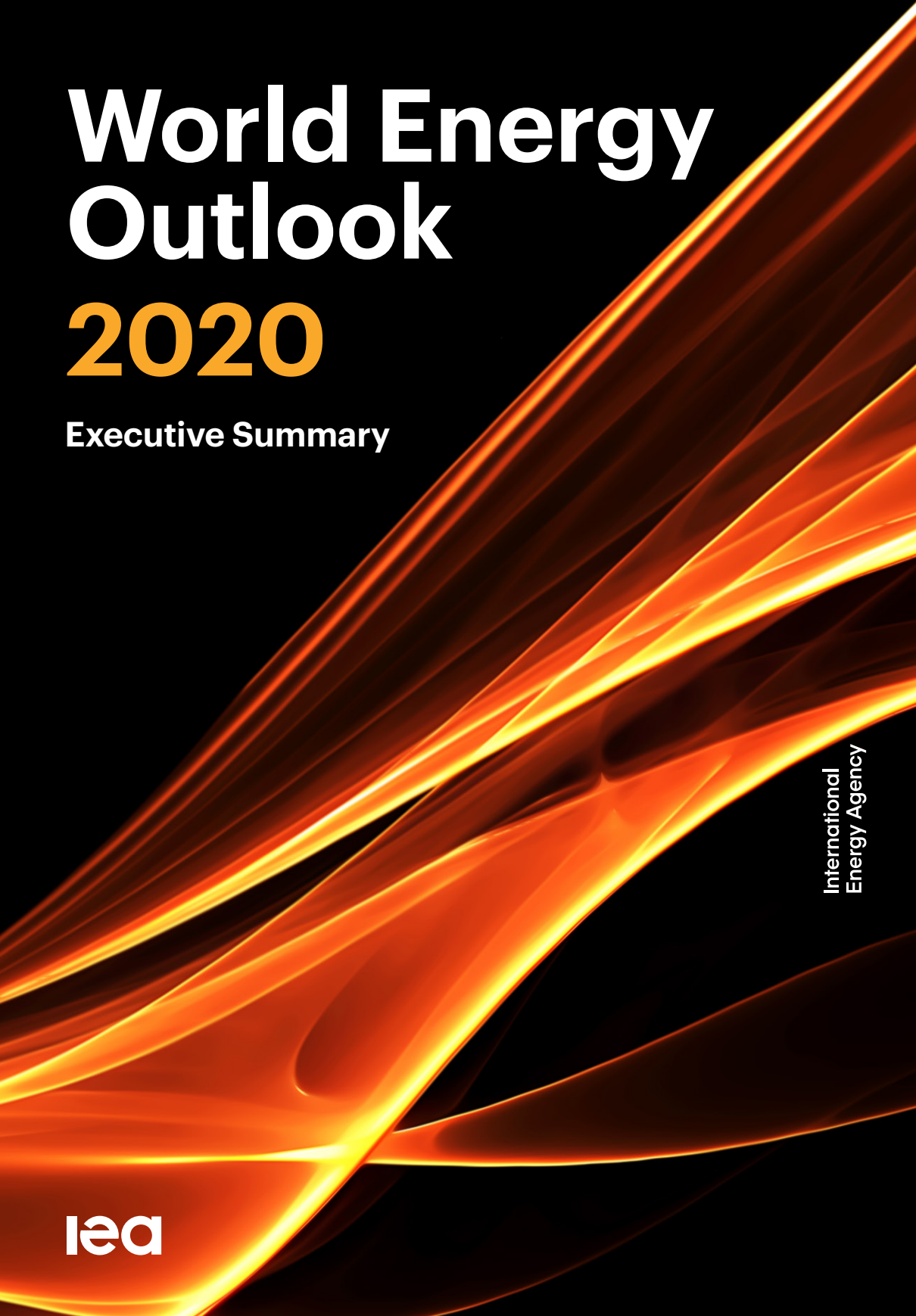
World Energy Outlook 2020

Executive Summary



International Energy Agency

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INTERNATIONAL ENERGY AGENCY

The IEA examines the full spectrum of energy issues including oil, gas and coal supply and demand, renewable energy technologies, electricity markets, energy efficiency, access to energy, demand side management and much more. Through its work, the IEA advocates policies that will enhance the reliability, affordability and sustainability of energy in its 30 member countries, 8 association countries and beyond.

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The Covid-19 pandemic has caused more disruption to the energy sector than any other event in recent history, leaving impacts that will be felt for years to come. This IEA *World Energy Outlook (WEO)* examines in detail the effects of the pandemic, and in particular how it affects the prospects for rapid clean energy transitions. It is too soon to say whether today's crisis represents a setback for efforts to bring about a more secure and sustainable energy system, or a catalyst that accelerates the pace of change. The pandemic is far from over, many uncertainties remain and crucial energy policy decisions have yet to be made.

