HSBC Global Research

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Energy & Climate Watch

The 'race to net zero' is on

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- The IEA's net zero pathway to 2050 lays out clear, and in some cases immediate, implications for the energy sector
- The implied actions and milestones could become new 'anchors' for sentiment among several actors
- Report is the first of several that will likely set tone for climate talks later this year, with a focus on need for urgent action

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An energy pathway for net zero by 2050 with clear implications for oil & gas: The IEA's "Net Zero Emissions by 2050" scenario (published on 18 May 2021) provides one of the most detailed energy system pathways that aims to bring energy-related emissions down to net zero by 2050. This is two decades earlier than the more commonly referenced date of 2070 (which would deliver the goals of the Paris Agreement) and reflects the rising climate ambitions among countries, companies and investors. While it draws on some well-known decarbonisation traits – such as pushing clean energy deployment and ramping up technology innovation – it also takes a markedly more bearish view on the need for new future fossil fuel supply investment. The scenario details that the world needs no new upstream oil & gas project sanctions beyond 2021, and outlines a materially diminished future role for fossil fuels to reach net zero in 2050; starting almost immediately.

It's not a forecast, but crucially demonstrates technical feasibility: The IEA pathway is very ambitious, contains significant uncertainties and pushes the limits of the speed and scale of global climate action; but it is deliverable. Crucially, it highlights that a 2050 net zero energy system is technically feasible, if action is taken both swiftly and broadly. This implies that that what is missing is sufficient ambition and conviction to act – a notion could that could serve as a relevant backdrop for whether credible national climate commitments are put forward at COP26 in November this year, and followed up with policy frameworks that deliver.

Findings could shape attitudes of policymakers, corporates and investors: It can be argued that the IEA's net zero pathway will carry more weight than previous similar works, given the institution's role in global energy analysis. Many actors use its scenarios to benchmark and check consistency of actions, policies and strategies with global climate targets. With the new pathway detailing a set of granular milestones to meet a net zero ambition, we believe it could influence thinking in policy design, corporate strategies as well as investor efforts to align with climate goals – and with it potentially creating new expectations.

The first of a number of flagship climate releases in a busy climate year: In a year that is set to be crucial for shaping the global trajectory on climate action for many years, the new IEA pathway gives the clearest description of 'how' to get to a net zero energy system. It is likely to be viewed in parallel with the forthcoming latest iteration of The Intergovernmental Panel on Climate Change's (IPCC) work on the potential implications of climate change for the world. Both pieces, among others, are likely to frame the rounds of debate on climate set to take place globally in 2021.

This is an abridged version of a report by the same title published on 20-May-21. Please contact your HSBC representative or email AskResearch@hsbc.com for more information.

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Threading the net zero needle

- IEA scenario highlights that net zero energy by 2050 is feasible, but challenging…
- Absence of need for new fossil fuel supply investment could increase scrutiny of some company and country 'net zero' strategies
- In crucial year for climate efforts, it could influence several strands of the debate, setting new expectations around action and urgency

Demanding, ambitious, unparalleled, transformational, formidable

The IEA's net zero scenario is designed to provide clarity around the practicalities of increased climate ambition

Narrow, but achievable, is how the IEA described its pathway to delivering a net-zero energy system within 30 years, to limit global warming to 1.5°C, as part of its "*Net Zero Emissions by 2050*" report of 18 May 2021. The main thrust of the piece follows a well-trodden path for ambitious energy-climate scenarios – more technology innovation and massive clean energy deployment, coupled with an accelerated phase-out of fossil fuels. However, certain headline findings (such as the immediate negative implications for global upstream oil & gas investment) can be described as 'new', and the granularity of the pathway provides an expanded and clearer list of actions and milestones dates for parties to consider on a journey to net zero.

IEA's three-point plan for net zero by 2050

1. *Push existing decarbonisation measures to their maximum* – namely, activity in clean electricity (wind & solar), energy efficiency and electric vehicles needs to step up markedly
2. *Ramp-up innovation efforts to bring developing technologies up to scale deployment* – spending on the likes of hydrogen, carbon capture, synthetic fuels and bioenergy
3. *Sharp and almost immediate reduction in fossil fuel consumption and investment* – this extends across oil, natural gas and coal and calls for halting of new incremental project sanctioning beyond what is currently approved

The scenario is not without its pre-conditions and significant asks; for example, it needs: 1) global energy spending to increase markedly; 2) climate action ambition to both rise and be followed with conviction; 3) governments, companies and citizens to commit; and 4) action to start today.

