

Global Energy Review 2021

Assessing the effects of economic recoveries on
global energy demand and CO₂ emissions in 2021

INTERNATIONAL ENERGY AGENCY

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Abstract

As the world enters a second year of the Covid-19 pandemic, the annual *Global Energy Review* assesses the direction energy demand and carbon dioxide emissions are taking in 2021. The latest statistical data and real-time analysis confirm our initial estimates for 2020 energy demand and CO2 emissions while providing insights into how economic activity and energy use are rebounding in countries around the world – and what this means for global emissions.

The accelerating rollouts of Covid-19 vaccinations in many major economies and widespread fiscal responses to the economic crisis are boosting the outlook for economic growth and leading to a rebound in energy demand in 2021. The report explores whether the rebound in activity risks pushing CO2 emissions to a new high and to what degree new policies targeting a sustainable recovery are able to curb a rebound in emissions.

The pace of global vaccine rollouts, the possible emergence of new variants of the Covid-19 virus, and the size and effectiveness of economic stimulus measures all represent major uncertainties for the outlook. This analysis therefore not only charts a possible path for energy use and CO2 emissions in 2021 but also highlights the many factors that could lead to differing outcomes.

Key findings

- **The Covid-19 pandemic continues to impact global energy demand.** Third waves of the pandemic are prolonging restrictions on movement and continue to subdue global energy demand. But stimulus packages and vaccine rollouts provide a beacon of hope. Global economic output is expected to rebound by 6% in 2021, pushing the global GDP more than 2% higher than 2019 levels
- **Emerging markets are driving energy demand back above 2019 levels.** Global energy demand is set to increase by 4.6% in 2021, more than offsetting the 4% contraction in 2020 and pushing demand 0.5% above 2019 levels. Almost 70% of the projected increase in global energy demand is in emerging markets and developing economies, where demand is set to rise to 3.4% above 2019 levels. Energy use in advanced economies is on course to be 3% below pre-Covid levels.
- **Global energy-related CO₂ emissions are heading for their second-largest annual increase ever.** Demand for all fossil fuels is set to grow significantly in 2021. Coal demand alone is projected to increase by 60% more than all renewables combined, underpinning a rise in emissions of almost 5%, or 1 500 Mt. This expected increase would reverse 80% of the drop in 2020, with emissions ending up just 1.2% (or 400 Mt) below 2019 emissions levels.
- **Sluggish demand for transport oil is mitigating the rebound in emissions.** Despite an expected annual increase of 6.2% in 2021, global oil demand is set to remain around 3% below 2019 levels. Oil use for road transport is not projected to reach pre-Covid levels until the end of 2021. Oil use for aviation is projected to remain 20% below 2019 levels even in December 2021, with annual demand more than 30% lower than in 2019. A full return to pre-crisis oil demand levels would have pushed up CO₂ emissions a further 1.5%, putting them well above 2019 levels.
- **Global coal demand in 2021 is set to exceed 2019 levels and approach its 2014 peak.** Coal demand is on course to rise 4.5% in 2021, with more than 80% of the growth concentrated in Asia. China alone is projected to account for over 50% of global growth. Coal demand in the United States and the European Union is also rebounding, but is still set to remain well below pre-crisis levels. The power sector accounted for only 50% of the drop in coal-related emissions in 2020. But the rapid increase in coal-fired generation in Asia means the power sector is expected to account for 80% of the rebound in 2021.

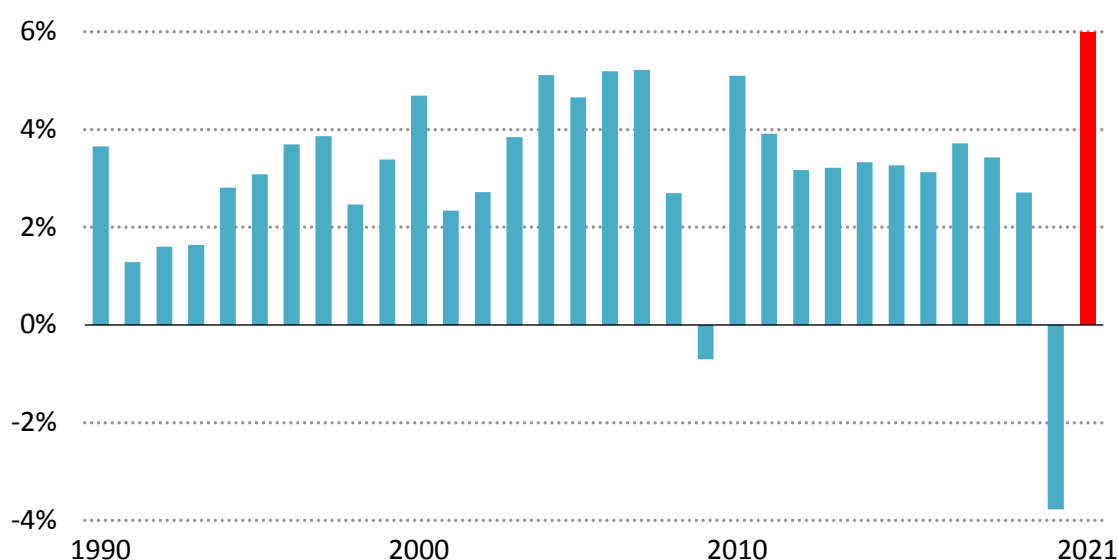
- **Among fossil fuels, natural gas is on course for the biggest rise relative to 2019 levels.** Natural gas demand is set to grow by 3.2% in 2021, propelled by increasing demand in Asia, the Middle East and the Russian Federation (“Russia”). This is expected to put global demand more than 1% above 2019 levels. In the United States – the world’s largest natural gas market – the annual increase in demand is set to amount to less than 20% of the 20 bcm decline in 2020, squeezed by the continued growth of renewables and rising natural gas prices. Nearly three-quarters of the global demand growth in 2021 is from the industry and buildings sectors, while electricity generation from natural gas remains below 2019 levels.
- **Electricity demand is heading for its fastest growth in more than 10 years.** Electricity demand is due to increase by 4.5% in 2021, or over 1 000 TWh. This is almost five times greater than the decline in 2020, cementing electricity’s share in final energy demand above 20%. Almost 80% of the projected increase in demand in 2021 is in emerging market and developing economies, with the People’s Republic China (“China”) alone accounting for half of global growth. Demand in advanced economies remains below 2019 levels.
- **Renewables remain the success story of the Covid-19 era.** Demand for renewables grew by 3% in 2020 and is set to increase across all key sectors – power, heating, industry and transport – in 2021. The power sector leads the way, with its demand for renewables on course to expand by more than 8%, to reach 8 300 TWh, the largest year-on-year growth on record in absolute terms.
- **Renewables are set to provide more than half of the increase in global electricity supply in 2021.** Solar PV and wind are expected to contribute two-thirds of renewables’ growth. The share of renewables in electricity generation is projected to increase to almost 30% in 2021, their highest share since the beginning of the Industrial Revolution and up from less than 27% in 2019. Wind is on track to record the largest increase in renewable generation, growing by 275 TWh, or around 17%, from 2020. Solar PV electricity generation is expected to rise by 145 TWh, or almost 18%, and to approach 1 000 TWh in 2021.
- **China alone is likely to account for almost half the global increase in renewable electricity generation.** It is followed by the United States, the European Union and India. China is expected to generate over 900 TWh from solar PV and wind in 2021, the European Union around 580 TWh, and the United States 550 TWh. Together, they represent almost three-quarters of global solar PV and wind output.

Economic impacts of Covid-19

2021: A year of global economic recovery?

While the global health crisis continues in the early months of 2021 with second and even third waves of the virus in many regions, accelerating vaccine rollouts and major stimulus packages in many advanced economies have provided a beacon of hope. The IMF projects the global economy will grow by 6% in 2021, more than compensating for the 3.5% drop in 2020.

