people highlight the need to apply border taxes for imports in order to bring steel from geographic areas with no carbon market into line with market prices and not encourage relocation ([ArcelorMittal](#), May 2020). However, a 2008 study in the journal Energy Economics ([Demailly, D., Quirion, P.](#), 2008) showed low risk of loss of competitiveness not justifying opposition to stronger European emissions trading system (EU-ETS) requirements which have applied to industry in Europe since 2011 ([EU Commission](#)). Then, a 2016 study in the journal Energy Policy concluded that the risks of leakage linked to the EU-ETS, i.e. the risk that taxes on the steel industry generate more emissions outside European borders following relocations, are not significant ([Branger, F., Quirion, P.](#), 2016).

2 . Ways to reduce GHG emissions from steel production

The infrastructures necessary for the production of steel, whatever the production process, are extremely heavy and every change requires long-term vision: it is estimated that a site has a service life of more than 50 years and organizes its investments for 10 to 15 year horizons ([McKinsey](#), 2020). The implementation of decarbonisation solutions today is therefore particularly important for the sector to have any hopes of meeting Paris Agreement deadlines.

• ENERGY EFFICIENCY: AN OPTIMUM ALREADY REACHED? • The World Steel Association (or worldsteel), the world federation of steel producers, launched the Climate Action Programme in 2008 to collect data on CO_2 emissions from manufacturers and to establish ways of reducing them. In a recent statement about the steel sector's contribution to a low-carbon society, the Climate Action Programme notes that the amount of energy required to produce one tonne of steel (energy intensity) has significantly decreased during the 20th century (**fig. 3**).

Today, energy intensity stands at 20 Gigajoules/t, a drop of 61% compared to 1960 ([worldsteel Climate Action Programme](#), 2020). However, this quantity has stagnated for ten years: **worldsteel estimates that a limit has been reached, and that most of the blast furnaces built today are operating optimally, close to thermodynamic limits ([worldsteel Climate Action Programme](#), 2020).**

Manufacturers are, however, still seeking to reduce their energy consumption by adapting certain processes all down the value chain: the Sustainability Report by Baowu Group, the Chinese leader that follows the world leader ArcelorMittal closely, is full of examples of processes that have been put in place to reduce energy consumption and/or find sustainable outlets (such as the production of light steel for the automotive industry to reduce fuel consumption) and produce "Green Steel". However, steel energy intensity for the group did not decrease between 2010 and 2018 ([Baowu Group](#), 2019).

As potential energy efficiency gains are marginal or even absent, other players are betting on new technologies to transform the steel industry and make it one with less GHG emissions.

FIGURE 3

AVERAGE ENERGY INTENSITY OF A TONNE OF STEEL FROM 1960 TO 2017, INDEXED TO 1960

Source: [worldsteel Climate Action Programme](#), 2020
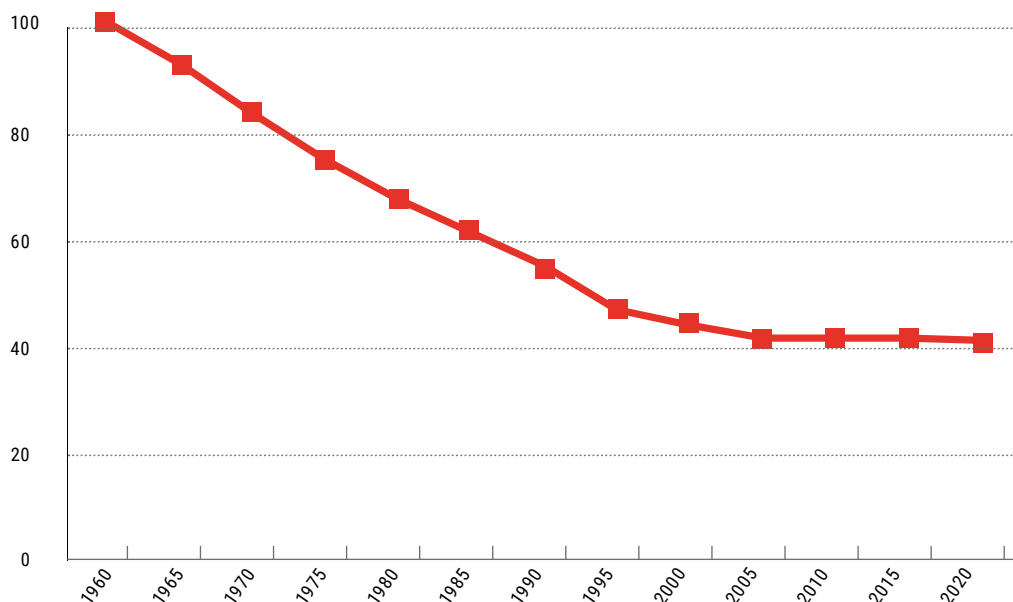
• **REDUCING THE USE OF COKE IN BLAST FURNACES** • Coke is the main element involved in the transformation of iron ore into steel, but also the main cause of CO_2 emissions. So, companies try to optimize its use: the giant ArcelorMittal, world leader in steel production with an annual production of nearly 100 million tonnes ([World Steel Association](#), 2020), is researching how to replace coke with bio-waste as part of its SmartCarbon program (which enables avoiding CO_2 emissions from coke production); the German firm ThyssenKrupp injects hydrogen into its blast furnaces to accelerate reduction and reduce the need for coke. However, hydrogen cannot completely replace coke: at best, it is estimated that injecting hydrogen into a blast furnace could reduce its emissions by 20% ([Industrie et Technologie](#), 2020).

It is also possible to replace the iron ore with DRI in the blast furnace, which makes coke's reducer function less important and therefore allows for much less use of it ([ArcelorMittal](#), 2020).

• THE CARBON CAPTURE TEMPTATION: AN ILLUSION? • Unlike other sectors where GHG emissions are geographically diffuse, those of steel production are very localized, on production sites. Thus, great hopes rest on Carbon Capture and Storage (CCS) or Carbon Capture and Use (CCU) technologies, which could be coupled with existing infrastructure to capture their emissions, and to reuse them: ArcelorMittal and the American company LanzaTech specializing in carbon capture and its transformation into bioethanol have [signed a partnership](#) to equip steel mills with CCS/CCU infrastructure. Nevertheless, despite proven industrial feasibility, these technologies are not mature enough to be deployed on a massive scale, mainly because of their excessively high costs compared to carbon prices ([Climate Chance](#), 2018). The growth of sites with the equipment is still very slow ([McKinsey](#), 2020).

• CONFRONTING THE GROWTH OF THE SECTOR, CIRCULARITY • The electric chain, based on DRI and scrap, has been expanding since the late 1990s in the United States and Europe - respectively 70% and 64% of production in 2018 ([Létard](#), 2019). This is reflected in DRI production, which in 2019 grew faster than coal production for the third consecutive year ([World Steel Association](#), 2020). This circular steel production emits much less CO_2 than the linear route: the decline of the blast furnace industry in the United States (72% of production in 1980, 32% today) has led to a 37% decrease in GHG emissions since 1990 ([Létard](#), 2019). Although the recycling rate for used steel is already high, further optimizing this rate could allow for reductions in the sector's emissions, as there are less emissions when the manufacturing process uses an electric furnace compared to a blast furnace. In a 2018 report, the Energy Transition Commission think tank notes, for example, that in so-called "developed" economies steel consumption has been relatively stable for several years. Indeed, steel production is proportional to GDP only during major industrialization phases, and slows down when an economy is based more on the tertiary sector ([Roberts et al](#)., 2016). According to them, in those cases, moving a recycling rate from 85% to 95% could enable reducing demand for virgin steel by two-thirds, which would result in lower CO_2 emissions ([Energy Transition Commission](#), 2018). However, their ideal scenario of developing circularities in the sector would lead to a drop of GHG emissions of only 20% by 2050 compared to the "business as usual" scenario, which would lead to emissions of about 2.5 $GtCO_2$/year, still way too high in view of the decreases in global emissions required to limit global warming to 1.5°C or 2°C. Given the increase in production expected in the coming years, in particular driven by emerging economies, it is necessary to find new ways of manufacturing steel to drastically reduce its carbon impact.

•HYDROGEN: THE MIRACLE SOLUTION? • As we have seen, hydrogen is involved in the reduction of iron ore, whether in the blast furnace or in DRI production. Today, 96% of hydrogen is obtained from natural gas which involves CO_2 emissions. The manufacture of hydrogen by electrolysis of water, much more costly in energy and money (even if public plans are being put in place to support the sector as in Europe), is today very marginal. A priori it has less emissions, but that depends on the electricity source used.

Manufacturers are therefore trying to develop a DRI manufacturing process using hydrogen only . Such processes (based on "fluidized bed" furnaces) had already been developed in the United States or Trinidad and Tobago in the 1990s, but had to be stopped a few years later due to a lack of profitable outlets ([Ranzani da Costa](#), 2011). While the use of such a process combined with "green" hydrogen would significantly reduce emissions from steel manufacturing the absence of carbon monoxide in the manufacture of DRI has two consequences that make this whole process more difficult:

• Since reduction of iron ore by CO gives off heat and its reduction by H_2 absorbs heat, the absence of CO makes it necessary to supply heat continuously during the process. It is therefore necessary to ensure that the source of this heat is not responsible for GHG emissions, or at least that these emissions are offset by emissions avoided by abandoning natural gas.

• This DRI manufactured with hydrogen does not contain carbon, whereas using the conventional process and because of the carbon monoxide it contains between 1.2% and 4.5%. This has two important consequences: on the one hand, it cannot be transformed directly into steel without the addition of carbon (and must therefore be coupled with thinking about the carbon source used and the capture of the inevitably resulting CO_2 emissions); on the other hand, it makes its melting in an electric furnace more difficult (the melting temperature is higher for pure iron than for an iron-carbon alloy) and, therefore, the amount of electrical energy to be supplied is greater, which requires more electricity production infrastructure and may once again lead to an increase in CO_2 emissions if the electricity is not carbon-free (Industrie et Technologie, 2020).

Some giants of the steel industry have already positioned themselves in the race to perfect this process: In 2019, ArcelorMittal announced a partnership with the American Midrex Technologies - which produces 2/3 of the direct reduced iron, mainly from natural gas - to launch production of DRI from hydrogen at demonstrator level in Hamburg. By relying on this technology taking off, on equipping existing sites with CCS/CCU technologies and on reducing the use of coke, the steel giant has set itself the goal of a 30% reduction in emissions by 2030 and to be carbon neutral before 2050. The group has already announced the delivery of the first 30,000 tonnes of "low carbon" steel before the end of 2020 (Novethic, 25/10/2020).

In Sweden, steelmaker SSAB, mining company LKAB, and state-owned power generation and distribution company Vattenfall joined together to create the Hybrit project in 2016, which aims to create a fully carbon-free steel production line before 2026 by means of the production of DRI from "green" hydrogen. Construction of the pilot plant is expected to be completed in 2021.

CONCLUSION

From the Industrial Revolution and even more so in the second half of the 20th century, the steel industry has established itself as a strategic sector, engine for growth and industrialisation. Even today even if the production slows down in western economies more based on the tertiary sector, increasing production objectives are not questioned. Initiatives to decarbonize its production are emerging, mainly from the world's leading companies that are setting up pilot projects to adjust existing processes or develop breakthrough technologies. Although the prospects for short-term emissions reductions seem relatively slim, the use of hydrogen gives rise to hope among players in the medium term, but the industrial feasibility of such methods remains to be proven.

Here we put forward a broad outline of these solutions to decarbonise the steel sector, which ultimately shows that a broader reflection on the continuous increase in steel production and on potential substitute materials is required. We explore these leads in the Building section of this Synthesis report.

Please do not hesitate to respond to this document, or to suggest any relevant additional reports or data by writing to the following address: contribution@climate-chance.org

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INDUSTRY

Fashion and Covid-19: fast fashion is accelerating its recycling

Fashion and Covid-19: fast fashion is accelerating its recycling

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As well as being responsible for 25% of the pollution of the world's waters and one third of the discharge of microplastics into the oceans, the production and use of our clothes emit about 4% of global greenhouse gas (GHG) emissions. The Covid-19 pandemic was seen by some as an opportunity to rethink the sector, building on new production circuits and on the development of second-hand markets. However, the players lack binding international frameworks to operate a real change of course.

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1 GHG emissions due to the production and use of textile clothing and shoes are estimated to be 2.1 GtCO$_2$e per year, i.e. approximately 4% of global emissions. In addition to being responsible for 25% of the pollution of global waters, the sector therefore has a carbon impact which has exploded in the space of 30 years and which could still increase in the coming years.

2 The two main raw materials used by the textile industry are cotton and polyester, a synthetic fiber whose production has grown substantially over the last 30 years, rising from around 12 million tonnes in 1995 (25% of the market) to 58 million tonnes in 2019 (52% of the market). However, it is the result of petrochemical processes that are highly emitting GHGs - the manufacture of 1 kg of synthetic fiber emits 12 kg of CO$_2$, making it one of the main sources of emissions in the textile industry today.

3 The public debate has recently focused on waste, an issue that has gained in importance since the Covid-19 pandemic which generated large volumes of unsold products and stopped activities in Western countries. While the last few years have seen the emergence of numerous public measures and private initiatives aimed at promoting recycling and reuse, the climate issue and the reduction of GHG emissions from the sector are still struggling to be seen as a major issue in the eyes of stakeholders.

4 Logics favoring sustainability and the reduction of environmental impacts are emerging among private actors, in parallel with ecological concerns among some consumers, but are rarely integrated into global strategies. Climate commitments from large groups are attempting to outline individual long-term trajectories, but they remain isolated. They are also criticized for not questioning a development model based on production growth. Thus, despite numerous initiatives, the climate and environmental impacts of the textile industry continue to grow rapidly.

1. A considerable expansion, with dramatic climatic, environmental and social impacts

• THE TEXTILE INDUSTRY: A FEW DEFINITIONS AND ORDERS OF MAGNITUDE • Textile, apparel, clothing, fashion… All these words refer to the same representations, and are often used interchangeably. But do they mean exactly the same thing?

The textile industry produces fibres (filaments which are the elementary components of materials organised in bundles, i.e. the yarns) from natural materials (cotton, linen, hemp, wool, silk, processed wood to create viscose, etc.) or synthetic materials (polyester, polyamide such as nylon, etc.).

FIGURE 1A

WORLD PRODUCTION OF TEXTILE FIBRE IN 2019 (IN MILLION METRIC TONNES) - *Source: Textile Exchange, 2020a*

OTHER PLANT BASED: ~ 6.5 (~ 5.9%)
CONTTON: ~25.7 (~ 23.2%)
MMCFS: ~ 7.1 (~ 6.42%)
OTHER SYNTHETICS: ~ 6.4 (~ 5.7%)
POLYAMIDE: ~ 5.6 (~ 5.0%)

WOOL-SHEEP: ~ 1 (~ 1%)
WOOL-OTHER: ~ 0.05 (~ 0.05%)
DOWN: ~ 0.27 (~ 0.24%)
SILK: ~ 0.16 (~ 0.001%)
POLYESTER: ~57.7 (~ 52.2%)

~ 111 MILLION MT

FIGURE 1B

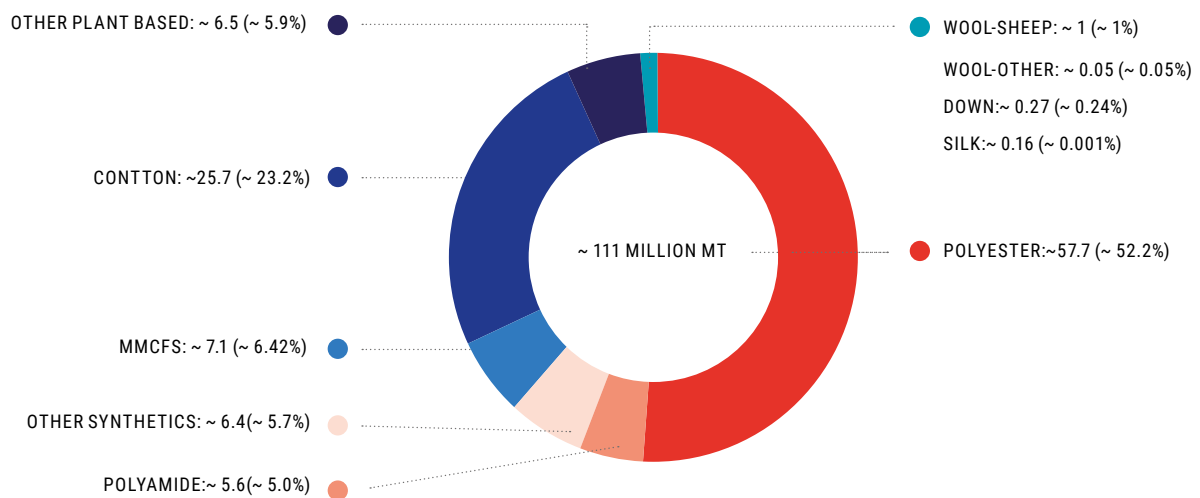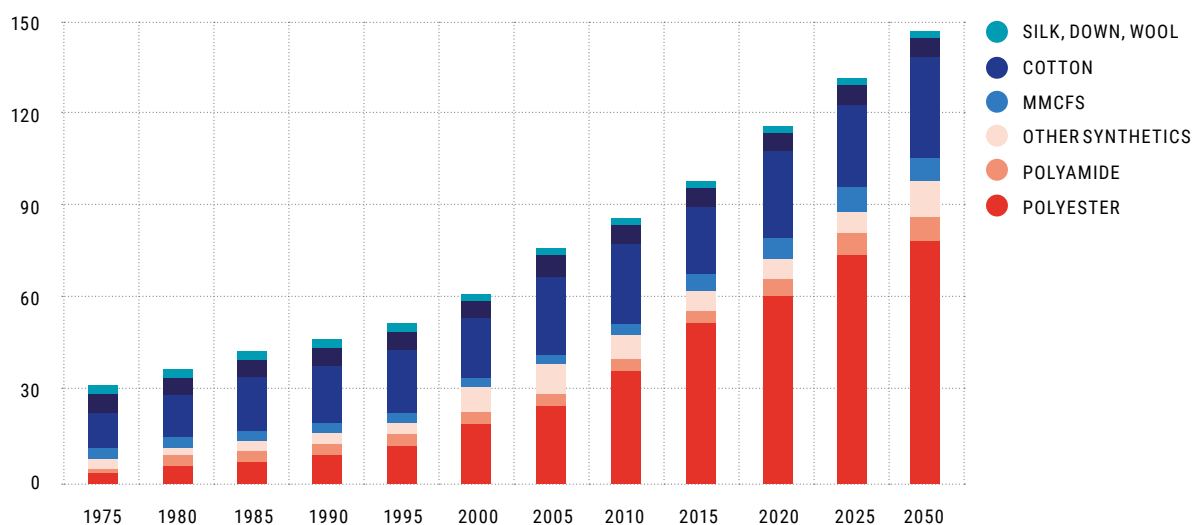TRENDS IN THE WORLD PRODUCTION OF TEXTILE FIBRE SINCE 1975 AND PROJECTIONS FOR 2020, 2025 AND 2030
Source: Textile Exchange, 2020a

SILK, DOWN, WOOL
COTTON
MMCFS
OTHER SYNTHETICS
POLYAMIDE
POLYESTER

The textile fibre production was around 111 million tonnes (Mt) in 2019 (**fig. 1**), a figure which has doubled in 20 years and could reach 146 million tonnes in 2030. It was dominated by polyester (52%),

cotton (23%) and man-made cellulosic fibres (MMCF, 6.4%) ([Textile Exchange](#), 2020a). Polyester has experienced the highest growth over the last 30 years, rising from about 12 million tonnes in 1995 (25% of the market) to 58 million tonnes in 2019 (52% of the market).

These textile fibres are then transformed into threads, which can be dyed, woven, or knitted, to produce different sorts of manufactured goods, first and foremost clothes. In 2015, approximately 55% of the production of textile fibres went to the clothing and footwear industry (which can use other raw materials such as leather), 23% to industrial textiles (e.g. in cars, or for the manufacture of composite materials) and 22% to home textiles (e.g. carpets, curtains, towels, etc.) ([Angel](#), 2016).

After the steps of raw material production, transformation into textiles and then into manufactured pieces (processes themselves divided into several sub-steps provided by different industries), the textile goods used by consumers, and then their end-of-life is managed (or not). In this report, given the complexity of the textile industry and its proximity to our daily lives, we focus on the entire textile value chain, from the production of fibers to their transformation by the textile industry and to the end of life of manufactured goods. All of these steps, often organised in silos, are processes responsible for greenhouse gas (GHG) emissions and sources of pollution.

Finally, the fashion industry is an ill-defined term which is the binder of all these steps: as well as bringing together all the production processes of different apparel industries (clothes, accessories, shoes, jewels, watches, etc.), it is also the social reality underlying the use and consumption processes. Through advertising, fashion shows, and influence, its role is to direct consumers' desires to sustain the offering.

KEYS TO UNDERSTANDING

FAST FASHION: WHEN FASHION RACES OUT OF CONTROL

In 2005, the dismantling of the Multifibre Agreements within the framework of the creation of the World Trade Organization, liberalised the textile sector and removed the remaining barriers to the globalisation of production circuits ([Les Amis de la Terre](#), 2019). Many brands then engaged in a race to minimise production costs , with the whole world as a playground. At the same time, after the 2008 crisis, several American retailers wishing to bring consumers back began to move forward the dates of their sales and to require new collections from the brands more and more frequently. This practice is spreading quickly in the rest of the world, also as a reaction to the competitive pressure from online sales sites which are subject to less strict rules regarding sales, and from the rise of the Instagram social network which is driving brands to regularly publish new contents ([M. le magazine du Monde](#), 04/09/2020). Whereas the clothing brands traditionally organised their sales (and therefore their production) over two seasons, (spring/summer, autumn/winter), the pace of these cycles is accelerating, leading to a very rapid renewal of collections. Zara, H&M or Primark launch collections that last just a few weeks. The consumers are therefore encouraged by the low prices and the novelties constantly flowing in to align themselves with the new fashion trends and therefore to constantly renew their wardrobe. This production model, based on globalised just-in-time chains to lower prices, therefore intensifies over-consumption and intensifies production and consumption. Fast fashion therefore reflects the combination of increasing production rates and the search for the lowest possible costs over the entire production chain.

BOX 1

The textile industry is a sector with familiar but difficult to define outlines. In this report, we will juggle both between the perimeters of the different industries (clothing, apparel, textile, fashion

etc.) and between the stages of the life cycle of the products of these industries (production, manufacture, use and end of life, etc.).

• RISING EMISSIONS, DOMINATED BY THE FIBER PRODUCTION PHASE •

A recent study by the Global Fashion Agenda (GFA), supported by the McKinsey consulting firm, estimated the total emissions for the whole life cycle of clothes and shoes in 2018 to be 2.1 billion tonnes of GHG (2.1 GtCO$_2$e) (fig. 2), i.e. about 4% of global GHG emissions, mainly due to the fiber production (38%), the transformation of fibres into clothes (33%), and use (20%).

FIGURE 2

GHG EMISSIONS DUE TO THE PRODUCTION AND USE OF CLOTHING AND SHOES IN 2018
Source: Global Fashion Agenda, 2020
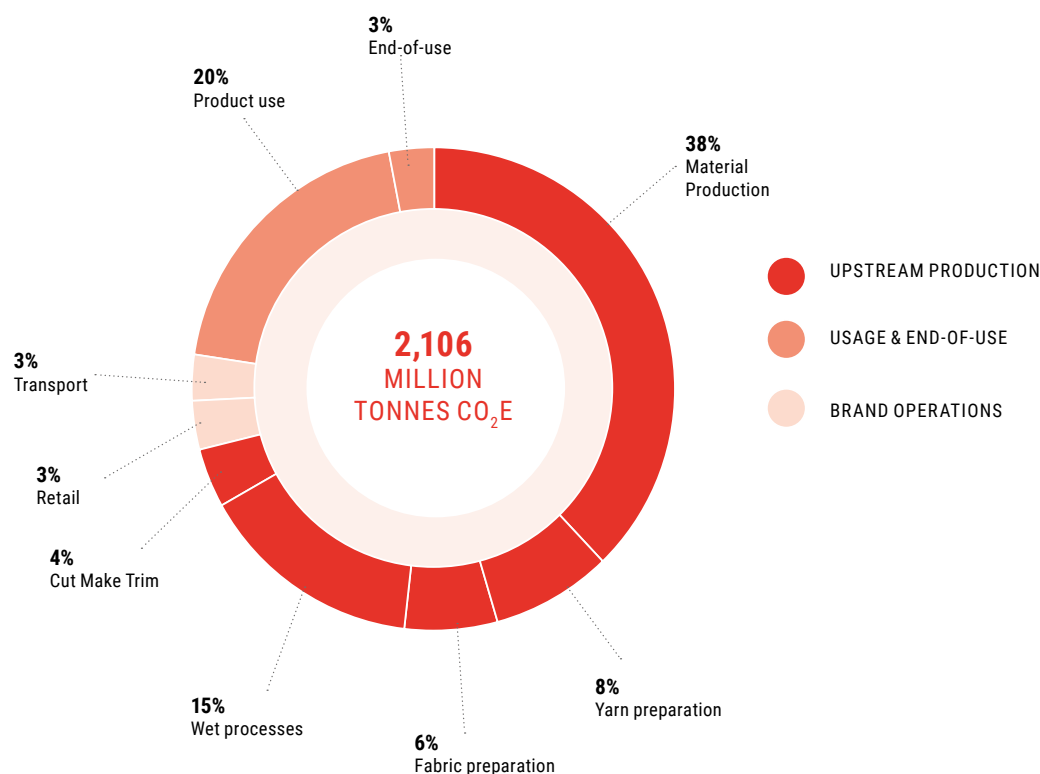
It is however difficult to get an idea of the exact figures of these global GHG emissions and of the weight of the different stages, since the sources are lacking, the methodologies differ, and the rare studies trying to tackle this endeavour are sometimes contradictory (**tab. 1**). For instance, for the year 2015, two studies of 2016 and 2017 by the same authors estimated emissions to be around 1.7 GtCO$_2$e (GFA, 2017; McKinsey, 2016), which would mean a significant growth (about 23%) in three years. And the study by the Ellen MacArthur Foundation think tank, dedicated to the circular economy, again supported by McKinsey, reported 1.2 GtCO$_2$e emitted in 2015 during the production and transformation processes (without including use) of the whole textile industry. The estimated impact of clothing use (washing, drying, ironing) in these various reports for 2015 ranges from 120 MtCO$_2$e (Ellen MacArthur Foundation, 2017) to 585 MtCO$_2$e[1] (McKinsey, 2016).

A 2018 study by the environmental consulting firm Quantis reported the emission of 3.99 GtCO$_2$e for the whole apparel and footwear life cycle in 2016, of which 3.29 GtCO$_2$e for clothing alone, a

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1 - Calculation based on McKinsey (2016). Style that's sustainable: a new fashion formula, which estimates a carbon impact of 23 kgCO$_2$e/kg for production, 11 kgCO$_2$e/kg for use, and 1.7 GtCO$_2$e of emissions for the whole life cycle.

figure they had estimated at 2.44 GtCO$_2$e in 2005 and 2.84 in 2010. The distribution of the emissions this report describes is significantly different from that of the GFA study : according to them, it is the yarn preparation (28%) and treatment and dyeing (36%) stages that have the highest emissions, whereas the production of the fibres accounts for only 15% of the emissions and the use phase for 2%. It emphasizes that this increase in climate impact is accompanied by increased pressure on ecosystems, consumption of resources (including freshwater), and the endangerment of human health (Quantis, 2018).

TABLE 1

ESTIMATES OF RECENT GHG EMISSIONS FROM SECTORS RELATED TO APPAREL BY DIFFERENT SOURCES

Source	Year	Scope	Emissions
Global Fashion Agenda (GFA) & McKinsey, *Fashion on Climate*, 2020	2018	Whole clothing and footwear industry, entire life cycle	2.106 GtCO$_2$e
Quantis, *Measuring Fashion,* 2018	2016	Whole clothing and footwear industry, entire life cycle	3.99 GtCO$_2$e
McKinsey, *Style that's sustainable: a new fast fashion formula*, Octobre 2016	2015	N/A	1.714 GtCO$_2$e
Global Fashion Agenda (GFA) & BCG, *Pulse of the Fashion Industry*, 2017	2015	Whole clothing and footwear industry, entire life cycle	1.715 GtCO$_2$e
Ellen MacArthur Foundation & McKinsey, *A new textile economy: Redesigning fashion's future*, 2017	2015	Whole textile industry (clothing, household linen, industrial textile - without footwear). Phases of raw material production and transformation into textile fabrics.	1.2 GtCO$_2$e

These studies show the importance of the fiber production phase in the climate impact of the textile industry as a whole, and of the clothing and footwear industry in particular. This is primarily due to the carbon intensity of synthetic fibres (about 60% of the fibres produced - mostly polyester) which is much higher than that of cotton: 11.9 compared to 4.7 kgCO$_2$e/kg (Ellen MacArthur Foundation, 2017). Their production is based on the transformation of 48 million tons of oil per year and accounts for almost half of the emissions calculated by the Ellen MacArthur Foundation's report (530 MtCO$_2$e in 2015, i.e. 44% of emissions).

Finally, at product level, a study by the French Agency for Ecological Transition showed that in France, the carbon footprint of one kilogram of woolly jumpers is about three times higher than that of one kilogram of polyester t-shirts (Ademe, 2017) (**fig. 3**).

Whereas there is a lack of consistency and clarity in the available data, the significant contribution of the clothing sector to global warming has been established. Nevertheless, the extreme segmentation of the production circuit steps and the geographic division between, schematically, an Asian production and a consumption in Europe, in the United States and in China (UNEP, 2020), makes it difficult to manage the GHG emissions from the sector. In France for example, the GHG emissions from the wider textile sector (leather, travel goods, shoes as well as textile and clothing), which is responsible for almost 8% of the French carbon footprint, are imported emissions in their majority (High Council on Climate, 2020). To date, there is no specific binding international framework or plan for this sector in terms of GHG emissions.