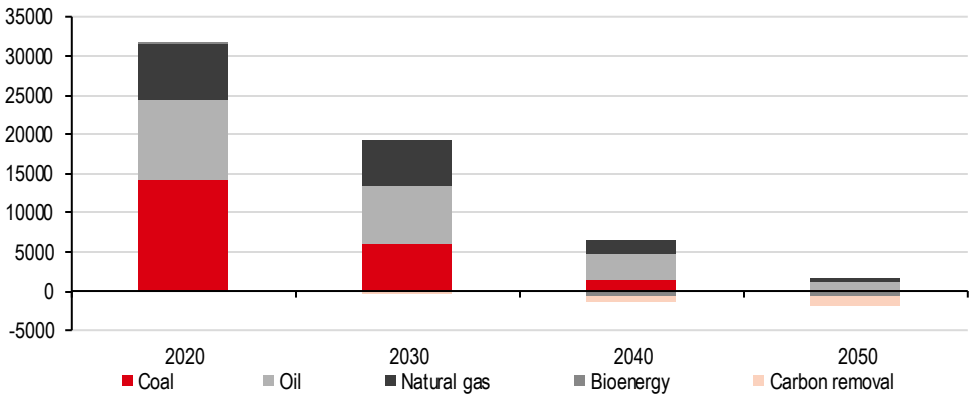
Its relevance

In short, the report highlights that, according to the group of leading energy experts (rather than scientists or NGOs), getting to net zero energy by 2050, with as few emissions or technological 'loopholes' as possible, can be done. While it also points to the significant actions needed to be taken, it does somewhat shift the narrative from one of technical feasibility toward a question of ambition and conviction. In doing so, it could provide a new anchor or benchmark for expectations around the future actions of countries, companies and investors, with respect to the degree of their alignment to ambitious climate mitigation goals.

IEA net zero pathway in charts

The pathway reaches 'net zero' emissions in 2050 from energy with limited need for 'negative' CO_2

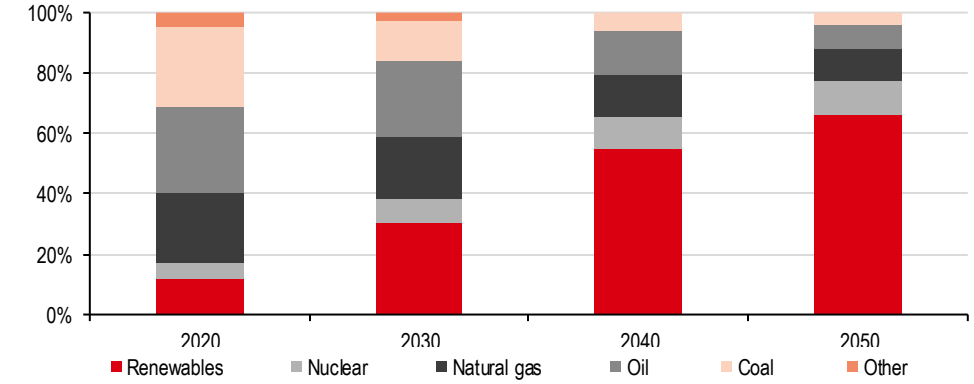
Global emissions to 2050 by fuel source / activity (m tonnes CO_2e)



