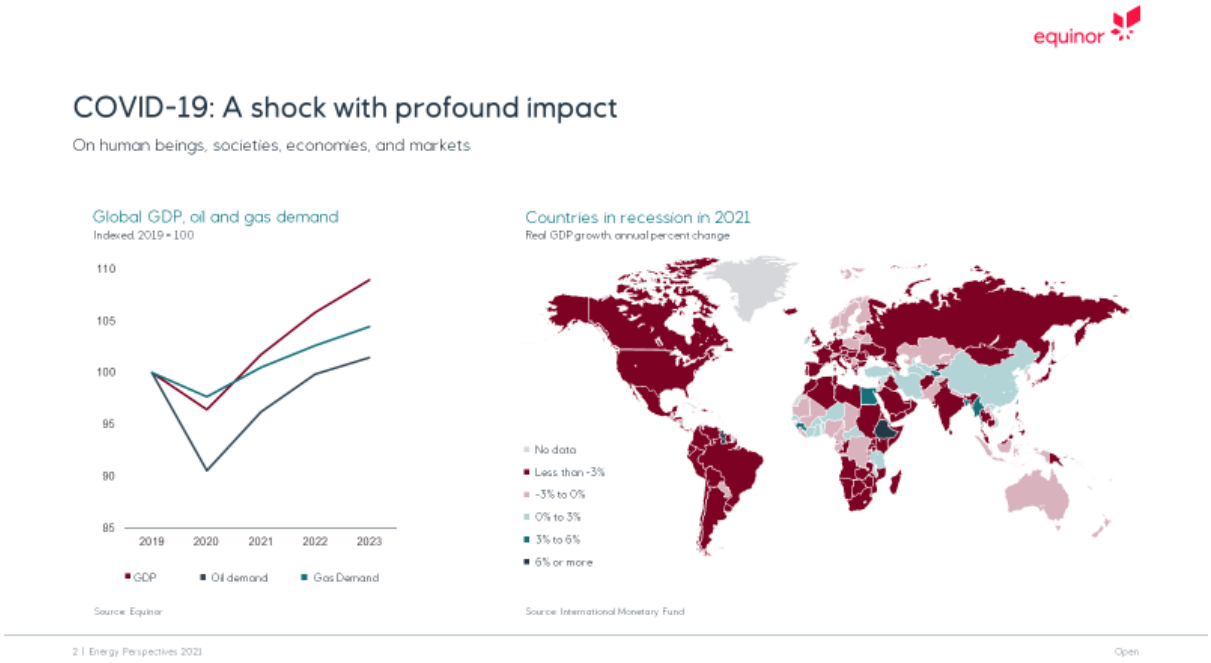
Welcome to the 11th edition of Energy Perspectives!

This is an independent report that informs Equinor's strategy and offers a fact-based contribution to the energy transition debate.

This year's edition is an update of the edition from November last year, and with a lot happening on the global arena the last 6 months, there is a lot to consider when looking 30 years ahead.

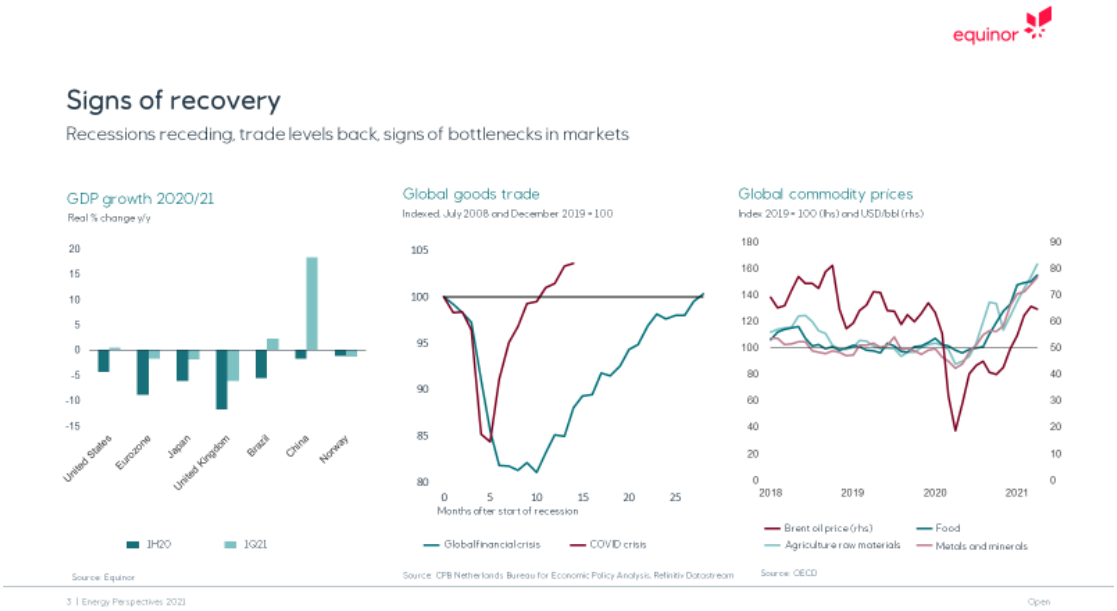
As always, this report and its data and conclusions would be impossible without the excellent work of many of my colleagues, to whom I extend my appreciation and gratitude. You are the best!



Covid19 is not over. In a global perspective, we are still dealing with its impact and the enormous effects it has on people, societies, economies, and markets. We are not through it yet. And we might have to live with recurring infection spikes, especially in parts of the world that do not get sufficient access to vaccines.

Recurring lockdowns entailed that energy demand, and in particular oil demand due to its use as a transport fuel, was hit hard. Recovery is in the making, and faster than many feared, but oil demand, as an example, is still not back to pre-Covid19-levels.

The map shows how the pandemic has affected economies across the globe, with almost all countries pink or red, that is, with negative economic development. Industrialised countries are on their way out of recession while disabling the virus, but the uncertainty is still high in many emerging economies.