FIGURE 3

THE CARBON IMPACT OF THE VARIOUS PRODUCTION PHASES FOR SEVERAL ITEMS OF CLOTHING

Source: Ademe, 2017
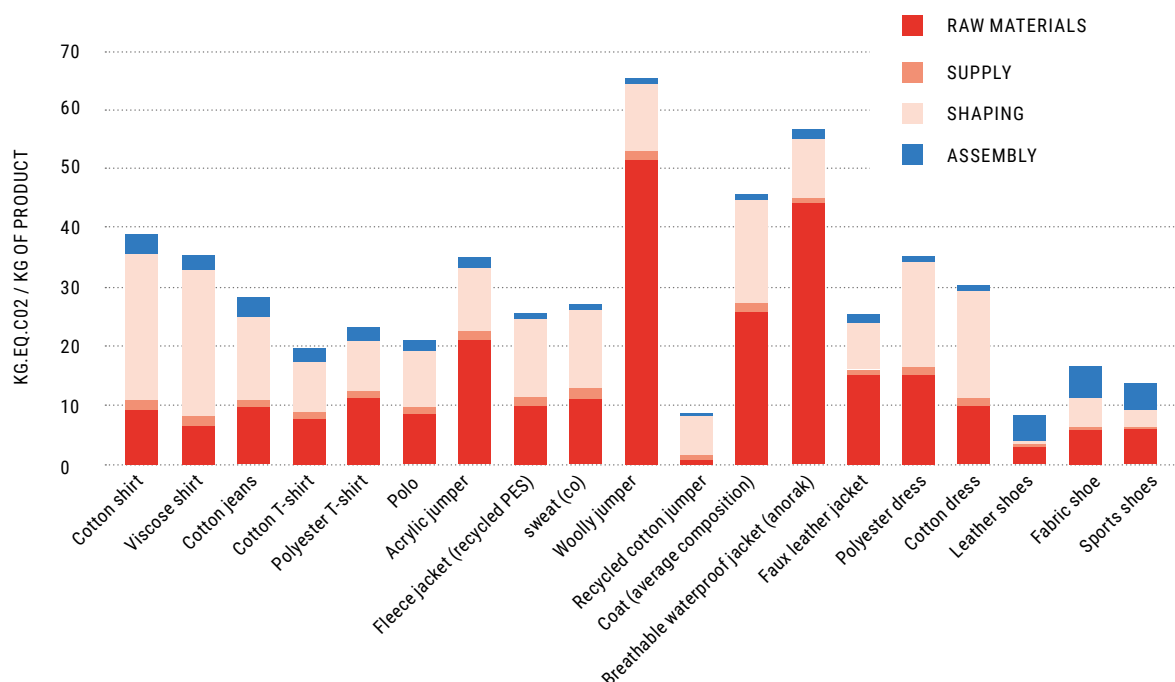
• ENVIRONMENTAL AND SOCIAL IMPACTS WHICH HAVE COMPELLED SOME PUBLIC AUTHORITIES TO LEGISLATE • More than GHG emissions, the environmental, socio-economic and health impacts of the textile industry are widely known and documented, brought to light in a spectacular way by catastrophic events in the low-wage countries where production has been massively re-located.

1. Working conditions of textile workers

In 2013, the collapse of the Rana Plaza building in Bangladesh, which housed production workshops of sub-contractors of major brands, killed over 1,100 people, mainly women workers. This event alerted the general public to the working conditions underlying the production of our clothes: substandard buildings, precarious employment, absence of social protection, daily exposure to chemical substances that are hazardous to human health (colorants, detergents, dyes, etc.). The Accords on fire and building safety in Bangladesh were signed a few months later by almost 300 European textile groups and the Bangladeshi government, providing for the safety measure inspections in the factories of the European brands' subcontractors to be reinforced. Today, thanks to the Accord, safety measures have been strengthened in these factories, but the work remains very tiring, in particular due to the ever-tighter delivery times imposed by fast-fashion multinationals (Box 1). More recently, the Australian Strategic Policy Institute revealed in a report at the beginning of 2020 that Uighur populations were used by the Chinese government for forced labour in the textile factories of subcontractors of many European and American brands including Nike, Adidas, Puma, H&M... (ASPI, 01/03/2020).

In France, the Law on the corporate duty of vigilance of the parent and outsourcing companies was adopted in 2017. A world first and still unique today, this law requires French companies employing over 5,000 people in France or 10,000 people in the world to publish and implement a "vigilance plan" to prevent the risks of human rights abuses, and risks to the safety and health

of people or the environment generated by their activities and by the activities of their subsidiaries, subcontractors, or suppliers. They can therefore be held responsible for any danger posed to human beings or for any environmental damage that has occurred along their value chain. This law prompted some companies to strengthen their social and environmental responsibility, sometimes under the pressure of NGOs and activists, but the sometimes blurred lines of the obligations imposed by the law have enabled others not to formally respect it (General Council for the Economy, 2020). In a report published in early 2019, Les Amis de la Terre and several other NGOs (Amnesty International, CCFD-Terre Solidaire, Collectif Éthique sur l'Étiquette…) noted that no fashion retailer has yet presented such a plan, including Zara or H&M, and considered that the three analysed plans of Carrefour, Auchan and Casino, which have their own clothing brands, are very insufficient (Renaud et al., 2019).

2. Water consumption and pollution

FIGURE 4

SATELLITE IMAGES OF THE ARAL SEA IN 1989 (LEFT) AND IN 2014 (RIGHT) - *Source: Wikipedia, NASA.*
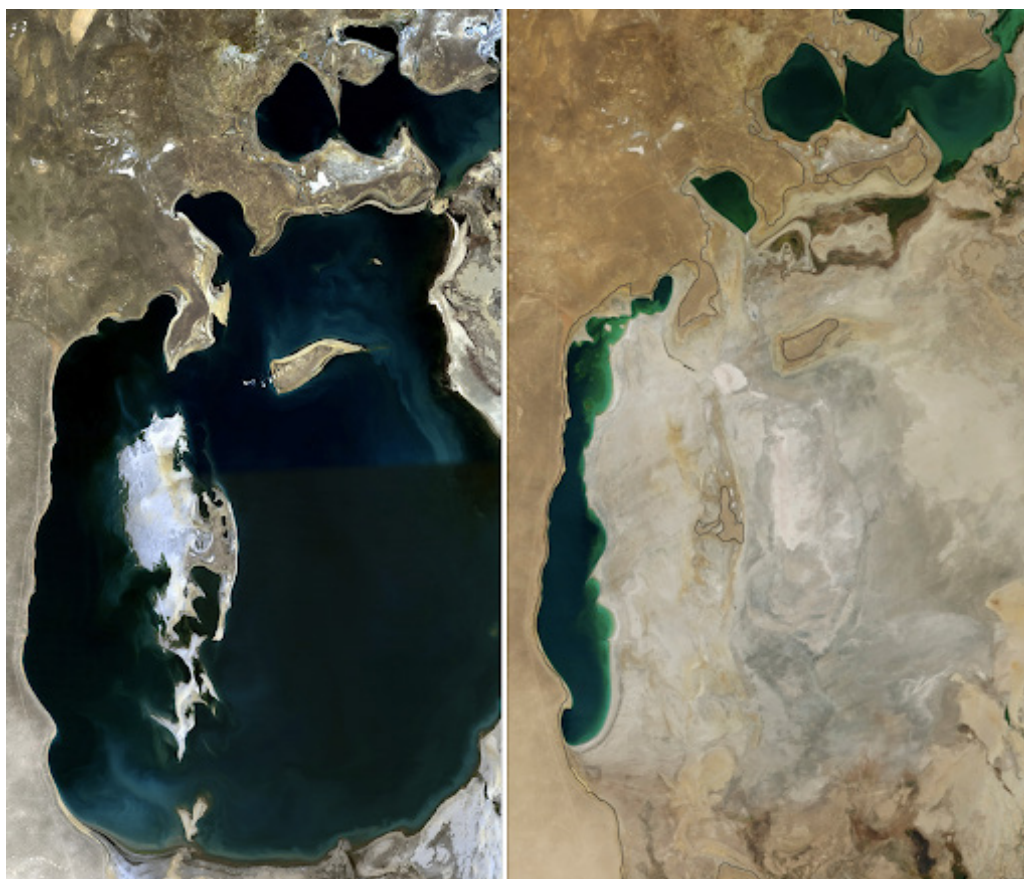
Cotton production uses 2.4% of the world's agricultural lands, but spreads 22.5% of global insecticides (more than any other monoculture) (McKinsey, 2020) and 8 million tonnes of fertilizers each year (Ellen MacArthur Foundation, 2017). All these substances pollute the groundwater, damage soil quality and threaten biodiversity.

The water consumption necessary for its cultivation, partly revealed by the photographs of the drying up of the Aral Sea owing to the diversion of the rivers flowing into it **(fig. 4)**, makes the textile industry the third water consumer in the world, after wheat and rice growing (Qu'est ce qu'on

fait?!, 2019). With 4,600 litres/kg of fibres[2], the whole cotton production for the textile industry alone consumes 84.5 billion m^3 of water per year, i.e. 93% of the total water consumption in the whole textile industry (Ellen MacArthur Foundation, 2017).

The remaining 7% are consumed for the production of other fibres and for dyeing processes, which are also responsible for massive pollution: they use 43 million tonnes of chemical products (Ellen MacArthur Foundation, 2017), whose releases are responsible for 25% of the pollution of the world's waters (McKinsey, 2020). Hence, the Citarum river in Indonesia, along which more than 500 textile factories are based, is considered as the most polluted river in the world. Following revelations of much higher pollutant levels than the acceptable limits, which therefore endanger ecosystems and biodiversity but also the surrounding population, the Indonesian authorities increased the number of inspections, closed factories deemed too polluting, and undertook to make every effort to ensure that the Citarum water be drinkable by 2025 (Sciences et Avenir, 04/03/2018).

Added to this, we use about 20 billion m^3 per year for washing our clothes (Ellen MacArthur Foundation, 2017). Synthetic fibres are degraded in our washing machines, and release almost 500,000 tonnes of microplastics into the oceans each year. This is the largest source of ocean pollution by microplastics (about 35%) ahead of tyre degradation (28%) (IUCN, 2017). In France, the "Agec" Law (**box 2**) provides for the obligation to equip all new washing machines with microplastics filters from 2025.

3. Deforestation and land use changes

To manufacture man-made cellulosic fibres, whose growth was higher than that of polyester in recent years (The Fiber Year, 2019)[3], it is estimated that about 150 million trees are cut each year, close to a third of which coming from fragile forests (McKinsey, 2020), which would account for about 1% of the total annual deforestation[4].

Moreover, cotton crops occupy 2.4% of the world's agricultural lands, which are impoverished by monoculture and by the use of crop protection products (McKinsey, 2020). Land use for the textile industry also includes sheep pastures: 278 hectares are necessary to make 1 tonne of wool - compared to 1 ha per tonne of cotton - Ellen MacArthur Foundation, 2017).

These land use changes therefore contribute to the diminished carbon capture capacity of the world's forests and soils, and increase the pressures on biodiversity, and tensions with agriculture for food production.

4. Waste accumulation

The amount of waste generated by the clothing industry is considerable: it is estimated that less than 1% of garments thrown away are recycled to create new garments, while about 12% are downcycled, i.e. recycled into lower-value products which may not subsequently be recycled to make clothes. In total, 87% of the textile materials used for clothes manufacturing end up incinerated or landfilled, which represents the equivalent of one garbage truck full of clothes disposed of every second (Ellen MacArthur Foundation, 2017).

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2 - Other sources even estimate 10,000 litres/kg, like Retviews, The State of Sustainable Fashion, 2020, or even 20,000 litres/kg like WWF, Changing Fashion, 2017.

3 - Growth is estimated to be 2% for polyester and 3% for MMCFs in 2018.

4 - Calculation based on the total annual deforestation estimate of:

The European Union recognises since 2008 the Extended Producer Responsibility (EPR), whereby manufacturers are responsible for the costs of managing the end-of-life of the goods they produce. At present, it does not yet apply to the textile sector. Nevertheless, the EU has defined an action plan to accelerate the circular economy as part of its Green Deal, including the generalisation of EPR including its extension to the textile sector (already applied in France, cf. **box 2**), fostering access to clothing repair or collection services for consumers, and support for the textile recycling channel (European Commission, 2020). The separate collection of textile waste in all EU countries will be compulsory from 2025.

EXPERIENCE FEEDBACK

CIRCULARITY OF THE TEXTILE SECTOR IN FRANCE

France is the only EU country where EPR is applied in the textile sector, since 2007. Under the terms of Article L. 541-10-3 of the French Environmental Code, *"all natural persons and legal entities engaged in the professional marketing of new domestic textile products (clothing, shoes or household linens) on the national market are required to contribute to or provide for the recycling and processing of waste derived from these products"*.

In concrete terms, those engaged in offering textiles for clothing, household linen and footwear on the market must either have their own waste recycling and processing system, or make a financial contribution to the "Re_Fashion" organisation (formerly "Eco-TLC"), lawfully accredited by the public authorities since 2009 to take charge of the textile end-of-life (Ademe, 2015). Furthermore, the Law against waste and for a circular economy ("Agec") adopted in 2019 provides for the prohibition for all retailers, producers, distributors and e-commerce platforms to eliminate their unsold goods starting no later than 31 December 2021. Finally, according to the Recovery Plan established following the Covid-19 pandemic, 500 million euros will be earmarked for the circular economy in the coming years.

BOX 2

These kinds of measures are aimed at promoting the collection of clothes for reuse or recycling. Collection systems are unevenly organised between countries. In Germany, almost 75% of the clothes are collected, in China or in the United States between 10 and 15%, whereas many countries have no collection system (Ellen MacArthur Foundation, 2017). In 2017, submerged by waste coming from all over the world, China prohibited the importation of textile waste (cf. Bilan sectoriel 2019 p. 123, Climate Chance).

In response to ecological and social alerts, the public debate was structured around some social and waste management issues, giving rise to significant advances for some geographic areas and some specific textile life-cycle stages, but not to a real change of course of the sector as a whole. The challenge of reducing GHG emissions failed to become a central part of the debate, especially since emissions mainly come from the upstream phase during production. However, in the countries where the majority of textile consumption takes place, the current measures concern mainly the downstream phase of the value chain, namely the management of end-of-life and reduction of waste. Today, the textile sector still has no specific binding national or international framework on the issues related to climate change.

2. The commitment of private players: isolated initiatives that are struggling to rethink the sector as a whole

• AN INCREASING NUMBER OF INITIATIVES ALONG THE WHOLE VALUE CHAIN • What about the private sector? Regularly questioned on their social and environmental responsibility, do companies take the lead in efforts to reduce the negative impacts of their activities, or do they rather timidly follow the pressures from the legislations and/or from consumers?

In a recent study by the CDP on water pollution, 38% of the clothing factories surveyed indicated that they monitor their releases in at least 75% of their installations in 2018. In 2019, this figure rose to nearly 50%. But among them, only 10% declared that they set targets in terms of pollution reduction (CDP, 2020).

In 2019, 50% of the clothing companies surveyed indicated that they monitor their releases in at least 75% of ther installations.

INDICATOR

50%   10%

Among them, only 10% declared that they set targets in terms of pollution reduction
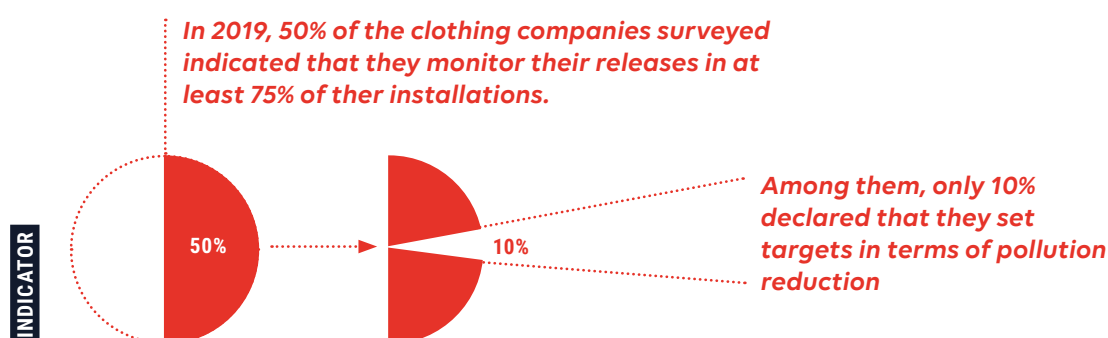
The companies are therefore becoming increasingly aware of the negative impacts of their activities, but what do they do to remedy this? Many initiatives have emerged in recent years to develop production circuits that are more attentive to their polluting waste, to their carbon footprint and to the working conditions of their employees.

We identify five types of action by the companies along their value chain to reduce their climate and environmental impacts: the use of raw materials that have less impact, the development of less resource-intensive and less polluting textile dyeing and treatment processes, the reduction of freight transportation, and finally the implementation of circularity and sustainability logics.

1. Raw materials that have less impact

The strong environmental impact of cotton (water and fertilizer consumption) and polyester (energy consumption and CO_2 emissions) has led some brands to switch to fibres derived from alternative raw materials such as linen and hemp, which are less water- and fertilizer-demanding than cotton. Yet they are struggling to overcome their bad reputation (linen is known to be expensive, hemp is associated with its psychotropic cousin), and their production for the textile industry has been stagnant since a few years around 860,000 Mt/year for linen and 60,000 Mt/year for hemp (Textile Exchange, 2020a), with a production which is mainly French for linen and American for hemp.

X2

The share of organic cotton in the production of the manufacturers of garment has more than doubled in 6 years, but still does not reach X2 than 1% of the cotton produced.

1%
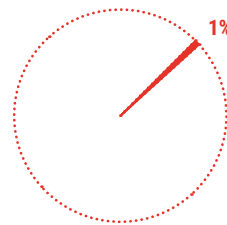
Organic cotton, whose carbon footprint is 46% lower than that of conventional cotton and requires 91% less water ([Textile Exchange](), 2014), is also gaining market share. Its production has more than doubled in the space of 6 years to reach 239,797 Mt in 2019, but reached only 1% of the mass of cotton produced ([Textile Exchange](), 2020a). The market share of *preferred cotton*[5] reached 25% in 2019 compared to 22% in 2018 and 5% in 2013 ([Textile Exchange](), 2020a). It accounted for almost 80% of the cotton used by the 40 of the Sustainable Cotton Challenge launched by Textile Exchange signatory brands (among which Nike, Adidas, H&M, Inditex, Levi's…), whereas this figure was 67% for the previous year.

This boom was made possible by the launch of many initiatives such as the Chetna Coalition which supports Indian farmers in the cultivation of organic cotton, and by commitments and calls for action such as the Sustainable Cotton Challenge 2025 signed by many brands which undertake to use only sustainable cotton by 2025. Finally, rather than trying to *do better* with the same materials, some brands have decided to *do otherwise* by developing their own fibre. The Austrian company Lenzing, for instance, has created the *Tencel* fibre, derived from wood fibre, whose closed-loop production process reduces the impact of raw material production ([WWF](), 2017).

2. New processes for dyes and treatments

Many technical innovations that have emerged in recent years enable the saving of polluting substances, energy or water at some specific stages of the processing of fibres into clothes.

Innovative dyeing processes have flourished in various brands: *ColorDry* has enabled Nike to save 20 million litres of water ([WWF](), 2017); the Swiss company Archroma has developed a sulphur-based tint for jean which enables 84% of water and 25% of CO_2 emissions to be saved compared to conventional tints ([WWF](), 2017). Others use natural products for fabrics dyeing: the American restaurant chain Chipotle Mexican Grill, for example, has launched a collection of clothes dyed with avocado cores from their restaurants.

3. Reduction of transport emissions

Since most of the textiles and clothing production is concentrated in a handful of countries, and since most of the manufacture circuits are segmented, the clothes that we wear travel long distances to arrive in our wardrobes. The re-location of some activities can reduce GHG related to freight transport which account for 3% of the total emissions of the sector according to McKinsey and GFA. This is the bet of the French brand 1083, which has based all its production stages in mainland France, where the greatest distance between two cities is 1083 km. The suspension of economic activities following the Covid-19 pandemic and the resulting complications in supply chains could prompt textile companies to geographically reconcentrate their activities in the coming years ([McKinsey](), 26/03/2020).

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5 Category which brings together organic cotton, fair-trade cotton, or cotton that is certified under various ethical and environmental labels.

4. Durability of clothes

GLOBAL SALES AND USE OF CLOTHES (VOL., BN UNITS, 2000-17) - *Source: Roland Berger, 2019*
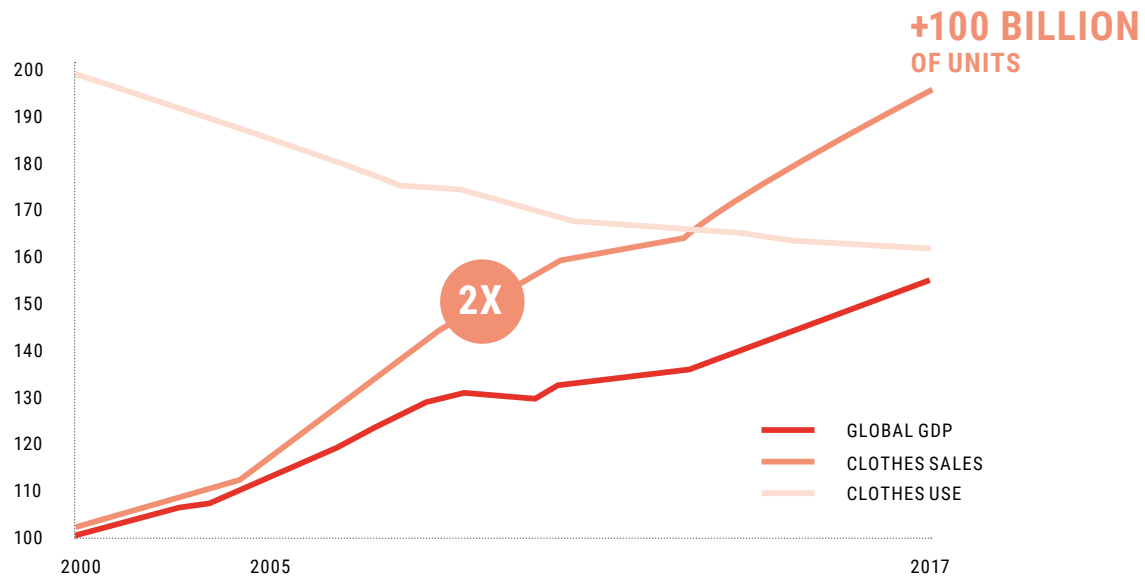
The increasingly rapid renewal of collections and the relative decline in prices (**box 1**) has led to a decrease of the use of items purchased. A garment is worn on average 15% fewer times today than in 2000, while production has doubled at the same time **(fig. 5)**. **In reaction, some brands adopt sober designs which are less likely to be out of fashion, either by making easily repaired and/or replaceable pieces, or by offering clothing repair services:** Nudie Jeans freely repairs its jeans in its Repair Shops; Vaude gives instructions for repairing its clothes on its website in partnership with Ifixit, and sells replacement parts and repair tools; Patagonia even reaches out to consumers at its "Worn Wear Tours" and offers to repair clothes whatever their brand. **Public players can foster these approaches, as in Sweden where the government reduced the VAT for clothing repair services from 25% to 12%** (PRI, 02/01/2017).

In order to prevent their garments from being quickly disposed of after purchase, brands such as Atelier Unes in France back their production with pre-orders from their customers, who can even participate in the creation of new clothes through surveys (Reporterre, 25/08/2020). In 2011, the American brand Patagonia stood out with its campaign "Don't Buy This Jacket", encouraging consumers to buy their jacket only if they really needed it.

Clothing rental services, such as renttherunway.com, have also emerged in recent years, allowing users wishing to regularly change their garments to reduce the impact of their consumption. The Swiss website walkincloset.ch even offers clothing swaps where people meet and exchange their clothes.

5. Production circularity

Some players such as H&M develop manufacturing circuits based on recycled materials, and organise clothes collections to feed these circuits. Aware that most recycled garments are in fact transformed into lower quality products (downcycling), the Swedish brand developed, in partnership with the Hong-Kong Research Institute of Textiles and Apparel, a technology for recycling clothes into clothes. A demo is based in its shop in Stockholm since 12 October 2020 (Edie, 2020).

The raw material to be recycled is not necessarily derived from textile materials, as in the French brand Corail, which manufactures its sneakers out of plastic bottles collected in the Mediterranean Sea. Some companies have even developed processes for converting CO_2 into fibres: Covestro and the Institute of Textile Technology of Aix-la-Chapelle have created a plastic elastic fibre based on CO_2 instead of crude oil ([Textile Exchange](), 2020a).

Following a similar logic, biodegradable clothes have been developed, such as those of the *F-ABRIC* collection of the Swiss brand FREITAG, which decompose in a few months onto organic matter when they are composted. According to the model Arizona Muse, engaged for a more sustainable fashion, this logic should be systematic, given that all clothing is a future waste ([GGKP](), 2020).

Thus, companies' efforts seem to focus on reducing resource consumption and waste production at specific stages of the value chain, without systematically taking the necessary distance to consider their overall climate impact. Some large companies do have, however, climate targets, such as the Kering Group, which says to be carbon neutral, through the purchase of renewable electricity certificates and the offsetting of emitting activities, two ways insufficient according to the study of a French student collective *Pour un Réveil Écologique*, because they do not guarantee a decrease in energy consumption or a change in business model ([Pour un Réveil Écologique](), 2020). Apart from these few statements, the climate is not a major angle of approach of the textile and clothing sector.

• A BOOMING SECOND-HAND MARKET • The second-hand market has established itself in recent years as a credible ecological alternative to the purchase of new clothes. In its 2020 annual report, the ThredUp online resale american platform noted an acceleration in the growth of the second-hand market in 2019 which is increasing much faster than the fast fashion market. It could therefore weigh almost twice that of fast fashion in less than 10 years (which will not prevent the latter from growing also).

This second-hand market is supported by increasingly popular online platforms like ThredUp in the United States or Vinted in Europe, and by young people who are increasingly adopting this mode of shopping. 40% have already purchased a second-hand item among people under the age of 24, compared to 20% in the age group above 38 years (ThredUp, 2020) **(fig. 6)**.

40% have already purchased a second-hand item among people under the age of 24, compared to 20% in the age group above 38 years (ThredUp, 2020)
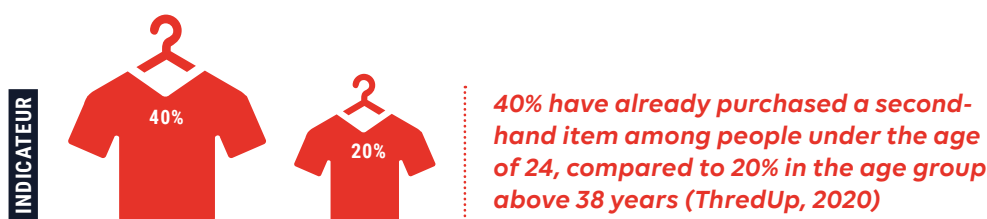
FIGURE 6

SIZE OF THE MARKET OF FAST FASHION, THRIFT & DONATION AND ONLINE RESALE
(2009 AND 2019 DATA. 2029 PROJECTION) - *Source: ThredUp, 2020*
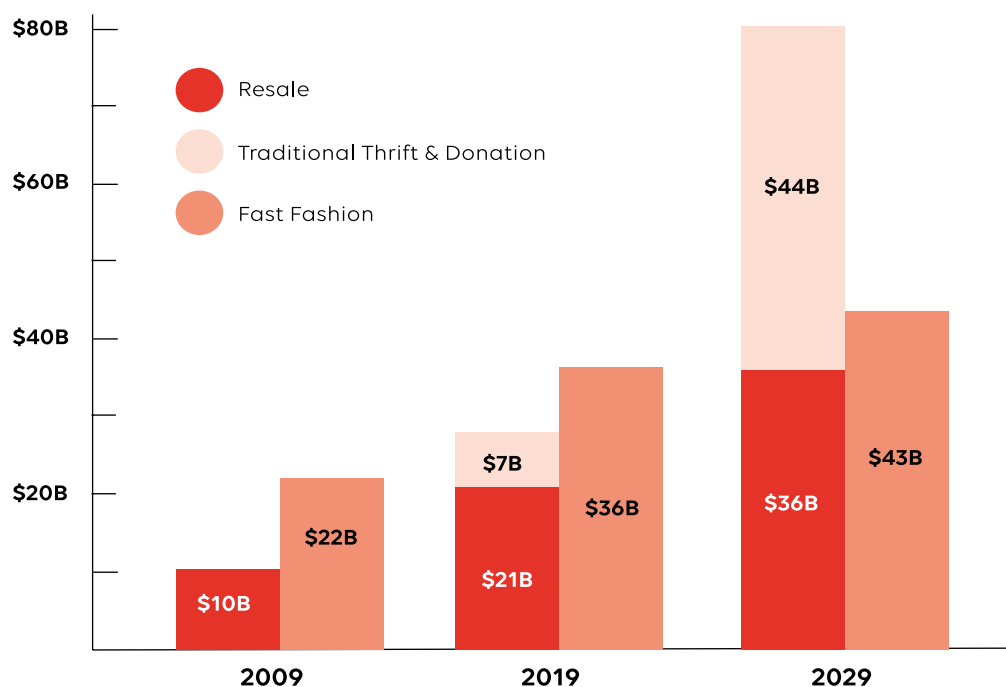
Moreover, the Covid-19 pandemic seems to have accelerated this trend: two thirds of the American women surveyed by ThredUp who had never resold clothes are willing to do so since the 2020 spring lockdown, first and foremost to make money. **Environmental concerns have also gained ground: the brands qualified as eco-responsible performed the best during the March and April lockdown on ThredUp.**

Before the Covid period, consumers planned to spend more on second-hand and sustainable fashion. A survey conducted in the midst of the lockdown showed an accentuation of these trends (ThredUp, 2020). The lockdown may therefore have the effect of intensifying online sale (but not only sustainable purchases, as reflected in the popularity of Amazon).

Imitating Macy's or JCPenney which have partnered with ThredUp in the United States, some French brands like Gemo, or Kiabi have recently opened thrift spaces in their shops, as a response to this new practice and its acceleration during the Covid period (Novethic, 08/09/2020).

This second-hand market trend is predominantly a western one. Some Southern countries, on the contrary, are invaded by second-hand clothes, and consumers look toward new clothes when their buying power allows them to. Uganda, for example, where 81% of the clothes purchased are second-hand (Ellen MacArthur Foundation, 2017), wants to develop its own textile industry, and no longer wants to import used clothes from the United Kingdom or the United States (BBC, 31/01/2018). "Conventional" fashion therefore still has good years ahead of it, its projected growth is estimated at 2% per year by ThredUp.