Source: IEA

Surging renewables displace fossil fuels in the energy mix

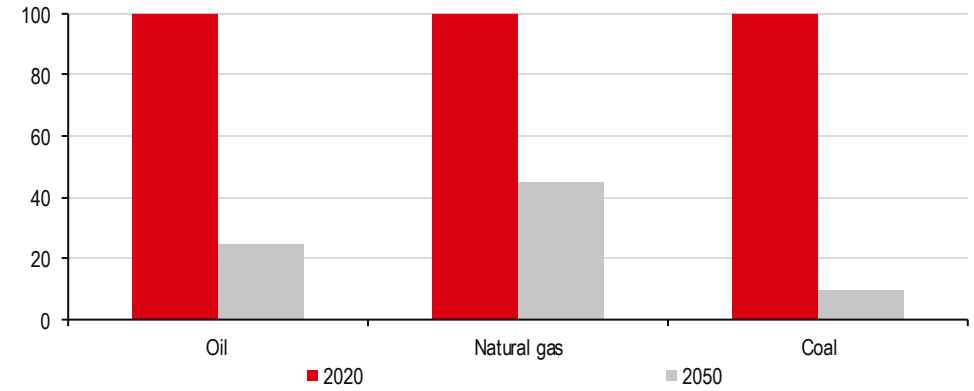
Energy supply to 2050 by fuel source (%)



Source: IEA

Absolute levels of oil, natural gas and coal use fall sharply to 2050

Coal, oil and gas supply/demand in 2050 (vs indexed 2020 levels)



Source: IEA

IEA 'net zero' by 2050 – in numbers, facts and context

Milestones, measures and facts about the IEA's pathway

- The IEA sees no new upstream oil & gas field developments required beyond those that are currently approved or sanctioned – effectively declaring a near-term peak in supply
- 2050 oil demand / supply is at 24mbd, compared to around 100mbd in 2019 (ie, pre COVID-19), with OPEC's share of supply rising to over 50% (from 34% in 2020)
- The world electricity system is carbon free by 2040, with 70% electricity from wind and solar in 2050 (from c10% today)
- Spending on energy needs to rise from around USD2trn a year today to USD5trn by 2030, and shift from mostly fossil-fuel based to largely low-carbon forms
- Around 45% of emissions reductions by 2050 are to come from technologies under development today (ie, not currently at commercial scale)
- Carbon prices in developed economies reach USD130/tonne CO_2 by 2030 and USD250/tonne CO_2 by 2050 (compared to current EU prices of cEUR50/tonne CO_2)
- The suite of actions needed include a number of energy demand measures that would change some everyday consumer choices (see page 7)
- The scope of the pathway covers the energy and industrial sectors, which together account for 90% of global CO_2 and 75% of total greenhouse gases (GHGs)
- In the scenario, the world economy in 2030 is around 40% larger than today but uses 7% less energy – highlighting the (often overlooked) role of energy efficiency measures
- The cumulative emissions in the scenario are consistent with levels to limit global warming to 1.5°C with 50% probability, and limited temperature overshoot
- According to the IEA, while government net zero pledges cover around 70% of global GDP and CO_2 emissions, fewer than a quarter are backed by legislation or policies

Comparison with HSBC scenarios and forecasts

We compare some of the IEA's data points with HSBC's own net zero pathway and market forecasts:

- HSBC's Future Frontier scenario models global zero-carbon electricity by 2035/2050 in developed/emerging markets, respectively
- Hydrogen electrolyser capacity globally of 850GW by 2030 (HSBC's current forecast is 126GW based on the current pipeline) and 3,000GW by 2045
- Carbon capture in the IEA's pathway reaches 4Gt CO2 by 2035 and over 7.5Gt CO2 by 2050 – HSBC's current forecast is 1Gt CO2 by 2050

What the report is…and what it isn't

The report outlines *one* route to net zero in the energy system, which is not exclusive, but one of many. The IEA's pathway does not rely on assumed carbon offsets outside of the energy sector, and has lower use of negative emissions technologies (like direct air capture) than other 1.5°C scenarios. It is also designed to facilitate economic growth and energy security. It achieves net zero emissions in the energy sector, but the other 25% of GHG emissions that occur in other parts of the system (eg, agriculture and land use) are not within its explicit scope. The pathway isn't a forecast or prediction, nor is it a country or company-specific decarbonisation template. It also rests on a series of assumptions that are arguably absent from today's on-the-ground reality.