Annual rate of change in world GDP 1990-2021



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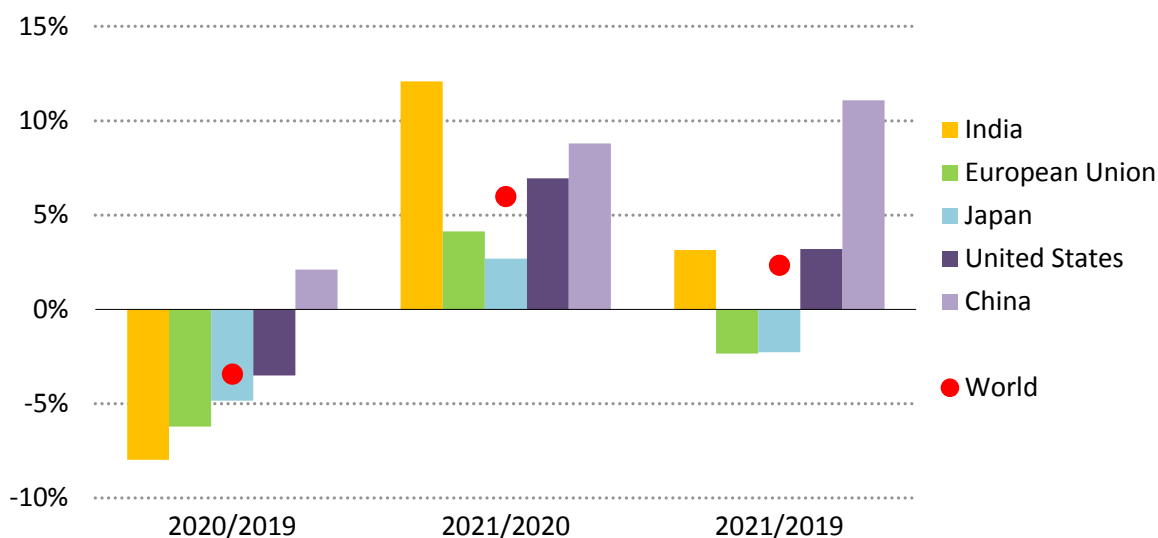
Source: IEA analysis based on economic data from the IMF and Oxford Economics.

Thanks to a successful vaccine program and the American Rescue Plan (“the Biden stimulus”), GDP in the **United States** will rise above pre-Covid-19 projections.

The **European Union**, on the other hand, was hit by a severe second wave in the winter of 2020/21, leading to renewed economic closures and lockdowns, with recovery further impeded by a slow start to vaccination campaigns. The impact of national stimulus packages may not be felt until the second half of the year. Economic output in 2021 is expected to remain 2.3% below 2019 levels. On a positive note, the bloc’s industrial production is back to pre-Covid levels, owing to a recovery in international trade. **China** curtailed the virus early on and was one

of the few economies to expand in 2020. Dynamic growth is expected to continue through 2021, driven by exports, but especially by domestic demand, including policy-sponsored infrastructure projects. Korea and Japan avoided repeated waves of the pandemic through testing and tracing, and likewise are benefiting from reviving world trade.

Change in GDP in selected regions, 2019 to 2021



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India is likely to be a key variable for the global economic outlook

India's combination of some of the world's [strictest lockdown measures](#) and limited stimulus spending led to one of the sharpest declines of any major economy, with GDP dropping by 7.2% in 2020. The outlook significantly improved at the end of the year, driven by recovering industrial production. Early estimates place India's annual GDP growth at 12% in 2021, though with significant uncertainties linked to the evolution of infections and the rollout of vaccines.

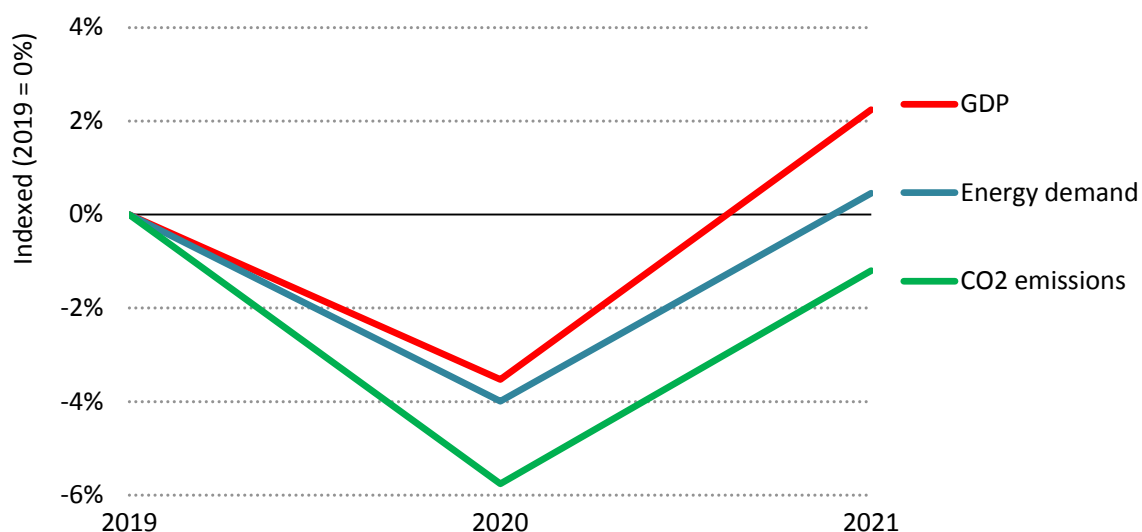
In many emerging markets and developing economies, economic recovery has been constrained by limited access to vaccine doses, capital flight and concerns over debt levels and rising interest rates. Adding to these pressures, Latin America has been hit by a second wave of the pandemic. Meanwhile, higher oil prices have increased revenues for oil exporters.

Energy demand

Global energy demand is set to increase by 4.6% in 2021f, surpassing pre-Covid-19 levels.

Global energy demand in 2020 fell by 4%, the largest decline since World War II and the largest ever absolute decline. The latest statistical data for energy demand in the first quarter of 2021 highlights the continued impacts of the pandemic on global energy use. Building on Q1 data, projections for 2021 indicate that as Covid restrictions are lifted and economies recover, energy demand is expected to rebound by 4.6%, pushing global energy use in 2021 0.5% above pre-Covid-19 levels. The outlook for 2021 is, however, subject to major uncertainty. It depends on vaccine rollouts, the extent to which the Covid-19-induced lockdowns scarred economies, and the size and effectiveness of stimulus packages. Current economic outlooks assume global GDP will surpass 2019 levels, lifting demand for goods, services and energy. However, transport activity and, particularly, international travel remain severely suppressed. If transport demand returns to pre-Covid levels across 2021, global energy demand will rise even higher, to almost 2% above 2019 levels, an increase broadly in line with the rebound in global economic activity.

Evolution of global GDP, total primary energy demand, and energy-related CO2 emissions, relative to 2019.



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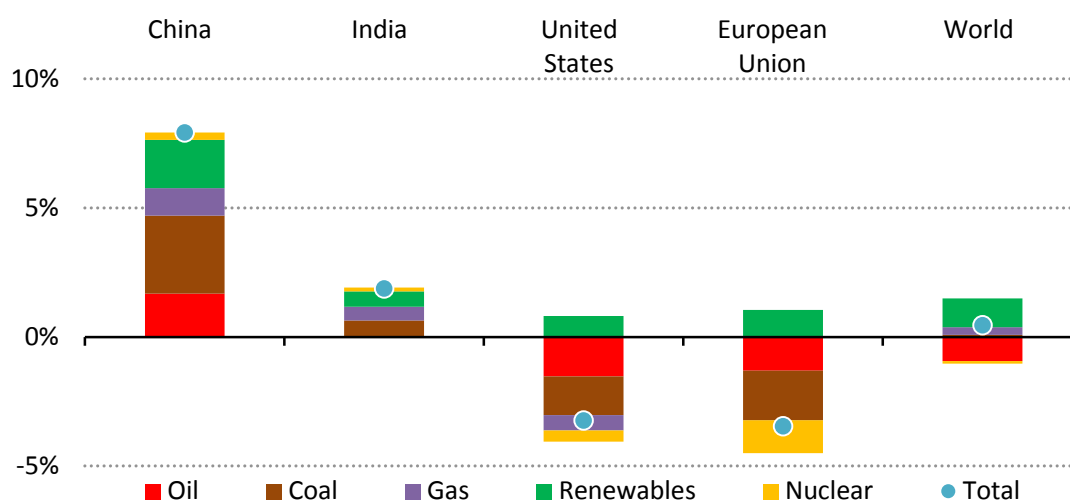
Energy demand by fuel

The drop in demand in 2020 did not affect all fuels evenly. Oil was by far the hardest hit, with restrictions on mobility causing demand for transport fuels to fall by 14% from 2019 levels. At the peak of restrictions in April, global oil demand was more than 20% below pre-crisis levels. Overall, oil demand was down by almost 9% across the year.

In 2021, oil demand is expected to rebound by 6%, faster than all other fuels. The last time oil demand increased this rapidly was in 1976. Despite the strong rebound, oil demand remains 3% (3.1 mb/d) below 2019 levels. Road transport activity has remained subdued through much of the year, expected to recover to pre-Covid-19 levels only in the last months of 2021, while air transport demand is on track to remain markedly below 2019 levels for all of 2021. Only in Asia and, notably, in China does oil demand climb well above pre-Covid-19 levels.