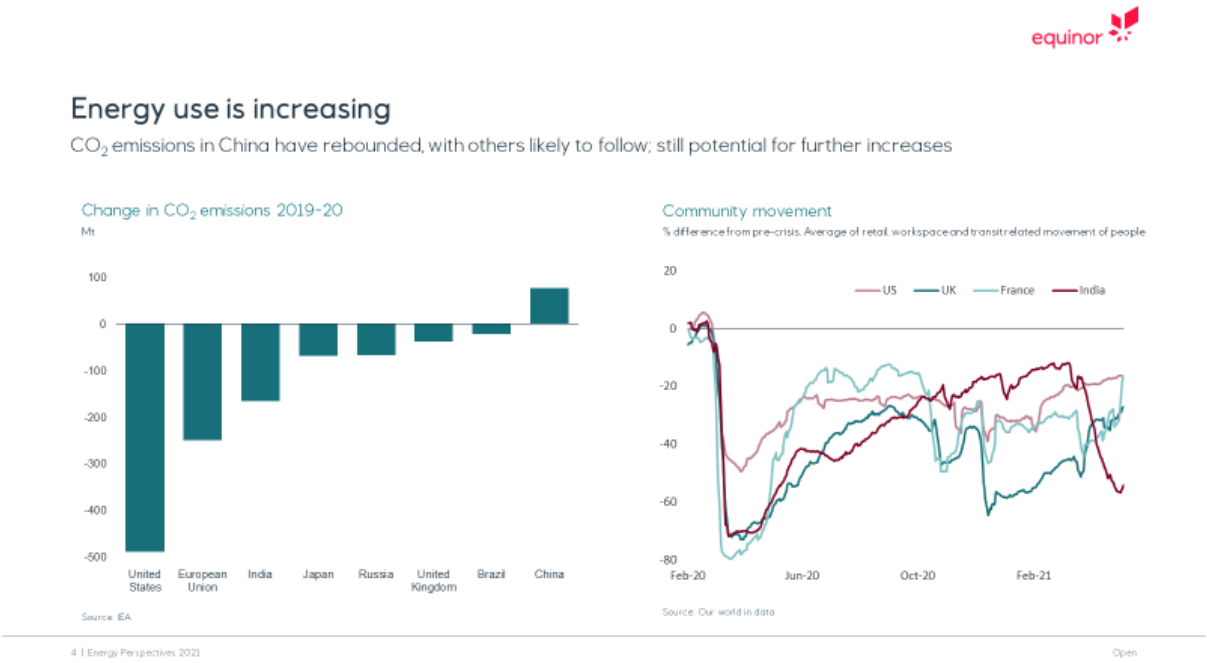


We are seeing signs of recovery. Thanks to the development and rollout of vaccines and massive public spending to stimulate demand, there are signs that the situation is being brought under control so that we can live with the virus more like we do with normal flus.

GDP growth is beginning to recover, the development in the first quarter of this year being much better than in the first half of 2020. China was hit first, got control first, and is leading the way out of the recession.

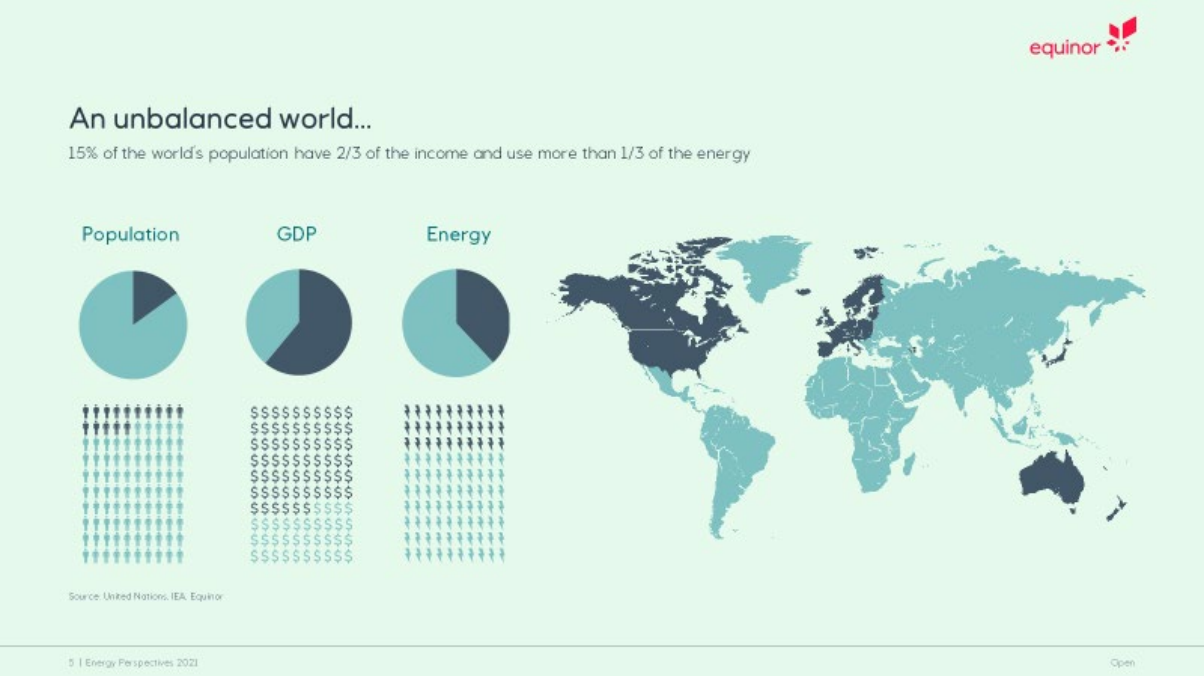
And compared to the financial crisis, it looks like a much faster recovery, signalling that the nature of these two crises and the efficiency of the counteracting measures are very different.

Recent developments in commodity prices could indicate that demand increase meets with supply chain challenges and bottlenecks. Inflationary pressure is on the rise, also in parts of the renewables space, as an example. Inflation poses a challenge to governments and central banks on managing fiscal and monetary policies in what is still a very fragile economic situation.