• A LOGIC WHICH REMAINS PRODUCTION-ORIENTED AND CONSUMERIST • Some brands have therefore developed collections qualified as "sustainable", "ethical" or "conscious", or second-hand channels, often accompanied by thunderous statements, like the American retailer Walmart's goal to achieve carbon neutrality in 2040. However, the brands' communications and commitments

are not always in tune with the reality of their activities: a recent report by the Retviews agency showed that the H&M's *Conscious* collection represented only 9% of the garments for sale, and that of Zara *Join Life* 14%. Yet these brands are signatories to the Fashion Industry Charter for Climate Action initiated in 2018 at the COP24 and to the Fashion Pact initiated by the French government and the Kering group in the margins of the G7 in 2019, whereby they commit to achieving carbon neutrality before 2050 (Retviews, 2020). All in all, even if the number of garments characterised as "sustainable" remains very low compared to the market as a whole - in the order of 1% (McKinsey, 2019), it seems to have considerably increased in recent years (the garments stamped as "sustainable" offered for sale have increased five-fold between 2017 and 2019 according to McKinsey, 2019).

KEYS TO UNDERSTANDING

THE WORDS "SUSTAINABLE"OR "DURABLE" HIDE VERY DIFFERENT REALITIES ACCORDING TO THE PRACTICES THEY DESCRIBE.

They sometimes refer to a labelling which in fact only corresponds to a certain practice at a certain stage of the manufacturing circuit. For example, a certification validating an organic cotton production (such as GOTS - Global Organic Textile Standard) does not say anything about the dyeing methods used or the transport emissions efforts. Similarly, a garment with a "fair trade" label might well be made from conventional cotton. The segmentation of production circuits therefore makes a global labelling standard difficult.

Tools have therefore emerged to attempt to assess (and potentially certify) the whole manufacturing circuit. Labels such as Sloweare attempt to bring together several issues in their certification. Traceability applications such as ClearFashion give consumers a better access to information about manufacturing circuits. The online sale platform Zalando will select its suppliers via the Higg Brand & Retail Module (Higg BRM) developed by the Sustainable Apparel Coalition (SAC)[6], a tool which enables performances in terms of CO_2 emissions, human rights and environmental pollution to be measured by means of indicators (Apparel Coalition, 2020).

BOX 3

Although it is difficult to assess the impact of public legislations and private initiatives, it does not seem possible today to state that the clothing sector is undertaking sufficiently far-reaching and rapid transformations to stem its climatic and environmental impact. By taking the hierarchy of waste treatment methods drawn up by the NGO Zero Waste as a reference, whose concept inspired the European Directive on waste (Directive 2008/98/EC), we can identify the level of ambition followed by the players as regards the standards of the circular economy..

Most of the efforts of companies and legislations that we have identified fall within the area of **Recycling/Composting** or **Reuse**. However, it is very difficult to assess their impact: despite their growing popularity, these circularities are themselves costly in terms of both energy and time. The "circular" act of purchase therefore makes it possible at best to reduce the carbon footprint of a purchase, but not to eliminate it: the impact of the transport of a used item or of the industrial recycling processes must be taken into account. Furthermore, other negative externalities remain, for instance those related to use (a synthetic fibre continues to release microplastics during its passage through the washing machine for example).

6 - Created following an appeal by Patagonia and Walmart, the SAC now brings together many brands intervening at every stage of the clothing value chain. It develops in particular the Higg Index to help the players in the textile industry to assess their social and environmental performances and those of their peers.

HIERARCHY OF WASTE TREATMENT METHODS - *Source: Zero Waste International Alliance*

RETHINK
REDUCE
REUSE
RECYCLE/ COMPOST
MATERIAL RECOVERY
RESIDUALS MANAGEMENT
UNACCEPTABLE

Most of the efforts of companies and legislations that we have identified fall within the area of **Recycling/Composting** or **Reuse**. However, it is very difficult to assess their impact: despite their growing popularity, these circularities are themselves costly in terms of both energy and time. The "circular" act of purchase therefore makes it possible at best to reduce the carbon footprint of a purchase, but not to eliminate it: the impact of the transport of a used item or of the industrial recycling processes must be taken into account. Furthermore, other negative externalities remain, for instance those related to use (a synthetic fibre continues to release microplastics during its passage through the washing machine for example).

Moreover, evidence calls into question the environment benefit of recycling and reuse. Studies that have shown the reduction of the environmental impact of a garment allowed by its reuse or recycling are based on the calculation of the avoided impact of producing a new garment. These benefits would not exist if the whole production system were environmentally friendly or if it produced at a very low rate (Sandin & Peters, 2018). Worse, they can make us forget that problems related to production are always far from being resolved[7], or may even encourage the purchase of new items since the consumers are assured that they will be able to subsequently resell the item, and are therefore relieved from feelings of guilt by the idea that their purchase will be recycled or reused (Sun & Trudel, 2017). The effect of the growth of recycling and reuse sectors on the reduction of the global impacts of the clothing industry therefore still remains very uncertain (Hirschlag, A., 07/11/2019).

Some practices fall within the **Reduce** category, such as the use of raw materials that have less impact or the development of dyeing or treatment processes that need less water, polluting chemicals and energy. These practices may of course lead to real advances, especially when they structure the whole activity of a company rather than being adopted at the margin to adjust specific processes in some specific collections. Nevertheless, there are still very few initiatives to reduce clothing production: at best, some brands have succeeded in limiting it (either based on pre-orders, or by setting themselves quotas like Patagonia). However, according to Alma Dufour, overproduction campaigner at Les Amis de la Terre, it is there that collective and coordinated actions are needed: *"No brand which has large quantities placed on the market can be ecological if, by 2030, it does not plan to reduce its production by 25% or even by half."* (Reporterre, 25/08/2020).

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7 - Flore Berlingen, Recyclage : le grand enfumage, Rue de l'échiquier, June 2020. "Recycling enables us not to call into question the disposable and the related economic interests, and especially to avoid asking what it reveals – an overproduction – and the origins of this overproduction, to be found in the foundations of capitalism and productivism."

Finally, the fact of offering repair services and thinking about the sustainability of the products can be related to the **Rethink** category. The fashion industry is currently operating in an antagonistic fashion: it seeks to renew the desires of consumers, and to make them coincide with those of producers, thereby limiting the circularity and production reduction logics. So these efforts remain isolated and they have finally little impact on the sector which, as a whole, to produce more, to consume more resources, to put more pressure on ecosystems and to emit more GHG (Quantis, 2016).

The Covid-19 pandemic and the lockdown measures have put an unprecedented halt to the sector, and this was seen by some as an opportunity to **rethink *the system as a whole.***

"Mindful of the current state and the radical changes this entails, Saint Laurent has taken the decision to rethink its approach to time and to introduce its own calendar. Now more than ever, the brand will control its frequency and will legitimize the value of time, at its own pace, while fostering the relationship to people and their daily lives. Accordingly, Saint Laurent will not present its collections within the framework of the official 2020 calendars. Saint Laurent will decide on its agenda and its launches will follow an optimised plan, guided by the needs of creativity."

Press release from Yves Saint Laurent, 27 April 2020

"The COVID-19 pandemic is hitting the fashion industry from every angle and severely affecting all of the global fashion capitals, and while there is no immediate end in sight, there is an opportunity to rethink and reset the way in which we all work and show our collections."

Joint statement by the CFDA and BFC, organisers of the New York and London Fashion Week, 19 May 2020[8]

"We agreed that the current environment although challenging, presents an opportunity for a fundamental and welcome change that will simplify our businesses, making them more environmentally and socially sustainable and ultimately align them more closely with customers' needs. "

Open letter to the fashion industry, initiated by the Belgian designer Dries Van Noten on 12 May 2020[9]

These statements reflect the consumer concerns identified during the first wave of Covid-19 and the first lockdown measures. In a survey carried out by McKinsey in April 2020 among German and British consumers, on the changes in consumption habits due to the Covid-19 crisis, 65% of respondents were planning to purchase more "sustainable " fashion items, 71% were planning to keep the items they already had for longer, and 57% were willing to repair items to prolong usage **(fig. 7)**.

However, after the end of the lockdown measures in early 2020, the market returned to the bases it has known and used for years. The number of digital catwalk shows increased, starting with that of Chanel on 6 June, which provided an opportunity for the director of fashion activities for the brand to state again that the schedule which prevailed until then was the right one: *"We will not complain about a pace that we have developed for our business"* (M, le magazine du Monde, 04/09/2020).

EXPRESSED WILLINGNESS TO CHANGE CLOTHING CONSUMPTION HABITS AFTER THE COVID-19 CRISIS
Source: McKinsey, 2020

	I will be buying more high-quality items that last longer	I will be repairing fashion items instead of buying new ones	I will be throwing out fashion items less often
Strongly agree	7		11
Agree	19	7	23
		16	
Somewhat agree	39	34	37
Somewhat disagree	19	23	17
Disagree	9	13	8
Strongly disagree	6	8	4
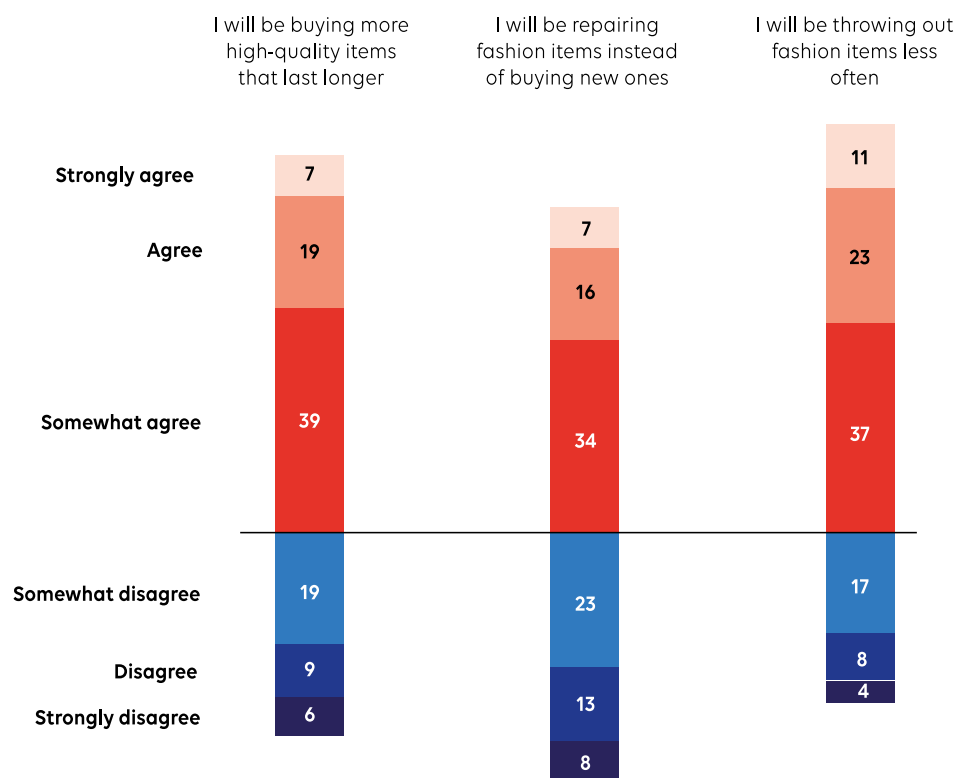
CONCLUSION

Whereas the sustainable fashion and second-hand markets are gaining ground, it is difficult to measure their impacts and they largely remain within a production-oriented and sectoral growth logic, which prevents the annual growth of resource consumption and negative externalities of the textile clothing industry from being curbed. Some problems have been dealt with by the public authorities, such as improving the working conditions of workers particularly in Asia, and textile waste management. But climate is never included in these regulation attempts, and has so far only been the subject of declarations of intent by European brands.

Even if the Covid-19 pandemic has marked an unprecedented halt for the sector, no structural change has been observed since despite the increasing number of declarations of intent. According to Textile Exchange, it is now important to apply a similar logic to the whole fashion sector to the one we implement against the virus: just as we adopt strategies to "smooth the curve" of contaminations and not exceed the health system capacity threshold, we should act to smooth the climate risk curve not to exceed the resilience capacity of the planet Earth.

Please do not hesitate to respond to this document, or to suggest any relevant additional reports or data by writing to the following address: contribution@climate-chance.org

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INDUSTRY : TEXTILE

WASTE

Asian restrictions and the pandemic trigger miscellaneous efforts to resolve the waste crisis

WASTE

Asian restrictions and the pandemic trigger miscellaneous efforts to resolve the waste crisis

Observatory Climate Chance: **Antoine Gillod** • Research Officer • **Amaury Parelle** • Coordinator

Consumption of the main sources of global waste (electronics, textiles, food, paper and plastic) is constantly rising. Yet capacities are under pressure to collect and manage waste in the wealthiest countries due to a combination of two factors: the closing of Chinese borders to imported recyclable waste since late 2017, and the Covid-19 pandemic. Put to the test, the inadequacy of local recycling capacities in countries in the North illustrates the extensive investment required by companies and local authorities to set up a truly circular economy. What progress has been made since 2019, and what are the first signs of the impact of Covid-19 on the action of non-state actors?

CONTENTS

Synthesis report on climate action by sector
KEY TAKEAWAYS 2020

WASTE

1 The Covid-19 pandemic has led to increased production of household and medical waste, posing difficulties for collection systems in cities like Seoul. In the United States, where 92% of waste is not recycled, the pandemic and pressure from manufacturers have delayed announcements to ban single-use plastics anticipated by some cities and states. In addition, the 15 million informal refuse pickers operating in the world are exposed to an increased risk of contamination and social distress due to a drop in activity.

2 Single-use plastics are caught in a crossfire: on the one side, hindered by the extension of prohibition laws (in the Caribbean, Asia and in particular Africa), and on the other, promoted by the petrochemical industry looking for outlets in developing countries, where they encourage the expansion of urban waste management services to counter plastic prohibitions. Plummeting crude oil prices have brought down the cost of virgin plastic, at the expense of recycled plastic in a context of economic recession where manufacturers seek out the cheapest options in the absence of any obligation. Disposable medical equipment, used widely during the pandemic, now litters natural areas.

3 The disruption of the international recycled waste market caused by the Chinese National Sword Policy has boosted illegal trafficking of waste from countries in the North to East Asia. Various states (USA, Japan, Australia, the EU, etc.) have reinforced legislation to encourage domestic recycling, while Chinese companies cut off from their supplies have started to invest abroad to get closer to the resources required for their activities.

4 While consumer goods companies that made commitments in recent years have improved their transparency, few have engaged in an approach to reduce waste at source, opting for a circular approach based on recycling rather than re-use and reparability. The legal absence of extended producer responsibility (ERP) in numerous countries appears to aggravate this situation.

5 The ERP reforms in some Canadian provinces and new container deposit schemes in Australian provinces see local governments react to the crisis by focusing on multi-actor governance of waste collection and sorting systems. Few consolidated data provide an overview of the action carried out by cities and regions, yet they continue to explore solutions, such as pneumatic waste collection, pay-as-you-go, and more complex circular economy systems.

1. Global trends in materials production and consumption and waste production

Given the absence of new statistics on emissions since the report *What a Waste 2.0* ([World Bank](#), 2018), analyzed in the 2019 Sector-based Report, here we develop our analysis to focus on the production of different types of waste and on the materials extracted to produce all of the goods in the world.

• AT THE ORIGIN OF WASTE, MATERIALS EXTRACTION CONTINUES AT AN EXPONENTIAL PACE • *What a Waste 2.0* reported that 1.6 $GtCO_2e$ were emitted in 2016 by waste processing, which is 5% of global emissions. This estimate includes over 2 billion tons of solid municipal waste, and 7 to 10 billion tons when counting commercial, industrial and construction waste ([UNEP](#), 2015). These emissions, calculated on the basis of tons of waste treated, are difficult to evaluate given the absence of efficient collection and management systems in most countries, and due to the different methods used from one country to the next.

In addition, they only reflect part of the raw materials extracted to manufacture goods and services each year. The *Circularity Gap Report* takes a different perspective on the factors behind the increase in global waste production by applying orders of magnitude to materials extracted annually and their recovery rate (recuperation or recycling). The report estimates that a volume of 100.6 billion tons of additional materials entered the economy[1] in 2017 (**fig. 1**), i.e., 13 tons per person. Only 8.6 billion tons came from recovered materials.

32.6 billion tons of these materials introduced into the economy become waste: while 8.6 billion are recovered (recuperated or recycled), the remaining 24 billion tons comprise mining waste, unrecorded waste, waste put into landfill or incinerated. These estimated figures are much higher than those reported by the United Nations Environment Program (UNEP) in 2015, which the authors put down to improved statistics on waste management. Whatever the limits of this methodology, successive reports point to a negative trend: an 8% rise in consumption of materials from 2015 to 2017, and drop in the recovery rate from 9.1% to 8.6% ([Circle Economy](#), 2020). This negative trend can be explained by the following main factors:

• Our dependence on the extraction of new resources, the growth of which is much higher than the rate of materials recovery at end of use. Thus, materials used for the global economy have quadrupled since 1970, while the population has only doubled.

• The quantity of materials required for the habitat, infrastructures and services needed by a growing global population. 50% of extracted materials are used in products not destined for long-term use.

• The lack of end-of-life processing and recycling, coupled with inappropriate product design. The report nevertheless notes progress, in particular in Europe, where solid waste recovery increased by 11% on average from 2011 to 2016, with recovery rates above 80% in Sweden, Austria and Luxembourg.

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1 - Half of the total comprises sand, clay, gravel and cement used in construction work, and other minerals extracted from quarries to produce fertilizers. Coal, oil and gas make up 15% and metal minerals constitute 10%. The final quarter comprises plants and trees used for food and fuel.

FIGURE 1

FINAL USE OF EXTRACTED AND RECOVERED MATERIALS IN 2017 PER BILLION TONNES

Source: Circularity Gap Report initiative, 2020

Housing	Communication	Mobility	Healthcare	Services	Consumables	Nutrition
38.8 Gt	5.6 Gt	8.7 Gt	9.3 Gt	10 Gt	6.9 Gt	21.3 Gt
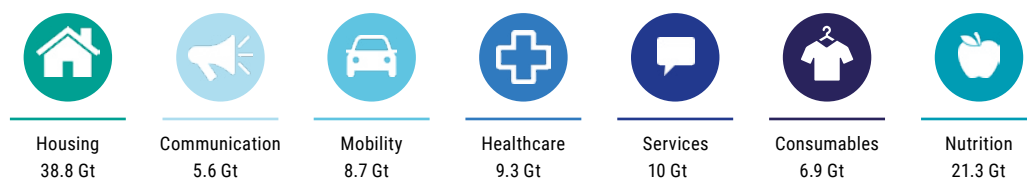
• GREATER GLOBAL PRODUCTION OF ALL TYPES OF WASTE • Here we present an overview of the latest data on production and management, production associated with GHG, and regulation trends. In OECD countries, three trends stand out:

• Annual waste production is rising steadily in most countries, few of which manage to uncouple it from demographic and economic growth (Japan, Hungry, France, Czech Republic, Spain).
• The production of solid municipal waste appears to have peaked in around 2000. On average, an OECD inhabitant generates 525 kg, which is 20 kg more than in 1990 but 35 kg less than in 2000.
• Recycling is making progress, but landfill remains the main way to manage waste. The vast majority of garbage in Colombia, Israel and Turkey ends up in landfill, while Slovenia, Germany and Italy boast remarkable recycling rates (OECD, 2019).

FIGURE 2

MUNICIPAL WASTE MANAGEMENT BY TYPE OF OPERATION IN OECD COUNTRIES IN 2018

Source: OECD, 2019

- ■ % COMPOSTING
- ■ % INCINERATION WIHTOUT ENERGY RECOVERY
- ■ % INCINERATION WITH ENERGY RECOVERY
- ■ % LANDFILL
- ■ % OTHER DISPOSAL
- ■ % OTHER RECOVERY
- ■ % RECYCLING
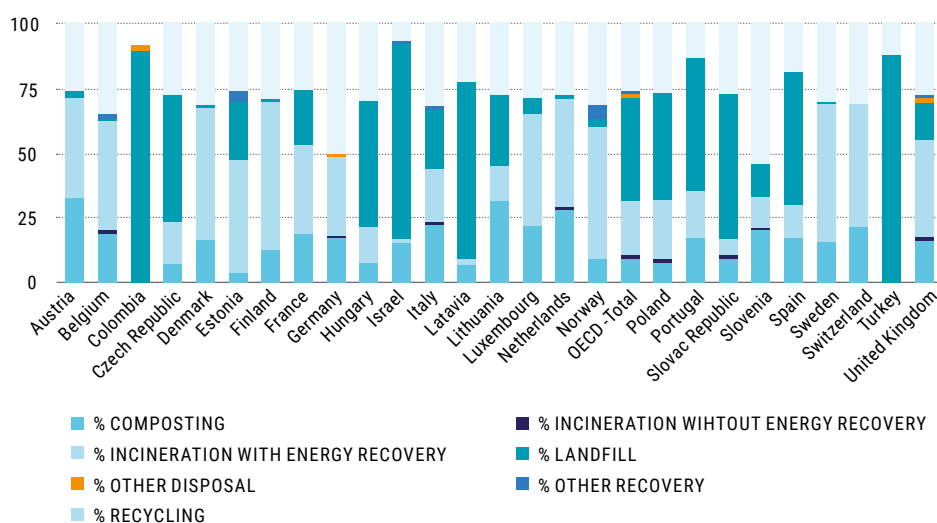
• The OECD concurs with the conclusions of the Circularity Gap Report: the material footprint, or in other words the raw materials used, including those indirectly extracted abroad or incorporated into imported merchandise to satisfy demand, continues to grow in most countries. Consumption of materials per capita is much higher in OECD countries than anywhere else in the world, despite higher materials productivity (amount of economic output per unit of materials consumed) and a decrease in directly consumed materials, in particular since the 2008 financial crisis.

To get a recent picture of global trends in waste flows, we look closely at five major sources: electronic waste, textile waste, paper waste, organic waste and plastic waste.

1. Electronic waste

The level of e-waste amounted to 53.6 Mt in 2019, or 7.3 kg per capita, which is an increase of 21% in five years according to the latest *Global E-waste Monitor* **update published in 2020.** This publication also anticipates that waste could reach 74 Mt by 2030 ([UNU/UNITAR and ITU](#), 2020). In terms of volume, Asia produces the most e-waste (24.9 Mt), but the concentration per capita is greater in high-income countries, reaching 28.5 kg in Norway (**fig. 2**) ([UN E-waste coalitions](#), 2019). In Europe, 40% concerns imported appliances ([EEA](#), 2020).

The reported average recycling rate of e-waste is also higher in Europe (42.5%) than in Asia (11.7%) and North America (10%). The average recycling rate (17.4%) increases more slowly than the annual waste flow, moving in the opposite direction from SDG 12.5 objectives. Few data are available on what ends up in landfill, is picked by informal workers in unfavorable conditions, or remains forgotten in households (estimated at 100 Mt). The value of this e-waste and the rare materials it contains is estimated at 57.5 billion USD dollars per year ([UNU/UNITAR and ITU](#), 2020).

The fewer recycling processes in place, the greater the GHG emissions and e-waste, leading to more extraction and refining of raw materials. The carbon footprint of electronic goods is variable, since it is concentrated on the usage phase for washing machines and driers, and on extraction for cell phones. The emissions increase as the lifespan of these apparatus goes down: the lifespan of four appliances (smartphones, televisions, washing machines and vacuum cleaners) is around 2.3 years shorter than what customers expect ([EEA](#), 2020). The reasons cited are variable, including so-called "planned obsolescence", being outdated by technological innovation or marketing strategies, a drop in product quality, and a lack of repair options.

FIGURE 3

MAPPING OF INTERNATIONAL E-WASTE FLOWS

Source: [UNU/UNITAR and ITU](#), 2020
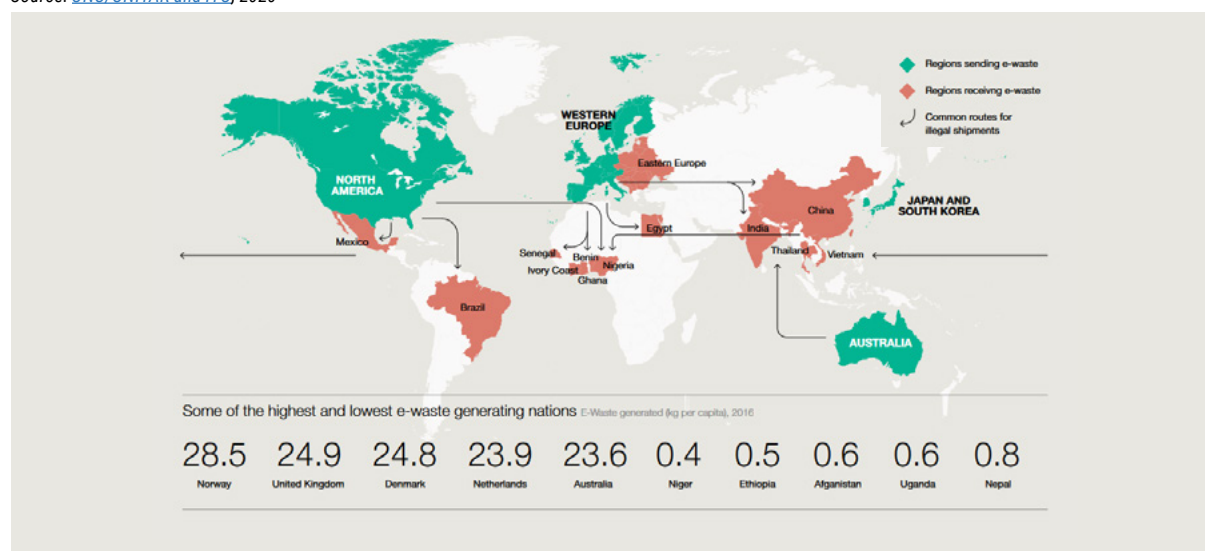
71% of the world's population is currently covered by regulations on producing electronic waste in 78 countries, 55 of them in Africa and Asia. A growing share of these laws aim at extended producer responsibility (EPR) to encourage the set-up of local recycling facilities and make companies responsible for the products that they put on the market, even after they are consumed. Nevertheless, most of these regulations are non-binding and lack sufficient implementation and investments to really stimulate waste collection and management.

2. Textile waste[2]

The production of textile fibers has doubled in 20 years, reaching 111 Mt in 2019, mostly polyester (52%), cotton (23%) and synthetic cellulose fibers. Polyester has seen the biggest growth over the last 30 years, from about 12 Mt in 1995 (25% of the market) to 58 Mt in 2019. GHG emissions from the production and use of clothes textiles and shoes alone are estimated at 2.1 $GtCO_2e$ a year, or about 4% of global emissions.

It is estimated that the equivalent of a skip full of clothes is thrown away every second, and that only 12% of these are recycled (Ellen MacArthur, 2017). Yet the carbon footprint of a kilogram of recycled cotton is 46% lower than that of regular cotton (Textile Exchange, 2014). By releasing almost 500,000 tons of microplastics into the oceans every year, the clothes industry is the biggest source of marine pollution by microplastics, ahead of tire degradation (Boucher and Friot, 2017).

Collection systems are organized differently depending on the country. In Germany, almost 75% of clothes are collected, compared to 10% and 15% in China and the USA respectively, while numerous countries have no collection system in place. In contrast, 81% of clothes purchased in Uganda are second hand.

FIGURE 4

INFOGRAPHIC: VALUE OF RECYCLED OR RECOVERED E-WASTE AND ITS IMPACT ON THE CLIMATE AND ENVIRONMENT - *Source: UNU/UNITAR and ITU, 2020*
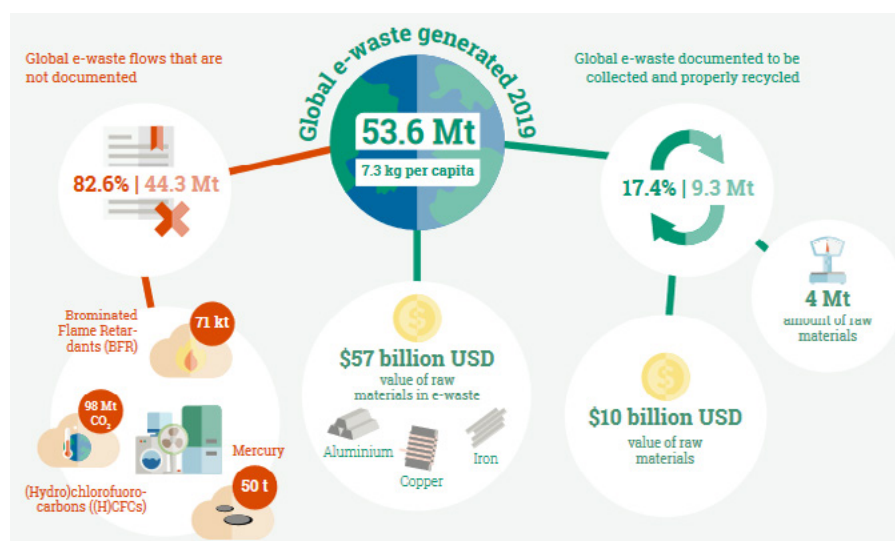
3. Paper waste

420 Mt of paper and cardboard were produced in 2018, according to the Bureau of International Recycling (BIR), 46% of it in Asia (China is the leading producer) and 26% in Europe (BIR, 2020). However, consumption in relation to the number of inhabitants is much higher in North America (209 kg), Europe (116.8 kg) and Oceania (110.2 kg) than in Asia (48 kg), Latin America (45.7 kg), the Middle East (30.5 kg) and Africa (7.3 kg). Production has decreased by 3 Mt compared to 2017, particularly influenced by China (-5%) where demand for paper for newspaper printing is decreasing. On the other hand, packaging, which represents 61% of the paper and cardboard produced, has gone up on all continents (BIR, 2020).

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2 - A full analysis of this industry can be found the 2020 Sector-based Report, page 155.

Half of total production comprises virgin fibers, the other half recuperated fibers. The production of paper and cardboard from recuperated fibers is concentrated in Asia (~50%), Europe (25%) and North America (20%). The large majority of these recuperated fibers goes into packaging (86%) (BIR, 2020).

Recuperated paper and cardboard are included in the materials banned from import into China, and dropped by 39% in 2019 compared to 2018, and 60% since 2016 (Resources Recycle, 2020). The opening of new recycled fiber factories in the United States since early 2020 has boosted demand for corrugated cardboard and mixed paper (Resources Recycle, 2020).