How the scenario's implications may shape perceptions

How to reach net zero will likely be viewed alongside the implications of not meeting the goal…

We consider how the IEA's findings could inform discussions across engagement and benchmarking on climate mitigation action – including among governments, corporates and investors. It can be argued that the scenario (coming from the world's leading energy institution) adds enhanced credibility to the net zero ambition narrative, and arms parties with concrete data points concerning what is needed to reach the end-goal of a fully decarbonised energy system by 2050.

With global climate talks due to take place later this year, the IEA's findings may be seen to cover the 'what needs to be done' aspect of the climate-energy challenge. It is likely to be viewed in conjunction with the expected release of new findings from the IPCC (6th Assessment Report) around the potential impacts of not drastically curtailing global warming through sharp, and almost immediate, emissions cuts.

Policy

At a policy forming level, the IEA's roadmap could serve to not only guide overall ambition setting at a country level but also provide a sense check that influences debates around specific measures, say on certain fuels or technologies. For example, the role of natural gas (among others) in the EU Taxonomy for sustainable investment has been a hotly contested topic (*Financial Times*, 21 April). The new IEA pathway provides a clearer opinion around the consistency of new incremental upstream oil & gas investment (beyond currently approved projects) with net zero 2050 ambitions, which leaves significantly less scope for interpretation than previously. That is to say, while the IEA's scenario is not *the* definitive route to net zero emissions – which the European Union has legally set as its goal – it does, in our view, peg that debate closer towards one where there is notably less space for new investment in, say, natural gas supply.

Company climate strategies

…and findings could pose questions for policy makers, companies and investors

Leading on from the question about how net zero pathways could form policy decisions, it is also likely to influence engagement on, and interpretation of, corporate climate strategies. As company 'net zero' ambitions have become increasingly common – particularly in emissions intensive sectors – there has been a desire by stakeholders to test the consistency of company actions and spending patterns with overarching 'net zero' ambitions. For example, we recently highlighted the fact that oil & gas company upstream investment plans could come under increasing scrutiny for their compatibility with 2050 climate goals. The IEA's energy scenarios have often served as a benchmark for assessing alignment of company strategies with emissions ambitions – the new pathway laid out by the IEA will likely serve as a more stringent hurdle for companies to demonstrate alignment with 'net zero', in our view.

Investor portfolio alignment efforts

Finally, investor efforts to decarbonise investment portfolios and aligning them with a high degree of climate ambition could, in the future, reference the actions and milestones of the IEA pathway as a way to judge consistency with achieving global net zero in energy by 2050.

The feasibility question – do we have the tools that we need?

Debate has surfaced over whether net zero relies on yet-to-be invented means…

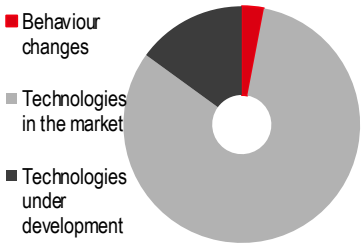
Whether the world has the means required to meet net zero emissions ambitions has shot up the agenda in recent days following comments from John Kerry, US Special Presidential Envoy for Climate, which implied that around 50% of emissions reductions *"are going to come from technologies we don't yet have"*.

In practise, the comments appear to refer to technologies that are not economical or available at scale today, but that are expected to have a meaningful role in reducing future emissions (for example, direct air capture and green hydrogen). In the context of the broader discussion around the energy transition, this speaks to the need to push innovation in emerging emissions-reducing technology, while ramping up the deployment of more established options.

In the charts below, the IEA identifies that technology readiness is significantly more advanced when considering what needs to be done in the energy system by 2030 to be aligned with net zero ambitions – in theory, removing the notion of a technology-based roadblock to short-term action. Energy investments in coming years are particularly important for minimising the amount of 'locked-in' future emissions from new, long-cycled, infrastructure builds. The technology availability gap starts to appear more prominently in the following 20 years (evidenced by the fact that over 45% of emissions reductions are expected to come from currently under-developed options), which the IEA argues highlights the need for meaningful innovation in coming years.