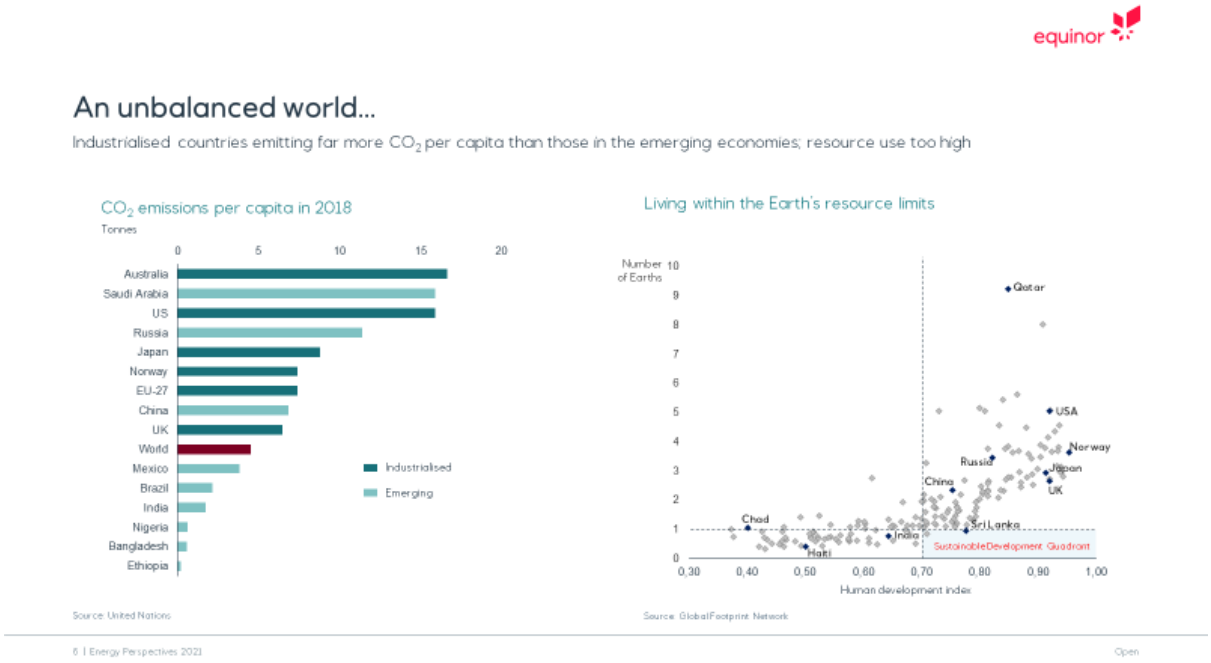
Increasing economic activity entails increased energy demand and rising CO_2 emissions, in the same way the crash last year resulted in a massive reduction in emissions. There is still a link between economic growth and CO_2 emissions via energy demand, since fossil fuels are completely dominant – a dominance which is impossible to change overnight.

There are signs that large parts of transport are beginning to recover to pre-Covid levels, but there is still a significant potential for increase, both in domestic transport in countries still grappling with the crisis and cross-border transport of goods and people. Furthermore, the general capacity utilization in different economies is still far below par, with room for further pickup in activity.



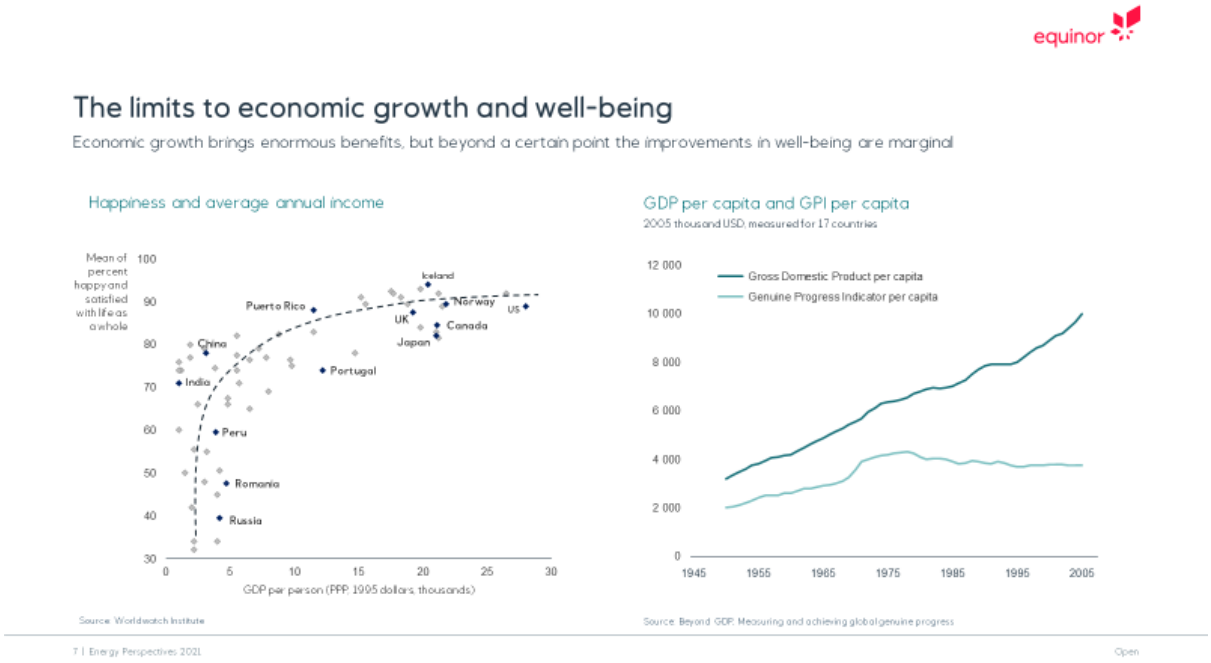
As the Covid19 crisis and recovery vividly demonstrate, we continue to live in an unbalanced world. 15% of the world's population have 2/3 of the income and use more than 1/3 of the energy.

The lifestyles of us among these 15% are already unsustainable, and if the remaining 85% of the world wish to even come close to copying the lifestyles in the industrialized economies there is no chance of a sustainable future. Things must change, and fast.



The difference in lifestyles is visible in terms of CO_2 emissions per person, driven by the much higher energy use in the industrialised countries, and of course also impacted by the economic structure in different countries.

There is a need to change the link between human development and resource use, as demonstrated by the chart to the right. We must change our behaviour while improving quality of life where that is urgently needed – and we need more than just careful nudging to get it done.