FIGURE 5

PRODUCTION OF PAPER AND BOARD BY SEGMENT, AS PERCENTAGE OF GLOBAL TOTAL IN 2018

Source: Bureau of International Recycling, 2020
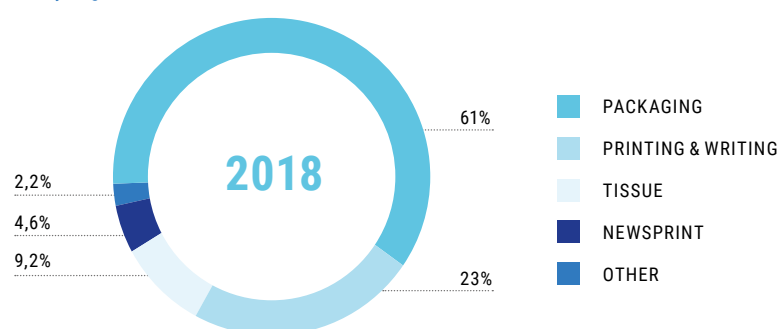
4. Organic waste

According to the latest FAO estimates, in 2011, loss from food waste amounted to 1.3 billion tons a year, which is an annual 3.3 $GtCO_2e$ over the entire value chain, with numerous methodological reservations. The FAO differentiates food loss (post-harvest up to, but not including, retail level) from food waste (at retail and consumption levels), calculated by UNEP which has not yet published its results. Loss, calculated by the FAO, amounts to 14% of the economic value[3] of harvest, storage, transport, processing, wholesale and retail sale. The level of loss, which is greater for fruit and vegetables than for cereal crops, differs depending on the type of product (FAO, 2019).

Although food loss and waste contribute significantly to global emissions and are included in the Sustainable Development Goals (SDG 12, target 12.3[4]), they are absent from all of the Nationally Determined Contributions (NDCs) featuring in the Paris Agreement (The Guardian, 24/09/2020). In the United States, organic waste is nevertheless the main input of landfills, while only 4% of households have access to a municipal compost service, with the effect that only 6% of food waste is diverted from landfill or combustion (GreenBiz, 04/09/2020). In Europe, organic waste makes up the largest share of municipal waste (34%), of which 60% is food and 40% garden waste. About 88 Mt of food is wasted annually (173 kg per person), which is 20% of food production. Plastic contamination reduces the possibilities for recuperating this food waste.

A European Union Directive dating from 2018 makes it obligatory to separate organic waste from general household waste by 2023. To date, the situation is variable: 17% of organic waste is converted to compost (11% in 2004), while only half of municipal organic waste is collected separately; rates

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3 - These estimates measure the loss in volume for different staples, then give them an economic value before aggregating them. The products with the greatest value therefore have more weight in the estimate of loss than low-value products.

4 - Target 12.3 of the SDGs aims at halving per capita global food waste at the retail and consumption levels and reducing food product loss along the production and supply chains, including losses post-harvest, by 2030.

vary from 80% in Austria and Slovenia to under 10% in Bosnia-Herzegovina, Cyprus, Macedonia, Portugal, Spain and Turkey. 48% of Slovenian households and 41% of Flemish households have access to domestic composting, which considerably reduces collection and processing requirements (EEA, 2020)

Over the total lifespan of food consumption, food waste represents 15% to 22% of GHG emissions, the equivalent of an average 2.1 tCO$_2$e per ton of waste, or 186 MtCO$_2$ in total (Scherhaufer et al., 2015, 2018). Most of these emissions related to food waste (73%) occur during its production (EEA, 2020).

5. Plastic waste

710 million tons of plastic have been dispersed in nature, according to a study published in *Science*, including 11 million tons in the sea (Lau, W.W.Y., et al., 2020). This pollution is fueled by increasing production of products mainly destined for single use. The latest figures available from UNEP for 2015 report 400 Mt of plastic waste produced per year, 36% of which simply for plastic packaging (UNEP, 2018). From 1,000 to 5,000 billion plastic bags are produced per year (Heinrich Böll, 2020).

FIGURE 6

DISTRIBUTION OF PRODUCTION OF SINGLE-USE PLASTIC ARTICLES IN 2014

Source: Heinrich Böll, 2020
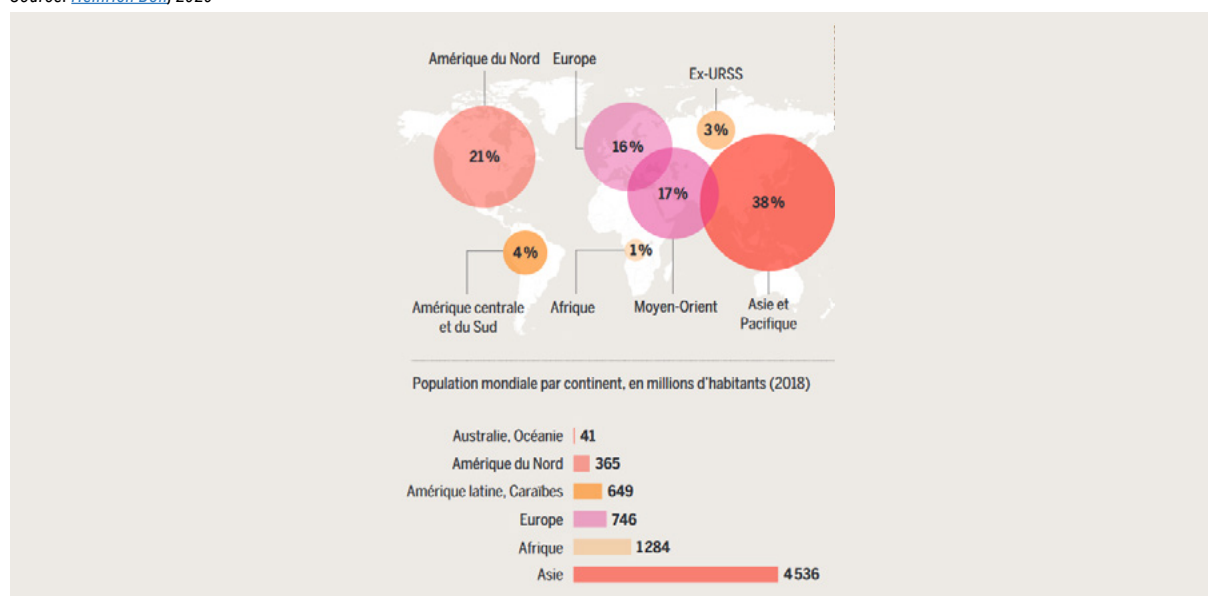
Recycling capacities cannot keep up with production, which has doubled in 20 years. Of the almost 6.3 tons of plastics produced since 1950, only 9% were recycled, most ending up in landfill (79%) or combustion (12%) (Geyer et al., 2017).

At global scale, production continues to grow, now led by Asia in absolute terms but not necessarily per capita (**fig. 6**). However, in 2019 the demand for plastic materials continued on a downward trend that began in 2016 in the EU-28 (-7.1%). The reasons are to be found in the drop in global car sales and decreased production in China; in contrast, the demand for plastic from the construction sector has increased (Collins, W, 2020).

OUTCRY ABOUT MICROPLASTICS

The problems raised by microplastics and their impacts on the environment and human health have received significant media coverage this year, and were the focus of prolific scientific papers in 2020.

With a diameter ranging from 1 μm to 5 mm, microplastics are the result of the degradation of large items abandoned in nature. Their accumulation in ecosystems, measured by the exponential production of virgin plastics over decades, is increasingly documented. While in 2014, researchers estimated the number of plastic bits floating in the ocean at 5 trillion (Eriksen et al., 2014), a new study based on samples extracted using very fine nets in the Gulf of Mexico and the English Channel estimates that this total could in fact be as much as 125 trillion (Lindeque et al., 2020). Other studies have provided more precise details about the concentration in different marine areas: in the North Pacific Gyre (Brandon et al., 2019), the North Atlantic (Barboza et al., 2020; Pabortsava et al., 2020) and the Mediterranean (Kane et al., 2020). The latter study focused on the Tyrrhenian Sea, where it measured the largest concentrations of microplastics ever observed in a sea bed, up to 1.9 million pieces per square meter. The study by Barboza et al. also provided proof of the neurotoxicity of plastics ingested by fish, and estimated that an adult man can swallow up to 842 microplastics a year by eating fish. Roche et al. (2020) have shown that fish who use vision to find their way are particularly likely to ingest microplastics that they confuse with food. Microplastics are also found in birds that prey on invertebrates in fresh water rivers (D'Souza et al., 2020).

For more information, an overview of these studies was published during the summer by Mongabay (15/07/2020).

BOX 1

2. Geopolitics and the health crisis spark uneven changes in the international recycling market

Since 2018, plastic has been subject to economic and geopolitical tensions that have impacted all global waste flows. Focusing accusations from environmental associations for years because of the pollution that they generate in ecosystems, numerous countries have begun to act on single-use plastics, targeting them with new laws. On an international scale, Chinese restrictions on waste imports in early 2018 as part of the country's *National Sword Policy*, and the revision of the Basel Convention on hazardous waste in June 2019, have pushed municipalities and companies to organize themselves to tackle the disruption in global waste exchanges. The lockdowns implemented to combat the spread of Covid-19, combined with upsets in the oil market, have also had a considerable impact on waste management production and strategies at local level.

• ANTI-PLASTICS LAWS STILL IN FULL SWING • Anti-plastics laws feature extremely diverse instruments and strictness levels. Some countries, such as Germany and Denmark, opted to tax plastic bags as early as the 1990s. Others have partially or totally prohibited some types of plastic, mostly single-use products (bags, straws, tableware, etc.). The latest report on the subject, published by UNEP in July 2018, listed 127 countries out of the 192 UN members that had passed some form of legislation regulating the production of plastic bags, and 27 countries that totally or partially prohibit single-use plastics (UNEP, 2018). To date, "*Africa is the continent with the highest percentage of countries implementing prohibitions on the use of plastic*", with 34 countries out of 54 (Heinrich Böll, 2020). From South America to Asia and Africa, developing countries are the fastest to enact strict bans.
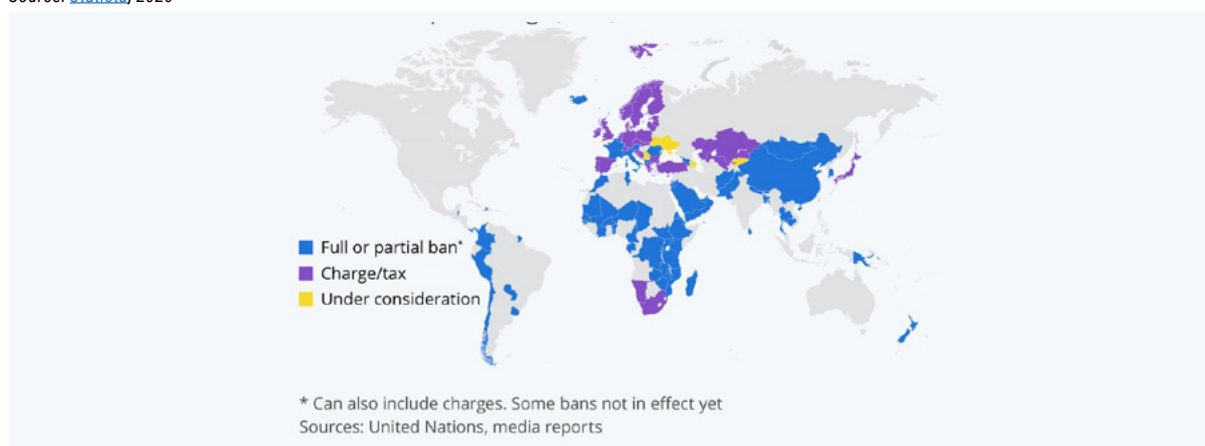
In 2020, new countries promulgated their own laws. Seven Caribbean states prohibited the import of single-use plastics and polystyrene on 1 January 2020: Jamaica, Belize, Barbados, Dominican Republic, Grenada, Trinidad and Tobago and the Bahamas (The Yucatan Times, 04/12/2020). Forbes reported that 10 of the 30 biggest global producers of plastic waste per capita were in the Caribbean (Forbes, 20/09/2019), headed by Trinidad and Tobago, which produced close to 1.5 kg of plastic per person per day. Significant results have been recorded in Antigua and Barbuda, which began phasing out plastic products in 2016, and reportedly reduced the share of plastics in its waste disposal sites from 19.5% to 4.4% from 2006 to 2017 (Global Voices, 30/01/2020).

In China in January 2020, the National Commission for Reform and Development and the Ministry of the Environment announced the banning of numerous single-use plastics by 2025. At the end of the year, non-reusable plastic bags will be prohibited in all major towns, and then throughout the island by 2022. Other types of single-use plastics are being phased out by 2025 (Le Monde, 21/01/2020). This year also marks the start in **France** of the phasing-out of single-use plastic products, beginning with disposable plates, cups and cotton swabs. The exclusion of these products, decided by decree, is a response to a Directive by the **European Union** and Council on the reduction of the impact of certain plastic products on the environment, voted in June 2019 which all European Union Member States are obliged to transpose into their national legislation (Directive (EU) 2019/904). The European Commission also presented its Circular Economy Action Plan in March 2020, to guide waste policies in the Union in line with the objectives of the European Green Deal (COM (2020) 98).

In the United States, where 92% of waste is not recycled, in February 2020 the Senator of New Mexico Tom Udall and the Californian Representative Alan Lowenthal presented the *Break Free From Plastic Pollution Act of 2020* (H.R. 5845, 11/02/2020). The bill aims to increase the responsibility of producers of non-recycled materials, and restrict the use of disposable plastic products. A calendar of recycling performance targets has been proposed, and the bill requires the EPA to establish recycling and composting standards for all towns and federal states. However, the health crisis provoked by Covid-19 has delayed the bill's adoption. In early fall, it was still at the examination stage, suspended due to the health crisis (The National Law Review, 09/09/2020).

Having been asked to leave by the front door at the start of the year, single-use plastics have come back in through the window in public debates in the United States due to Covid-19. Lobbying by the plastic industry has seen some states take advantage of the health context to undo existing legislation banning single-use plastic bags. In normal times, fifteen states had already prohibited local authorities from taking measures to ban single-use plastic bags. Since the spread of the virus, local elected representatives from all parties have suspended taxes on plastic bags, and some states and cities (including Philadelphia, sixth largest city in the country) have postponed prohibition decisions that were imminent before the crisis. In a letter addressed to the US Department of Health and Human Services, the Plastic Industry Association called for a "*public statement on the health and safety benefits seen in single-use plastics*", quoting a 2011 study by the University of Arizona claiming that reusable plastic bags accumulate bacteria and viruses on their surface, making them conducive to spreading pathogens to people and food. Other studies, however, have since disputed the conclusions of this publication (Citymetric, 08/05/2020).

FIGURE 7

COUNTRIES WITH NATIONAL REGULATIONS LIMITING OR PROHIBITING THE USE OF PLASTIC BAGS

Source: Statista, 2020

Full or partial ban*
Charge/tax
Under consideration

* Can also include charges. Some bans not in effect yet
Sources: United Nations, media reports

• REACTIONS TO CHINESE AND SOUTH ASIAN POLICY • Keen to move away from its role as the world's dumping ground, and to combat illegal trafficking of waste imported from abroad, China has upset the global recycling economy, generating geopolitical tensions and obliging states, municipalities and companies to change their practices.

Since 1992, an estimated 72.4% of the world's plastic waste destined for recycling, or a cumulation of 170.5 Mt, have been exported to China and the port of Hong Kong, according to a study published in *Science Advances* (Brooks, A.L. & al., 2018). Most of this waste has gone through illegal import channels. After several years of increasingly restrictive policies targeting these uncontrolled transboundary movements[5], China adopted a repressive approach with the announcement of its *National Sword Policy* in February 2017. The repression, which initally involved an anti-criminal policy aimed at customs fraud and criminal networks hidden behind trafficking of illegal waste import licenses, in fact also concerns consumer goods, agricultural produce and weapons (resource.co, 23/02/2017). The constraints have led to the confiscation of thousands of tons of foreign waste on Chinese territory, and the arrestation of smuggler bands. Very quickly, though, the Chinese government began to totally exclude imports of some types of solid waste, notifying the WTO that it was preparing a ban on 24 types of waste, including several types of non-industrial plastic, mixed papers, textiles and vanadium slag, a rare metal (Resource Recycling, 19/07/2017).

This ban, which has been extended to salvaged materials (such as scrap metal and paper fibers), takes two main forms. The first is a reinforcement of a standard aimed at improving the quality of imported waste, by limiting to 0.3%~1% the rate of "contamination" in recyclable materials, in other words the extent to which they are mixed with other non-recyclable materials. This is a prohibitive rate because it is almost unattainable, thus disqualifying numerous potential shipments from entry into China (Waste Dive, 16/11/2017). Secondly, on the basis of this standard, China has begun to reduce the volume of imports granted to local operators of waste-recycling centers and manufacturers looking for second-hand materials. The *National Sword Policy* has thus become synonymous with a wider policy aimed at imports of foreign waste (**box 2**).

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5 - Since the launch of the Green Fence operation (2013). For an overview of the history of these policies, see the timeline produced and updated by Resource Recycling.

KEYS TO UNDERSTANDING

CHINESE IMPORT QUOTA POLICY ON WASTE AND SCRAP

Throughout the year, the Department of Solid Wastes and Chemicals at the Ministry of Ecology and Environment of the People's Republic of China sparingly delivers special authorizations to import certain materials. The import permits, which are published in batches, are eagerly awaited and scrutinized by international stakeholders waiting to export their waste and by the Chinese recycling centers and industries that depend on these materials.

For example, the 12th batch of the year, announced on 17 September 2020, authorized the entry into Chinese ports of 730,000 tons of recuperated paper fibers, along with 135,000 tons of "red metals" (copper, bronze and brass), 120,000 tons of aluminum residue, and only 2,600 tons of ferrous scrap (Recycling Today, 21/09/2020). These are extremely low volumes that, depending on the metal, have been reduced by up to 80% from one year to the next, with last year marking the first batch published according to the new rules (Argus, 20/06/2019).

According to information from the Chinese Ministry and the Bureau of International Recycling (BIR), the quota system will be maintained until the end of the year and terminate at the end of 2021 (BIR, 07/07/2020). At that date, imports of solid waste will be totally prohibited, or requalified as "resources" rather than "waste", following case-by-case decisions that are already the object of negotiations and lobbying from manufacturers concerned about finding outlets for their residues (BIR, 14/10/2019). This information confirms the intentions expressed by the Chinese government in late April when revising the law on the prevention and control of environmental pollution by solid wastes (BIR, 30/04/2020). Along with authorizations on import volumes, the ministry has upscaled quality standards relating to second-hand raw materials entering the country.

BOX 2

In January 2019, imports of plastic waste had dropped by 99%, and paper by more than one-third (Resource Recycling, 29/01/2019). This new Chinese policy has profoundly impacted global waste exchanges and in the last two years has set the pace of strategies by North American, European and Australian actors in the sector.

• REDIRECTED WASTE SHIPMENTS FROM THE NORTH COME UP AGAINST REINFORCED LAW IN RECEIVING COUNTRIES • At the macroeconomic scale, countries in the North dependent on Chinese recycling industries initially turned towards neighboring countries in South East Asia to find new outlets for their waste shipments.

In a short amount of time, cargoes of waste previously destined for Chinese ports began to be redirected towards Thailand, Malaysia and Vietnam (The Guardian, 05/10/2018). These countries admitted difficulties tracing waste once it entered the country, leading Interpol to suggest that exporting countries were overestimating their recycling rates (Interpol, 2020). The biggest international maritime companies have also reacted to the total closure of Chinese borders to solid waste in 2021. Most recently, CMA-CGM, the fourth biggest container transporter in the world, reported that it will refuse all new cargoes of solid waste destined for China. Its main competitors, APM-Maersk, Mediterranean Shipping Company (MSC) and Hapag-Lloyd, have all made similar decisions in recent months (Resource Recycling, 25/08/2020).

Although European exports of waste have increased by 66% since 2004, they remained relatively stable from 2018 to 2019. However, the destinations have radically changed. While exports to China slumped from 10.2 to 1.2 Mt from 2009 to 2019 (with a more recent drop for plastic and paper), Turkey has become by far the biggest importer of EU waste, amounting to 11.4 Mt (including

9.9 Mt of ferrous waste), and Malaysia is now the main destination for recyclable plastic from Europe (Eurostat, 16/04/2020; Eurostat, 09/07/2020). The European Court of Auditors esteems that, "*Member States are at risk of missing the new European targets for plastic packaging recycling*": 50% in 2025 and 55% in 2030. Nevertheless, the Extended Producer Responsibility Alliance (Expra) estimates that a 60% maximum recycling rate for plastic packaging is theoretically attainable (European Court of Auditors, 2020).

In fact, the new "target" countries soon began sending back entire containers of waste that do not conform to contamination regulations. For example, early this year, 150 containers loaded with 3,737 tons of waste were sent back, including 43 to France, 42 to the United Kingdom, 17 to the United States and 11 to Canada (Business Insider, 21/01/2020). Sri Lanka returned 21 containers of waste mixed with hazardous material to the United Kingdom (BBC, 27/09/2020).

These sovereign decisions have since been backed up by a reinforcement of international law on waste control. In May 2019, 187 countries at the Conference of Parties adopted a series of amendments to the Basel Convention on the control of transboundary movements of hazardous waste and their disposal. These "plastic amendments" establish that from 1 January the notification and consent procedure applying to hazardous plastic waste (Annex VIII) shall be extended to include household plastics requiring special consideration (Annex II). As a result, all shipments of this type will now require authorization from the state of the receiving port (Plastic Recycling Update, 15/05/2020). The United States, although not a party to the Basel Convention, has opposed the adoption of this amendment, while the new rule has already been transcribed and standardized in the OECD control system for transboundary movements of wastes destined for recovery operations (OECD/LEGAL/0266, 07/09/2020). Hong Kong has already applied this new measure by making the Basel Convention amendment part of its national legislation (Resource Recycling, 22/09/2020).

• EXPORTING COUNTRIES CONSOLIDATE THEIR DOMESTIC RECYCLING CAPACITIES • The Chinese decision has highlighted the weakness of municipalities' waste management and recycling capacities, in particular in the United States and Australia. Today, only one American in two has direct access to a curbside recycling program (The Recycling Partnership, 2020). The specialist online publication *Waste Dive* listed 60 municipalities that have dropped these services since the first decisions made by China in 2017, because they are now less profitable due to a lack of local outlets for recyclable waste (Waste Dive, 23/09/2020). According to research by Jan Dell, founder of the NGO The Last Beach Clean Up, based on the latest data from the U.S. Census Bureau[6], only 2.5% of the plastic consumed in the United States was recycled in the country in 2015; six times more were incinerated, and most of it (75.4%) was sent to landfill. The new Chinese policy reduced the volume of exports from 6% to 3.3% from 2015 to 2018 (Plastic pollution coalition, 30/04/2019). During the first half of 2020, exports of plastic waste from the United States dropped once more, by 18% compared to 2019, following a 47% drop from 2018 to 2019 (Plastic Recycling Update, 12/08/2020).

To make up for this gap in treatment capacities, on 16 June 2020, the Representatives Haley Stevens (Dem.) and Anthony Gonzalez (Rep.) presented a bipartisan bill, the *U.S. Plastic Waste Reduction and Recycling Act*, aimed at increasing research and development and planning greater capacities for treating plastic waste in the country. The initiative, which wants to make the United States the leading country in plastics recycling, aims less at reducing upstream production of waste than at improving downstream processing. This measure is more sympathetic to producers than the *Break Free from Plastic Pollution Act of 2020*, and as a result has received support from numerous professional federations, including the American Chemical Council, the American Chemistry Society, the

6 - Dated 2018. The next export statistics will not be published until 2021 by the U.S. Census Bureau.

American Beverage Association and the Plastics Industry Association (Recycling Today, 16/06/2020).

Australia also presented a National Waste Policy Action Plan in November 2019, drawn up in partnership with the Australian Local Governments Association (ALGA), to implement the National Waste Policy adopted in 2018. Its objectives are to reduce waste production per capita by 10% by 2030, to increase domestic waste management capacities, and to improve the recycling rate. A Recycling Modernization Fund has been created with a budget of 190 million dollars and aims to generate 600 million dollars of additional investments from federal states, municipalities and manufacturers (Australian Government, 06/07/2020). A timetable of the progressive prohibition of exports of plastic, paper, glass and tire waste has been drawn up from 2020 to 2024. The ban on exporting glass waste, initially due to come into force in July 2020, has been postponed to January 2021 due to Covid-19.

In July 2020, the Japanese government unveiled a plan for municipal collection of all household plastic waste. The objective is that municipalities will work together to collect plastics by 2022. Currently, numerous plastic products are categorized as combustible waste or sent to landfill (Japan Times, 22/07/2020).

• AVOIDANCE STRATEGIES: THE RISE IN CRIME AND THE BIG OIL'S OFFENSIVE AGAINST ANTI-PLASTICS LAWS •

The global plastic waste recycling market was estimated at 34.8 billion US dollars in 2016, and is projected to reach 50.36 billion by 2022 (d'Ambrières, W., 2019). Although subject to strict international regulations, gaps exist in some countries that struggle to organize the value chain from collection through to processing. Tougher anti-plastic legislation has proved vulnerable to two phenomena: the development of illegal activities on the fringe of the market, and intense lobbying practices designed to legally weaken normative barriers to plastics production.

In an unpublished report, Interpol analyzed emerging criminal trends on the global plastic waste market from the start of the implementation of the Chinese policy in January 2018. Based on data and information from 40 countries, Interpol details a wide range of practices beyond the bounds of law: transfers of illegal waste shipments to other destinations, unauthorized dumping, illegal incineration, administrative fraud, etc. All of these alternative channels have opened up in the absence of domestic recycling capacities in countries previously dependent on China (Interpol, 2020). These infractions sometimes result in considerable fines for big companies. This summer, the number two British waste management firm Biffa Waste Services Ltd was given a £350,000 fine on appeal after breaking regulations on waste shipments in order to enter badly sorted waste into China (resource.co, 08/07/2020). In France, a brokerage firm was fined €192,000 for having illegally shipped twenty containers of waste to Malaysia, where they were refused entry (Novethic, 14/09/2020).

In January 2019, petrochemical giants (ExxonMobil, Chevron, Total, Eni, BASF, Dow, Braskem, etc.), manufacturers of plastic consumer goods (PEPSICO, Procter & Gamble, etc.) and urban services suppliers (Veolia, Suez, etc.) got together to create *Alliance to End Plastic Waste*, a coalition with a budget of 1.5 billion US dollars aiming to bring an end to plastic waste in East Africa and Asia. This explicit environmental mission is ostensibly encouraging, yet does not totally disguise the companies' economic ambitions on those potential plastics markets.

In fact, a recent survey by the *New York Times* reveals that this initiative to develop urban waste collection and treatment services is simply part of a strategy to influence plastic restriction policies, which are particularly strict in Africa. The survey reveals that the American Chemistry Association (ACA), whose members include Exxon, Chevron, Shell and Dow Chemistry, has attempted to make

Kenya change its 2017 policy banning single-use plastic bags, one of the most ambitious in the world. These pressures, put on officials in both countries, aim to insert clauses into a trade agreement currently being negotiated between Kenya and the United States which would prevent the Kenyan government from taking measures against the production and trade of plastic in the country. The objective, described in a letter addressed to a member of Congress by the president of the ACA and consulted by the *New York Times*, is unequivocal: "*We anticipate that Kenya could serve in the future as a hub for supplying U.S.-made chemicals and plastics to other markets in Africa through this trade agreement*". The strategy identifies filling "*a global need to support infrastructure deve-lopment to collect, sort, recycle, and process used plastics, particularly in developing countries such as Kenya*" ([New York Times](#), 30/08/2020).

In July 2020, *Alliance to End Plastic Waste* announced that it had formed a strategic partnership with UN-Habitat, the United Nations agency for the sustainable development of cities. The partnership aims to employ a digital tool developed by UN-Habitat to map waste flows, potential leaks of plastic outside waste management systems, and ideas for improving collection, recycling and recovery in developing cities. The six selected cities include Nairobi and Mombasa in Kenya, along with Addis Ababa and Bahir Dar in Ethiopia, Thiruvananthapuram (Kerala) and Mangalore (Karnataka) in India ([PR Newswire](#), 21/07/2020). In total, according to Carbon Tracker, the oil industry aims to make investments of 400 million US dollars in new production capacities for virgin plastic in the next five years ([Carbon Tracker](#), 2020).

This constitutes a considerable economic challenge for a petrochemical industry subject to pro-environment pressures from civil societies in the North and the Chinese offensive against plas-tic waste. However, the drop in oil prices in 2020, combined with demand for emergency medical equipment, are boosting the demand and competitiveness of virgin plastic compared to recycled plastic ([Reuters](#), 05/10/2020).

• **COVID-19: HOUSEHOLDS AND HOSPITALS GENERATE MORE WASTE DURING THE PANDEMIC** • Few data are currently available to measure the impact of the Covid-19 epide-mic on recycling activities around the world. Two trends stand out in what is available. On the one hand, the first studies and reports from municipal services correspond to confirm an increase in the production of waste from household and health facilities during lockdown periods. Panic buying, the promotion of disposable merchandise, and emergency production of surgical masks and other personal prevention equipment are all identified as on the upswing ([Sarkodie et Owusu](#), 2020).

The Association of Cities and Regions for Sustainable Resource Management (ACR+) carried out an online survey to make an inventory of local authorities' experiences in managing waste during Covid-19. The reports produced and shared by waste collection operators in some towns indicate clear trends. For example, the city of Milan recorded a drop in solid municipal waste (-27.5%), as did Barcelona (-25%), while in Catalonia in general the production of medical waste went up by 350% ([ACR+](#), 2020).

On the other hand, recycling rates appear to have plummeted since the start of the year. According to the Independent Commodity Intelligence Services, quoted by Reuters, the demand for recycled material from packaging businesses went down by 20% to 30% in the second quarter in Europe ([Reuters](#), 05/10/2020). The same source reports that recycling activities in Asia have shrunk by 50%, and up to 60% for some companies in the United States. For plastic, the phenomenon results from a lower price for virgin plastics generated by the drop in crude oil prices, which determine the costs of petrochemical processes. As a result, recycled plastics, which even in normal times are more expensive than virgin plastics, are even less competitive and generate additional costs that resin

producers and manufacturers at the end of the chain are not always prepared to pay during an economic crisis (Plastics Recycling Update, 06/05/2020).

EXPERIENCE FEEDBACK

COVID-19, A DOUBLE-EDGED SWORD FOR INFORMAL WASTE PICKERS

Generally exposed to health risks, professional and informal refuse collectors were put under the spotlight as being qualified among the "essential activities" since the start of the pandemic. In cities, the risks take on a different nature with the changing composition of waste and the risk of contamination with the virus, which survives on collected materials. In the United States, professionals say they have found their job increasingly difficult since the start of the pandemic, since the rising levels of household garbage force them to multiply their curbside pickups (CNBC, 16/05/2020).