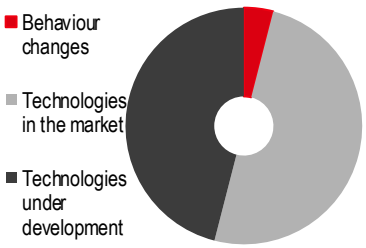
…and while the net zero toolbox is largely known, it will need innovation

Emissions reductions by technology readiness (% in 2030)



Source: IEA

Emissions reductions by technology readiness (% in 2050)



Source: IEA

Policy support and investment will be crucial to pushing innovation in 2020s

In terms of monetary amounts; the IEA points to the fact that decarbonisation technologies in areas such as electrification, hydrogen, bioenergy and carbon capture only get about a third of current public R&D funding that the more established zero-carbon electricity generation and energy efficiency technologies receive. It sees the need for up to USD90bn of public money to be allocated to demonstration projects in such emerging technologies by 2030; it estimates that less than 30% of that amount is currently accounted for in spending plans. We have previously highlighted the need for some key technologies to undergo significant deployment through policy support and corporate investment in the coming years in order to be in a position to play a meaningful role in future emissions reduction efforts.

Is the IEA's net zero pathway realistic?

One could argue that the scenario is unrepresentative of current global climate-energy decision-making

A question in many readers' minds will be whether a feasible scenario is a realistic one. By its own admission, the IEA net zero scenario is very ambitious and requires a number of trends, attitudes and commitments to drastically divert from current states. As a long-dated modelling exercise, it also inherently contains both assumptions and uncertainties. For example, it relies on several principles, namely that the energy transition is orderly, underpinned by rational decision-making in technology choices and policy making (eg, with respect to costs and benefit trade-offs), and features global cooperation towards delivering global net zero emissions. One can reasonably argue that none of these conditions are currently representative of the energy system dynamics.

Net zero also means pushing several technologies and measures to untested levels

All climate scenarios that limit warming to 1.5°C envisage significant and widespread change in the energy system with adoption levels of certain technologies at many multiples of current rates. However, compared to other prominent 1.5°C compliant scenarios, the new IEA pathway does foresee a proportionally smaller role for some (currently) less developed technologies, such as carbon capture and carbon dioxide removal. However, it sees a bigger role for others such as green hydrogen; it also relies on aggressive energy efficiency measures to help curb energy demand within the context of a growing economy and population. It takes a bullish view on how much wind and solar can power the world energy system – at around 70% of global electricity generation in 2050, a level that will seem unrealistic to many. Furthermore, while it factors in a less prominent role for bioenergy than other scenarios; the land devoted to the production of such energy would need to increase by 25% to reach 410m hectares in 2050 in its scenario (roughly equivalent to an area the size of India and Pakistan).

A collective effort is needed across governments, corporates and citizens

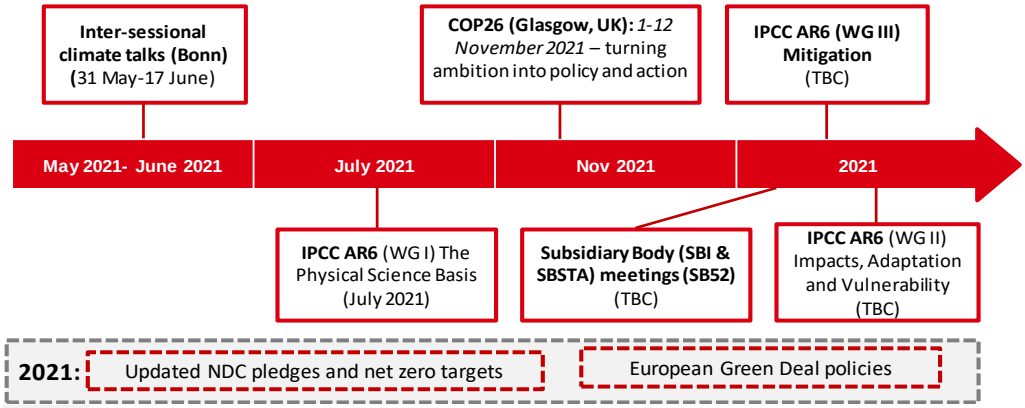
The lion's share of the focus of climate-energy models has often historically been on the supply side of the energy equation – in particular, an emphasis on lowering fossil fuel production. However, as the scope of climate mitigation plans have expanded beyond the role of upstream energy actors, we have noticed an evolution of the discussion to include a broader set of participants, including the likely required actions of individuals in climate mitigation action.