There is potential for such a change, since indications are that resource-intensive consumption not automatically translates into higher well-being for the richest nations.

That being said, economic growth is undoubtably a good thing, lifting people out of poverty and improving quality of life. For the richest, however, continued growth is not bringing about any discernible improvements in well-being, and in some cases, there is evidence that living standards and quality of life are actually declining.

These dilemmas pose enormous challenges for the future of our energy demand, economies and societies.

So where will we be 30 years from now? There are many signposts as to where we may be heading, if these signs were to prevail and dominate. And the outcome space is vast, depending on which drivers become the most important. A world dominated by the signposts in the left part of the picture will be very different from a world dominated by the signposts to the right.

How can we combine and bring them together to understand where the choices we make today could lead?

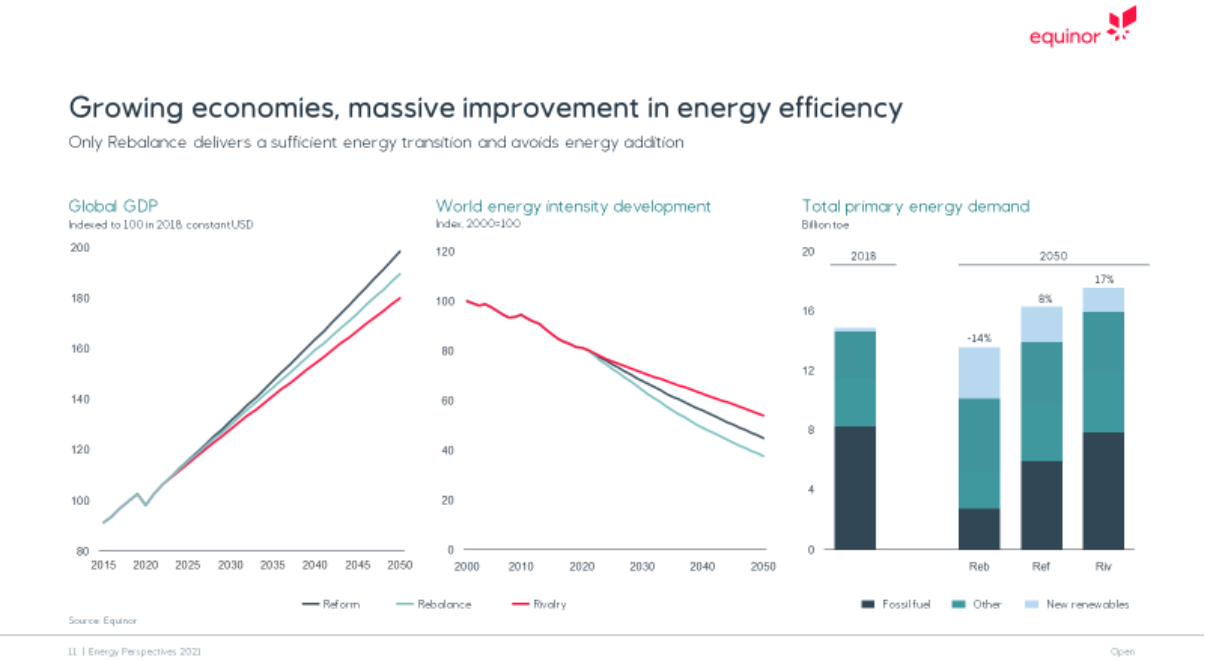
We do this with scenarios…

As previously, we have two scenarios that describe different outcomes if different existing drivers dominate the development.

Reform is a market- and technology-driven pathway, building on existing policies in a relatively benign geopolitical setting.

Rivalry is a pathway driven by higher levels of conflict, more focus on energy security, increased prevalence of trade tensions and thereby slower technological improvements.

Our third scenario, Rebalance, is as previously one possible recipe for a sustainable development towards the goals in the Paris agreement. It focuses on a balanced, but very challenging development that combines rapidly declining greenhouse gas emissions with economic development, access to energy and improved quality of life – allowing emerging countries to grow and improve quality of life. For this to happen, we need an immediate geopolitical climate of unprecedented cooperation on policy measures and burden sharing.

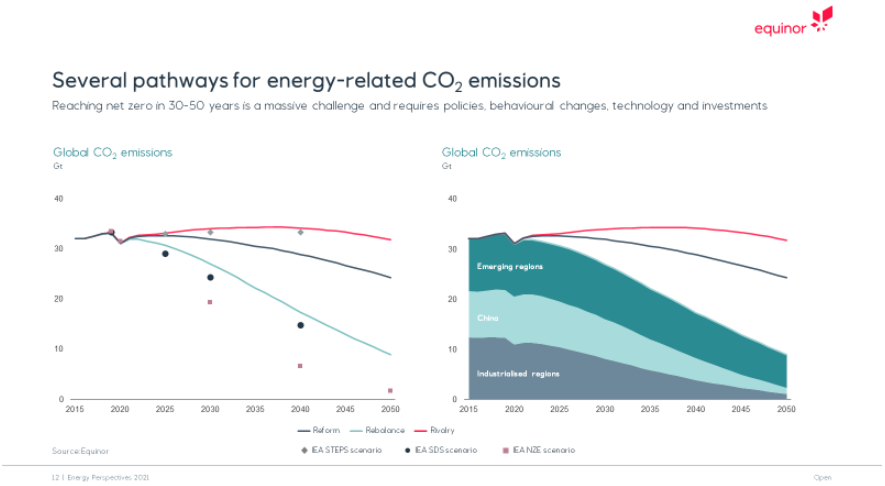


Our three scenarios offer three distinct paths for economic growth, energy demand and the energy mix.

Rivalry has the lowest economic growth, but the highest energy demand, as lack of international cooperation and slower technological development make for delayed transition, lower efficiency and higher resource use.

Reform is our market driven scenario, optimised for growth and low-cost energy. The energy transition continues at pace, but without the political and financial support required to deliver more expensive low carbon technologies or to phase out fossil fuels as quickly as required to achieve climate ambitions.

Rebalance requires not only the technological breakthroughs and cooperation of Reform, but immediate and sustained global cooperation and support for renewable energy sources and low carbon solutions. In addition, we must see large behavioural changes and unprecedented improvements in efficiency, driven by policy measures, regulation, and technology.