This *Outlook* explores different pathways out of the Covid-19 crisis, with a particular focus on a pivotal next ten years to 2030. At this hugely consequential moment for the energy sector and for the urgent global response to climate change, the *WEO-2020* illustrates the historic nature of the choices, opportunities and pitfalls that will shape where we go from here.

A huge shock to the system

Our assessment is that global energy demand is set to drop by 5% in 2020, energy-related CO_2 emissions by 7%, and energy investment by 18%. The impacts vary by fuel. The estimated falls of 8% in oil demand and 7% in coal use stand in sharp contrast to a slight rise in the contribution of renewables. The reduction in natural gas demand is around 3%, while global electricity demand looks set to be down by a relatively modest 2% for the year. The 2.4 gigatonnes (Gt) decline takes annual CO_2 emissions back to where they were a decade ago. However, the initial signs are that there may not have been a similar fall in 2020 in emissions of methane – a powerful greenhouse gas – from the energy sector, despite lower oil and gas output.

There is no single storyline about the future

Uncertainty over the duration of the pandemic, its economic and social impacts, and the policy responses open up a wide range of possible energy futures. By considering different assumptions about these key unknowns, along with the latest energy market data and a dynamic representation of energy technologies, this *Outlook* examines:

- The **Stated Policies Scenario** (STEPS), in which Covid-19 is gradually brought under control in 2021 and the global economy returns to pre-crisis levels the same year. This scenario reflects all of today's announced policy intentions and targets, insofar as they are backed up by detailed measures for their realisation.
- The **Delayed Recovery Scenario** (DRS) is designed with the same policy assumptions as in the STEPS, but a prolonged pandemic causes lasting damage to economic prospects. The global economy returns to its pre-crisis size only in 2023, and the pandemic ushers in a decade with the lowest rate of energy demand growth since the 1930s.
- In the **Sustainable Development Scenario** (SDS), a surge in clean energy policies and investment puts the energy system on track to achieve sustainable energy objectives in full, including the Paris Agreement, energy access and air quality goals. The assumptions on public health and the economy are the same as in the STEPS.

- The new **Net Zero Emissions by 2050 case** (NZE2050) extends the SDS analysis. A rising number of countries and companies are targeting net-zero emissions, typically by mid-century. All of these are achieved in the SDS, putting global emissions on track for net zero by 2070. The NZE2050 includes the first detailed IEA modelling of what would be needed in the next ten years to put global CO_2 emissions on track for net zero by 2050.

The shadow of the pandemic looms large

Global energy demand rebounds to its pre-crisis level in early 2023 in the STEPS, but this is delayed until 2025 in the event of a prolonged pandemic and deeper slump, as in the DRS. Prior to the crisis, energy demand was projected to grow by 12% between 2019 and 2030. Growth over this period is now 9% in the STEPS, and only 4% in the DRS. With demand in advanced economies on a declining trend, all of the increase comes from emerging market and developing economies, led by India. The slower pace of energy demand growth puts downward pressure on oil and gas prices compared with pre-crisis trajectories, although the large falls in investment in 2020 also increase the possibility of future market volatility. Lower growth in incomes cuts into construction activities and reduces purchases of new appliances and cars, with the effects on livelihoods concentrated in developing economies. In the DRS, residential floor space is 5% lower by 2040, 150 million fewer refrigerators are in use, and there are 50 million fewer cars on the road than in the STEPS.

The worst effects are felt among the most vulnerable

Reversing several years of progress, our analysis shows that the number of people without access to electricity in sub-Saharan Africa is set to rise in 2020. Around 580 million people in sub-Saharan Africa lacked access to electricity in 2019, three-quarters of the global total, and some of the impetus behind efforts to improve this situation has been lost. Governments are attending to the immediate public health and economic crisis, utilities and other entities that deliver access face serious financial strains, and borrowing costs have risen significantly in countries where the access deficit is high. Regaining momentum on this issue is particularly challenging in the DRS. In addition, we estimate that a rise in poverty levels worldwide may have made basic electricity services unaffordable for more than 100 million people who already had electricity connections, pushing these households back to relying on more polluting and inefficient sources of energy.