In 2020, coal demand dropped by 220 million tonnes of coal equivalent (Mtce), or 4%. The largest declines in coal use for electricity generation were in advanced economies, down 15%, which accounts for more than half of coal's global decline. Coal was particularly squeezed in the power mix by lower electricity demand, increasing output from renewables, and low gas prices. In 2021, coal demand has rebounded strongly, reversing all of the declines in 2020, though with major geographic variations. The decline in 2020 was concentrated in the United States and Europe, and demand in advanced economies is expected to recover only one-quarter of its 2020 drop, curtailed by renewables deployment, lower gas prices and phase-out policies. Meanwhile, China is projected to account for 55% of the 2021 increase.

Change of primary energy demand by region and by fuel in 2021 relative to 2019



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Lower prices enabled gas to be more resilient than coal in 2020, with demand falling only by 2%. The combination of continued lower prices and rapid growth in economies across Asia and the Middle East should drive growth of 3% in gas demand in 2021. As a result, global natural gas demand in 2021 is projected to rise 1.3% above 2019 levels, the strongest anticipated rebound amongst fossil fuels.

Renewables have proven largely immune to the pandemic as new capacity has come online and as they have benefited from priority market access in many markets. Overall, renewables usage grew by 3% in 2020, largely due to an increase in electricity generation from solar PV and wind of 330 TWh. Generation from solar PV and wind is set to grow by 17% in 2021, up from 16% in 2020. Hydro and biomass generation should also accelerate, with total generation from renewables growing by 8.3% in 2021, which is faster than 2020's 7% increase. Two years of rapid growth means the share of renewables in total electricity generation will reach almost 30%, up from less than 27% in 2019.

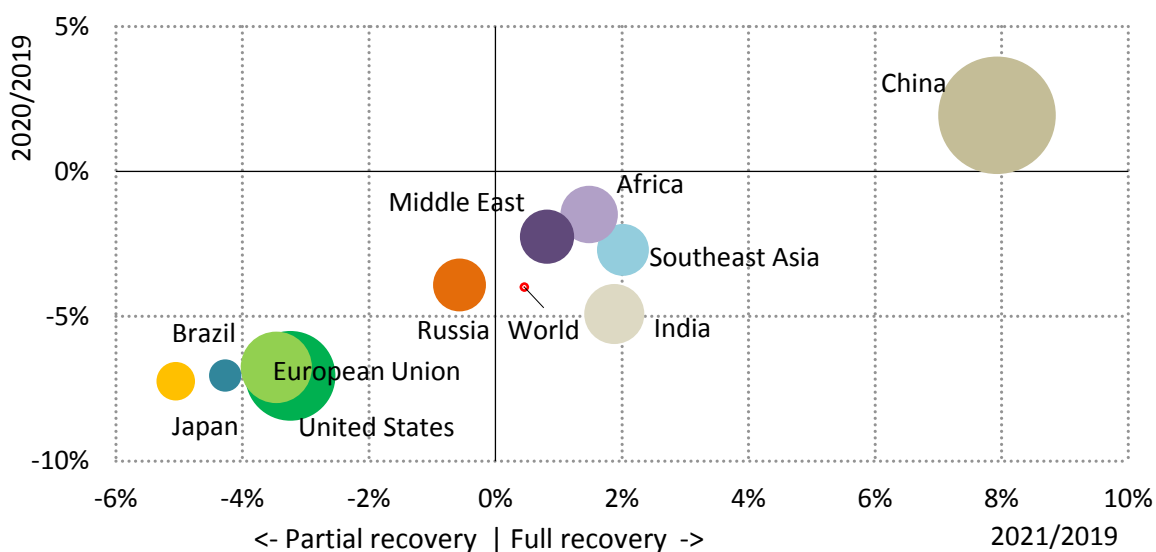
Energy demand by region

The world's biggest economies have been impacted by Covid-19 to different degrees. Energy demand across advanced economies fell by over 6% on average in 2020, with every advanced economy at some point experiencing a contraction of economic output.

Looking to 2021, advanced economies are expected to see rapid recoveries in economic output and energy demand across most sectors. However, recoveries will not begin in earnest until the second half of the year because of continued impacts of the pandemic, especially in the European Union.

In the United States, despite the recently announced USD 2.3 trillion stimulus-spending programme, energy demand is projected to increase only 4% in 2021, with demand remaining 3% below 2019 levels.

Rate of change of energy demand in 2020, and 2021 energy demand relative to 2019 levels, by region



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Note: Bubble size is relative to regional primary energy demand in 2021.

Most emerging market and developing economies also experienced a drop in energy demand in 2020, albeit less than in advanced economies. Demand declined 5% in India, around 3% in Southeast Asia, 2% in the Middle East and 1.5% across Africa.

China was a notable exception, the only major economy to experience both an increase in economic output and in energy demand in 2020. While restrictions to control the outbreak of Covid-19 depressed demand in the first quarter, the economy began to recover from April. For the remainder of the year, energy demand grew by 6% on average from pre-Covid-19 levels. Despite the impressive growth of renewables, increasing electricity demand led to an [all-time high coal burn in December 2020](#).

Economic activity in China is set to further accelerate in 2021, and energy demand is expected to grow by 6%, with demand in 2021 almost 8% higher than in 2019, thus cementing China's position as the economy least impacted by Covid-19.

India's steep economic slide in 2020 pushed oil demand down by more than 8%, while coal demand for power generation and industry fell by 5% and 11%, respectively. India's CO2 emissions were more than 40% lower in April 2020 than they were a year earlier, making it the steepest monthly decline in emissions seen in any part of the world last year. But with India's economy expected to bounce

back strongly in 2021, energy demand is set to rebound by 7%, pushing demand 2% above 2019 levels. Coal demand is expected to increase by almost 9%, contributing the most to rebounding demand, as electricity demand recovers.

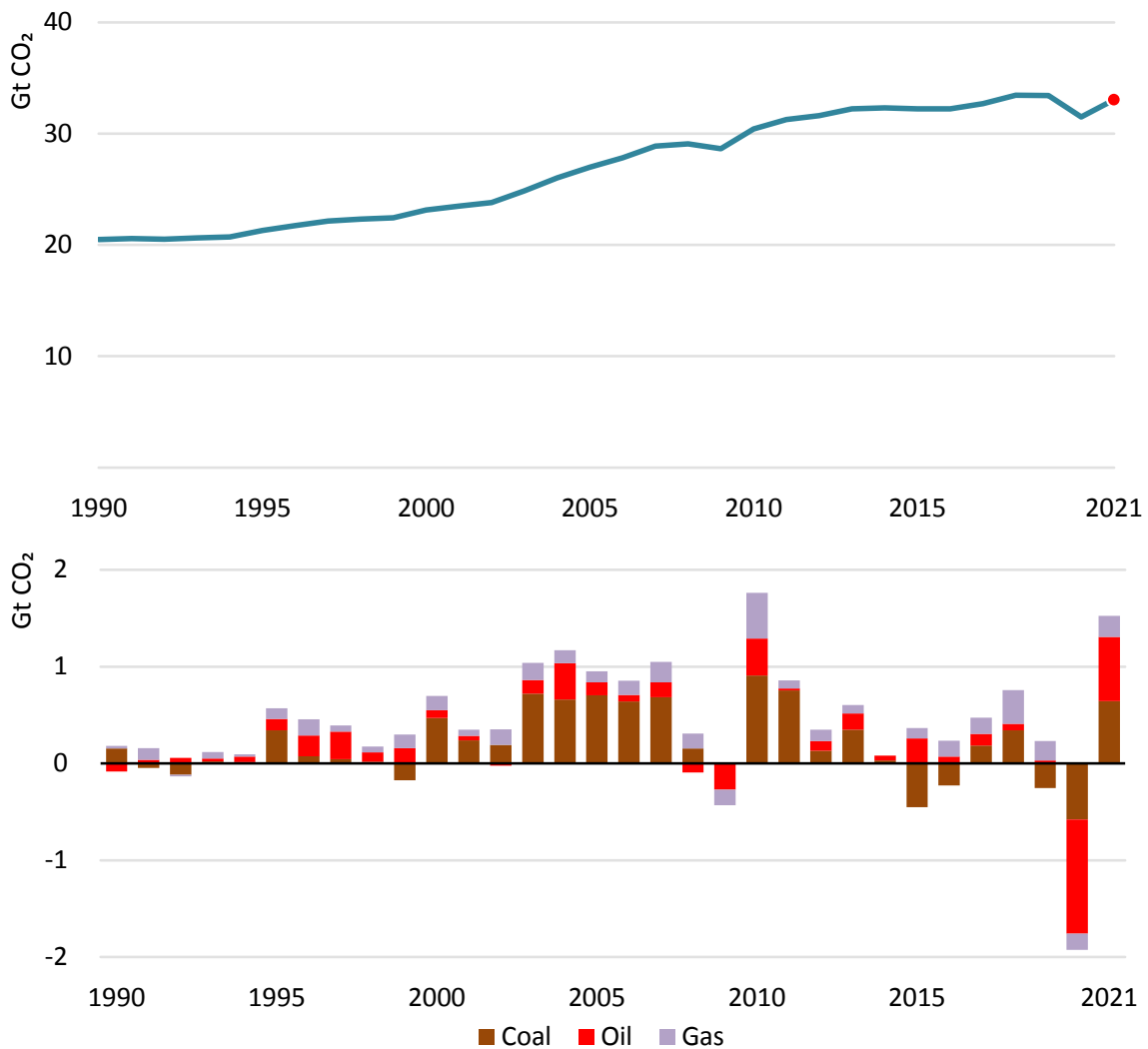
CO₂ emissions

Global CO₂ emissions declined by 5.8% in 2020, or almost 2 Gt CO₂ – the largest ever decline and almost five times greater than the 2009 decline that followed the global financial crisis. CO₂ emissions fell further than energy demand in 2020 owing to the pandemic hitting demand for oil and coal harder than other energy sources while renewables increased. Despite the decline in 2020, global energy-related CO₂ emissions remained at 31.5 Gt, which contributed to CO₂ reaching its highest ever average annual concentration in the atmosphere of [412.5 parts per million in 2020](#) – around 50% higher than when the industrial revolution began.