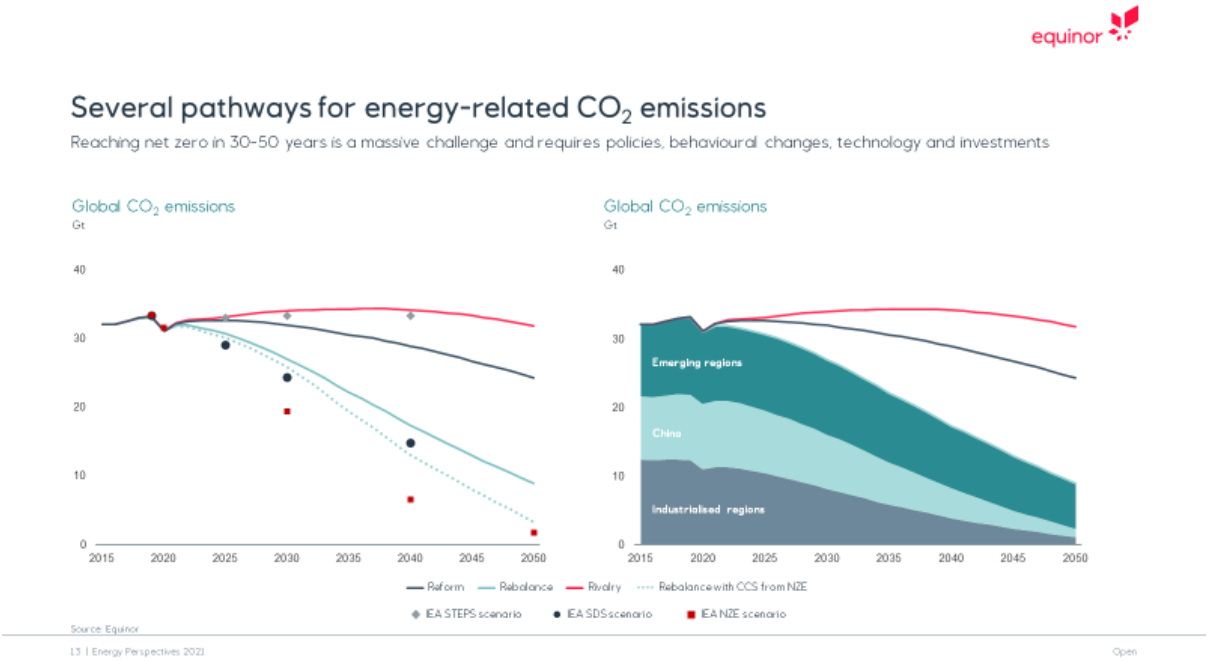


Use of fossil fuels results in greenhouse gas emissions, and CO_2 in particular. Our scenarios yield very different paths for energy-related CO_2 emissions, as do scenarios from other institutions. In the chart we compare our scenarios to the three most recent IEA scenarios; STEPS, SDS and NZE.

In Rebalance, the industrialised countries achieve net zero by 2050. China, the world's largest emitter, must be well on the way to achieving its net zero ambition by 2060, while emerging regions still have a way to go reach net zero. However, note the significant drop in emissions also here, despite significant economic and population growth in these regions.

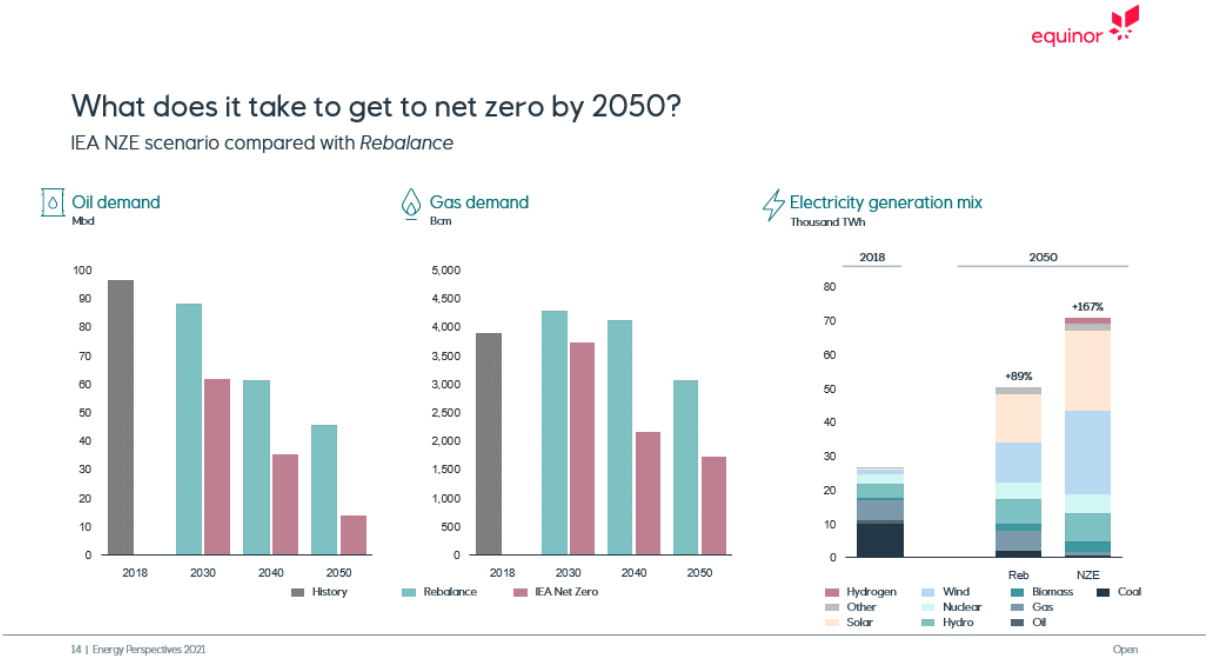
IEA's Net Zero Emissions scenario illustrates how challenging a net zero emission world by 2050 would be. Our Rebalance scenario does not go this far. The key difference between IEA's Net Zero Emissions scenario and Rebalance is the scale and timing of the energy transition and emission reductions. IEA NZE assumes more and earlier reductions than Rebalance, with a very ambitious and unlikely development already from today. Note that emissions fall faster in absolute terms in Rebalance during the 2040s.