These risks are all the greater for informal garbage collectors who work in landfills looking for recyclable materials. A reported 15 million informal "ragpickers" exist throughout the world, collecting 15% to 20% of waste (WeForum, 24/06/2020). Their work, in the absence of regulations and sanitary equipment, makes them particularly vulnerable to the risk of contamination from the virus – partly from contact with potentially contaminated waste, and partly because it is difficult to distinguish the symptoms of Covid-19 from other diseases contracted regularly from toxic fumes from waste (Spotlight, 08/07/2020). To inform workers in the sector about the risks of the pandemic in their everyday activities, the NGO Women in Informal Employment: Globalizing and Organizing (WIEGO), which works with informal waste pickers, has published a short guide of good practices, available in 16 languages (WIEGO, 2020).

The drop in recycling activities also threatens their livelihoods, and all the more so since, outside traditional economic circuits, ragpickers do not benefit from emergency aid and recovery packages. In Brazil, informal collectors working alone or in cooperatives but not associated with local authorities, are excluded from emergency financial aid programs. The National Movement of Recyclable Waste Pickers (MNCR) sent an open letter to the city of Sao Paulo to draw attention to their situation, i.e. at least 20,000 individuals and 30 cooperatives in that city alone (MNCR, 2020), and almost 800,000 people responsible for collecting 90% of recycled waste around the country (MNCR, 14/09/2020).

In Brazil, Colombia, India, South Africa, Kenya and even France, the Global Alliance of Waste Pickers (GlobalREC) identifies several campaigns launched by groups of waste-picker associations and cooperatives to support their members with donations of food and sanitary equipment (GlobalREC, 20/10/2020).

BOX 3

3. Companies: growing recycling markets, reduction action under study

• PROGRESS IN CORPORATE DATA TRANSPARENCY • During the 2020 "proxy season", when most companies hold their general assemblies, attention was focused on As You Sow, a non-profit foundation that promotes corporate accountability through shareholder action, and which also supports the cause of corporate waste reduction. Its latest report measures the progress of 50 companies from the beverage, fast food, consumer packaged goods and retail sectors, rating them A to F on six "pillars" where action is needed to manage the plastic pollution that they generate (**fig. 8**).

Taking all of these criteria, none of the companies received an A, while 12 were given a C, 22 a D and 15 an F. Unilever was the only one to obtain B-, the highest grade, mainly because it is the only company to have committed to reducing its plastic packaging overall: -100,000 tons by 2025 ([Unilever](), 07/10/2019). **As You Sow notes that the commitments made by companies are focused on package design, but rarely on how to make it reusable. The absence of legal extended producer responsibility in the United States and companies' regular opposition to its implementation do nothing to boost inaction in the sector** ([As You Sow](), 2020).

Only Coca-Cola, Colgate-Palmolive and Wendy's have followed As You Sow's recommendations by publishing the exact number of packaging units that they produce, revealing that Coca-Cola produces 88 million single-use plastic bottles each year, a much higher figure than the three other biggest agribusiness groups in the world: Nestlé (1.7 million), Danone and Unilever ([Heinrich Böll](), 2020).

FIGURE 8

SCORES OF THE 50 COMPANIES GRADED BY AS YOU SOW ON THE 6 PILLARS OF THEIR PACKAGING PRODUCTION
Source: [As You Sow](), 2020
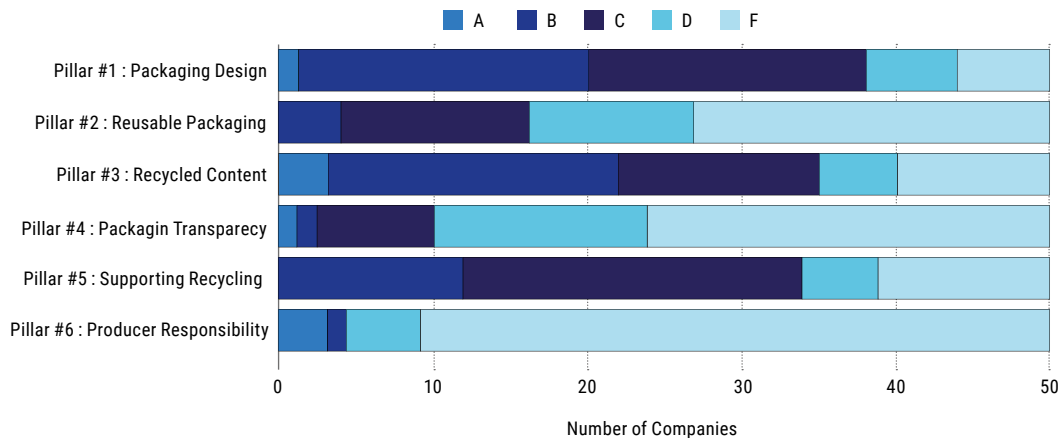
NONE COMPANY

INDICATOR

None company rated A by "As you Sow" according toof their prevention practicesplastic pollution management

FIGURE 9

OVERVIEW OF PROGRESS PUBLISHED IN 2019 BY THE 10 BIGGEST PLASTIC-CONSUMING COMPANIES THAT ARE SIGNATORIES OF THE NEW PLASTIC ECONOMY - *Source: Ellen MacArthur Foundation, 2019*

	PACKAGING DESIGN	RECYCLED CONTENT	STAGE OF ENGAGEMENT WITH REUSE	PLASTIC PACKAGING VOLUME
	%, by weight, of plastic packaging reusable, recyclable, or compostable ● 2018 ● 2025 Target	%, by weight, of post-consumer recycled content in plastic packaging ● 2018 ● 2025 Target	Stages: opportunity analysis / piloting / small part of portfolio / significant part of portfolio	Millions of metric tonnes per annum
1. Nestlé	65%	2% / 15%	Small part of portfolio	1.7
2. Procter & Gamble	NOT A GLOBAL COMMITMENT SIGNATORY			
3. PepsiCo	77%	3% / 25%	Small part of portfolio	2.3
4. AB InBev	NOT A GLOBAL COMMITMENT SIGNATORY			
5. Unilever	~50%*	<1% / 25%	Small part of portfolio	0.7
6. JBS	NOT A GLOBAL COMMITMENT SIGNATORY			
7. Tyson Foods	NOT A GLOBAL COMMITMENT SIGNATORY			
8. Mars, Incorporated	19%	0% / 30%	Small part of portfolio	0.2
9. The Coca-Cola Company	99%**	9% / N/A***	Significant part of portfolio	3.0
10. L'Oréal	N/A****	5% / 40%	Small part of portfolio	0.1

New Plastic Economy, a coalition led by the Ellen MacArthur Foundation and UNEP, monitors the implementation of commitments taken in 2018 by close to 200 companies responsible for 20% of plastic packaging production (**fig. 9**). Governments and civil society organizations are associated with the initiative. According to its latest report dating from 2019, 34 companies published their plastic consumption figures for the first time, revealing that only 3% of their packaging is reusable (Ellen MacArthur Foundation, 2019):

• About 60% of brands, retailers and packaging producers in the group of signatories that use or have used PS, ePS or PVDC plastics have eliminated these materials from their portfolio or have concrete plans to do so.

• 43 signatory packaged goods companies, packaging producers and retailers – 36% of the group – are currently working on testing and piloting reuse business models on different markets and types of products. However, under 3% of signatories' packaging is currently reusable.

• About 60% of signatories' plastic packaging is currently reusable, recyclable or compostable in practice on a large scale. The coalition's target is to reach 100% by 2025.

ReSource, an international coalition established in 2019 and led by WWF, gathers about one hundred companies to meet three objectives:

• Eliminate unnecessary plastics
• Double the global recycling rate
• Switch to more sustainable raw materials for the remaining plastic

3%

*3% of the packaging of the 200 signatory companiesof the Global Commitment coalition arereusable*

FIGURE 10

ESTIMATED MANAGEMENT OF PLASTIC WASTE BY RESOURCE MEMBERS COMPARED TO GLOBAL MANAGEMENT BY SIGNATORIES OF THE ELLEN MACARTHUR FOUNDATION'S GLOBAL COMMITMENT INITIATIVE

- Recycling
- Incineration
- Landfill
- Mismanaged

Resource Members · Global Average
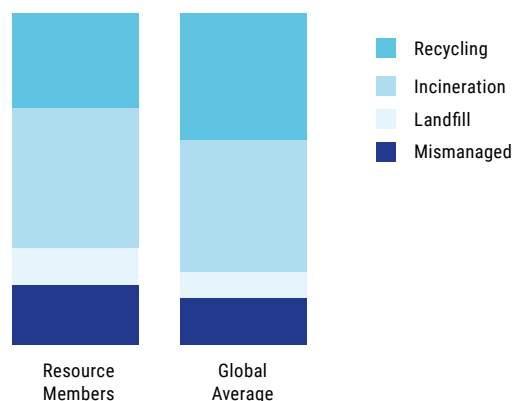
For each company, the *ReSource Footprint Tracker* measures the quantity of plastics used and sold, the types of polymer used, the source of materials, and whether the latter return into the production system or become waste. For its first report, *Transparent 2020*, the coalition estimated that its five main members (Keurig Dr Pepper, McDonald's, Procter & Gamble, Starbucks and The Coca-Cola Company) consume 4.2 Mt of plastic per year, of which only 8% is recycled plastic (WWF, 2020). Half of it is sent to landfill or incinerated, and 28% is not managed. Although these companies dominate their sectors, they are not necessarily representative of sectorial trends and strategies.

Coca-Cola, PepsiCo and Nestlé are the top three plastic polluters in the world according to the NGO Break Free From Plastic. For decades, these three companies have acknowledged their responsibility, yet without managing to honor their commitments, according to a Reuters survey, which questioned the three companies about their latest targets established in 2018: the results are mixed but none seem to be on the way to reaching their objectives, whether for 2025 or 2030 (Reuters, 05/10/2020).

• VOLUNTARY REDUCTION OF PRODUCTION SOURCES AT THE ORIGIN OF WASTE • Beyond efforts for transparency and commitment, and any legal framework defining extended producer responsibility (cf. infra), social expectations put pressure on the biggest waste-producing companies to pay the price and make voluntary efforts to reduce their impact upstream in the production chain. This requires that companies deploy all available techniques for reducing the use of so-called virgin raw materials at source, from packaging design to the incorporation of recycled materials, and including repairing and extending the lifespan of products.

At the initiative of France, the Netherlands and Denmark, 70 signatories including fourteen European Union Member States, companies like Bonduelle, Suez, Veolia, Carrefour, Nestlé, Auchan, Carbios, Sphere, Faerch and Citeo, and two NGOs, joined the European Plastics Pact last March. The Pact says it "*is inspired by and works towards the vision laid down in the Ellen MacArthur*

Foundation's New Plastics Economy" to improve the circular management of waste. Signatories of the pact, which held their first annual meeting on 8 October, are pursuing four goals by 2025: to reduce virgin plastic usage by at least 20% and the use of plastic by 10%; to design 100% recyclable or reusable products as soon as possible; to use at least 30% of recycled plastic in new plastics; and to increase the rate of recycling by 25%.

Groupe SEB in France has been working with the companies ESR and Véolia since 2016. ESR is a company approved by the French state to collect electronic waste. Once collected, this waste is partly recovered by Veolia in the form of raw materials, mostly plastics, which are used by Groupe SEB to produce new appliances sold in stores (Usine Nouvelle, 2016). In the meantime, SEB has gone one step further by offering European consumers a catalogue of over 6 million spare parts to repair 93% of the appliances commercialized by the group, through over 6,000 approved repair companies. **To achieve this, the group keeps spare parts for ten years following the end of production. SEB reports a 40% surge in repairs outside of guarantees in the last five years** (Entrepreneurs d'avenir, 2019).

BEVERAGE GIANTS WANT TO RECUPERATE ALL OF THEIR BOTTLES

The biggest American beverage producers have launched *Every Bottle Back*, an initiative to improve the collection and recycling of their "100% recyclable" plastic bottles. Coca-Cola Co., Keurig Dr Pepper and PepsiCo are members of the initiative, in partnership with WWF, The Recycling Partnership and Closed Loop Partners. The project aims to invest 100 million USD to develop recycling programs in US locations. WWF will provide strategic scientific advice to measure the impact, while The Recycling Partnership and Closed Loop will support awareness-raising activities and deployment of concrete collection and recycling systems in local communities. The metropolitan area of Dallas-Fort Worth (Texas) and the town of Broken Arrow (Oklahoma) benefitted from these investments in early 2020 (The Recycling Partnership, 29/10/2019). Broken Arrow, which has a population of 100,000, received funding for its first ever curbside pickup program. In Dallas-Fort Worth, the investment will fund on a complex technological system to sort waste using artificial intelligence for optical recognition of waste.

BOX 4

• RECYCLING AND RECUPERATION, A STRATEGIC MARKET TO SUPPLY COMPANIES • On the same date as "Black Friday" in November 2020, but in a totally different spirit, the low-cost furniture company IKEA announced a program to buy back furniture in an attempt to check excessive consumption. Returned furniture will be paid for in IKEA vouchers amounting to up to 50% of the purchase price of items in good condition, with no expiry date. The program will run from 24 November in 27 countries, including Australia, Canada, France, Germany, Italy, Japan and Russia, but not the United States. The initiative has no official end-date in the United Kingdom and Ireland (The New York Times, 14/10/2020).

In France, Apple has come to an agreement with the General Directorate for Competition Policy, Consumer Affairs and Fraud Control (DGCCRF) to pay a transactional fine of 25 million EUR for "*misleading commercial practices by omission*" due to not informing consumers about a slowdown of their appliances following an update of the operating system. On the other hand, accusations of planned obsolescence made by the association HOP, the origin of the complaint, were not upheld (Le Monde, 07/02/2020), unlike the judgement made by the Italian competition authorities in October 2018. In July, the firm Palo Alto announced that it was pursuing carbon neutrality for 2030 on its entire production chain, and was producing a roadmap to do so, featuring measures

to improve recovery and recycling of the materials comprised in its batteries. Apple has reported that it reduced its carbon footprint by 4.3 $MtCO_2$ in 2019 thanks to innovations in the design of its products and materials recycling. A repair program has also been launched in the United States, along with the use of robotic devices to facilitate sorting and recycling of metals used in its appliances ([Apple](), 21/06/2020).

Also in the electronic devices domain, the recycling of batteries comes up regularly in discussions on the ecological and digital transition, and the increasing strategic interest shown by European governments is opening up more and more market opportunities, including in the recycling industry. Veolia and Solvay have thus announced the creation of a consortium for recycling lithium-ion batteries from electric and hybrid vehicles in Europe: Solvay will bring its chemical expertise to enable its partner, which has been operating in dismantling batteries in France since 2013, to optimize the extraction and purification of critical metals ([Veolia](), 09/09/2020). Ganfeng Lithium, the Chinese leader in lithium production and supplier to Tesla and LG Chem, plans to set up a battery recycling factory in Mexico ([Financial Times](), 17/09/2020). Redwood Materials, a start-up created by the cofounder of Tesla, is one of the first companies to have received a grant from the *Climate Pledge Fund*, which pledges 2 billion USD for the climate, announced by Amazon in 2020 ([The Verge](), 17/09/2020).

EXPERIENCE FEEDBACK

USING BACTERIA TO RECYCLE E-WASTE AND EXTRACT RARE METALS

Mint Innovation, a New Zealand company, is on the point of opening the first factory recycling electronic waste in the United Kingdom. It should be capable of processing 20 tons per day in 2021. To extract metals, traditional foundries use lixiviation processes that require a great deal of energy, and employ chemicals like cyanide. Instead of cyanide, Mint Innovation intends to use bacteria to extract and purify the rare metals in this e-waste, some of which have been used by the mining industry in the past. This process, known as biolixiviation, has been experimented for several years in a partnership between the British company N2S and the laboratory at [Coventry University]() in the UK as part of the Knowledge Transfer Partnership program. Mint Innovation recognizes that although the procedure uses little energy and therefore emits less CO_2, it still requires certain products such as acids.

The United Kingdom's exit from the European single market is behind the motivation to develop a recovery system: the country's production of e-waste is higher than the EU average and it exports more to developing countries. The prospect of future customs duties is part of the reason for developing a local industry ([The Guardian](), 22/08/2020).

BOX 5

As we mentioned last year: faced with the difficulties raised by global restricts on waste exchanges since 2018, some US towns have found the answer in Chinese companies that, deprived of recycled materials in China, get supplies directly from the United States. The trend continues and is increasingly documented. The cardboard packaging giant Nine Dragons has for example opened new paper mills in Wisconsin, West Virginia and Maine. Given that recycled fibers are now subject to import quotas from the Chinese government (see supra), these new factories have the dual advantage of preserving local employment and bringing Nine Dragons closer to its recycled paper supply sources ([CNBC](), 01/03/2020; [The New York Times](), 23/01/2020).

4. Local governments look for circular economy models adapted to their needs

• LATEST NEWS ON INTERNATIONAL INITIATIVES • On 1st October at the 9th Conference on Sustainable Cities and Villages in Mannheim, Germany, 26 European municipalities presented the *European Circular Cities Declaration*. The initiative is run jointly by ICLEI, CSCP[7], the Ellen MacArthur Foundation, Eurocities, UNEP and Pioneer Cities. The declaration, which follows on from the European Green Deal commitments to a circular economy, aims to set up a network of organizations engaged in transforming the European linear economy into a sustainable economy, in order to share their experiences and build a common vision of what a "circular city" might be. The initiative targets both capital cities (Helsinki, Copenhagen, Prague, Tirana, Budapest, Oslo, etc.) and mid-size cities (Seville, Grenoble, Florence, Ghent, Guimarães, etc.).

Another project, financed by EU funds, was showcased at the conference: *CityLoops*, which involves seven mid-sized towns (50,000-600,000 inhabitants): Apeldoorn, Bodø, Mikkeli, Porto, Seville and Roskilde/Høje-Taastrup. Their objective is to develop a methodology and indicators of circular material flow analysis, and to test instruments to facilitate planning and decision-making to improve the management of two types of waste: construction and demolition waste (C&DW), and organic waste. The project was launched in late 2019 with a four-year budget.

Piloted by ICLEI, Urban Transitions Alliance is a network of cities with an industrial heritage that have committed to sustainable urban development. Along with Baltimore, Beijing E-Town and Panaji (India), the project "Circular Turku" (Finland) is one of ICLEI's flagship partnerships. The town of Turku wants to replicate at regional level the *Resource Wisdom* roadmap that it developed in 2015 with Sitra, the Bank of Finland's public fund for investment and innovation. The initiative, launched at the end of 2019, is implementing a multi-stakeholder governance model: based on the methodology of ICLEI's *Green Circular Cities Coalition*, the city of Turku produced an exhaustive mapping of 700 actors available to take part in all kinds of activity related to circularity. Turku then put together informal working groups involving stakeholders on six themes with a circular economy perspective: planning and governance; water, energy and food systems; building and construction; resource management; public procurement; and "industrial symbiosis" projects (Turku, 2020).

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7 - The Collaborating Centre for Sustainable Consumption and Production (CSCP) is a think and do tank, created by UNEP and the Wuppertal Institute for Climate, Environment and Energy, that accompanies UN Member States, cities and companies in developing models for sustainable consumption and production.

WASTE MANAGEMENT STRATEGIES OF THE MOST SUCCESSFUL FRENCH LOCALITIES

In a recent report, the French environment and energy management agency, Ademe, along with Zero Waste France and the consulting firm Ecogeos, looked at the practices of 58 "pionee-ring territories" whose (non-recycled) residual waste production figures are half the national average. The household garbage production rate of these localities is also a one-third lower than in the rest of the country, with a cost per capita 22% below that of other areas. All of which proves that an efficient waste management system is not necessarily more expensive for the community.

What are the keys to the success of these areas? The report identifies several common factors. Although they are mostly rural, that is not enough to explain the results observed. "Polluter pays" pricing clearly pays a role, since 54 of the 58 areas have set up a system to invoice waste treatment in line with the quantity produced per inhabitant. Like the city of Besançon, the only agglomeration of the seven studied to have applied this system, and also the most efficient in its category, with 150 kg of residual waste per inhabitant per year.

Other factors play a significant role. Half of the areas studied have reduced the frequency of residual garbage pickup to once a fortnight. Combined with composting of organic waste, this policy gives residents an extra incentive to sort their biowaste. Involvement from local politicians and the impetus of waste treatment facilities foster the local coherence of waste management.

Source: Zero Waste France, 15/09/2020 ; Ademe, Août 2020

BOX 6

• FACED WITH A SURGE IN WASTE, NORTH AMERICAN MUNICIPALITIES ARE REORGANIZING THEIR COLLECTION SYSTEMS • In the United States, the data available are not sufficiently recent to be able to quantify how the Chinese decision has impacted municipalities' recycling and waste management practices. The latest EPA report on the subject only considers statistics from 2017 (EPA, 2019). Yet a number of articles and testimonials by waste company managers have related the difficulties immediately encountered by some municipalities in the months that followed the Chinese decision (Yale360, 07/03/2019). The federal organization of the United States, which results in diverse waste management policies, makes it difficult to produce an overall assessment of the country. Federal standardization of regulations is in fact the aim of two major initiatives launched since 2018.

The *America Recycles Day Summit*, organized by the EPA in November 2018, was one of the first responses to the recycling crisis at federal level. At the end of the event, 45 organizations, including companies, representatives of federal, regional, local and tribal governments, universities and NGOs, signed a commitment that initiated the *America Recycles Network*. Together, the 263 signatory organizations created working groups to identify the objectives and actions required to reinforce municipal waste recycling systems. In the final report entitled *National Framework for Advancing the U.S. Recycling System*, the EPA selected and compiled remarkable actions implemented at local level (EPA, 2019). Drawing from the work achieved, the EPA has submitted a new *National Recycling Strategy* for public consultation, which will establish federal objectives to reduce contamination, improve the efficiency of recycling processes, and boost markets for recyclable materials and products.

In June 2019, the NGO Recycling Partnership organized its first *Leadership Summit* in Detroit. Financed by the PepsiCo Foundation, the Walmart Foundation and the retail corporation Target,

the summit gathered representatives from 50 American cities in workshops focused on concrete methods and solutions to improve recycling, reduce contamination from municipal waste and raise awareness. This year, ten of the participating cities received grants and technical support from The Recycling Partnership to transform their local recycling and waste management programs (Waste 360, 08/10/2020).

EXPERIENCE FEEDBACK

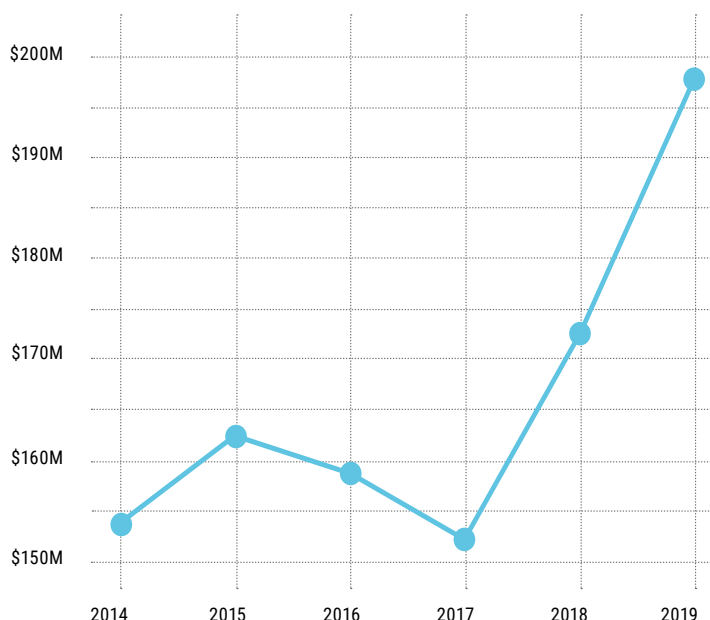## IN QUEBEC, FINANCIAL EPR IS TRANSFORMED INTO OPERATIONAL EPR

In February 2020, Quebec began a reform of its Extended Producer Responsibility (EPR) system. Until then, companies assumed their responsibility by making a financial contribution collected by a third-party organization, then paid out to municipalities via a governmental agency to reimburse all or part of their collection and recycling costs. The system is more or less the same as in France, where companies make an eco-contribution. It has proved effective: 99% of Quebecois currently have access to a municipal recycling program.

However, the profitability of the system relies on selling on recyclable waste to manufacturers. Yet, without investments to develop a reliable local end market, municipalities have remained dependent on exporting their sorted waste abroad, in particular to China. The closure of Chinese borders has therefore inflated the costs of selective collection declared by Quebec municipalities (**fig. 11**). Without local outlets, the prices of paper bales and recyclable plastics have slumped, triggering a loss of earnings for sorting centers, ultimately passed on to companies via ERP.

FIGURE 11

NET COSTS OF RECYCLING PROGRAMS DECLARED BY QUEBEC MUNICIPALITIES
Source: Resource Recyling, 2020

In February, the Quebec government therefore announced the transformation of its *financial EPR* into *operational EPR*. From 2025, companies will be responsible for residual materials throughout the waste lifecycle, from the point the product hits the market to its processing, with the aim of forcing companies to develop circular economy circuits in Quebec to reach new obligatory recycling targets.

In October 2020, Ontario, Canada's most populous province, announced a reform of its *Blue Box Program*, extending the list of products that can be thrown into the blue recycling box, and making companies pay the collective cost of collection and management. However, some already fear that by internalizing ERP, companies will pass the cost onto consumers in higher product prices (CBC, 20/10/2020).

Source: Resource Recycling, 13/04/2020

BOX 7

• PNEUMATIC REFUSE COLLECTION SYSTEMS MUSHROOMING IN CITIES • Originally devised to circulate mail in large American towns starting in the 19th century, underground pneumatic systems are an increasingly popular way to collect waste. Instead of dump trucks driving through streets to pick up garbage from the curbside, municipalities are installing garbage chutes in buildings. When a resident throws her trash into one of the hatches in her place of residence or in the street, the waste lands in a network of underground tubes where it is propelled by a high-pressure system to reach a dump truck several kilometers away, which only needs to make a short journey to its final destination, the sorting center.

The company Envac currently dominates this market, and claims that the system reduces the emissions produced by dump trucks by up to 90%. Forty-four cities including Seoul, Doha and Barcelona have made the Swedish company's pneumatic system their default infrastructure for collection. In Stockholm, where over 100 systems of the kind are already in operation covering 120,000 households, the municipality intends to install pneumatic collection for all new groups of 1,000 dwellings within a 2-km radius.

However, the most exemplary city is Bergen in Norway, as reported in the online magazine *Quartz*. In 2018, the country's second-largest city (270,000 inhabitants) extended its pneumatic network, in operation since 2007. The objective is to make it accessible to all households and companies in the country. The system includes a pay-as-you-go mechanism to encourage garbage sorting: citizens can only use non-recyclable waste chutes five times a month free of charge, after which they pay 85 cents of a euro each time. As a result, plastic recycling has gone up by 20% and volumes of non-recyclable waste have shrunk by 8% (Quartz, 30/09/2020).

• IN AUSTRALIA, GOVERNANCE OF CONTAINER REFUND SYSTEMS IS A MATTER OF DEBATE • The debate on the return of a refund system for beverage containers opened up in France last year following a vote on the anti-waste and circular economy law. Whereas Germany and Lithuania report record return rates (96% and 92% respectively), in France the reintroduction of a refund is awaiting the results of evaluations by Ademe in 2023. Local authorities are concerned at losing a source of income at the expense of large companies, which would be detrimental to the operations of their sorting centers. Some associations are also opposed to refunds on materials like plastic, because it increases recycling, which consumes energy, instead of encouraging eco-designs aimed at reuse higher up in the chain. What is the policy in foreign countries? We take the case of Australia, where refunds have been standard practice in all states since 2017 to prevent littering from drink containers like cans, plastic bottles and cartons.

Initially adopted in New South Wales (NSW), the deposit refund scheme model spread to Queensland and Australian Capital Territory and was this year inaugurated in Western Australia. The state of Victoria has put forward a proposal to launch its own program in 2023 (The Guardian, 02/11/2020). The principle operates in the same way everywhere: a list of eligible waste is drawn up, and citizens are refunded 10 cents for each bottle returned to a collection point or an automatic container installed in the state. They can also choose to donate the money directly to charity.

Currently, debate is ongoing in Tasmania to determine the best model to adopt for the island state's future system. In fact, two models of governance exist that give companies a different place in the management of refund collection systems: one is the producer responsibility organization model, such as used in Queensland, and the other is the so-called "split" model applied in NSW.

In Queensland, the Containers for Change program launched in November 2018 is coordinated by a non-profit organization called Container Exchange (CoEx), which acts as an eco-organization. CoEx is thus responsible for setting up and operating the system and for managing the refund collection network, and covers all of the associated costs with a responsibility to reach a beverage container return rate of 85% by 2021-2022 (Queensland, 2020). In contrast, the system in place in New South Wales is organized around split governance: on the one side a coordinator that collects funds from industry and data and monitors performance, and on the other side the operators of the collection network, whose aims are to maximize the rate of return of waste, improve user experience, and make collection points more accessible (NSW, 2018).

SOUTH KOREA, WASTE MANAGEMENT MODEL UNDER THREAT

Waste separation was made obligatory in Korea by law in 1991. In a series featuring ten "zero-waste" cities in Asia, the Indian newspaper *Down to Earth* looked back over Seoul's successful attempt to manage waste. The system is based on one of the strictest national legislations in the world, extended producer responsibility in place since 2003, and a "pay-as-you-throw" system established in 2013 that charges residents different volume-based fees for garbage placed in special biodegradable bags (Down To Earth, 27/12/2019). In its most recent measure, dating from 2018, the government banned disposable bags.

This system has proved particularly effective in stemming food waste: currently, 95% of thrown-away food is recycled as compost, animal feed or biogas, compared to 2% in 1995 (WeForum, 12/04/2019). This is quite a feat in a country where the tradition of small side dishes called *banchan* generates significant waste (The New Yorker, 02/03/2020). In Seoul, the 6,000 automatic garbage collectors in the town are equipped with RFID chips to evaluate the weight of food waste deposited by individuals, which creates an incentive to previously remove the 80% humidity comprised in food waste. To create more uses for compost in the city, a municipal policy has extended the area of urban farms to 170 ha, the equivalent of 238 soccer pitches (iGrow, 08/01/2020).