Solar becomes the new king of electricity…

Renewables grow rapidly in all our scenarios, with solar at the centre of this new constellation of electricity generation technologies. Supportive policies and maturing technologies are enabling very cheap access to capital in leading markets. With sharp cost reductions over the past decade, solar PV is consistently cheaper than new coal- or gas-fired power plants in most countries, and solar projects now offer some of the lowest cost electricity ever seen. In the STEPS, renewables meet 80% of the growth in global electricity demand to 2030. Hydropower remains the largest renewable source of electricity, but solar is the main driver of growth as it sets new records for deployment each year after 2022,

followed by onshore and offshore wind. The advance of renewable sources of generation, and of solar in particular, as well as the contribution of nuclear power, is much stronger in the SDS and NZE2050. The pace of change in the electricity sector puts an additional premium on robust grids and other sources of flexibility, as well as reliable supplies of the critical minerals and metals that are vital to its secure transformation. Storage plays an increasingly vital role in ensuring the flexible operation of power systems, with India becoming the largest market for utility-scale battery storage.

…but the downturn creates risks for the backbone of today's power systems

Electricity grids could prove to be the weak link in the transformation of the power sector, with implications for the reliability and security of electricity supply. The projected requirement for new transmission and distribution lines worldwide in the STEPS is 80% greater over the next decade than the expansion seen over the last ten years. The importance of electricity networks rises even more in faster energy transitions. However, the financial health of many utilities, especially in developing economies, has worsened as a result of the crisis. There is a disparity in many countries between the spending required for smart, digital and flexible electricity networks and the revenues available to grid operators, creating a risk to the adequacy of investment under today's regulatory structures.

Covid-19 has catalysed a structural fall in global coal demand…

Coal demand does not return to pre-crisis levels in the STEPS and its share in the 2040 energy mix falls below 20% for the first time since the Industrial Revolution. Coal use for power generation is heavily affected by downward revisions in electricity demand and its use in industry is tempered by lower economic activity. Coal phase-out policies, the rise of renewables and competition from natural gas lead to the retirement of 275 gigawatts (GW) of coal-fired capacity worldwide by 2025 (13% of the 2019 total), including 100 GW in the United States and 75 GW in the European Union. Projected increases in coal demand in developing economies in Asia are markedly lower than in previous *WEOs*, and not enough to offset falls elsewhere. The share of coal in the global power generation mix falls from 37% in 2019 to 28% in 2030 in the STEPS, and to 15% by then in the SDS.

…but without an additional policy push, it is too soon to see a rapid decline of oil

The era of growth in global oil demand comes to an end within ten years, but the shape of the economic recovery is a key uncertainty. In both the STEPS and the DRS, oil demand flattens out in the 2030s. However, a prolonged economic downturn knocks more than 4 million barrels per day (mb/d) off oil demand in the DRS, compared with the STEPS, keeping it below 100 mb/d. Changes in behaviour resulting from the pandemic cut both ways. The longer the disruption, the more some changes that eat into oil consumption become engrained, such as working from home or avoiding air travel. However, not all the shifts in consumer behaviour disadvantage oil. It benefits from a near-term aversion to public transport, the continued popularity of SUVs and the delayed replacement of older, inefficient vehicles.

In the absence of a larger shift in policies, it is still too early to foresee a rapid decline in oil demand. Rising incomes in emerging market and developing economies create strong underlying demand for mobility, offsetting reductions in oil use elsewhere. But transport fuels are no longer a reliable engine for growth. Oil use for passenger cars peaks in both the STEPS and the DRS, brought lower by continued improvements in fuel efficiency and robust growth in sales of electric cars. Oil use for longer-distance freight and shipping varies according to the outlook for the global economy and international trade. Upward pressure on oil demand increasingly depends on its rising use as a feedstock in the petrochemical sector. Despite an anticipated rise in recycling rates, there is still plenty of scope for demand for plastics to rise, especially in developing economies. However, since oil used to make plastics is not combusted, our scenarios see a peak in total oil-related CO_2 emissions.

Looking beyond the glut: long-term policy questions for natural gas

Natural gas fares better than other fossil fuels, but different policy contexts produce strong variations. In the STEPS, a 30% rise in global natural gas demand by 2040 is concentrated in South and East Asia. Policy priorities in these regions – notably a push to improve air quality and to support growth in manufacturing – combine with lower prices to underpin the expansion of gas infrastructure. By contrast, this is the first *WEO* in which the STEPS projections show gas demand in advanced economies going into slight decline by 2040. An uncertain economic recovery also raises questions about the future prospects of the record amount of new liquefied natural gas export facilities approved in 2019.