We see a growing prevalence of the notion that governments need to take the imperative to shape policy that provides clarity and an acceptable risk/reward for companies to channel investment. However, this policy and corporate investment need to be met by willing consumer actions. For example, the IEA estimates that over half of the cumulative emissions reductions in its pathway are in some way linked to consumer choices such as purchasing an electric vehicle or spending to improve home energy efficiency. In addition, there is increasing evidence to suggest that certain behavioural changes in energy consumption will be needed, such as foregoing car ownership and/or using more public transport and restricting long-haul air travel.

Net zero pathways and climate in 2021

A large part of the significance of the IEA's new report is its relevance for 2021, a crucial year for climate change ambitions. The coming months are set to build towards global climate talks at COP26, where nations are expected to revisit nationally determined contributions (NDCs) to the efforts to deliver on the goals of the Paris Agreement. Some major emitting nations have already indicated that they are revamping ambitions in advance of the conference. Scientific research around the potential impacts of climate change is also due to be updated over the course of the coming months, which will likely raise the urgency to act in discussions (see chart below).

Climate milestones in 2021



Source: HSBC

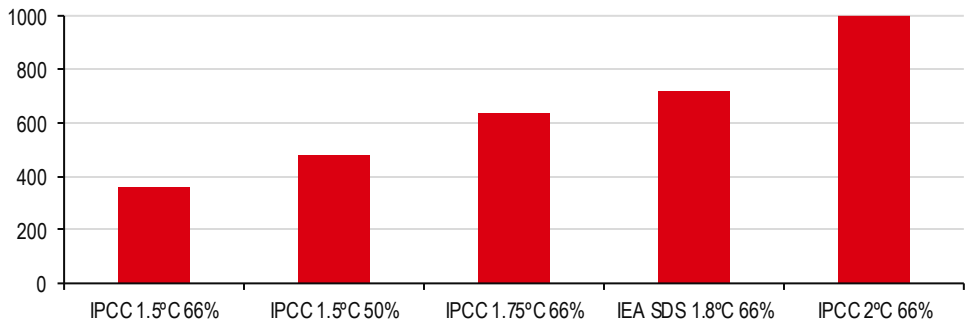
Net zero by 2050 is broadly consistent with limiting warming to 1.5°C…

The difference between 1.5°C and 2°C and the need for 'net zero' by 2050

The rise in prominence of 'net zero' emissions as a policy objective has meant that accompanying implied actions are increasingly aggressive and ambitious. This is due to the fact that because of historical emissions, the world's temperature has already warmed by more than 1°C compared to pre-industrial levels. The more we continue to emit (current total annual GHGs are in the order of 50GtCO$_2$e), the more needs to be done, and on a quicker timeframe, to bring emissions down to a net zero level to apply the brakes on atmospheric CO$_2$ level rises. According to scientific evidence, this reduction needs to happen in accordance with estimated 'carbon budgets' which vary according to warming limits and probability (chart below).

Estimated remaining global carbon budgets (cumulative emissions in GtCO$_2$e)