However, the metropolitan area of Seoul, home to almost 25 million people and half of the country's population, has reached the limits of its capacities for collection and landfill. The 10 million inhabitants of the city alone generate 9,189 tons of solid municipal waste a day. Sudokwon landfill, reputedly the largest in world, is likely to reach saturation point by 2025 (The Korea Times, 08/09/2020). Given that 9% of Korean waste is buried, the metropolis needs to urgently find a new site or add new incinerators to the four in use, which currently process 23% of the city's waste (The Korea Times, 15/10/2020). To make matters worse, the peak demand for deliveries during the Covid-19 lockdown put pressure on collection services, which were overwhelmed by the volumes of waste generated during the period (The Los Angeles Times, 21/10/2020).

BOX 8

A comparative study of return systems in the two states carried out by the think tank Total Environment Centre (TEC) gives an indication of their efficiency. At the end of its first year, CoEx reported a return rate of 33% in Queensland, far from its target, compared to 71% in NSW. Not only is it more efficient, but the system in NSW turns out to be cheaper per unit collected (5.9 cents) than

the Queensland system (8.24 cents). What are the reasons for this big difference in performance? The study points the finger at the domination of beverage sector representatives in Queensland's eco-organization, who occupy 4 of the 7 chairs on the board. TEC also reports that few containers are eligible for the program, and recommends that the glass bottles collected should be re-used rather than recycled (TEC, 2020). As to the split management system in NSW, it has obtained better results faster thanks to its higher ratio of collection points per head of population (although still far from the top European standards), and greater investments in "reverse vending machines".

Boomerang Alliance, a network of 49 associations and local governments that has promoted the creation of return systems in Australia since 2003, also puts Queensland's low results down to the domination of representatives from the beverage sector on the CoEx board of directors, which focuses the eco-organization program on profitability rather than efficiency (Boomerang Alliance, 06/10/2020).

5. Civil society, a force of progress involving protests and social & technological innovations

• IN RUSSIA, "PEOPLE'S PATROLS" WIN THE WAR ON MOSCOW'S WASTE • Last year, we observed the national protest movement that had erupted in Russia in reaction to the dispatch of waste produced by Moscow to remote regions. The protests began in 2018 after 57 children were poisoned by toxic fumes from a dump (Climate Chance, 2019). "People's patrols" began to occupy roundabouts to keep watch and prevent access to future dump sites. In particular, the inhabitants of the region of Arkhangelsk, over 1,000 km from Moscow, began protesting in December 2018 against the construction of a 300 ha landfill destined to take in 6% of the capital's household waste, amounting to 500,000t/year (Reporterre, 13/06/2019). Since then, local authorities newly appointed by President Putin have withdrawn their support from the project's promoters (The Barents Observer, 11/06/2020), after a court ruled the project illegal and ordered its destruction (The Moscow Times, 09/01/2020).

This victory for militant locals is nevertheless unlikely to challenge the new foundations of waste management policy in Russia, whose inefficiency is partly due to corruption. The movement began with the adoption of a new federal law on the "production and consumption of waste", which included destroying numerous landfills throughout the country, splitting regions into "waste management areas", and handing their management over to private operators based on calls for tender. The winning companies were granted 10 to 15-year contracts funded by a new public service charge paid by citizens. Yet the Russian newspaper *IStories*, a member of the global anti-corruption consortium OCCRP[8], revealed in a recent report that a total 28 billion USD in contracts had been granted to four of the biggest landfill operators in the country, all of them run by oligarchs close to Putin (OCCRP, 23/06/2020). In March, the Russian Academy of Sciences also produced a virulent evaluation of the country's incinerators, decrying the absence of sorting before incineration as "unacceptable" in the country (Kommersant, 26/03/2020).

• REPAIR: A FLOURISHING LOCAL SOLUTION IN EUROPE AND THE UNITED STATES • The right to repair is a call to slow down frequent replacements of complex objects through extending their lifespan, by making it easier to obtain spare parts and repair items at home or by professionals.

In the United States, "the right to repair" has become the watchword and cause of the Repair Association, which works to encourage states pass new laws to authorize independent electronics

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stores and consumers to get hold of spare parts, manuals and layouts for telephones and other electronic devices. In 2019, bills were put before 20 federal state legislatures, both Democrat and Republican (PIRG, 26/12/2019). To date, none have passed.

In Europe, the Coolproducts campaign led by the European Environmental Bureau and the European Environmental Citizens Organization ECOS lobbies European institutions to promote ambitious eco-design and energy label standards. The Commission has introduced the right to repair in its circular economy strategy within the European Green Deal, presented last March. Already, by October 2019, the Commission had adopted ten implementing regulations of the Ecodesign Directive (2009), obliging manufacturers of everyday consumer goods to design more sustainable, repairable appliances by 2021, including televisions, screens, refrigerators, freezers, clothes washers and driers, dishwashers and lighting appliances (European Commission, 01/10/2019). Coolproducts estimates that over 20 years, a clothes washer with a long life will emit 1.1 tCO$_2$ less than a model with a short life (Cler, 01/10/2019).

The Repair Café model, which started up in the Netherlands, has spread throughout the world and now comprises almost 2,000 cafés, including 200 in France. The cafés are convivial gatherings of volunteers and people looking to get their objects repaired (Reporterre, 17/12/2019). According to a study by the French environment and energy management agency (Ademe), only 36% of French citizens repair their goods or get them repaired when they break down. Of these, 55% carry out the repairs themselves and 45% turn to a professional. The structure of the second-hand market clearly has an influence on whether people repair or not because the study also points out that in 86% of cases, the visible presence of local repairers and easy access to spare parts have an impact on the tendency to repair (Ademe, 2020).

The main target of citizens' movements for the right to repair are large electronics companies, which are generally hostile to this kind of legislation. The anti-trust survey carried out against GAFA in the United States revealed that Apple is actively combating "right to repair" bills currently being debated in about twenty states (The Verge, 30/07/2020). The company has long been criticized for making repair services subject to its license to obtain spare parts. To claim their rights, citizens' movements have thus turned to the courts. One example involves Nintendo's Switch gaming console which, despite a huge commercial success during lockdown, disappointed some of its users who had persistent problems with a joystick. Faced with the impossibility of getting the lever repaired for free, a class action lawsuit was launched to tackle the Japanese giant in the United States (The New York Times, 23/10/2020), and a complaint filed with the public prosecutor in France by the consumer association UFC-Que Choisir (Que Choisir, 22/09/2020)

• CLEANING UP OF POLLUTED AREAS MOBILIZES CIVIL SOCIETY AND INNOVATION • As a complement to prevention, the success of operations to clean up beaches and rivers continues, despite being put on pause due to the pandemic. These initiatives have an exemplary, awareness-raising effect among the general public. In 2019, we reported the biggest clean-up operation in the world, which took place in Mumbai from 2015 to 2018. Since then, innumerable similar operations have taken place, praised for their environmental and social impact. In 2019, the Estonian NGO Let's Do It World successfully gathered 21 million people in 180 countries on *World Clean Up Day*, organized every year in September. The European Union has also launched its own initiative, *#EUBeachCleanUp*, in partnership with the United Nations and the Smurfs brand.

21 MILLION PEOPLE

21 million people mobilised in 180 countries for the World Clean Up Day in 2019

In Switzerland, the annual clean-up of Lake Geneva, which has run for 25 years, mobilized about 250 people, and the 1.2 tons of waste collected included a few surprises. Numerous disposable facemasks, the use of which as escalated since the pandemic, were discovered at the bottom of the lake (Le Matin, 20/09/2020).

Projects with greater technological scope also receive widescale media coverage. The Ocean CleanUp encountered a setback last year when the giant floating barrier set up in the Pacific Ocean to clean the infamous "seventh continent" of plastic broke under the strain of ocean currents during testing in waters off San Francisco (GEO, 04/01/2019). Since then, in 2019, the NGO founded by the Dutchman Boyan Slat has launched two *Interceptor* prototypes into the sea in Jakarta and Malaysia. These floating platforms use solar energy and float on waterways, where they can trap up to 50 tons of waste a day (L'Usine Nouvelle, 03/11/2019). This year, The Ocean CleanUp received support from Microsoft. To facilitate waste reconnaissance, artificial intelligence (AI) has been trained to recognize and identify plastic, thanks to the labeling of over 30,000 photos of waste during two annual hackathons organized by Microsoft (Microsoft, 30/07/2020).

In France, the association The Sea Cleaners is developing a similar project called *Manta, "A deep-sea ship capable of collecting and continuously processing huge quantities of plastic macro-waste floating on the ocean surface"*, which operates using a combination of solar energy and wind power.

CONCLUSION

Following the double blow of the crisis provoked by the Chinese policy banning imports followed by the Covid-19 pandemic, the waste sector is in the process of reorganization. Without managing to move beyond the dominant recycling paradigm, cities in the North are restructuring their collection and processing capacities to correspond to their high levels of goods consumption. Subject to pressure from civil society and national laws to combat single-use plastic, the biggest waste-generating companies are attempting to take advantage of a recycling market that is both economically and socially profitable, and strategic for their supplies, and even critical for the electronics sector.

Please do not hesitate to respond to this document, or to suggest any relevant additional reports or data by writing to the following address: contribution@climate-chance.org

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WASTE

LAND USE

Local action boosts the lackluster performance of international commitments on land and forests

Local action boosts the lackluster performance of international commitments on land and forests

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As the milestone year of numerous climate change initiatives, 2020 was a logical point to examine the disappointing record of commitments to reduce deforestation and restore ecosystems. Ultimately, all attention has focused on the Covid-19 pandemic, bringing a harsh reminder of how dependent our societies are on the fragile balance of ecological systems. The pandemic has upset the agendas of climate change players, but has also highlighted the interdependence between health, climate and biodiversity issues. A connection may be necessary to move on from the announcements made over recent years and make concrete steps that will at last act to slow down deforestation.

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LAND USE

1 All of the progress reports come to the same conclusion: the zero-deforestation commitments set for 2020 have not been achieved and emission indicators for the sector are in the red: 6.2 $GtCO_2$ were emitted by land use in 2019 compared to an average 5.5±2.7 $GtCO_2$ from 2009-2018. Rather than halving levels by 2020, as set out in the New York Declaration, deforestation went up by 44% from 2014 to 2018. In the Sahel, the Great Green Wall project launched in 2007 is a long way from its objectives and has had to alter its approach.

2 Forest cover continues to be threatened in a number of ways: primary tropical rainforests were subject to the third most destructive year since 2000, combined with record forest fires in 2019, emitting up to 6.7 $GtCO_2$ or 15% of global annual emissions. Natural forest regeneration is diminishing faced with the anthropization of forests and plantations of alien species.

3 40% of the most influential companies from sectors at risk of deforestation, and 68% from the financial sector, have made no commitments concerning deforestation, and voluntary commitments have generated disappointing results. Around the world, companies, local and even national governments (Turkey, the US, Armenia, Pakistan, etc.) see reforestation and afforestation as a means to compensate their emissions to move towards carbon neutrality. But the effectiveness of these sometimes colossal projects relies on effective long-term management of the species planted, as illustrated by the failure of the Turkish project.

4 In contrast, community management of land and forests has proved effective in reducing soil degradation and illegal deforestation, while involving local crops and practices in forest protection objectives. Indigenous communities, like in Ecuador, have pursued successful legal action to stop major projects that contribute to the artificialization of land.

5 The Covid-19 pandemic has profoundly disorganized efforts to protect forests, and testimonials point to a sharp increase in illegal logging everywhere. The zoonotic nature of the Covid-19 virus, which points to a breakdown in natural barriers between species, has however contributed to putting the One Health concept at the forefront of reflections on a convergence between the agendas of climate, biodiversity and desertification conventions that regulate international cooperation on the environment..

1. Trends and global data on emissions and land management

• **STEADY UPWARD RISE IN EMISSIONS LED BY TROPICAL DEFORESTATION** • In 2019, net CO_2 emissions from the land sector were estimated at 6.2 $GtCO_2$, a steep rise compared to the average of 5.5±2.7 $GtCO_2$ from 2009 to 2018 (Global Carbon Project, 2019), amounting to about 14% of total emissions from human activity. Most of these emissions reflect the continued loss of forest cover, although over the last decade the global pace has slowed down, as mentioned in the 2020 edition of the *Global Forest Resource Assessment* (FAO, 2020) illustrated by figure 1.

FIGURE 1

ANNUAL RATE OF FOREST EXPANSION AND DEFORESTATION, 1990-2020

Source: FAO, 2020
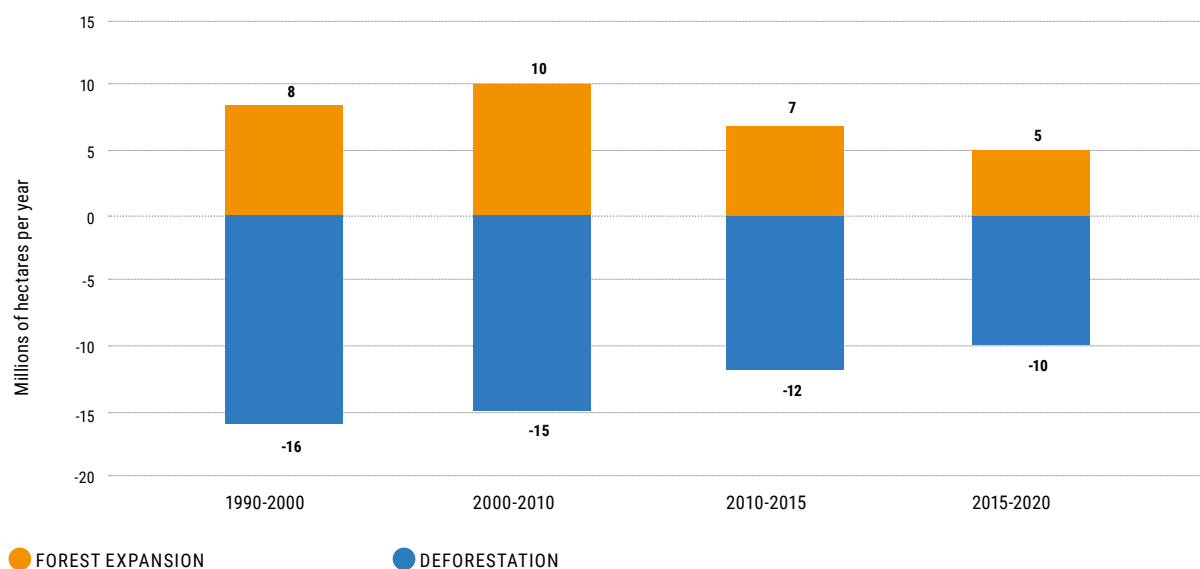
In fact, forests around the world lost an average 4.7 million hectares per year (Mha/year) during the 2010-2020 decade compared to 5.2 Mha from 2000 to 2010 (FAO, 2020) (**fig. 1**).

These figures are however net balances between gains in forest area, and so carbon sequestration in some regions of the world, and loss of forest areas in other, mainly tropical, zones (**fig. 2**). This net balance therefore disguises regional differences in the dynamics of forest losses and gains. The global increase in forest area between 2000 and 2010 is thus mainly due to afforestation in Asia, where China recorded an increased forest area of 1.94 Mha/year, coupled with a significant reduction in deforestation in Indonesia, where loss of forest cover slowed down from a pace of 1.73 Mha/year between 1990 and 2000 to 0.75 Mha/year between 2010 and 2020.

FIGURE 2

ANNUAL RATE OF FOREST AREA CHANGE, BY DECADE AND BY REGION 1990-2020

Source: FAO, 2020

Legend:
● 1990 - 2000   ● 2000 - 2010   ● 2010 - 2020
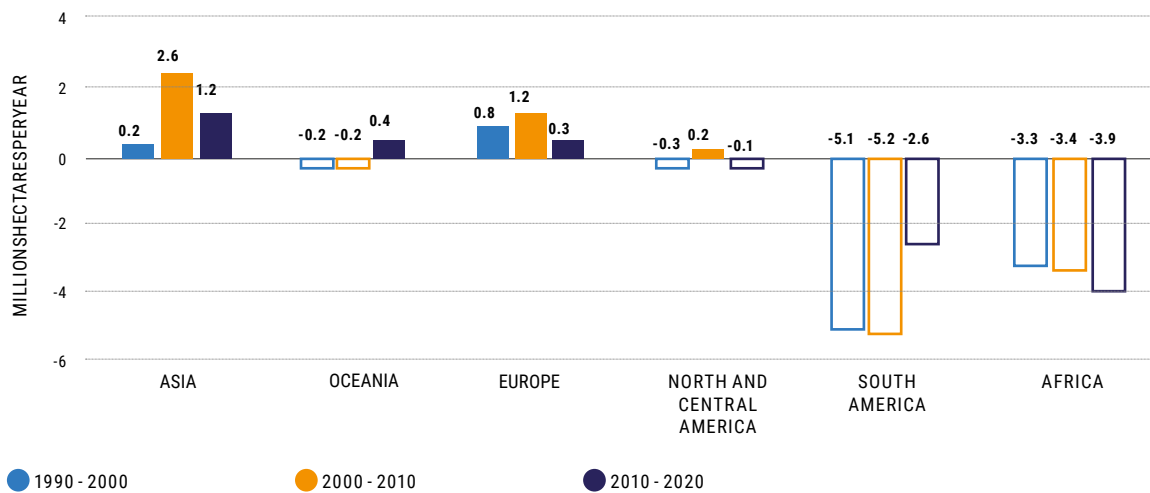
Deforestation continues in the forests of Africa, which lost the most forest cover over the last decade, mostly in East and South Africa, where the deforestation rate went from 1.35 Mha/year in the 1990s to 1.91 Mha/year during the last decade. However, the drop in deforestation observed in South America over the last decade is relative since the ten-year period analyzed disguises a recent worrying reversal of the trend in Brazil. According to the INPE (Brazilian National Institute for Space Research), 10,129 km² of Amazonian rainforests were razed in 2019, a 34% increase compared to 2018, which already featured the highest levels since 2008. The trend has continued in 2020, so that already by May the razed area was 85% larger than in the same period the previous year (Mongabay, 10/06/2020).

The recent trend is also marked by an anthropization[1] of forests since the surface area of naturally regenerating forests dropped by an average 8 Mha/year from 2010 to 2020, while that of planted forests, which comprise 44% of alien species, went up by 3 Mha/year (**fig. 3**). Oil palm plantations doubled their surface area from 1990 to 2020, going from 4.20 Mha to 9.34 Mha, most of them located in Asia and in particular Malaysia, where an additional 4 Mha of oil palm plantations were recorded between 1990 and 2020.

1- Anthropization is the conversion of open spaces, landscapes, and semi-natural environments by human action.

FIGURE 3

ANNUAL RATE OF CHANGE FOR NATURALLY REGENERATING AND PLANTED FOREST, BY DECADE, 1990-2020

Source: FAO, 2020
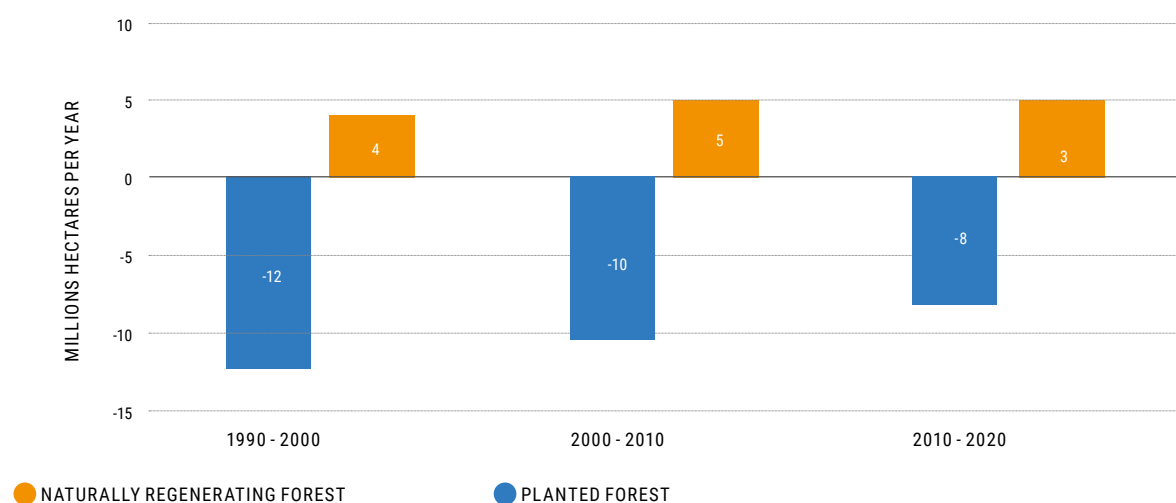
These trends have an impact on carbon storage in forests which, according to the *Global Forest Resource Assessment*, went from 668 gigatons in 1990 to 662 Gt in 2020, corresponding to a release of 4 Gt of carbon into the atmosphere. Nevertheless, the FAO notes that the average carbon density per hectare increased slightly over this period, from 158.8 to 163.1 tons per hectare.

These data can also be compared with the scientific study by Hubau et al. (2020) published in the journal Nature, which takes measurements on 565 experimental sites to calculate the evolution of carbon sinks in African and Amazonian rainforests. The researchers thus observed considerable growth of trees in both forest areas in response to an increase in atmospheric carbon and temperatures. However, the responses of carbon sinks in the two biggest stretches of rainforest on Earth have been very different, due to the mortality of trees, which is stable in Africa but on the increase in the Amazon. This stability in Africa appears to have begun reversing in 2010 and the researchers conclude time-delayed carbon saturation in the two basins. On the whole, carbon absorption in the world's intact rainforests reached a peak in the 1990s.

Globally, about 1.15 billion hectares are managed for timber and non-timber forest products, amounting to 31% of the global forest area, mostly located in Europe, at a relatively stable level since 1990. The 424 million hectares allotted to biodiversity conservation, and the 398 million hectares allotted to land and water protection have increased since 1990. The 22% of forests designated as multi-purpose are on a downward trend, as are forests dedicated to social services.

• **RECORD FOREST FIRES** • In 2019, about 6.7 GtCO$_2$ were emitted by forest fires around the world according to the European Centre for Medium-range Weather Forecasts (ECMWF, 2019), which is about 15% of total global annual CO$_2$ emissions (Global Carbon Project, 2019). Throughout the year, wildfires of record intensity took place on all continents (**fig. 4**).

FIGURE 4

CARBON DIOXIDE FROM FOREST FIRES HAS DECREASED IN RECENT YEARS, EXCEPT FOR 2019

Source: Global Fire Emissions Database, 2020
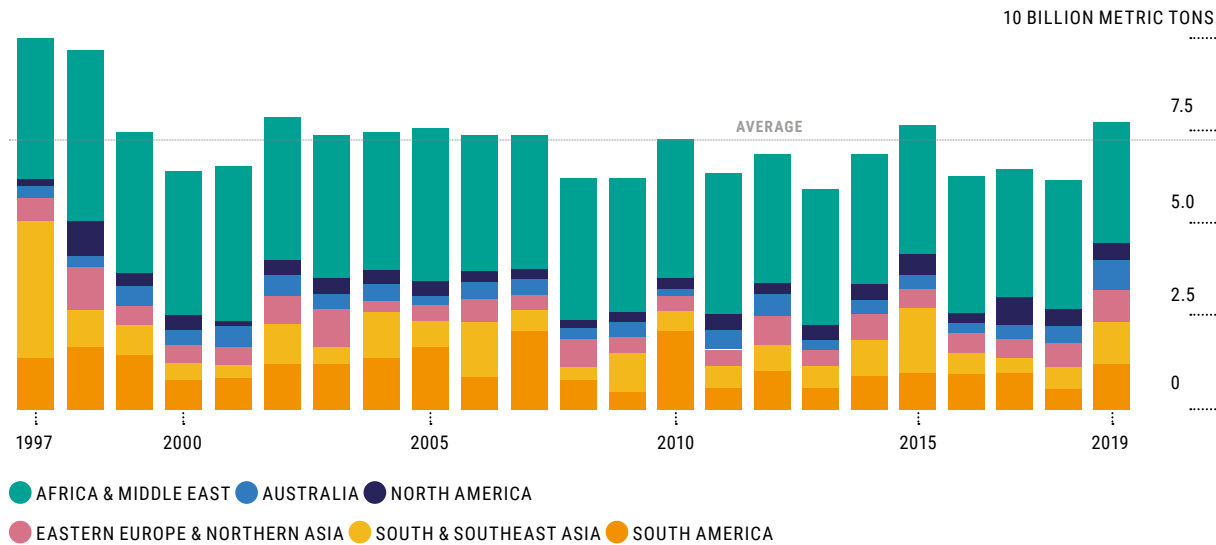
From February to May 2019, unprecedented wildfires burned 29,000 hectares in the United Kingdom following an exceptionally warm, dry summer.

From June 2019 to March 2020, 25.5 million hectares burned in Australia, with devastating consequences for inhabitants and biodiversity: a scientific report produced for the WWF estimated that the fires displaced or killed 3 billion animals, including 143 mammals, 2.46 billion reptiles, 180 million birds and 51 million frogs (WWF Australia, 2020). In the Amazon, the worrying increase in burned surface area identified in 2019 remains high and is likely to be affected by the health situation.

In June and July 2019, in the Arctic Circle, mainly in Siberia and Alaska, wildfires hit record levels in 2019, releasing 181 million tons of CO$_2$ into the atmosphere, a figure likely to be exceeded since fires in the Arctic region released over 244 million tons of CO$_2$ between 1st January and 1st September 2020 alone.

In California and Oregon, which are enduring their worst fire season ever recorded, wildfires are rampant due to dry vegetation and a persistent heatwave (**fig. 5**).

FIGURE 5

ANNUAL EMISSIONS FOR THE UNITED STATES, CALIFORNIA, OREGON AND WASHINGTON STATE

Source: ECMWF, 2020
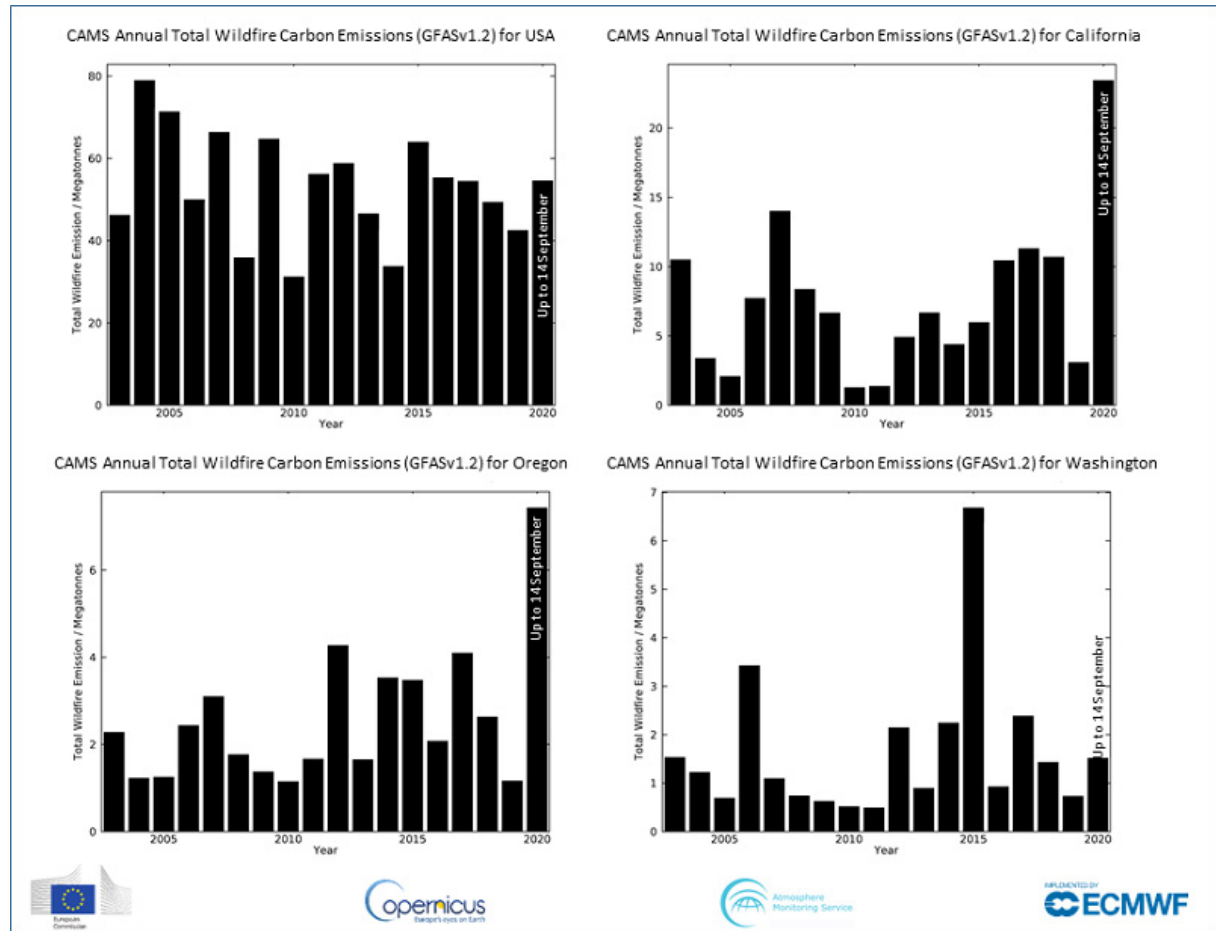
THE PARADOX BETWEEN A GLOBAL DECREASE IN BURNED SURFACE AREA AND THE INCREASED INTENSITY OF FIRES IN SOME REGIONS

The annual figures on areas burned disguise a complex trend. In fact, at the global scale, the average area burned each year has gone down by around 25% since the early 2000s (Andela et al., 2017), which can be explained by two compensating trends.