In 2021 global energy-related CO₂ emissions are projected to rebound and grow by 4.8% as demand for coal, oil and gas rebounds with the economy. The increase of over 1 500 Mt CO₂ would be the largest single increase since the carbon-intensive economic recovery from the global financial crisis more than a decade ago, it leaves global emissions in 2021 around 400 Mt CO₂, or 1.2%, below the 2019 peak.

Global CO₂ emissions rebound by nearly 5% in 2021, approaching the 2018-2019 peak.

Global energy-related CO₂ emissions, 1990-2021, and change in CO₂ emissions by fuel, 1990-2021



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CO₂ emissions by fuel

Despite global economic activity rising above 2019 levels in 2021 and global energy demand rebounding above 2019 levels, we do not anticipate a full return of CO₂ emissions to pre-crisis levels. Even with an increase in CO₂ emissions from oil of over 650 Mt CO₂ in 2021, oil-related emissions are expected to recover only around half of the 2020 drop and thus should remain 500 Mt CO₂ below 2019 levels. The likely partial recovery is entirely due to the continued impacts of the Covid-19 pandemic and related restrictions on transport activity in 2021. CO₂ emissions from international aviation are set to remain 200 Mt CO₂ (or one-third) below pre-pandemic levels in 2021, while emissions from road transport and domestic aviation are on track to be close to 350 Mt CO₂ (or 5%) below 2019 levels.

in 2021. A full recovery of global transport activity would push oil-related emissions above 2019 levels and increase global CO₂ emissions by over 1.5%, well above 2019 levels.

Global coal use is anticipated to rebound in 2021 and drive an increase in global CO₂ emissions of around 640 Mt CO₂. This would push emissions from coal to 14.8 Gt CO₂: 0.4% above 2019 levels and only 350 Mt CO₂ short of the global high in coal-related CO₂ emissions of 2014. The power sector accounted for less than 50% of the drop in coal-related emissions in 2020, but it accounts for 80% of the rebound, largely due to rapidly increasing coal-fired generation in Asia.

CO₂ emissions from natural gas combustion are expected to increase by more than 215 Mt CO₂ in 2021 to reach an all-time high of 7.35 Gt CO₂, 22% of global CO₂ emissions. Gas use in buildings and industry accounts for much of the trend, with demand in public and commercial buildings seeing the greatest drop in demand in 2020 but the biggest anticipated recovery in 2021.

CO₂ emissions by region

Emerging markets and developing economies now account for more than two-thirds of global CO₂ emissions, while emissions in advanced economies are in a structural decline, despite an anticipated 4% rebound in 2021.

China's emissions are likely to increase by around 500 Mt CO₂. With energy demand and emissions already growing in 2020, in 2021 CO₂ emissions in China should be 6%, or almost 600 Mt CO₂, above 2019 levels. All fossil fuels should contribute to higher CO₂ emissions in China in 2021, but coal is expected to dominate, contributing 70% to the increase, predominantly due to greater coal use in the power sector. Despite China's rapid growth in generation from renewables, output from coal-fired power plants has increased by 330 TWh, or nearly 7%, between 2019 and 2021.

Economic recovery in India in 2021 is set to push emissions almost 200 Mt higher than 2020, leaving emissions 1.4% (or 30 Mt) above 2019 levels. A rebound in coal demand above 2019 levels drove the emissions increase in India, with the expected rise in coal-fired electricity generation in 2021 likely to be three times greater than the increase in generation from renewables. CO₂ emissions in India are now broadly on par with emissions in the European Union at 2.35 Gt, although they remain two-thirds lower on a per capita basis and 60% below the global average.

In the United States, CO₂ emissions in 2021 are expected to rebound by more than 200 Mt CO₂ to 4.46 Gt CO₂, yet remain 5.6% below 2019 levels and 21% below 2005 levels. CO₂ emissions from coal are expected to be almost 12% below 2019 as coal use for electricity generation is likely to recover only 40% of the ground lost to renewables and natural gas in 2020. Oil use, the biggest contributor to CO₂ emissions in the United States, should remain almost 6% below 2019 levels as transport activity remains curtailed across 2021.

CO₂ emissions are likely to rebound less in the European Union, as the economic outlook is dimmer than in other parts of the world. The expected increase of 80 Mt CO₂ in 2021 will reverse only one-third of 2020's drop. EU emissions in 2021 should stand at 2.4 Gt. Most of the 90 Mt CO₂ drop in power sector emissions in 2020 will endure through 2021, with a slight anticipated increase in coal and gas-fired generation in 2021 reversing only 10% of the 2020 drop. The share of coal in electricity generation in the European Union has declined almost three-percentage points from 2019 to 2021, to less than 14%.

CO₂ emissions from advanced economies have fallen by 1.8 Gt CO₂ since 2000, and their share in global emissions has declined by twenty percentage points to less than one-third of the global total.

Oil

Oil demand in 2020 saw its biggest ever annual decline

Measures to restrain the spread of Covid-19 and the ensuing recession triggered an estimated 8.5 mb/d (8.8%) drop in oil demand in 2020 – the largest ever decline in both absolute and relative terms. The transport sector, responsible for around 60% of total oil demand, was severely impacted by mobility restrictions in 2020. Jet fuel and kerosene demand dropped by 3.2 mb/d (41%), with air passenger traffic 66% below 2019 levels, and gasoline demand declined by over 3 mb/d (12%). Fuel oil demand dropped by 0.5 mb/d (8%) as bunker fuel demand declined along with international trade. Continued freight transport activity mitigated the decline in gasoil demand to 1.8 mb/d (6%), and LPG/ethane and naphtha demand was roughly unchanged as petrochemical feedstocks benefited from increased sales of packaging, hygiene and medical equipment.

Oil demand's rebound in 2021 is softened by a sluggish aviation sector

The improving economic environment will support a rebound in global oil demand of 5.4 mb/d, or 6% above 2020 levels. Despite the rebound, demand across 2021 is expected to remain 3.2% below 2019 levels.

Covid-related restrictions on mobility continue to suppress oil demand for transport in the first half of the year, even if the impact is much less than a year earlier. Demand will rise progressively in the second half of 2021, as vaccination campaigns ramp up and travel returns. Nonetheless, oil demand is not projected to reach pre-crisis levels with demand in the fourth quarter of 2021 expected to be 1.4 mb/d lower than pre-crisis levels. International aviation's oil use is the slowest area to rebound and is expected to be 20% below 2019 levels even in December 2021. Excluding international aviation, oil demand is expected to return to 2019 levels in the last months of 2021.