Greater transparency on methane emissions seems to be on the way, with implications for the environmental credentials of different sources of gas. In carbon-intensive economies, natural gas continues to benefit from lower emissions, compared with coal. However, this is less of an asset in countries planning a pathway to net-zero emissions, where coal is often already in decline. Methane emissions along gas supply chains – as highlighted in the IEA's *Methane Tracker* – remain a crucial uncertainty, although better data from companies and from aerial measurements, including from satellites, should soon improve understanding of the sources of leaks from across the energy sector. In Europe in the STEPS, and in all parts of the world in the SDS, the challenge for the gas industry is to retool itself for a different energy future. This can come via demonstrable progress with methane abatement, via alternative gases such as biomethane and low-carbon hydrogen, and technologies like carbon capture, utilisation and storage (CCUS).

Major dilemmas facing oil and gas producers, and risks to investment

Lower prices and downward revisions to demand, resulting from the pandemic, have cut around one-quarter off the value of future oil and gas production. Many oil and gas producers, notably those in the Middle East and Africa such as Iraq and Nigeria, are facing acute fiscal pressures as a result of high reliance on hydrocarbon revenues. Now, more than ever, fundamental efforts to diversify and reform the economies of some major oil and gas exporters look unavoidable. The US shale industry has met nearly 60% of the increase in global oil and gas demand over the last ten years, but this rise was fuelled by easy credit that has now dried up. So far in 2020, leading oil and gas companies have

reduced the reported worth of their assets by more than $50 billion, a palpable expression of a shift in perceptions about the future. Investment in oil and gas supply has fallen by one-third compared with 2019, and the extent and timing of any pick-up in spending is unclear. So too is the ability of the industry to meet it in a timely way: this could presage new price cycles and risks to energy security.

Low-cost resources, low emissions and diversification are becoming the strategic watchwords for many producer economies and for oil and gas companies. Declines in production from existing fields create a need for new upstream projects, even in rapid energy transitions. However, investors are looking with increased scepticism at oil and gas projects due to concerns about financial performance and the compatibility of company strategies with environmental goals. Some of the financial concerns might ease if prices pick up and projects start to offer better returns, but questions about the industry's contribution to reducing emissions are not going to go away.

As things stand, the world is not set for a decisive downward turn in emissions…

Global emissions are set to bounce back more slowly than after the financial crisis of 2008-2009, but the world is still a long way from a sustainable recovery. CO_2 emissions in the STEPS edge above 2019 levels on their way to 36 Gt in 2030. Emissions are lower in the event of a delayed recovery, but a weaker economy also drains momentum from the process of change in the energy sector. Lower fuel prices, compared with pre-crisis trajectories, mean that payback periods for efficiency investments are extended, slowing the rate of global efficiency improvement. The pandemic and its aftermath can suppress emissions, but low economic growth is not a low-emissions strategy. Only an acceleration in structural changes to the way the world produces and consumes energy can break the emissions trend for good.

…but there are much more sustainable pathways out of the crisis…

A step-change in clean energy investment, in line with the IEA Sustainable Recovery Plan, offers a way to boost economic recovery, create jobs and reduce emissions. This approach has not featured prominently in the plans proposed to date, except in the European Union, the United Kingdom, Canada, Korea, New Zealand and a handful of other countries. In the SDS, full implementation of the IEA Sustainable Recovery Plan, published in June 2020 in co-operation with the International Monetary Fund, puts the global energy economy on a different post-crisis track. Additional investment of $1 trillion a year between 2021 and 2023 in the SDS is directed towards improvements in efficiency, low-emissions power and electricity grids, and more sustainable fuels. This makes 2019 the definitive peak for global CO_2 emissions. By 2030, emissions in the SDS are nearly 10 Gt lower than in the STEPS.

…that also bring cleaner air than during the 2020 lockdowns

Cities see major improvements in air quality by 2030 in the SDS, but without the disruptions to economic activity or people's lives that cleared the air in 2020. Over the next ten years, lower emissions from urban power plants, residential heating units and

industrial facilities in the SDS lead to falls of 45-65% in concentrations of fine particulate matter in cities, and cleaner transportation also brings down other street-level pollutants. Major reductions in indoor pollution in developing economies also come from improved access to clean cooking. The SDS does not eliminate all sources of air pollution entirely, but while the toll of premature deaths from poor air quality continues to rise in the STEPS, the SDS would avoid more than 12 million premature deaths over the next decade.

Avoiding new emissions is not enough: if nothing is done about emissions from existing infrastructure, climate goals are surely out of reach

Detailed new analysis shows that, if today's energy infrastructure continues to operate as it has in the past, it would lock in by itself a temperature rise of 1.65 °C. All of today's power plants, industrial plants, buildings and vehicles will generate a certain level of future emissions if they continue to rely on unabated combustion of fossil fuels. If all of these assets, as well as power plants currently under construction, were operated for similar lifetimes and in similar ways as in the past, they would still be emitting around 10 Gt of CO_2 in 2050. That is why the SDS not only includes much faster deployment of clean energy technologies, but also envisages the operation of existing carbon-intensive assets in a very different way from the STEPS. Existing coal-fired power plants, for example, are either retrofitted, repurposed or retired in the SDS in order to halve coal-fired emissions by 2030.