FIGURE 6

VARIATION OF GLOBAL BURNED AREAS IN% PER YEAR

Source: NASA Earth Observatory, 2020
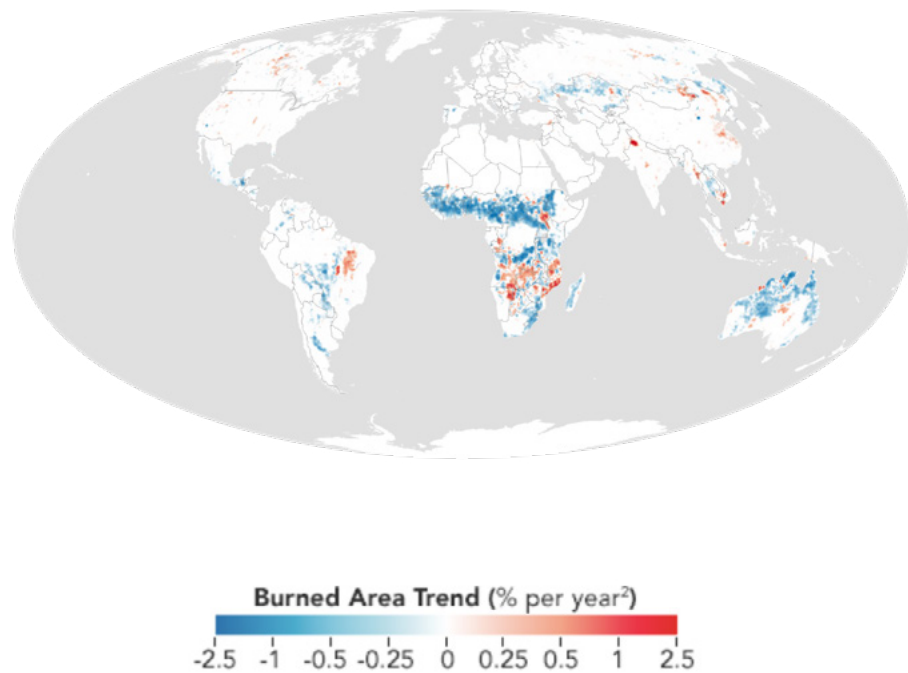
On the one hand, climate change creates meteorological conditions that increase the risk of wildfires. High temperatures augment evapotranspiration, which, combined with a decrease in precipitation, makes vegetation drier. As a result, fire seasons become longer and much more intense. For California, a 2020 study shows that the number of fall days with meteorological conditions conducive to fire more than doubled from 1980 to 2020 (Goss et al., 2020). On the other hand, changing land use, mainly in Central Africa, is leading to the disappearance of fire-prone savannahs and prairies and their conversion into crops, pasture land or urban areas, thus diminishing the risk of fire in these regions (Andela et al., 2017).

Source: Carbon Brief, 14/07/2020

BOX 1

• MILESTONE YEAR OF 2020: GLOBAL INITIATIVES WIDELY MISSED THEIR TARGETS • Several progress reports have been produced to evaluate the advances made, such as the progress report on the New York Declaration on Forests (NYDF Assessment Partners, 2019), the fifth edition of *Global Biodiversity Outlook* in September 2020 (CBD, 2020), and *The State of the World's Forests* published by FAO and UNEP (FAO & UNEP, 2020). All come to the same conclusion, i.e. global commitments have not been honored and the sector's emissions indicators are in the red. Concerning biodiversity, none of the 20 Aichi targets have been reached, and only six partially so (**fig. 7**).

The New York Declaration on Forests (NYDF) provides a good illustration of these mixed results. The declaration included a goal to halve the average deforestation rate observed from 2001-2013 by 2020 and to reach a target of zero deforestation by 2030. From 2014 to 2018, however, a 44% increase in deforestation was observed, with a 57% hike in CO_2 emissions due to loss of forest cover, taking levels from +3 $GtCO_2$ a year before the signature of the NYDF to +4.7 following signature. Goal 5, combined with the Bonn Challenge to restore 150 million hectares of degraded land by 2020, is also far from being achieved. Despite commitments beyond that target, successfully restored land has only reached 18% of the 150 Mha.

Objectives 2 and 3 of the New York Declaration have been partially reached. Goal 2, to help the private sector eliminate deforestation from its production chains, has made some progress with the adoption of commitments by several major companies. Today, only 8% of companies have made "zero-deforestation" commitments, covering the entire production chain and all of their raw materials. And the NYDF progress report indicates that the means for verification and monitoring are still largely absent from these commitments. Goal 3 relating to other economic sectors has also had mixed results. On the positive side, local communities and NGOs have won legal victories to protect forests from mining activities, and global initiatives have emerged to protect forests and biodiversity from economic activities, such as Forest-Smart Mining set up by the World Bank. On the downside, the tendency to reclassify protected areas to allow the development of operating infrastructures, and the strong increase in demand for minerals, oil and gas, put increasing pressure on forests.

Goal 7 of the NYDF has been reached. This objective aimed at establishing a post-2020 global agreement to reduce emissions related to deforestation and the degradation of forests with the aim to maintain global temperatures below +2°C compared to the pre-industrial era. The ratification of the Paris Agreement met with this objective.

FIGURE 7

VISUAL OVERVIEW OF INITIATIVES WITH PROGRESS INDICATOR

LAND USE

SUSTAINABLE DEVELOPMENT GOALS

SDG GOAL 1
Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation and contribute to the global effort of addressing climate change.

INDICATOR 15.1.1
Forest area
+22% from 1990 to 2017

INDICATOR 15.1.2
Protected areas
14.39% of the Earth surface in 2018

INDICATOR 15.2.1
Sustainable forest management

BONN CHALLENGE

GOAL 5
Restore 150million hectares of degraded landscapes and forest lands by 2020 and significantly increase the rate of global restoration thereafter, which would restore at least an additional 200 million hectares by 2030

NEW YORK DECLARATION ON FORESTS

GOAL 7
Agree in 2015 to reduce emissions from deforestation and forest degradation as part of a post-2020 global climate agreement Ratification of the Paris Agreement

GOAL 1
At least halve the 2001-2013 rate of loss of natural forests globally by 2020 and strive to end natural forest loss by 2030

GOAL 2
Support and help meet the private-sector goal of eliminating deforestation from the production of agricultural commodities

GOAL 3
Significantly reduce deforestation derived from other economic sectors by 2020

AICHI BIODIVERSITY

TARGET 5
At least halve the rate of loss of natural forests globally by 2020 and strive to end natural forest loss by 2030

TARGET 4
By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

TARGET 7
By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity

TARGET 9
By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment

ECCA 30

RESTORE 30MHA BY 2030 IN EUROPE CAUCASUS AND CENTRAL ASIA

INITIATIVE 20X20

RESTORE 20MHA IN LATIN AMERICA BY 2020

AFR100

RESTORE 1000 MHA IN AFRICA BY 2030

GLOBAL OBJECTIVES

REGIONAL OBJECTIVES

GOAL ACHIEVED

GOAL IN PROGRESS BUT NOT ACHIEVED

GOAL NOT ACHIEVED WITH FEW PROGRESS

• THE PANDEMIC IS ACCELERATING THE CONVERGENCE OF HEALTH, CLIMATE AND BIODIVER-SITY AGENDAS • SARS-CoV-2, the virus at the origin of the Covid-19 pandemic, like the previous HIV, H5N1, SRAS and Ebola viruses, crossed the species barrier to provoke Covid-19. Seventy-five per cent of emerging infectious diseases appear to be zoonoses ([Taylor, Latham et Woolhouse](), 2001), esulting from increasing proximity between humans and wild animals. Responsible factors are to be found both in the degradation of ecosystems, which is getting worse with climate change and deprives animals of their habitats, and in the trade of wild animals ([Dobson et al.](), 2020).

The interrelations between objectives to protect the climate, preserve biodiversity and foster human well-being, already examined by the One Health movement (**box 2**), have come to the forefront during the Covid-19 pandemic. Actions centered on biodiversity and climate are nevertheless still very compartmentalized. Funding and institutions tend to be devised and organized around either climate objectives, biodiversity, or development. For example, the UNFCCC did not issue any instructions to integrate biodiversity or nature into Nationally Determined Contributions in the frame of the Paris Agreement.

KEYS TO UNDERSTANDING

THE ONE HEALTH CONCEPT, A TOOL TO UNDERSTAND HOW HUMAN HEALTH RELATES TO ITS ENVIRONMENT

Human and veterinary medicine have always been interconnected by concepts and practices known variously as "veterinary public health", "comparative medicine" and "one medicine" ([Bresalier, Cassidy, et Woods, in Zinsstag et al](), 2020). In the 2000s, these interconnections were organized around a shared vision called "One Medicine, One Health". In parallel, a group formed under the name "One World, One Health" to tackle more wide-ranging concerns about the environment and life sciences, partially responding to a recognition of the zoonotic influence of emerging infectious diseases such as AIDS, and echoed by international institutions like the WHO, FAO and the OIE (World Organization for Animal Health). The One Health movement was formed from the progressive interweaving of the "One World" and "One Medicine" movements and now constitutes a threefold concept, strategy and objective. One Health puts forward a concerted vision of human, animal and environmental health to tackle emerging infectious diseases ([Destoumieux-Garzón et al.,]() 2018). While this very flexible concept has successfully encompassed different languages, ideas and working methods, its practical usefulness is still open to debate ([Bresalier, Cassidy, et Woods](), 2020). The central idea is that numerous synergies exist in protecting environmental, animal and human health; as a result, actions that would not be considered economically viable if only considered from one of the three angles, can become viable. Climate change puts all three systems under pressure ([Patz et Hahn](), 2012) and could therefore act as a catalyst.

BOX 2

WWF report looks at how biodiversity is included in the Nationally Determined Contributions (NDCs) of 100 countries. Some countries, such as Colombia (**box 3**) and Jordan, stand out for explicitly linking their climate commitments with the objectives of the Convention on Biological Diversity (CBD) in their NDCs. Morocco and Thailand are the only countries that mention in their climate commitments the protection of species threatened by extinction. On the other hand, developed countries (Annex 1 of the Kyoto Protocol) mainly describe objectives that concern their economies as a whole, and concentrate their action on the energy and transport sectors.

In 2020, Covid-19 has triggered initiatives to bring together climate and biodiversity challenges. Examples are: the call for Australian researchers to group the climate and biodiversity COPs, both

of which were de-programed in 2020 (<u>Turney, Ausseil, et Broadhurst</u>, 2020), the round table during the COP25 in Madrid on improving coordination between the three Rio Conventions; and the Beijing Call of 6 November 2019 whereby Presidents Macron and Xi JinPing affirmed their resolution to intensify efforts related to climate and biodiversity.

BIODIVERSITY CENTRAL TO COLOMBIA'S NDC

Colombia's NDC following the country's ratification of the Paris Agreement made the exemplary choice of looking for joint benefits between adaptation and mitigation, and integrating objectives to combat climate change into sustainable development goals (SDGs) and the preservation of biodiversity. Numerous connections between the proposed actions and biodiversity or sustainable development goals have been analyzed in depth in a report published by WWF-Colombia (<u>Transforma, WWF-Colombia</u>, 2019) which demonstrates the feasibility of these connections, and makes recommendations to go further in integrating biodiversity into climate goals. Among the actions anticipated by sector, those related to adaptation correspond in particular with 7 of the 20 Aichi targets. They include adaptation actions based on ecosystems, increasing protected areas, delimiting *páramos*[2], ecosystems, and taking climate change into account in basin management tools.

BOX 3

Nevertheless, in the short term, the Covid-19 pandemic has completely disrupted action to combat deforestation with impacts at local level. In Asia and South America in particular, numerous witnesses have reported a sharp rise in legal and illegal deforestation (<u>Mongabay</u>, 03/07/2020). Everywhere, social distancing measures and restricted movements have resulted in a significant decrease in surveillance operations, controls, and presence of institutional personnel and NGOs on the field. Contexts are however different. In Indonesia, while the rate of deforestation had been steadily decreasing for five years, in the first few months of 2020, machines returned en masse to fell oil palms. In Brazil, the sense of impunity related to President Bolsonaro's economic development policies for the Amazon was already strong, but has been made stronger still by the pandemic, and in April the deforestation rate was 64% higher than the previous year. In Peru, the increased price of gold in response to the economic crisis could also play a key role. In Madagascar, mangrove cutting has been postponed. Local inhabitants deprived of their subsistence farming and fishing have no other choice but to exploit forests to secure a source of energy.

At institutional level, numerous conferences were scheduled on the climate agenda to anticipate action post-2020. The Covid-19 pandemic has led to postponing these events to sometimes still uncertain dates. Some organizations have nevertheless initiated virtual sessions to sustain the momentum of their action and prepare the next meetings, for example, the *June Momentum for Climate Change* at the initiative of the United Nations Framework Convention on Climate Change (UNFCCC) (**tab. 1**).

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2 - A páramo is a high mountain biome found in the high Andes mountain range, above the continuous forest line yet below the permanent snowline. It features dense vegetation and humid soil rich in organic matter. Numerous Colombian rivers have their source here.

TABLE 1

OVERVIEW OF THE STATE OF PROGRESS OF INTERNATIONAL CONFERENCES FEATURING THE SUBJECT OF LAND USE.

Institution	Conference *(Full name)*	Initial date	Intermediate virtual sessions	Scheduled date	Objectives and expected decisions
UN / Convention on Biological Diversity	SBSTTA 24 *(Subsidiary Body on Scientific, Technical and Technological Advice)*	18-23 May 2020	15-18 Sept 2020	1st quarter 2021	• Post-2020 global biodiversity framework • Launch of the 5th Global Biodiversity Outlook
	SBI 3 *(Subsidiary Body on Implementation)*	25-29 May 2020			Review of CDB strategic plan for biodiversity 2011-2020
	COP15 *(Conference of Parties)*	15-28 Oct 2020, Kunming China		17-30 May 2021	Review of CDB strategic plan for biodiversity 2011-2020
UN / United Nations Framework Convention on Climate Change	SB52 (SBSTA52 et SBI 52) *(Bonn Climate change conference)*	1-11 June 2020	1-10 June 2020 "June momentum for climate change"		
	COP26 *(26th Conference of Parties)*	9-19 Nov 2020		1-12 Nov. 2021 Glasgow Scotland	Upgrading of Nationally Determined Contributions (NDC) decided in Paris in 2015
UN / United Nations Framework Convention on Climate Change	CRIC19 *(Committee for the review of the implementation of the convention)*	2020		10-12 Feb. 2021, Bonn	Prepare for UNCCD COP15: updates on the voluntary land degradation neutrality target setting process, operationalization of the Land Degradation Neutrality Fund and implementation of the Drought Initiative.

2. Tropical deforestation: companies under pressure, local communities in action

The 2020 FAO report on the state of the world's forests brings another reminder that tropical deforestation is not decreasing fast enough and continues to contribute to the loss of biodiversity and climate change (FAO & UNEP, 2020). Primary tropical rainforests thus lost 3.8 Mha in 2019, the third most destructive year since 2000 following the record-beating years of 2016 and 2017 (**fig. 8**). To stem this trend, at the same time as local action, and thousands of kilometers away from threatened ecosystems, initiatives come into play high up in the value chain, to act on the economic and financial drivers of deforestation.

FIGURE 8

LOST OF PRIMARY RAINFORESTS 2002-2019 - *Source: Global Forest Watch-WRI, 2020*
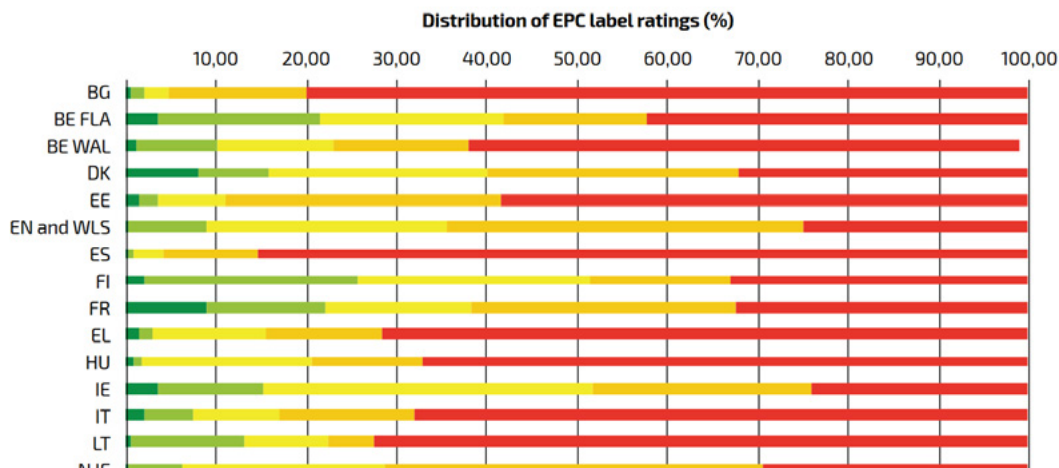
• COMPANIES STRUGGLE TO PUT THEIR VOLUNTARY COMMITMENTS INTO PRACTICE • This year once again, the *Forest500*[3] report provides an update on the action of the most influential companies to eliminate deforestation from their production chains. The conclusions show the failure of voluntary corporate commitment, given that 40% (140) of the companies audited across all sectors, and 68% (102) of companies from the financial sector, have no plan to reduce deforestation (Forest 500, 2020a). These companies include multinationals like Amazon and SPAR, and in the financial sector BlackRock and Aviva.

In 2010, the *Consumer Goods Forum* (CGF) made a clear commitment: by 2020 agricultural supply chains would no longer involve deforestation, reiterated in the 2014 New York Declaration on Forests. This network of over 400 companies, supposed to reflect the diversity of global industry in terms of location, product type and size, has a mandate to develop common standpoints for its members. The "zero-deforestation" commitments made individually by companies have increased since the CGF's engagement, but the results remain unimpressive, with few follow-up and verification mechanisms. The 2019 edition of *Forest500* 2019 (Forest 500, 2020a) evaluated 350 companies in terms of their commitments, transparency, verification methods and social considerations. In North America, 20% of companies have taken no action against deforestation, which is the lowest figure, since in Russia, 100% of the companies audited deny their environmental responsibility, while in China the figure is 81%. The companies that lag behind the most are in the soy and beef sectors (**fig. 9 and 10**).

100

210

100 companies out of the 210 that have made commitments neither evaluate nor monitor their implementation progress.

3 - Forest 500 comprises the most influential 350 companies and 150 financial institutions in supply chains of forest-risk commodities.

100 companies out of the 210 that have made commitments neither evaluate nor monitor their implementation progress, including Unilever, McDonald's, Nike, and VF Corp which owns Vans. The average score given to companies regarding publications and implementation is even worse than it is for commitments (25% compared to 48%).

RATE OF COMMITMENT BY SECTOR OF ACTIVITY. *- Source: Forest 500, 2020a*

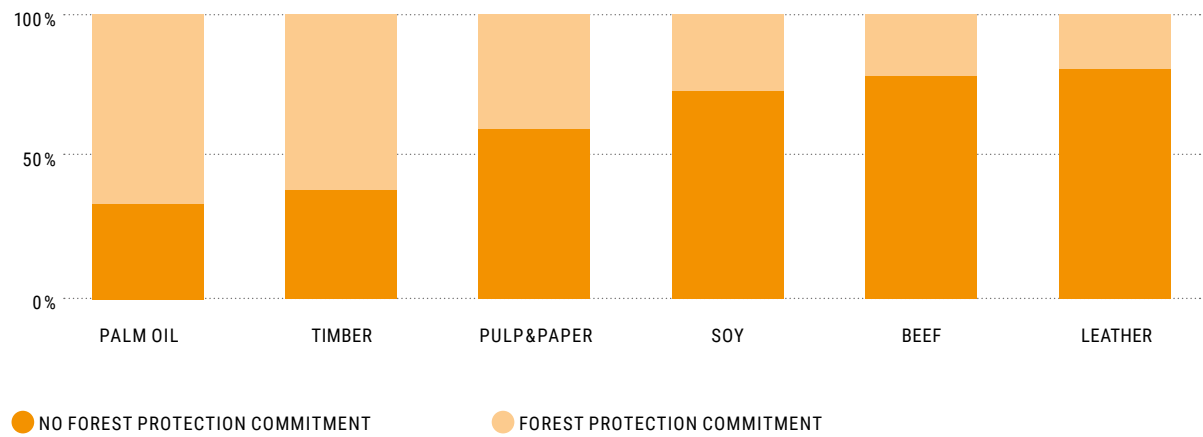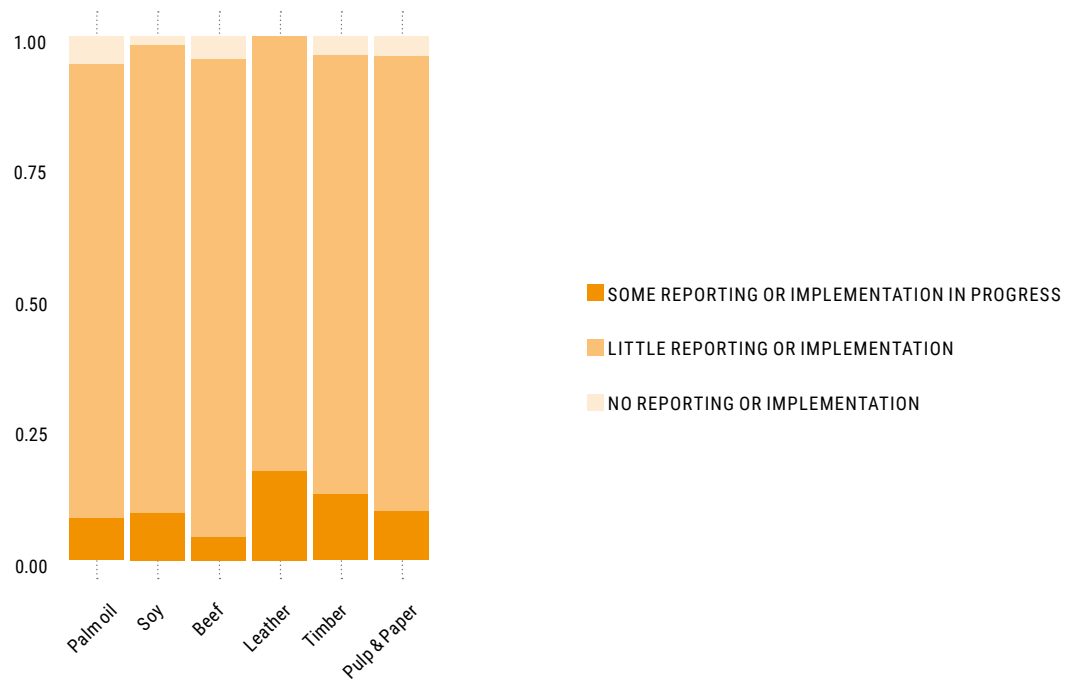● NO FOREST PROTECTION COMMITMENT   ● FOREST PROTECTION COMMITMENT

ACHIEVEMENT OF COMMITMENTS BY SECTOR OF ACTIVITY. *- Source: Forest 500, 2020a*

■ SOME REPORTING OR IMPLEMENTATION IN PROGRESS

■ LITTLE REPORTING OR IMPLEMENTATION

□ NO REPORTING OR IMPLEMENTATION

In addition, out of the 235 financial institutions that asked companies to act against deforestation following the Amazon fires in 2019 (Mongabay, 23/09/2019), only 33 have published a clear policy to combat deforestation (Forest500, 2020b). And only 21 of these investors apply these policies to all of the forest-risk goods that they finance.

INDICATOR

21

Only 21 financial institutions apply a policy to combat deforestation to all of the fores-risk goods they finance

The results as a whole are disappointing, but should not overshadow the genuine progress made by some companies. The Commonwealth Bank of Australia for example, has adopted a policy to ensure the legality of its clients for all commodities and encourages beef, timber, palm oil and soy producing companies to obtain certification. In the agribusiness sector, *Forest500* methods identify companies that lead the sector forward, such as Nestlé, Marks & Spencer and Cargill, which have made commitments for all of their raw materials, and companies whose attitude is closer to greenwashing, such as Hershey Co. and Carrefour, both of which have high commitment scores but very low scores in terms of implementation. The report nevertheless notes that even the "good" companies sometimes have difficulties honoring their commitments, like Nestlé, which has cancelled the 2020 deadline for its targets.

The SPOTT platform also evaluates companies, but focuses on the transparency of raw materials producers by concentrating on hardwood loggers, palm oil and natural rubber producers. Its 2019 report also points out the gap between commitments and achievements (Zoological Society of London, 2020) like for example the analysis of the 90 biggest paper pulp producers published in 2020, which shows that of the 56% companies that have made deforestation commitments, only 13% have anticipated surveillance and monitoring.

• THE PALM OIL INDUSTRY REACTS TO CRITICISM AND ORGANIZES A CHANGE IN COURSE •
Data recently published on the SPOTT platform on corporate evaluation provide an occasion to look more closely at the palm oil industry, one of the main drivers of deforestation, mainly in Indonesia and Malaysia, which feature the biggest number of industrial plantations, but also in Colombia, Nigeria and Brazil, dominated by smallholders. Although 60% of the palm-oil farmers evaluated had made a clear commitment to eliminate deforestation from their practices, only 4% demonstrated effective surveillance of deforestation, while 32% showed signs of monitoring but had not set up a robust methodology. SPOTT's 2019 report highlights the role of small farmers in the fight against imported deforestation. For palm oil, they represent about 40% of production, meaning that their integration into the supply strategies of big companies is essential. However, only 14% of companies publish maps showing the locations of their plantations, and certification is still limited for small-scale farmers: according to SPOTT, only five companies in 58 have certified more than 75% of their farmers.

Palm oil is nevertheless the commodity for which most companies have made commitments to protect forests (**fig. 9**), a lever of action that does not guarantee that commitments will be honored on the field. Certification aims to involve producers in more virtuous practices by giving them access to certain markets or more attractive prices. In the case of palm oil, Roundtable on Sustainable Palm Oil certification was one of the first to be created and only certifies plantations that do not farm to the detriment of primary forests or High Conservation Value Areas.

The final lever is regulation, which can be implemented in producing and importing countries alike. An example is the revised EU renewable energy directive (RED II) which came into force in December 2018. This regulation establishes that by 2030, 32% of the energy consumed by Member

States must be renewable, and 14% in the transport sector. The first version of this directive led NGO scientists to launch a warning about the demand that the policy would generate for food commodities, which drive deforestation, given that 65% of the palm oil imported to Europe is burned as an agrofuel (cf. Sweden-Transport case study). Following this mobilization, sustainability criteria were added to RED II, including a 7% limitation of food commodities in biofuel production and progressive elimination of the use of raw materials "with a high indirect land-use change risk" as a renewable energy by 2030. These are defined as raw materials for which the expansion onto land with high carbon storage has been higher than 10% since 2008, with an annual expansion rate above 1% (European Commission, 2019). Only palm oil corresponds to this definition and should therefore disappear from European gas stations by 2030. Nevertheless, Indonesia reacted to these restrictions by filing a complaint in December 2019 against the European Union for "discriminatory" policy, and Malaysia is threatening to join the complaint while taking massive action to certify its production.

EXPERIENCE FEEDBACK

## IN REACTION TO PRESSURE FROM EUROPE, MALAYSIA TRIES TO BOOST ITS IMAGE

The Malaysian Palm Oil Council (MPOC), representing the country's palm oil industry, has set up a partnership with the blockchain firm BloomBloc, The aim of the partnership is to create an application that can reliably trace the origin and conditions of palm oil production in the country. The initiative is part of a general effort to promote sustainable palm oil to win back the trust of the European market (Euractiv, 04/02/2020). The European Commission ranked palm oil as a carbon-intensive biofuel back in February 2019. Malaysia, which is targeting 100% "sustainable" certification for its palm oil by the end of 2020, established a surface area limit for crop expansion in March 2019 and has prohibited the conversion of permanent forests into palm oil plantations. In May 2019, Sime Darby, the biggest Malaysian palm oil producer, opened a free-access platform called "Crosscheck" that can trace palm oil right down the supply chain (Sime Darby, 23/05/2019). However, in the Euractiv article quoted above, the company's CEO expressed regret at the lack of demand for this sustainable palm oil.

BOX 4

• NGOS TRY TO SHED LIGHT ON THE FINANCING OF DEFORESTATION • As identified in the *Forest500*, eport, financial institutions are seldom committed to combating deforestation, yet their role in financing agribusiness companies makes them a keystone of the system. Banks are essential for initial investments in plantations and largely contribute to this profitable sector. The *Forests and finance* database managed by 6 NGOs tracks the financial flows that make deforestation possible by supporting sectors at risk. The database was set up in 2016 to analyze companies operating in South East Asia, but in 2020 was extended to cover Brazil and Central and West Africa. According to the latest data published, since the ratification of the Paris Agreement, credits granted to companies whose activities are at risk of deforestation amounted to 153.9 billion US dollars, an increase of 40%. These banks are primarily based in Brazil (95.2 billion US dollars), followed by China and Indonesia. The investors come from Malaysia, Brazil and the United States, with for example the pension fund BlackRock ranking fifth among global investors in sectors at risk of deforestation (**fig. 11**).

FIGURE 11

TOP 15 GLOBAL INVESTORS BY SECTOR IN 2020, IN BILLIONS OF US DOLLARS

Source: Forest & Finance, 2020
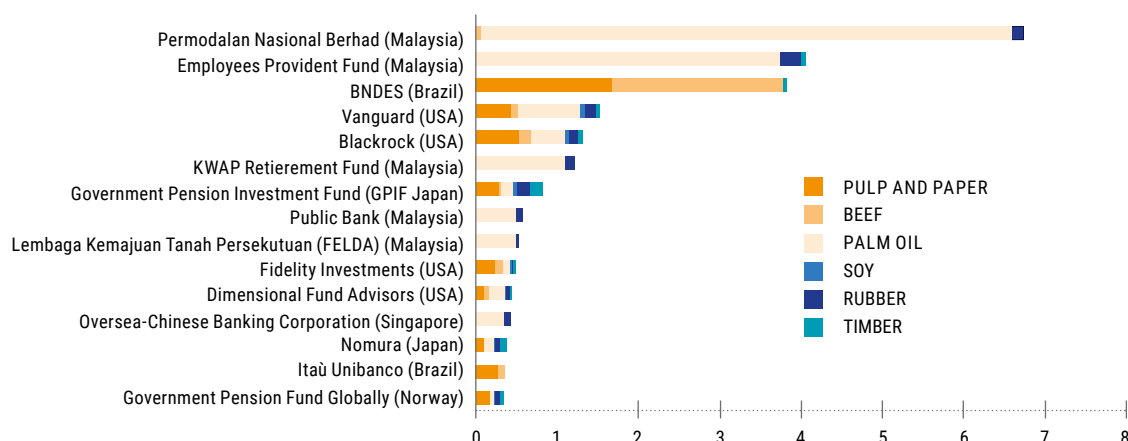
Researchers at Forests and Finance point out that among the 15 banks investing the most in deforestation-risk sectors, eight have signed the UN's *Principles for Responsible Banking* (cf. Bilan Finance 2020, Climate Chance). Among European countries, the Netherlands, France and Spain are the main creditors, mainly for plantations located in Brazil (**fig. 12**).