Change in quarterly oil demand in 2020 and 2021 relative to 2019 levels



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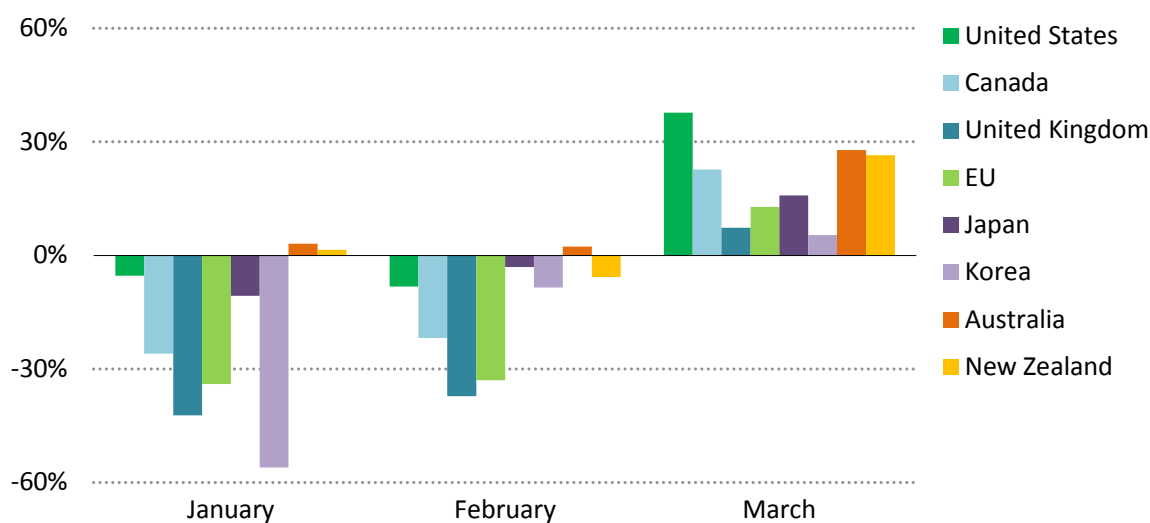
Note: Quarterly oil demand data in this figure include biofuels blended with oil products.
Source: IEA OMR March 2021.

China is the only major economy where oil demand in 2020 was above 2019 levels, and demand in 2021 is expected to grow further to almost 9% above 2019 levels. Oil demand in China fell 1.3 mb/d in Q1 of 2020 as the virus hit China and mobility was curtailed; however, removal of restrictions and a sharp economic rebound through the rest of the year saw oil demand return to growth. Without the increase in demand in China in 2021, global demand would be an additional 1 mb/d, or a further one percentage point, below 2019 levels.

Oil demand in the **United States** is expected to remain around 0.8 mb/d below 2019 levels, mainly as a result of the continued impact of the pandemic-related restrictions during early 2021. Demand in the **European Union** remains 0.4 mb/d below 2019 levels, with continued lockdowns expected to weigh heavily on 2021 annual totals. In **India**, after further lockdowns in the first half of the year, rapid demand growth in the second half of the year is likely to push 2021 oil demand back on par with 2019 levels.

Gasoline demand is set to increase by 1.8 mb/d in 2021 to reach 25.4 mb/d, even if it will remain 1.2 mb/d below pre-Covid levels. Demand is set to be 2 mb/d below 2019 levels during the first half of 2021 and, while demand should rise in the second half as restrictions are eased, it is expected to remain around 500 kb/d below pre-Covid levels. Behavioural changes from the Covid crisis, such as increased teleworking or greater use of bicycles in cities, outweigh greater preference for private cars vs. public transport in certain regions.

Road transport activity in 2021 relative to 2020, in selected advanced economies.



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Source: IEA analysis based on data from Apple Mobility.

Diesel demand is set to rebound by 1.5 mb/d to 28.5 mb/d in 2021 and should remain 0.3 mb/d below 2019 levels. Diesel is less impacted by restrictions on mobility because trucks have operated at near-normal levels as demand continues for goods held up during the pandemic. New Covid restriction measures implemented in 2021 are not anticipated to restrict manufacturing and the transportation of industrial goods.

Jet fuel and kerosene demand has been the oil product most affected during the pandemic. Air traffic is expected to recover slowly in the first half of 2021 and pick up in the second half when vulnerable populations in the developed world have been vaccinated. Pent up demand could push revenue passenger kilometres (RPKs) up by 50% y-o-y. In this case, we expect total jet fuel and kerosene demand to increase by 0.8 mb/d on 2020 levels in 2021, a rebound of 17%. Despite this growth, demand would still remain 30% below 2019 levels.

Petrochemical feedstock will be the only oil sector to surpass pre-crisis levels with plastics production driven by increased needs for packaging and personal protective equipment. We expect LPG, ethane and naphtha demand to increase by 0.8 mb/d in 2021 (4%).

Fuel oil demand will increase by nearly 0.3 mb/d in 2021 (4.5%) as it is expected to benefit from a rebound in bunker fuel demand and higher industrial activity. Most of the growth will be for the new, very low sulphur fuel oil introduced by International Maritime Organisation regulations.

Coal

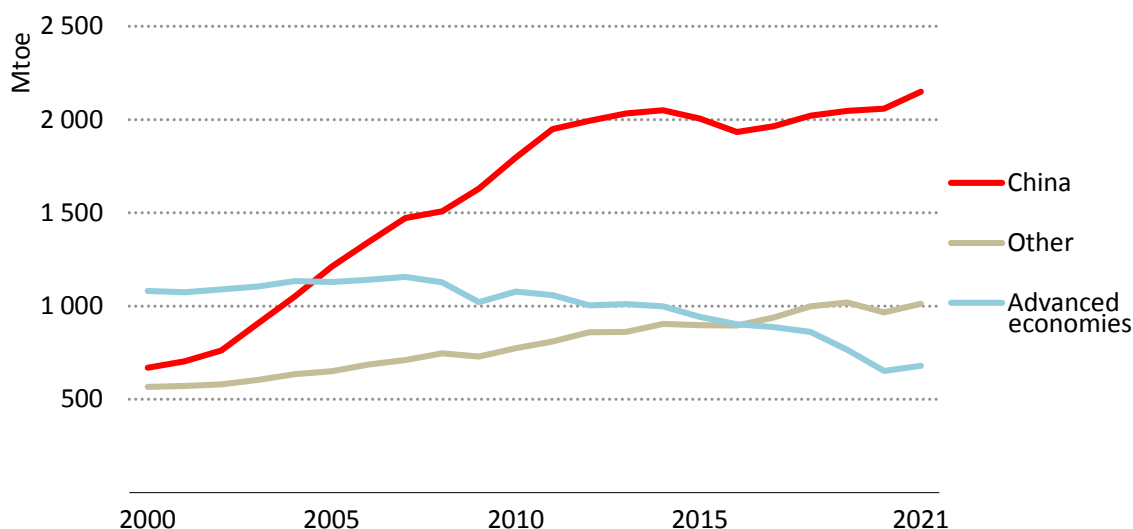
Coal demand experienced a major decline in 2020

Global coal demand declined 4% in 2020, the biggest drop since World War II. The main driver of the decline was lower electricity demand owing to Covid-19 restrictions and the resulting economic downturn. Preferential dispatch or use of renewables in many markets squeezed gas and coal in the electricity mix. Lower gas prices saw significant fuel switching away from coal, particularly in the United States and the European Union, where coal use for power fell 20% and 21%, respectively. Overall, declines in the power sector accounted for over 40% of lower global demand in 2020. The Covid-19 pandemic also affected industrial output, notably steel and cement, further lowering coal demand.

Coal demand is rebounding strongly in 2021, driven by the power sector

In 2021, we expect recovering economic activity to reverse 2020's decline in coal demand, with a 4.5% increase pushing global coal demand above 2019 levels. The power sector accounted for just over 40% of the drop in coal use in 2020, but the rapid increase in coal-fired generation in Asia sees it account for three-quarters of the rebound in 2021. Gas prices are also expected to rise in 2021, leading to some switching back to coal, notably in the United States and the European Union. The growth of coal consumption in 2021 is a continuation of the rebound in global coal demand that began in the final quarter of 2020. While an exceptional cold snap in December in northeast Asia was partly to blame for increasing coal demand, the rapid growth of coal-fired electricity generation is a reminder of coal's central role in fuelling some of the world's largest economies.

Coal consumption by region, 2000 to 2021



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China is the only major economy where coal demand increased in 2020. Strong economic growth underpins electricity demand in 2021, while post-Covid stimulus measures support production of steel, cement and other coal-intensive industrial products. We expect coal demand to increase by more than 4% in 2021, keeping demand well above the 2014 peak and reaching the highest ever levels for China.

The Chinese coal power fleet (including combined heat and power, or CHP, plants) represent around one-third of global coal consumption. The future of both Chinese and global coal demand depends on the Chinese electricity system. Electricity demand growth remains closely linked to economic growth in China, with demand increasing on a one-to-one ratio with GDP. What additional share of electricity demand is met by coal depends on how fast technologies such as renewables and nuclear come on line. Last year, despite the Covid-19 outbreak, renewable capacity additions increased to over 100 GW, largely owing to rushes to complete projects before a subsidy phase-out deadline. Because of accelerating increases in renewables deployment, coal is expected to meet only 45% of the projected 8% increase in electricity demand in 2021.

In **India**, April 2020 marked the lowest point of coal consumption in many years as a significant economic slowdown in the second half of 2019 was followed by Covid lockdowns. The economic recovery since led to a continuous rebound of coal consumption, with a 6% increase in the fourth quarter of 2020. Higher coal demand was also driven by a decline in generation from hydro, following 2019's exceptionally high output. Our estimate for India coal consumption assumes a

strong economic rebound in 2021, pushing Indian GDP firmly above 2019 levels and driving up coal demand by almost 9% to 1.4% above 2019 levels.