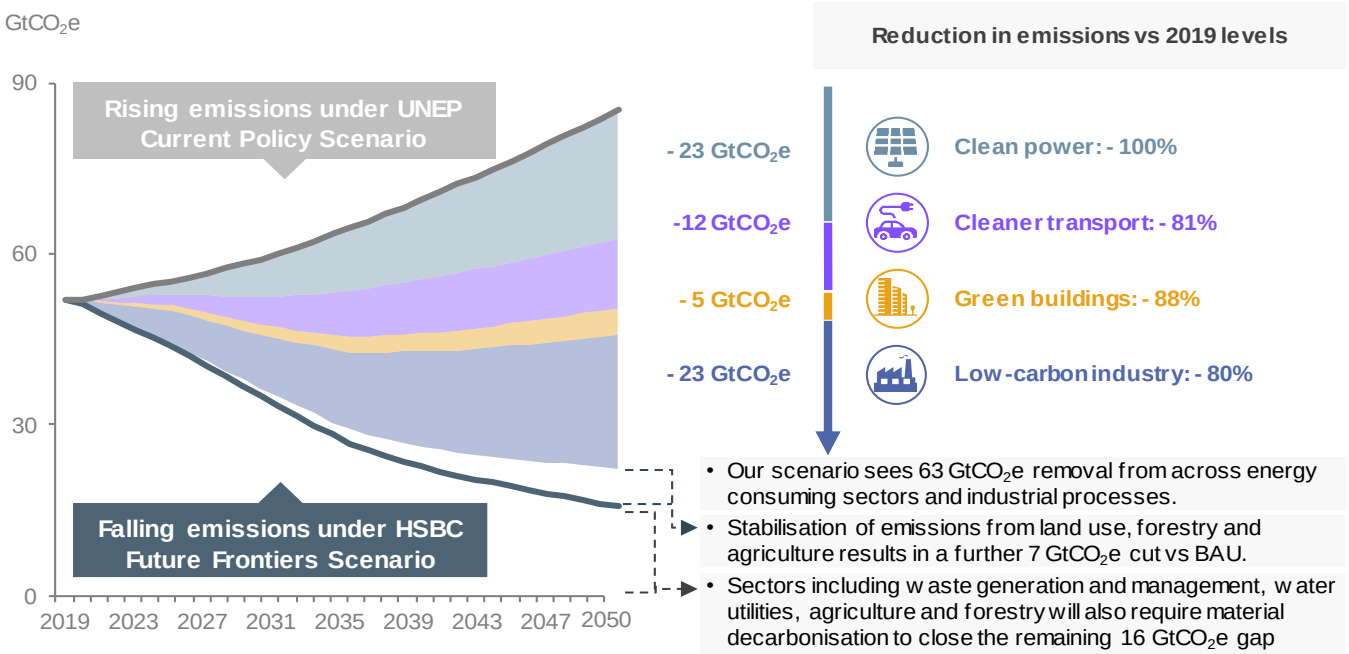
…which entails meeting a carbon 'budget' roughly half the size of 2°C



Source: IPCC, IEA

HSBC's Future Frontier pathway to 2050 net-zero

Our Future Frontiers Scenario shows how it is possible to close the gap between where we are headed and net-zero emissions by 81% by 2050



- Our scenario sees 63 $GtCO_2e$ removal from across energy consuming sectors and industrial processes.
- Stabilisation of emissions from land use, forestry and agriculture results in a further 7 $GtCO_2e$ cut vs BAU.
- Sectors including waste generation and management, water utilities, agriculture and forestry will also require material decarbonisation to close the remaining 16 $GtCO_2e$ gap towards net zero.

Clean power generation

- Coal and natural gas phased out by 2035 in developed markets, and mostly by 2050 in the rest of the world, with renewables growing rapidly, along with some nuclear, carbon capture and storage

Cleaner transport

- Diesel and gasoline make way for batteries and fuel cells in road transport by 2040, with global regulation limiting shipping and aviation emissions

Green buildings

- Retrofitting in existing buildings and green new builds increase energy efficiency, as oil and gas are replaced by electricity and hydrogen as energy sources

Low-carbon Industry

- A disparate sector requiring diverse solutions, such as materials efficiency and recycling, electrification, carbon capture and hydrogen reduce emissions from metals & mining, chemicals, cement, oil & gas and F-gases

Source: UNEP, HSBC

Note: Our Future Frontiers Scenario focuses on energy emissions, as well as emissions from non-energy industrial processes. Significant emitting sectors important to the energy transition which we do not cover include waste generation and management, water utilities, agriculture and forestry; $GtCO_2e$ refers to gigatonnes of carbon dioxide equivalent; The United Nations Environment Programme's (UNEP) Current Policy Scenario is used as business-as-usual emissions, where no further policy measures are taken to limit emissions beyond those already in place; Emissions from agriculture, waste and LUCF are capped at 2019 levels through to 2050 in our Future Frontiers scenario; Emissions reduction from the buildings sector versus 2019 level is shown at 88%, but can be described as a reduction of 96% by including indirect emissions, via decarbonised power.

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