FIGURE 12

TOTAL CREDIT BY FINANCING COUNTRY AND FOREST BASIN - *Source: Forest & Finance, 2020*
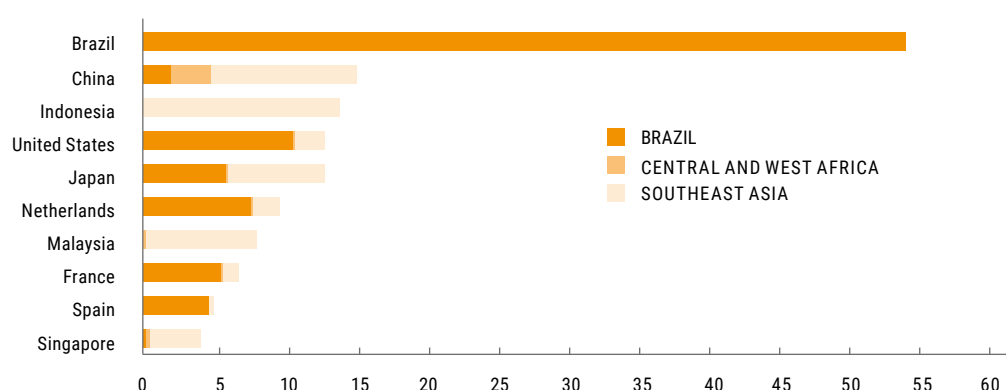
• ASIA: MAINTAINING PROGRESS FACED WITH THE PANDEMIC AND THE IMPORTANCE OF FARMING TRADITIONS • Data on deforestation in Indonesia are encouraging, with a drop in the country's deforestation rate in 2019 (**fig. 13**), elated to action taken by the palm oil industry. Nevertheless, following the economic crisis triggered by the Covid-19 pandemic, the government halved the budged allocated to preventing forest fires, further decreasing the means of teams on the field who were already limited by movement restrictions in place to limit the propagation of the pandemic (Reuters, 25/06/2020). The consequences could be devastating for Indonesian forests. Satellite data allowed the Glad laboratory at the University of Maryland to detect a 50% increase in forest loss over the first five months of 2020 compared to 2019, due to slashing and burning of land destined for agricultural use.

As a result, firefighters say that they rely more on social networks and citizens' alerts to identify outbreaks of fire. This involvement by local inhabitants in combating fires is also backed up by

scientists. Slash and burn was nevertheless prohibited by the government in 2015 following record fires. Farmers found themselves at a disadvantage, prevented by law from using this traditional clearing technique which is fast, cheap and known to increase soil fertility. CIFOR scientists set up a research program called *Participatory Action Research (PAR)* PAR) to work with communities to identify alternatives to slash and burn (Forest News, 05/02/2020), applying viable economic models and environmentally friendly practices. The *tebang imas* method, which involves manually clearing and applying pesticides under supervision, despite being more costly and longer, was approved by farmers thanks to its environmental benefits.

EXPERIENCE FEEDBACK

## SATELLITES REPLACE PATROLS DURING COVID

In Sri Lanka, faced with the pandemic and the risk that the economic and health situation will impact forests, the forest conservation department rapidly learned how to operate technological satellite monitoring tools. With lockdown, forestry officers are only authorized to travel to the site of observed violations. Since the start of lockdown, the department has produced manuals on how to use Global Forest Watch satellite monitoring tools and operates automated GLAD alerts to identify the start of slash and burn activities and act fast.

Source: Global Forest Watch, 23/07/2020

BOX 5

FIGURE 13

LOSS OF PRIMARY FOREST IN INDONESIA 2002-2019 - *Source: Global Forest Watch- WRI, 2020*
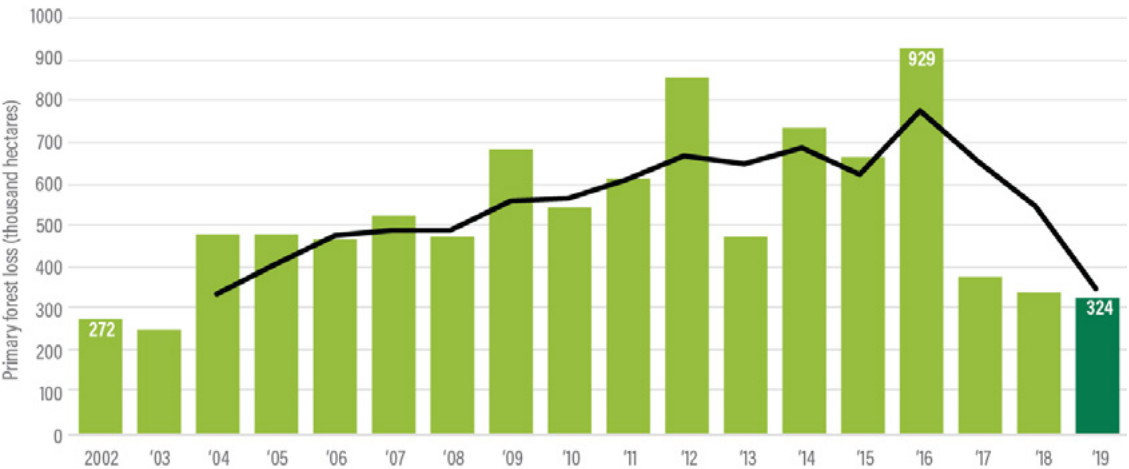
• SOUTH AMERICA: INDIGENOUS PEOPLE PUT PRESSURE ON GOVERNMENTS TO ACT • En In September 2019, Bolivia, Brazil, Colombia, Ecuador, Peru, French Guiana and Surinam signed the Leticia Pact led by the Colombian government, with the aim of coordinating their efforts to combat deforestation in the Amazon. At COP25, the signatory countries unveiled an action plan for the protection of the Amazon, comprising 55 actions on five themes (Anadolu Agency, 12/12/2019). The signatory countries went on to meet on 11 August 2020 at the 2nd presidential summit for the Amazon in order to revise and follow progress on the implementation of the cooperation agreement (El Espectador, 11/08/2020). It was announced that the Inter-American Development Bank (IDB) would head a fund for the Amazon that would grant funding facilities to signatory countries (El Tiempo, 12/08/2020). he objective of this fund will be to mobilize resources to conserve and sustainably use biodiversity, change production and consumption patterns, and boost the circular economy, sustainable development and the bioeconomy in the Amazon.

Yet in November 2019, two indigenous communities, the Sapara and Kichwa, obtained a resounding legal victory involving an oil-drilling project against one of the signatories of the Leticia Pact, Ecuador. The Chinese company Andes Petroleum, supported by the Ecuadorian government, threatened 158,000 hectares of Amazonian forest. For almost four years, activists worked to prevent the project by blocking landing strips to stop airplanes from accessing the site, taking legal action, and putting pressure on the Chinese embassy. The government therefore accepted to terminate the contract with the oil company for reasons of "force majeure". This victory joins a series of triumphs for Ecuadorian indigenous peoples following the abandonment of extraction projects in areas occupied by the communities of the Cofán de Sinangoe in February 2019 and Waorani n May 2019. The court decisions were mostly based on a lack of consultation and prior information, which are written into the country's constitution.

EXPERIENCE FEEDBACK

RELIGIOUS LEADERS COMMITTED TO THE CAUSE OF PROTECTING FORESTS

The Interfaith Rainforest Initiative, which is present in Peru, Indonesia, DRC, Colombia and Brazil, works to inform and mobilize religious leaders around the world. The aim is to encourage them to exchange and play a role in protecting forests and to support their communities on environmental issues. In January 2020, over 250 religious leaders gathered with indigenous communities, NGOs, scientists, governors and UN representatives at the ministry of the environment in Jakarta to launch the regional Indonesian chapter and commit to preserving the third biggest rainforest on the planet. The launch of the regional chapter of the Democratic Republic of the Congo took place in December 2019 in Kinshasa. The initiative also led to the Faiths for Forests Declaration, through which members of the initiative agree to employ their moral authority to mobilize their communities, influence governments and put pressure on the private sector to preserve rainforests.

*Source: UNEP, 21/02/2020*

BOX 6

3. Reforestation and forest management

• COMMUNITY MANAGEMENT PROVES EFFECTIVE • Researchers estimate that 294.4 million people live in regions with high potential for forest restoration, and 1.01 billion when including an 8 km radius around potential restoration zones, mostly in Brazil, the Democratic Republic of the Congo, India and Indonesia. Forest governance is central to this issue. A study published in August 2020 (Erbaugh et al., 2020) shows that restricting restoration to areas with few or no inhabitants reduces the overall potential of restoration by 89%, and also reduces the benefits for biodiversity, which are greater in inhabited areas (FAO, 2020).

Putting governance in the hands of populations that depend on the forest through community management is not a new idea and can also be found in REDD+ projects and NDCs. Goal 10 of the New York Declaration on Forests also defends reinforced governance of forests and leaving responsibilities to local inhabitants. However, on the field, implementation is sometimes difficult because it requires a robust legal framework and the means for local inhabitants to get involved. Progress has recently been made in involving locals in political processes.

Voluntary Partnership Agreements (VPAs), which are part of the EU plan to combat illegal timber production, are bilateral trade agreements between timber-exporting countries, which encourage good governance via clauses on transparency, application of the law, and support for populations that depend on the forest. VPAs facilitate dialogue between political decision-makers and local and indigenous communities. All of the countries in the Congo basin have VPAs, but Cameroon has gone the furthest in developing community forestry by setting up "community forests" in 1997. Community forests are granted to communities for 25 years (renewable), with maximum areas of 5,000 hectares, and are managed according to a management plan that limits logging. Cameroon's two decades of experience are valuable because they have helped identify the difficulties encountered by communities. In 2020, the NGO Forest People Programme published a guide on the management of natural resources aimed directly at populations, which sums up legislation and guides them in the concrete organization of community management. It identifies the main hindrances to effective community management as the elite's stranglehold on management processes perceived as costly and complex, and conflicts surrounding the sharing of income (Forest People Programme, 2020).

In the United Republic of Tanzania, community forest management is also and the government even included its growth in its NDC. Of the 48.1 million hectares of forested land in the country, an estimated 22 million are owned by local communities. The FAO reports that the state of these forests has improved, that illegal logging, overexploitation of pastures and soil erosion have diminished, and that the quality of the water and abundance of flora have increased in comparison with freely accessible forest regions. The legal framework for community management of forests in Tanzania is one of the most advanced in terms of recognizing usage rights and gives local communities the autonomy they need to set up their own boards of governance. Positive results are manifest on the protection of forest resources against poaching, logging and mineral extraction, although, like in Congo, difficulties persist regarding the recognition of indigenous peoples' rights and the difficulty of engaging farmers essential (FAO, 2020).

INDICATOR

26 22
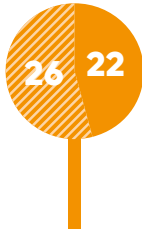
In Tanzania, 22 of the 48Mha of forested land belong to local communities, and their state improved

In South America, the Aliados Association was created in 2018 with the aim of helping local communities to develop products with a high level of social and environmental responsibility and giving them access to international markets. One of its actions has been to work with the 24 de Mayo community of indigenous Kichwa people in Ecuador to support them in developing the Ally Guayusa cooperative, which is totally owned and run by the community on their 6,000 hectares of land. The cooperative purchases the community's production of guayusa, a native plant traditionally used by Kichwas and grown using organic agroforestry practices. Jobs have been created to prepare the guayusa for sale as organic tea on local and international markets. The Aliados association is working with the local community to experiment with integrating native tree species, cinnamon, and fruit trees to diversify income sources for farmers while keeping the forest healthy (Mongabay, 20/05/2020).

• AFRICA: PROGRESS REPORT ON THE GREAT GREEN WALL • Among the large tree-planting projects launched in recent years, the *Great Green Wall* project in the Sahel stands out for its continental ambition. The aim is to revegetate the Sahel corridor, from Senegal to Eritrea, covering an area of 154 million hectares that is 7,000 km long and 15 km wide and crosses 11 countries. Launched in 2007 to combat the progression of the Sahara Desert, the concept has evolved in the light of new scientific data showing the gradual contraction of the southern edge of the desert and the revegetation of some areas of the Sahel. The *Great Green Wall* initiative is today an integrated ecosystem management project based on a patchwork of land uses and production systems that are resilient to climate change. The measures implemented include sustainable management and restoration of drylands, regeneration of natural vegetation, and water retention and conservation measures.

A UNCCD report published in September 2020 features thirteen actions and funding projects that have gathered national governments, the private sector and civil society, along with international institutions like UNCCD, FAO, the World Bank, the Global Environment Facility and IUCN. The objectives of the initiative announced at COP21 were to restore 100 Mha of degraded land, create 10 million "green" jobs, and sequestrate 250 MtCO$_2$. In 2020, only 4 Mha, or 4% of the target, had been restored in the Great Green Wall, mostly in Ethiopia, Niger and Eritrea. Taking into account action to restore ecosystems in the countries involved but beyond the route of the *Great Green Wall*, another 17.8 Mha can be added. The activities implemented as part of the *Great Green Wall* generally aim to increase resilience to climate change and support agricultural production, thus often going beyond the strict definition of reforestation. Examples of the activities involved in the Great Green Wall include the development of agroforestry practices, windbreak hedges, production of seedlings and young plants, development of irrigation systems, management of river basins, construction of wells and terraces, and stabilization of dunes, illustrated in **figure 14** (UNCCD, 2020).

FIGURE 14

CONTRIBUTION OF EACH ACTIVITY IN THE 4 MHA RESTORED TO DATE

Source: UNCCD, 2020
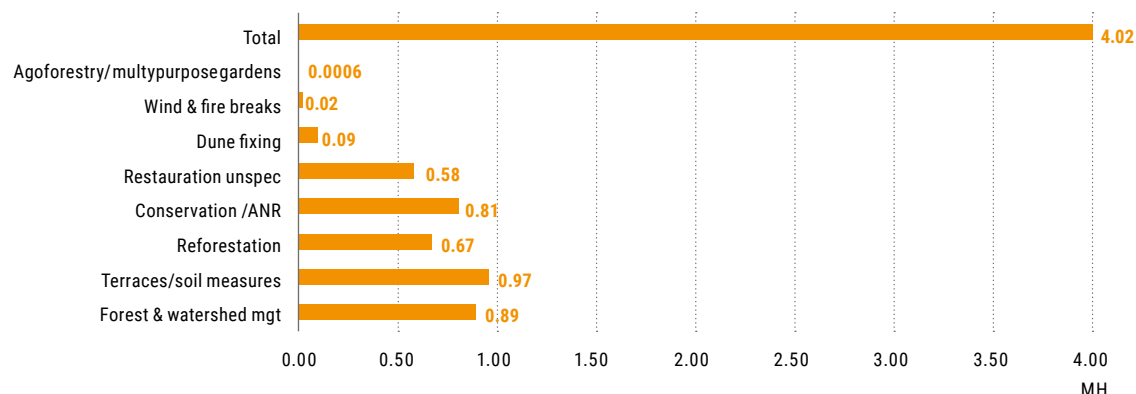
To implement initiatives at regional level, the Great Green Wall project is supported by large transboundary programs, each with a region or specific type of activity that gather funds and direct towards actions on the field. For example, the Sahel and West Africa Program (SAWAP) led by the World Bank has mobilized 70 million US dollars from the Global Environment Facility in addition to 1.25 billion dollars to finance the sustainable management of 1.5 million hectares for 17 million beneficiaries in nine countries.

In terms of carbon sequestration, the trajectory of current actions is way below targets, since at the current pace of restoration, by 2030 only 70 Mt of carbon will have been sequestrated in biomass and 15.5 Mt in soil, compared to the total target of 250 Mt.

The countries involved have reported the creation of over 335,000 permanent and temporary jobs, mostly to implement restoration activities and produce and sell non-timber forestry products. The UNCCD explains the slow progress by weak governance and insufficient national institutional support in the zones concerned, as well as the lack of an operational system to evaluate and monitor projects.

• MIDDLE EAST: RECORD PLANTATIONS DO NOT CONCEAL DEFORESTATION • Few data exist on the state of forests in the Far and Middle East, where mining activities and armed conflicts push environmental concerns to the background. In Turkey, however, citizens protest and demand accountability, for example by opposing the goldmine project developed by the Canadian company Alamos Gold in the Çanakkale region, close to the village of Kirazli. In July 2019, satellite imagery revealed the logging of about 200,000 trees by the mining company, despite the fact that Turkish authorities had only approved felling 45,000. As a result, several thousand people demonstrated to demand the revocation of exploitation licenses granted by the government covering 1.3 million hectares at the edge of the Kaz Mountains, a natural wildlife reserve since 1998. Following the demonstrations, the Alamos Gold concession, which expired in October 2019, had still not been renewed in July 2020.

A few months later, the Turkish government launched a national reforestation day. On 11 November 2019, 11 million trees were planted as part of a national campaign led by the ministry of agriculture and forests, encouraging citizens to "make Turkey green again". Ninety per cent of the trees planted, mostly pine, have reportedly died since due to drought. This failure highlights a tendency

for greenwashing and media hype. For Sükrü Durmuş, president of the agriculture and forest union, questioned by the opposition daily "Cumhuriyet", this reforestation project, called "Breath for the Future", is a *"populist operation designed to mask the reality of destruction"* ([Courrier International](#), 30/01/2020).

EXPERIENCE FEEDBACK

IN ARMENIA, TREES SERVE BOTH THE CLIMATE AND GEOPOLITICS

With the aim of reaching its Paris Agreement objectives of doubling the country's forest cover by 2050, in October 2019 the Armenian government set a goal to plant 10 million trees by 10 October 2020. The program is a scaling-up of the work carried out since 1994 by the NGO Armenia Tree Project (ATP), which nevertheless took 25 years to celebrate six million trees planted last year. The program, led with a view to adapt to climate change and absorb GHG emissions, also has a geopolitical scope, i.e. to plant and cultivate to claim ownership of land close to the Nagorno-Karabakh border, a territory inhabited by Armenians but under the control of Azerbaijan and a cause of conflict between the countries since 1988. A long survey by the journal Foreign Policy on the Armenian program warns against the temptation of making large plantation campaigns into a symbol, because they detract attention from the real issues behind deforestation, such as mining activities in the case of Armenia, which also threaten the country's very rich biodiversity.

Source: [Foreign Policy](#), 18/02/2020

BOX 7

• EUROPE AND THE USA: CARBON COMPENSATION IS FLOURISHING • Carbon compensation is a way for companies or individuals to opt to compensate their carbon emissions by financing carbon sinks in sectors and regions other than their own. Nature-based solutions (NBS), led by reforestation, currently concentrate the biggest carbon compensation investments with over 159 million US dollars invested in 2019, ahead of the renewable energy sector at only 60 million dollars ([Donofrio et al.](#), 2019).

Forest carbon credits are proving popular, in particular in the air sector ([Le Monde,](#) 26/01/2020). In December 2019, Anne Rigail, CEO of Air France, congratulated the decision made by the company to compensate 100% of its CO_2 emissions from around 500 daily domestic flights, starting from 1st January 2020. The projects supported financially are centered on reforestation and forest protection and were selected with the company EcoAct specialized in corporate decarbonation. The chosen projects all have international labels like the Gold Standard or VCS, or national labels such as the French *Label Bas Carbone*. In November 2019, the airline EasyJet announced that it would invest 29.2 million euros in carbon compensation in 2020, primarily reforestation.

INDICATOR

159 MILLION DOLLARS

159 million dollars invested in nature-based solutions through compensation in 2019

Given that the air sector, the main contributor to compensation projects, is in the middle of a crisis due to the Covid-19 pandemic, where does that leave compensation projects? This type of action, limited to financing of activities by third parties, is a way for companies to respond to pressure

from society and improve their image by reducing their carbon footprint. Scientists nevertheless strongly criticize what they qualify as an opportunist mechanism to avoid tackling the real problem of emissions reduction. The climatologist and member of the IPCC, Valérie Masson Delmotte, for example put pressure on Air France to rectify the promotion of the company's compensation actions on its website (Twitter, 27/07/2020). The climatologist reminded the airline of the importance of long-term carbon storage in the case of reforestation, and pointed out that avoiding deforestation and making investments in renewable energies does not remove carbon from the atmosphere.

This call to order reflects doubts as to the real commitment of carbon compensation actors, given that companies largely opt for this alternative rather than modifying their development models. In any case, the enthusiasm of investors at the World Economic Forum gathered at the Davos summit for the *One Trillion Trees*. campaign shows how climate action dominates the economic stage. In the United States, in August, the first regional chapter of *One Trillion Trees* was initiated. Two dozen companies, cities and organizations are at the origin of the initiative. They include Microsoft, Salesforce, Timberland, Clif Bar, Bank of America, Mastercard and the cities of Detroit and Dallas. The aim is to plant, restore and preserve 855 million trees in the United States by 2030. A regional website has been set up to follow the initiative (us.1t.org). Support for the initiative from US president Donald J. Trump (The New York Times, 12/02/2020), who was nevertheless responsible for the United States' withdrawal from the Paris Agreement, is somewhat surprising. The draft law was criticized by the Democratic opposition and environment protection associations, who describe it as greenwashing to detract from the emissions reductions needed and even an incentive for clearcutting based on the unfounded argument of wood's carbon neutrality (Roll Call, 26/02/2020).

EXPERIENCE FEEDBACK

NATURE-BASED SOLUTIONS IN SMALL ISLAND DEVELOPING STATES

The coming together of climate and biodiversity agendas brought center stage as a result of the Covid-19 pandemic (see part 1) has been taking shape since the late 2000s under the term of nature-based solutions. Defined by the IUCN as "*actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*", nature-based solutions are multifunctional and take a global approach to ecosystem resilience. In October 2020, the WWF and the International Labor Organization published a report that underlined the cost effectiveness of nature-based solutions and their proximity to sustainable development goals (WWF, 2020).

The island of Grenada is fully aware of the co-benefits of nature-based solutions. The NDC of this developing economy includes an engagement to preserve 20% of its land surface to contribute to the Aichi targets and the Caribbean Challenge Initiative. On 23 September 2019, Grenada announced the signature of a partnership plan for 2019-2023 with the aim of boosting the ambition of its NDC and implementing it (NDC Partnership). The forestry section of the plan anticipates the conservation of species, ecosystems, and genetic diversity, and the management of forest resources for climate resilience. For example, the project to adapt the Grenville/Soubise coastline centers on the ecological restoration of mangroves and coral reefs to protect coastal inhabitants from storms and flooding, preserve the habitats of a unique fauna on the line between the sea and land, and contribute to limiting climate change thanks to the significant carbon sequestration in these ecosystems.

BOX 8

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4. Farmland and artificialization

• THE EUROPEAN UNION CAUGHT BETWEEN THE GREEN DEAL, THE COMMON AGRICULTURAL POLICY AND URBANIZATION • Negotiations on the post-2020 Common Agricultural Policy (CAP) raised the question of accountability with the European Green Deal and its ambition of attaining carbon neutrality by 2050. The objectives of the Green Deal's agricultural strategy, entitled "From Farm to Fork", unveiled in May 2020, cover the entire value chain of the food industry, with key objectives including to :

• Reduce the use of chemical pesticides by 50% by 2030

• Reduce nutrient losses by 50% by maintaining soil fertility

• Reduce use of fertilizer by at least 20% by 2030

• Use 25% of European farmland for organic farming by 2030.

This strategy is not however mandatory and its alignment with the post-2020 CAP will be decisive to define the climate ambitions of European agriculture. The CAP budget proposals presented in June 2018 received a mixed response, as illustrated by the open letter published in the journal People and Nature on 8 March 2020 and signed by over 3,600 scientists (Pe'er et al., 2020). Researchers strongly criticize the proposal's lack of ambition regarding the climate and ecology, and in particular the spending cuts in Pillar 2 of the CAP, in other words funding to support organic farming conversions and help set up young farmers. They also point out the lack of clarity on actions beneficial to the climate and have made 10 concrete proposals for action to make the post-2020 CAP more ambitious, including: to transform direct payments into payments in the public interest by making funds conditional on practices with environmental benefits; and to make insurance against climate risk conditional on efforts to limit drought, fires and flooding. At present, the proposals adopted at the end of October 2020 by the European Council and Parliament have been the target of criticism from environmental NGOs.

The artificialization of land directly and indirectly contributes to climate change because, among other things, it accelerates the loss of biodiversity, prevents carbon storage by organic soils, increases the distances covered during individual journeys, and increases expenditure related to urban networks. In September 2019, the European Environment Agency published an update of its statistics on land cover and change from 2000 to 2018. The data show that the use of European land was relatively stable over the period, with about 25% arable land and permanent crops, 17% pastures and 34% forests. However, from 2012 to 2018, 711 km^2 of land were artificialized, most often to the detriment of fertile agricultural land around cities (European Environment Agency, 2019). The artificialization of land in Europe can be explained by demographic growth on the continent, with a projected increase in the European population of 30 million by 2050, and also by higher living standards leading to bigger dwellings, more secondary residences, and more commercial and industrial facilities to meet demand (EEA, 2019). The artificialized surface in Europe in 2018 was evaluated at 363 m^2 per inhabitant (Cling, J.P., et al., 2019).

FIGURE 15

ARTIFICIALIZED LAND IN 2018 IN M²/INHABITANT – EU COMPARISON - *Source: Eurostat, 2018*

square meters/ inhabitant
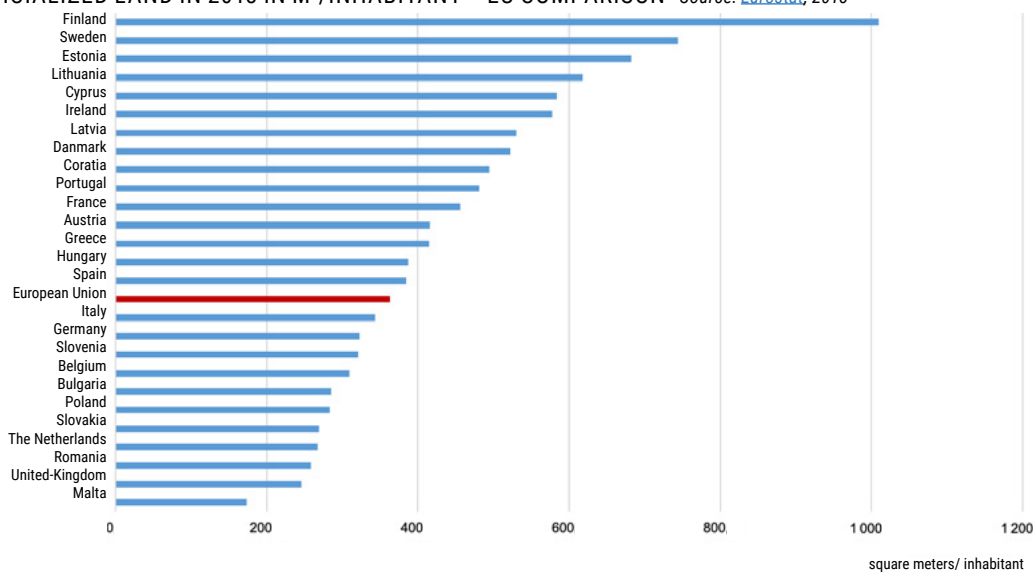
• ZERO NET ARTIFICIALIZATION PLAN IN FRANCE: DENSIFY CITIES TO PROTECT RURAL AREAS ? •

In France, this figure amounts to 456.2 m² per inhabitant and is increasing under the effect of four main mechanisms. Firstly, the rising price of land in city centers forces both less wealthy households and companies to move to the outskirts of cities, a movement compounded by another factor, which is household preference for individual houses and larger dwellings. The next factor is the tax set-up, which pushes local authorities to become more urbanized to collect property taxes, a considerable source of revenue. Lastly, according to a 2015 estimate, 9.5% of housing in France is vacant or used intermittently, which fosters the extension of urban areas.

Several French laws attempt to stem the artificialization of land by densifying urban areas and limiting their expansion: SRU in 2000, Grenelle II in 2010, and ALUR in 2014. More recently, the biodiversity plan published in July 2018 establishes a target of zero net artificialization. Its achievement nevertheless mostly relies on local authorities, which regret the lack of methodological clarity from the state (AdCF, 24/01/2020). The recently established observatory of land artificialization partly responds to this call for support (**box 9**).

On the field, local authorities are taking action and citizens are making their voices heard. The city of Paris plans on updating its local urban planning scheme (PLU) to make it more compatible with the climate commitments of the French capital. The approach is original because it involves a participatory democratic process. The revised PLU, whose completion is scheduled for 2024, will draw from contributions that all Parisians are invited to make on a special website, and from the work of a citizens' conference organized from 26 September to 17 October 2020 involving 100 participants drawn by lot.

Local areas are subject to different constraints. In the metropolis of Lille, the inter-municipal PLU (PLUI) covers 647 km² – the biggest in France – and was adopted by the metropolis council in December 2019 to come into force in June 2020. To draw up the plan, this time the farming community was widely consulted, involving a full update of the agricultural diagnosis by the chamber of agriculture to precisely map farms. The dialogue process led to 1,200 ha from the "to urbanize" land category being moved to a category of agricultural land. Another lever is the renewal of more than 2,000 ha of urban wasteland to allow urban densification (Terres et Territoires, 18/06/2020).

The densification solution nevertheless raises strong negative reactions by urban livers attached to green spaces in their towns, generating different responses from cities (Le Monde, 23/07/2020). The 2020 municipal election campaign in Lille focused on a real estate construction project on 23 hectares of urban wasteland to which local residents were opposed. In Bordeaux, a housing and retail project in the Jallère neighborhood has been cancelled by the new municipal team and replaced with a plan for an urban forest. In Rennes, densification also sparks discontent from some inhabitants concerned to preserve the history of the city (France 3 Bretagne, 21/02/2020).

EXPERIENCE FEEDBACK

MONITORING LAND ARTIFICIALIZATION

One of the difficulties of the land artificialization issue is the lack of large-scale statistics. In response, the French state launched a land artificialization website in early July 2019. The platform uses a homogenous method throughout the country to measure the main indicators of artificialization, which it makes available to citizens and local authorities. The idea is to publish an annal update on the state of artificialization as a way to monitor progress in achieving the goal of zero net artificialization. To produce this digital tool, the institutions CEREMA, IGN and IRSTEA worked hand in hand to build the database and the technology behind the platform.

BOX 9

CONCLUSION

The alarm bells that rang in 2019 have been confirmed in 2020. Progress reports produced by various initiatives come to the same conclusion: international objectives to protect ecosystems have not been achieved. The Covid-19 pandemic has taken center stage, upsetting agendas on negotiating treaties, preventing local patrols from combating deforestation, and in particular bringing a reminder of the connection between human, animal and environmental health. Stakeholders have adapted their strategies at their own level: online conferences, converging climate and biodiversity conventions, and the use of satellites to control deforestation. Action continues on the field, with community management for example showing good potential to combat deforestation and restore degraded ecosystems. However, achieving its full potential will require clearer commitment from economic and financial stakeholders, which currently lack the necessary dynamism.

Get in touch with us if you want to share any views, comments or piece of information to contribute to this report: contribution@climate-chance.org

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