Another key element that contributes to these differences is the assumption on Carbon Capture and Storage.



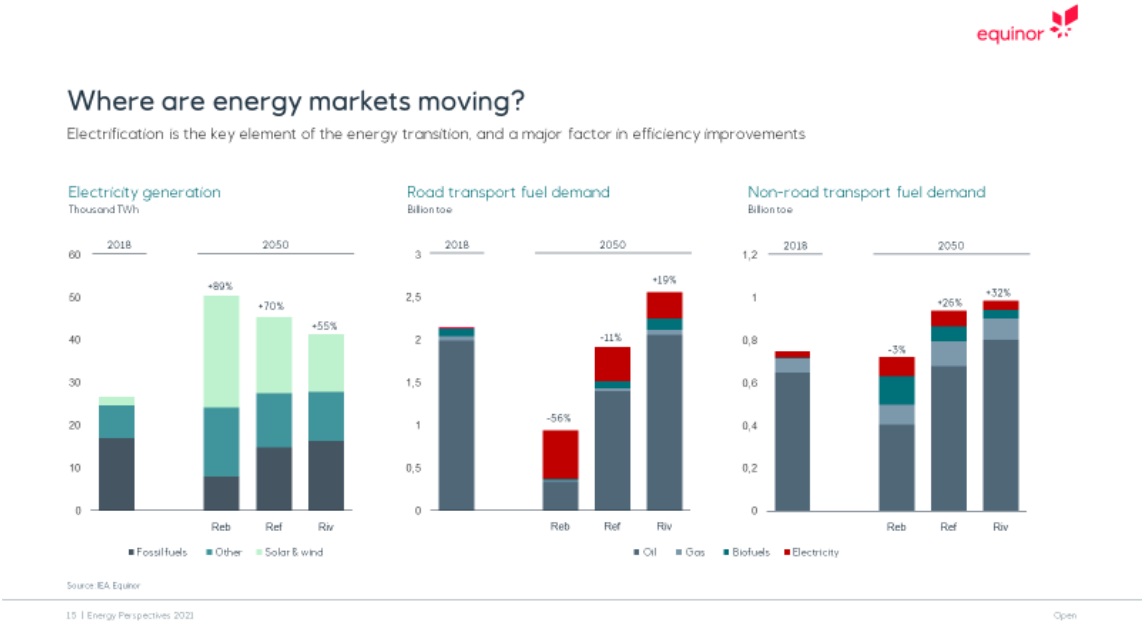
As an illustration, we show how the emission path for Rebalance would change if we had used the same levels of CCS as the IEA have used in their scenario, i.e. replacing the 2Gt of CCS we have in 2050 with IEA's pathway, ending at 7.6Gt.

This illustrates the importance of CCS as one of the components necessary to reduce emissions and potentially achieving net zero, and it highlights the urgent need for governments to establish policies and support that makes the technology competitive and scalable.



Given the attention received by the recent publication of IEA's very ambitious Net Zero Emissions scenario, it is valuable to compare with some of the other results in Rebalance. But remember there are many scenarios out there! In a world that achieves net zero by 2050, there will be even less room for fossil fuels, unless one has extreme assumptions on CCS. In IEA's version of net zero, oil demand starts to drop immediately, some would say impossibly fast, especially given their assumptions on economic growth. Gas demand follows with a very large decline after 2030. All of this made possible by an assumed vast improvement in energy efficiency and much more rapid growth in zero carbon electricity generation.

The chart to the right illustrates the difference between the two scenarios in terms of growth in electricity generation and new renewables, nuclear and hydroelectricity to 2050. Rebalance is a massive challenge – IEA's Net Zero Emissions is even more so, sooner and at an even higher speed.



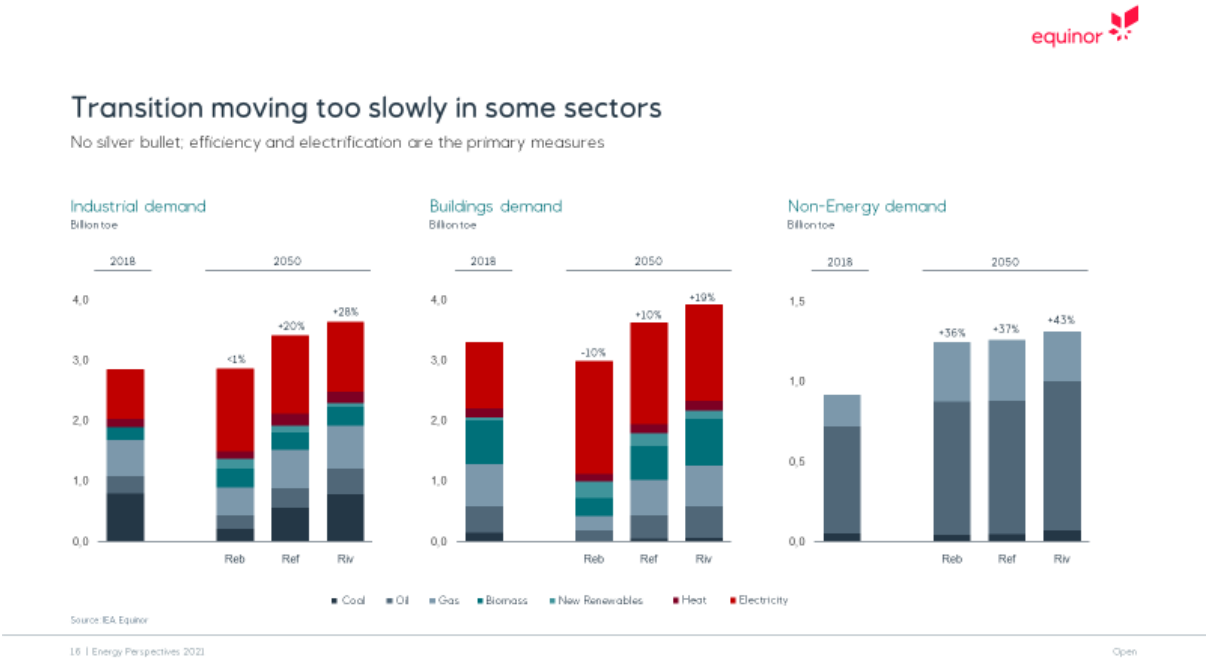
How will different parts of the energy system develop in our scenarios?