In the **United States**, coal remains on a structural decline even though 2021 is projected to be the first growth year for consumption since 2013. Recovering electricity consumption and higher gas prices underpinned increased coal use in December 2020, the first monthly year-on-year increase since November 2018. Coal demand from the power sector is expected to rebound by 10% from the lows of 2020, though that still should not push coal demand above 2019 levels. Coal-fired electricity generation represents 90% of coal consumption in the United States and has more than halved since 2010, with demand falling by one-third between 2018 and 2020.

In the **European Union**, coal-fired electricity generation is disappearing or becoming negligible in an increasing number of countries. Austria and Sweden closed their last coal power plants in 2020; others like Portugal will do so this year, and carbon allowances continue to deter coal generators. Germany, Poland and the Czech Republic account for two-thirds of EU coal use for power. In Germany, where coal and gas competition is more intense due to capacity availability, generation costs of gas and coal are moving in the same range. Therefore, small movements in fuel prices can change the relative competitiveness of coal and gas, and hence, of coal demand. With this uncertainty in mind, we expect coal demand to increase by only 4% in 2021, mostly pushed by the recovery of industrial consumption. This increase is a long way from reversing the 18% decline in demand in 2020.

A limited rebound for coal in the European Union in 2021 is primarily driven by economics, but recent political announcements imply continued declines in coal use. Throughout 2020 there were frequent announcements of green stimulus packages, zero emissions targets by mid-century, and plans to downsize coal generation capacity.

Natural gas

Natural gas demand declined less than other fossil fuels in 2020

Global natural gas consumption declined by 75 bcm (or 1.9% y-o-y) in 2020. This represents the largest recorded drop in gas demand in absolute terms, but it would be on a par with 2009 in relative terms. The decline was concentrated in the first half of the year, when global gas consumption declined around 4% y-on-y, driven by exceptionally mild weather and Covid-19 outbreaks. Gas was markedly less impacted than oil or coal demand in 2020, and a progressive recovery of gas demand was observed in the third quarter as lockdown measures eased, while seasonal electricity demand and competitive prices pushed up gas consumption.

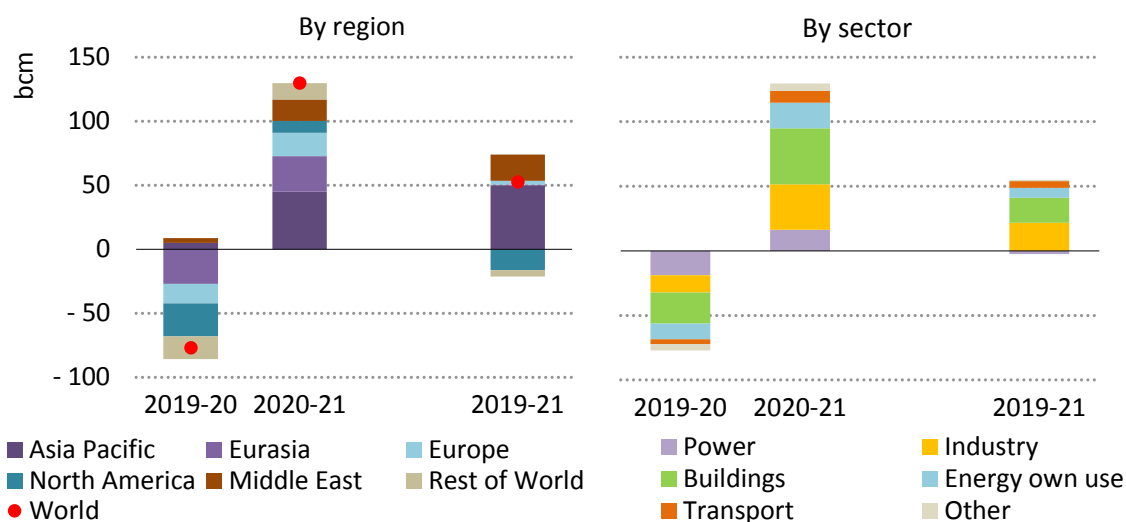
This relative resilience can be partly explained by fuel switching in electricity generation. The switch was particularly remarkable in the United States where gas demand for electricity generation increased by around 2% y-o-y in spite of a declining electricity demand, while in Europe gas-fired generation benefited from low prices and a sharp recovery in carbon prices in the second half of 2020. In Asia, gas for power grew in China, India, and Korea. With big declines in Russia and the Middle East, gas use in the power sector nonetheless accounted for one-quarter of the decline in gas demand in 2020, other declines came from the buildings and industry sectors, contributing respectively to 30% and close to 20% of total gas demand drop in 2020.

Gas bouncing back in 2021, but recovery remains fragile

Global gas demand is expected to recover 3.2% in 2021, erasing the losses in 2020, and pushing demand 1.3% above 2019 levels. This recovery in gas demand has been driven mainly by fast-growing markets – primarily in Asia and, to a lesser extent, the Middle East – and subject to uncertainties regarding industrial rebound or fuel price competitiveness. Demand in the European Union is expected to rebound to levels on a par with 2019. Growth in the United States is more gradual, with demand not expected to return to 2019 levels in 2021. Colder than average temperatures in the early months of 2021 across the northern hemisphere increased gas demand. Winter storms also led to some extreme supply-demand tensions and price spikes, first in January in northeast Asia and then February in

North America, notably in Texas. Rising prices have challenged the position of gas in electricity generation as seen in the United States where demand in the first quarter of 2021 was lower than the first quarter of 2020. Across the year, higher gas prices are expected to keep gas demand in the United States close to 2020 levels and around 2% below 2019 levels. In the European Union, higher carbon prices provide some support to gas vis-à-vis coal; preliminary data for the first quarter show an 8% y-o-y increase in gas demand in Europe. The picture is very different across developing Asia, where demand in 2021 is expected to increase by 7% on 2020 levels, putting demand 8.5% above 2019 levels. China leads the increase, with 2021 demand more than 14% (or 44 bcm) higher than 2019 levels.

Natural gas demand growth by region and sector, 2019-2021



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The industry and buildings sectors are expected to lead gas demand growth in 2021, with industry demand increasing by almost 5% as global output and trade volumes recover. China, India and other fast-growing Asian markets are driving this growth. Consumption from the buildings sector also grows around 5%, supported by colder temperatures in Q1. Gas use for electricity generation is expected to grow just 1% due to low electricity demand growth, increasing renewable capacity, and tougher price competition from coal.

Global gas demand in 2021 remains subject to significant uncertainty regarding not only electricity demand and industrial production but also the price evolution of gas vs. coal in key markets such as the United States, as well as in regard to the weather across the northern hemisphere towards the end of 2021.

Renewables

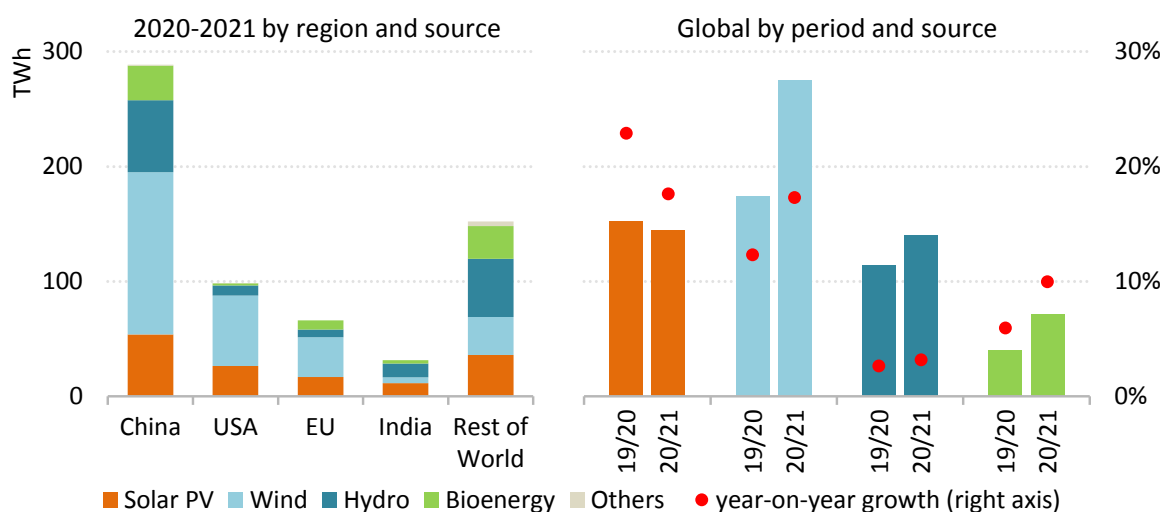
Renewables bucked the trend in 2020

Renewable energy use increased 3% in 2020 as demand for all other fuels declined. The primary driver was an almost 7% growth in electricity generation from renewable sources. Long-term contracts, priority access to the grid, and continuous installation of new plants underpinned renewables growth despite lower electricity demand, supply chain challenges, and construction delays in many parts of the world. Accordingly, the share of renewables in global electricity generation jumped to 29% in 2020, up from 27% in 2019. Bioenergy use in industry grew 3%, but was largely offset by a decline in biofuels as lower oil demand also reduced the use of blended biofuels.