The transformation has to extend well beyond the power sector

The power sector takes the lead, but a wide range of strategies and technologies are required to tackle emissions across all parts of the energy sector. Emissions from the power sector drop by more than 40% by 2030 in the SDS, with annual additions of solar PV almost tripling from today's levels. Electricity takes an ever-greater role in overall energy consumption, as rising output from renewables and nuclear power helps to bring down emissions from sectors – such as passenger transport – that are cost effective to electrify. The harder tasks for the transformation of the energy sector lie elsewhere, particularly in industrial sectors such as steel and cement, in long-distance transport, in the balancing of multiple changes taking place in parallel across a complex energy system, and in securing and maintaining public acceptance. Maintaining a strong pace of emissions reductions post-2030 requires a relentless focus on energy and material efficiency, electrification, and a strong role for low-carbon liquids and gases. Low-carbon hydrogen and CCUS scale up significantly, building on a decade of rapid innovation and deployment in the 2020s.

The vision of a net-zero emissions world is coming into focus…

The ambitious pathway mapped out in the SDS relies on countries and companies hitting their announced net-zero emissions targets on time and in full. These are mostly targets for 2050, although there are individual countries that have set earlier targets and, most recently, China announced a 2060 date for carbon neutrality. Realising these goals is important not only for the countries and companies concerned, but also for accelerating progress elsewhere by bringing down technology costs and by developing regulations and markets for low-emissions products and services.

…and ambitious actions over the next decade are critical

Reaching net zero globally by 2050, as in the NZE2050, would demand a set of dramatic additional actions over the next ten years. Bringing about a 40% reduction in emissions by 2030 requires, for example, that low-emissions sources provide nearly 75% of global electricity generation in 2030 (up from less than 40% in 2019), and that more than 50% of passenger cars sold worldwide in 2030 are electric (from 2.5% in 2019). Electrification, massive efficiency gains and behavioural changes all play roles, as does accelerated innovation across a wide range of technologies from hydrogen electrolysers to small modular nuclear reactors. No part of the energy economy can lag behind, as it is unlikely that any other part would be able to move at an even faster rate to make up the difference.

Getting to net zero will require unwavering efforts from all

To reach net-zero emissions, governments, energy companies, investors and citizens all need to be on board – and will all have unprecedented contributions to make. The changes that deliver the emissions reduction in the SDS are far greater than many realise, and need to happen at a time when the world is trying to recover from Covid-19. They rely on continuous support from key constituencies across the world, while also meeting the development aspirations of a growing global population. Achieving net-zero emissions globally by 2050 goes well beyond this, both in terms of the actions within the energy sector and those that would be required elsewhere. For any pathway to net zero, companies will need clear long-term strategies backed by investment commitments and measurable impact. The finance sector will need to facilitate a dramatic scale up of clean technologies, aid the transitions of fossil fuel companies and energy-intensive businesses, and bring low-cost capital to the countries and communities that need it most. Engagement and choices made by citizens will also be crucial, for example in the way they heat or cool their homes, or how they travel.

Governments have the decisive role

At a moment when Covid-19 has created extraordinary uncertainty, governments have unique capacities to act and to guide the actions of others. They can lead the way by providing the strategic vision, the spur to innovation, the incentives for consumers, the policy signals and the public finance that catalyses action by private actors, and the support for communities where livelihoods are affected by rapid change. They have the responsibility to avoid unintended consequences for the reliability or affordability of supply. Our secure and sustainable energy future is a choice – for consumers, investors and industries, but most of all, for governments.

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The World Energy Outlook, the IEA's flagship publication, provides a comprehensive view of how the global energy system could develop in the coming decades.

This year's exceptional circumstances require an exceptional approach. The usual long-term modelling horizons are kept but the focus for this new Outlook is firmly on the next ten years, exploring in detail the impacts of the Covid-19 pandemic on the energy sector and the near-term actions that could accelerate clean energy transitions.

The analysis targets the key uncertainties facing the energy sector in relation to the duration of the pandemic and its implications, while mapping out the choices that would pave the way towards a sustainable recovery.

The strategic insights from the *WEO-2020* are based on detailed modelling of different potential pathways out of the crisis, covering all regions, fuels and technologies and using the latest data on energy markets, policies and costs.