Both electricity generation and energy use in transport will undergo large changes in all our scenarios. In Reform, electricity generated from solar and wind will be greater than all the power generated from fossil fuels today. Even in Rivalry, all growth in electricity will be delivered from new renewable sources.

In Rebalance, wind and solar electricity in 2050 will be equivalent to ALL of today's generation. Nuclear, hydro, and some gas will still be required to match demand and to balance intermittent supply.

Increased electricity demand will come from all sectors, including the road transport sector, where electric vehicles will be dominating, and where efficiency gains are massive.

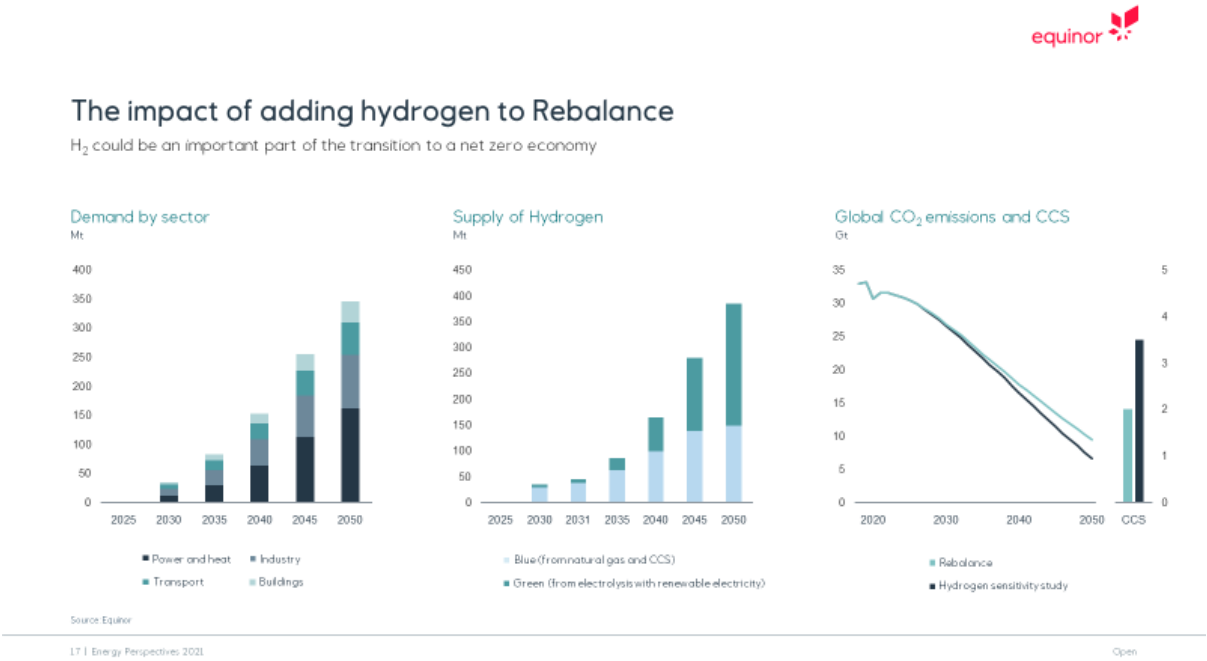
Oil will still play a significant role in the aviation and shipping sectors, where viable and scalable zero emissions alternatives are lacking, even though biofuels make significant progress.



The energy transition challenge is even larger in sectors outside of electricity and road transport.

In manufacturing and the buildings sector energy efficiency and electrification also play a crucial role.

Oil and gas demand for use in the petrochemical and plastics sector will grow to supply a growing world population with the products it demands, even with much higher focus on waste and recycling.

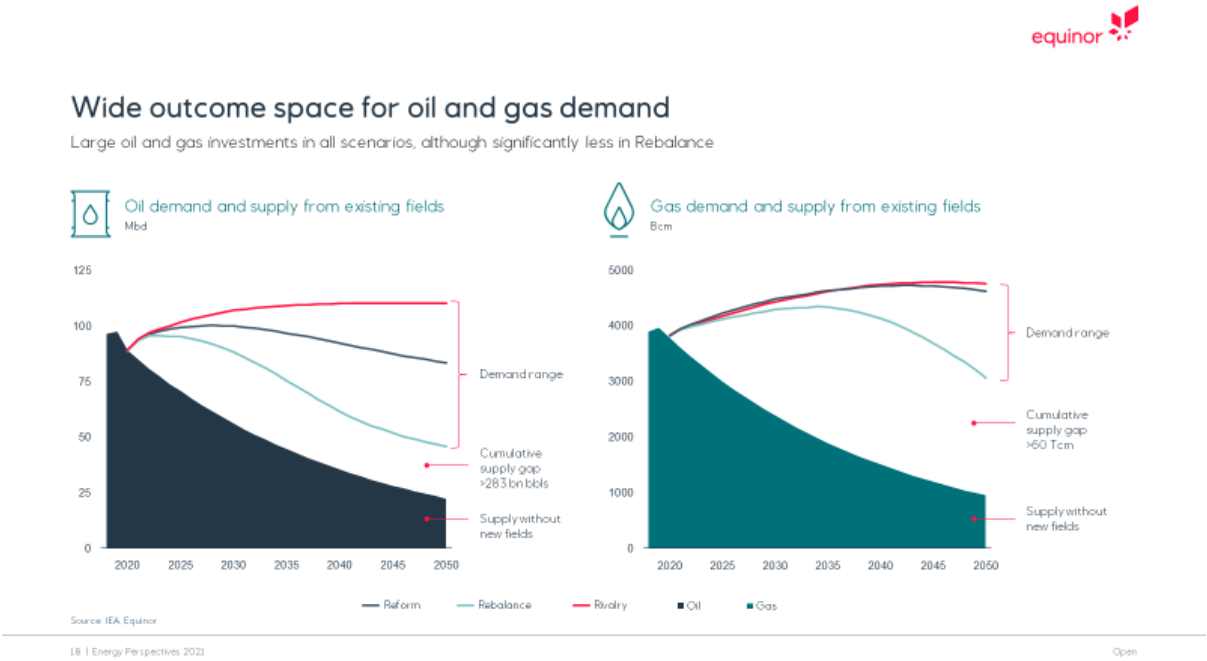


Electrification is an important component in the energy transition, but more is needed. There are processes that cannot be electrified and where fossil fuels today play a key role. In these circumstances, hydrogen could be the key to decarbonisation.