Renewables are on track to set new records in 2021

Renewable electricity generation in 2021 is set to expand by more than 8% to reach 8 300 TWh, the fastest year-on-year growth since the 1970s. Solar PV and wind are set to contribute two-thirds of renewables growth. China alone should account for almost half of the global increase in renewable electricity in 2021, followed by the United States, the European Union and India.

Renewable electricity generation increase by technology, country and region



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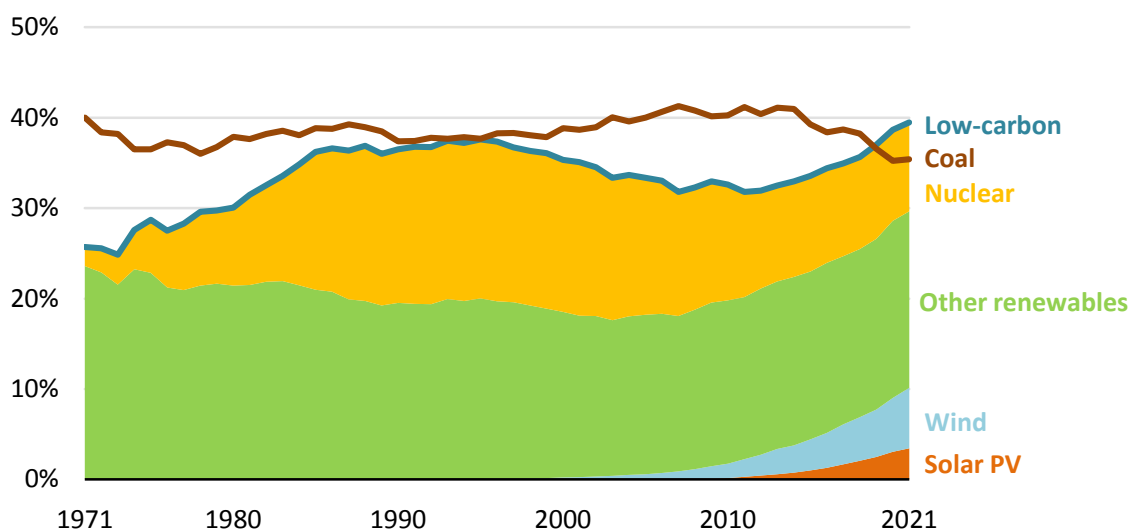
Wind is set for the largest increase in renewable generation, growing by 275 TWh, or almost 17%, which is significantly greater than 2020 levels. Policy deadlines in China and the United States drove developers to complete a record amount of capacity late in the fourth quarter of 2020, leading to notable increases in generation already from the first two months of 2021. Over the course of 2021, China is expected to generate 600 TWh and the United States 400 TWh, together representing more than half of global wind output.

While China will remain the largest PV market, expansion will continue in the United States with ongoing policy support at the federal and state level. Having experienced a significant decline in new solar PV capacity additions in 2020 as a result of Covid-related delays, India's PV market is expected to recover rapidly in 2021, while increases in generation in Brazil and Viet Nam are driven by strong policy supports for distributed solar PV applications. Globally, solar PV electricity generation is expected to increase by 145 TWh, almost 18%, to approach 1 000 TWh in 2021.

We expect hydropower generation to increase further in 2021 through a combination of economic recovery and new capacity additions from large projects in China. Energy from waste electricity projects in Asia will drive growth of bioenergy, thanks to incentives.

Increases in electricity generation from all renewable sources should push the share of renewables in the electricity generation mix to an all-time high of 30% in 2021. Combined with nuclear, low-carbon sources of generation will truly exceed output from the world's coal plants in 2021.

Share of low-carbon sources and coal in world electricity generation, 1971-2021



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In 2021, the biofuels market is likely to recover and approach 2019 production levels as transportation activity slowly resumes and biofuel blending rates increase. Biofuels are consumed mostly in road transportation, blended with gasoline and diesel fuels, and thus are less affected by continued depressed activity in the aviation sector.

Electricity

Electricity demand

Electricity demand in 2020

Global electricity demand fell by around 1% in 2020, with demand declining most markedly in the first half of the year as lockdowns restricted commercial and industrial activity. Demand was, at times, [20-30% lower than pre-lockdown periods](#). Compared to the same periods in 2019, after stripping out weather variations, China's demand dropped by more than 10% in February. The United States, after China the second-largest global electricity consumer, experienced a decline of almost the same magnitude in May during the peak of stay-at-home orders.

From March to April, weekly demand in Germany, France and the United Kingdom dropped more than 15% and, in Spain and Italy, by even more than 25%. Similarly, India saw demand decline more than 20% in several weeks between mid-March and the end of April. In Japan and Korea – where Covid-19 cases were fewer than in Europe and the United States – demand declined by around 8% in May.

Advanced economies recovered in the second half of 2020 but remained for the most part below 2019 levels. Some emerging markets and developing regions registered strong growth rates towards the end of the year, especially China and India, who recorded more than 8% and 6% year-on-year growth, respectively, in the last quarter of 2020.

Electricity demand in 2021

Electricity demand is expected to increase by 4.5% in 2021, supported by rebounding economic activity and rapid growth in major emerging economies such as China.

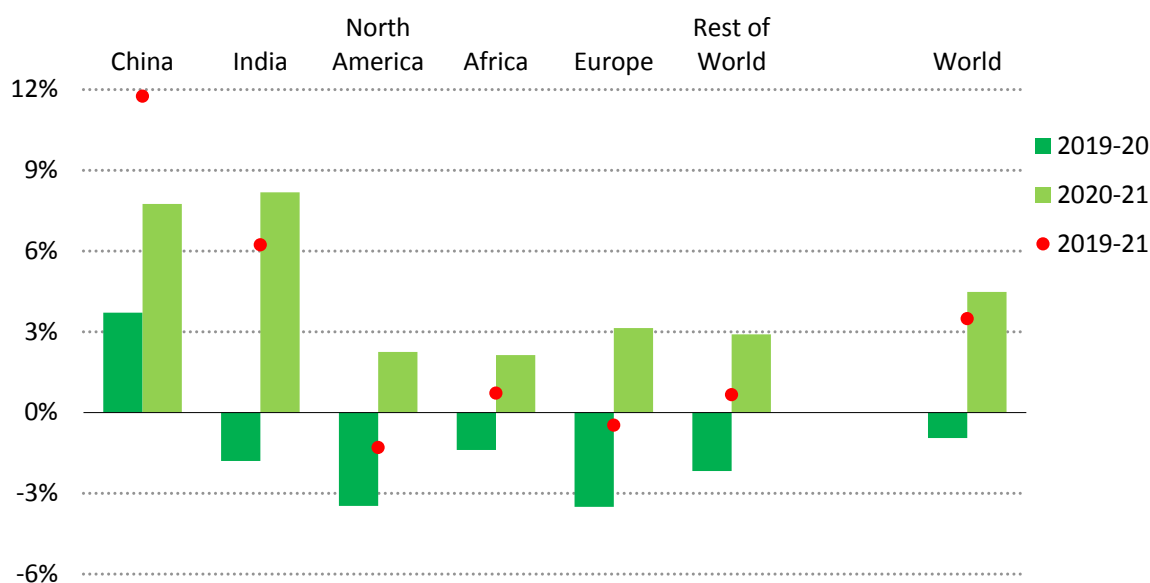
In advanced economies, vaccination campaigns against Covid-19 are expected to enable the progressive lifting of restrictions between spring and autumn. The anticipated demand growth of 2.5% should be sufficient to push demand within 1% of 2019 levels. In the United States, demand is expected to increase by around 2%, boosted by economic stimulus and colder temperatures during the early months of 2021. This increase should push demand to within 1.6% of 2019 levels.

The largest consumers in the European Union – Germany, France, Italy and Spain – are anticipated to remain below 2019 levels, with an increase of almost 3% in 2021 failing to fully make up for declines of 4% to 6% in 2020. It is similar in Japan, where demand is expected to rebound only 1% from 2020 levels, far from sufficient to reverse the 4% decline in 2020.

Demand in emerging and developing economies remains on the growth trajectory that resumed in the second half of 2020. This trajectory will be accelerated by the projected strong economic recovery for China and India.

With a projected 2021 GDP growth of 9% in China and 12% in India, electricity demand is expected to grow by around 8% in both countries compared with 2020. For China, the projected increase comes on top of 2020 growth, putting demand in 2021 almost 12% above 2019 levels. Southeast Asian countries are also expected to see a strong return to growth, with demand increasing 5% in 2021, putting total demand 3% above 2019 levels.

Change in electricity demand in 2020 and 2021 by region



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Electricity supply

Electricity supply in 2020

Record growth of renewables – led by wind and solar PV, which in 2020 grew by 12% and 23%, respectively, combined with a decline in global electricity

demand – put fossil fuel-fired and nuclear power plants in a tight spot in 2020. Demand from non-renewable sources decreased by more than 3%.

Coal was the hardest hit among all sources of electricity in 2020, down 440 TWh. The 4.4% drop in generation from coal was the largest ever absolute decline and the largest relative decline in the past fifty years. Driven by low gas prices, the United States alone accounted for almost half of the global net decline. The European Union was responsible for an additional 23% of the decline – a decline largely offset by increases in generation from renewable sources.

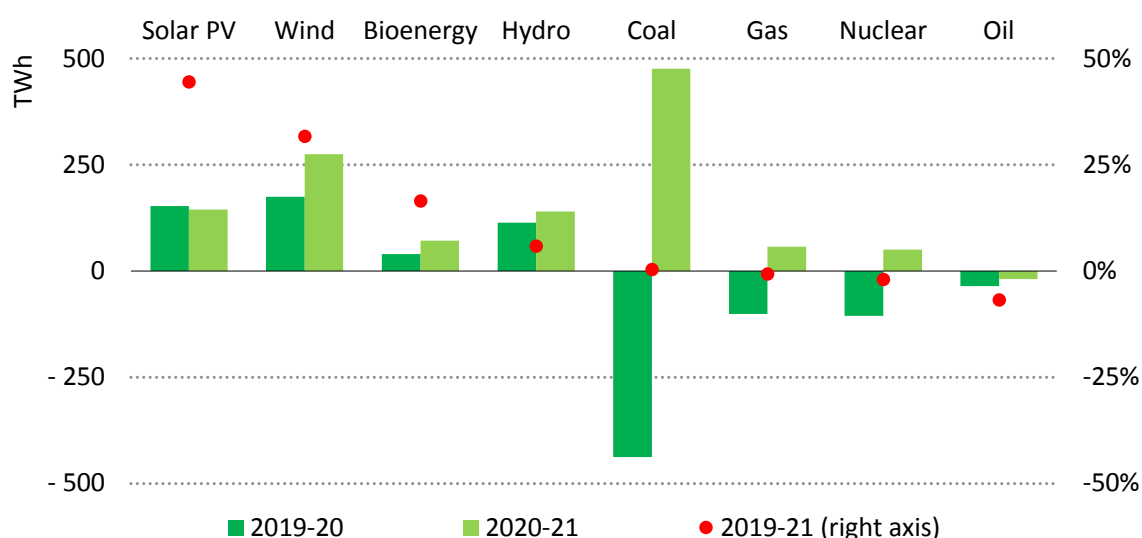
Gas-fired power plants experienced lesser declines in generation compared to coal, down only 1.6% in 2020. Gas was less affected owing to competitive prices, especially during the middle of the year. In the United States, where gas-fired generation increased by 2% in 2020, coal-fired generation dropped by a staggering 20%, or 210 TWh.

Oil continued its uninterrupted global decline since 2012, decreasing by 4.4%.

Electricity supply in 2021

Recent developments promise the 20th consecutive year of growth for renewables-based electricity generation in 2021. Expanding generation from renewables is expected to provide just over half of the increase in electricity supply in 2021. With generation from nuclear expected to increase by around 2%, the remaining electricity demand growth is met by coal and gas-fired power plants.

Change in electricity generation in 2020 and 2021



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The majority of the increase in electricity generation from fossil fuels is likely to be provided by coal-fired power plants, with their output expected to increase by 480 TWh. Due to upward pressure on gas prices, natural gas benefits to only a small extent (+1%). In the United States, where coal-fired generation dropped by around 20% in 2020, we expect about half of this loss to be reversed in 2021 – as coal-to-gas switching is unwound in some parts of the country. As a result, gas-fired generation falls by almost 80 TWh in 2021 in the United States.

Well over half of the increase in coal-fired electricity generation in 2021 is anticipated in China. Although representing about 45% of additional global renewable generation, around half of the 8% increase in electricity supply in China is provided by fossil fuels in 2021, pushing generation from coal in China up by 330 TWh (or 7%) on 2019 levels. In India, which is expected to have the second-largest absolute demand growth after China, 70% of additional electricity demand in 2021 will be covered by thermal generation – almost all from coal.

Nuclear

Nuclear power in 2020

Electricity generation from nuclear reactors decreased by around 4% – the largest decline since the aftermath of the Fukushima accident in 2011. Major reductions took place in the European Union (-11%), Japan (-33%) and the United States (-2%). The decline in Europe resulted from depressed electricity demand, temporary shutdowns for scheduled and unscheduled maintenance, and permanent shutdowns. In Japan, some reactors were temporarily shut for work required in order to meet new anti-terrorism safety standards. Nuclear power increased in China (5%) and Russia (3%), with new units being commissioned during 2019 and 2020. In Belarus and the United Arab Emirates, the first nuclear units entered commercial operation, with more units currently under construction.

Nuclear power in 2021

Nuclear power rebounds and increases 2% in 2021, reversing only half of the decline in output that took place in 2020. Seven new reactors came online in the second half of 2020 and Q1 2021, more than offsetting the three reactors retired over the same period. Up to ten more new reactors could be connected to the grid worldwide by the end of 2021, including four in China. Despite the increase in operational capacity over the course of the year, global nuclear power in 2021 remains slightly below the 2019 level.

Across advanced economies, nuclear power increases slightly in 2021, with output remaining 6% below 2019 levels. Nonetheless, nuclear remains the largest single source of low-carbon generation in these economies.

Nuclear power in the United States is expected to decline further in 2021, with five reactors scheduled to be retired during the year, leaving output more than 4% below 2019 levels. The anticipated declines in the United States in 2021 offset increases in other advanced economies. In Japan, the progressive restart of reactors is likely to increase nuclear output by 6% in 2021, reversing only a small fraction of the 30 TWh decline in output in 2020. Across the European Union, output is set to increase by more than 2% in 2021, due primarily to higher electricity demand in France and a new reactor in Slovakia, but this increase is insufficient to make up for the drop in 2020. In emerging market and developing economies, nuclear power is set to increase by over 5% in 2021, with new reactors coming

online in several countries, led by China and complemented by new reactors in India, United Arab Emirates, Pakistan and Russia. The growth in 2021 pushes output from nuclear to 8% above 2019 levels, with emerging market and developing economies increasing their share of global nuclear output to almost one-third, up from 29% in 2019.

Methodological note

This release is based on data for the first quarter of 2021 (Q1) from numerous sources, using data available as of mid-April 2021. Data are available for around two-thirds of global primary energy demand.

In general, the data collected include the latest monthly IEA country data submissions through end-February and end-March when available; other statistical releases from national administrations around the world; and IEA estimates where official data are missing.

Oil demand data by country issue from the recent market data compiled for the latest monthly IEA Oil Market Report, published on 14 April 2021.

Gas demand data have been collected for around two-thirds of global gas demand. Data include information from the EIA for the United States, transmission system operators in Europe, CQPGX for China, PPAC for India, KOGAS for Korea and LNG import data as a proxy for gas demand in several additional countries.

Coal demand data are derived principally from coal-fired electricity generation information, with available data covering around two-third of global coal demand.

Data collected for renewable energy production in 2020 and Q1 2021 were combined with renewable energy capacity additions in over 100 countries.

Daily, weekly and monthly electricity demand and generation data were compiled from several sources, such as the United States EIA hourly data, ENTSO-E hourly data for Europe, latest monthly submission for OECD countries, National Load Dispatch Centre daily data for India, as well as China and Brazil. Collected electricity demand and generation data cover around three-quarters of global electricity demand.

As a result of possible differences in data collection methodologies and data definitions, real-time and daily data may not match the methodologies used for monthly, quarterly or annual data.

The impact of the pandemic on sectoral and economy-wide activity was assessed based on quarterly and annual data from Oxford Economics (2021) for countries available (a combined share of more than 85% of global GDP for quarterly data and 95% for annual data). These were complemented by annual data from the [World Economic Outlook Database](#).

CO2 emissions include emissions from all uses of fossil fuels for energy purposes. CO2 emissions do not include emissions from industrial processes, industrial waste and non-renewable municipal waste. CO2 emissions from international marine and aviation bunkers are included at the world level only.

Acknowledgements, contributors and credits

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