The market for hydrogen as an energy carrier today is non-existent, and we do not explicitly model hydrogen in our three scenarios. However, we have applied a sensitivity study on Rebalance to illustrate the potential impact of a global hydrogen market on energy demand and CO_2 emissions.

Both blue and green hydrogen from gas or coal and renewable electricity, respectively, will be needed to meet potential demand, requiring much more electricity and a further 1.5Gt of CO_2 to be captured and stored per year by 2050 – a total of 3.5Gt, or 75% more than in Rebalance.

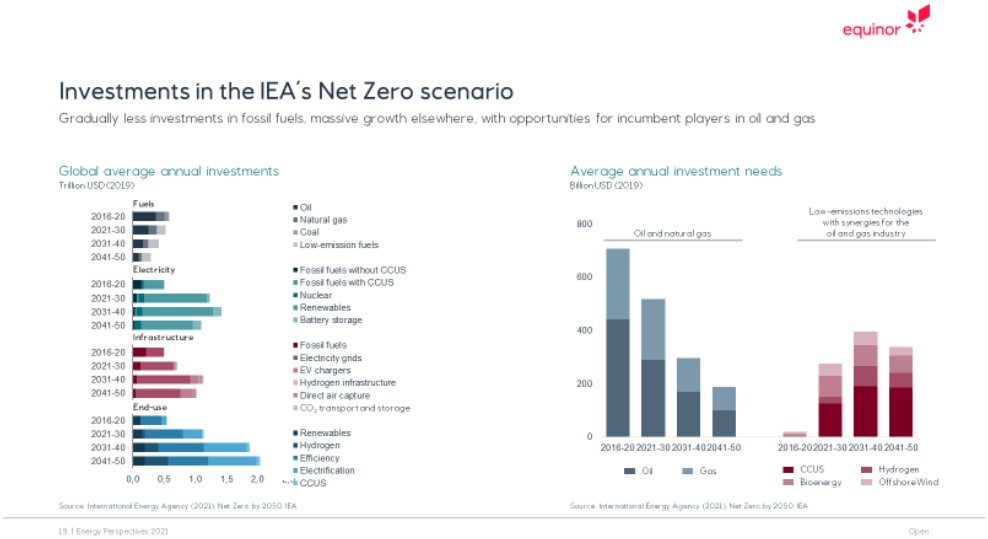
A supply of 400mt of H2 by 2050 could reduce emissions by around 30%, contributing to achieving a net zero economy.



Our scenarios not surprisingly deliver a very wide outcome space for oil and gas demand.

Supply from existing fields will decline every year, even if we keep investing in new wells and Enhanced oil and gas recovery. To satisfy demand even in Rebalance, there is a need for investing in new sources of supply, from discovered and probably even some competitive, carbon-efficient undiscovered resources. With much tougher energy and climate policies and falling demand, the competition between different sources of supply will be fierce in Rebalance.

The need for new volumes of oil in Rebalance the next 30 years is more than volumes delivered by Opec over the last 20 years, and the need for new gas is more than the combined supply from North America, Russia and the Middle East over the last 30 years.

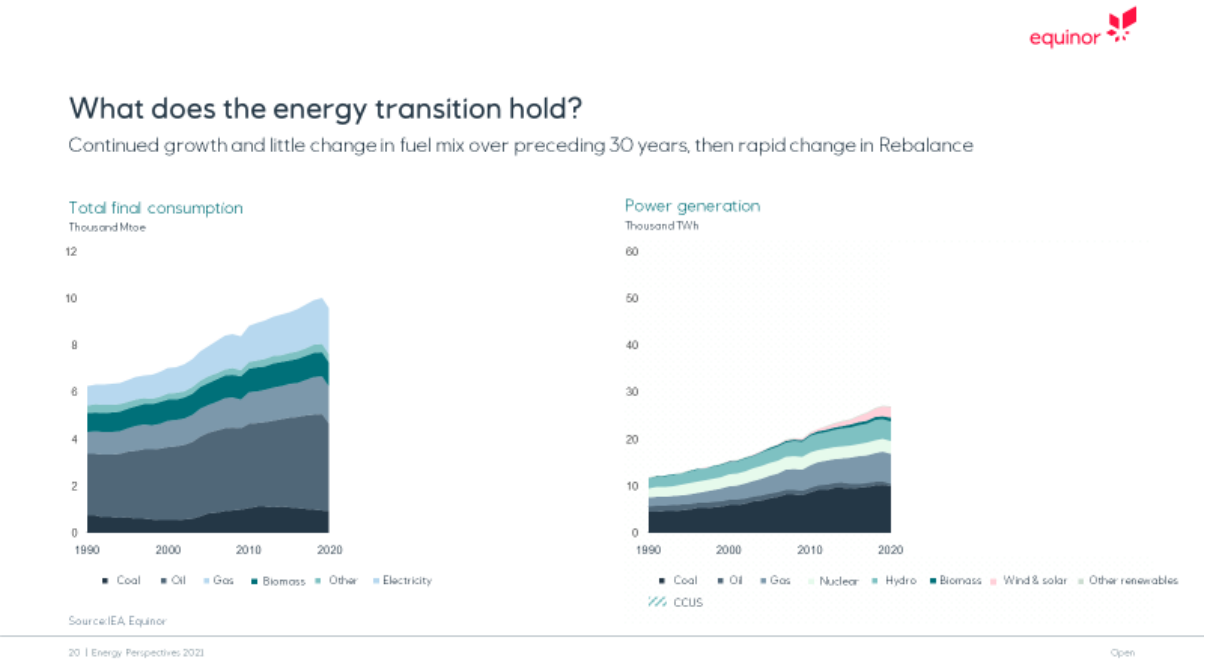


We do not model investment levels explicitly in Energy Perspectives.

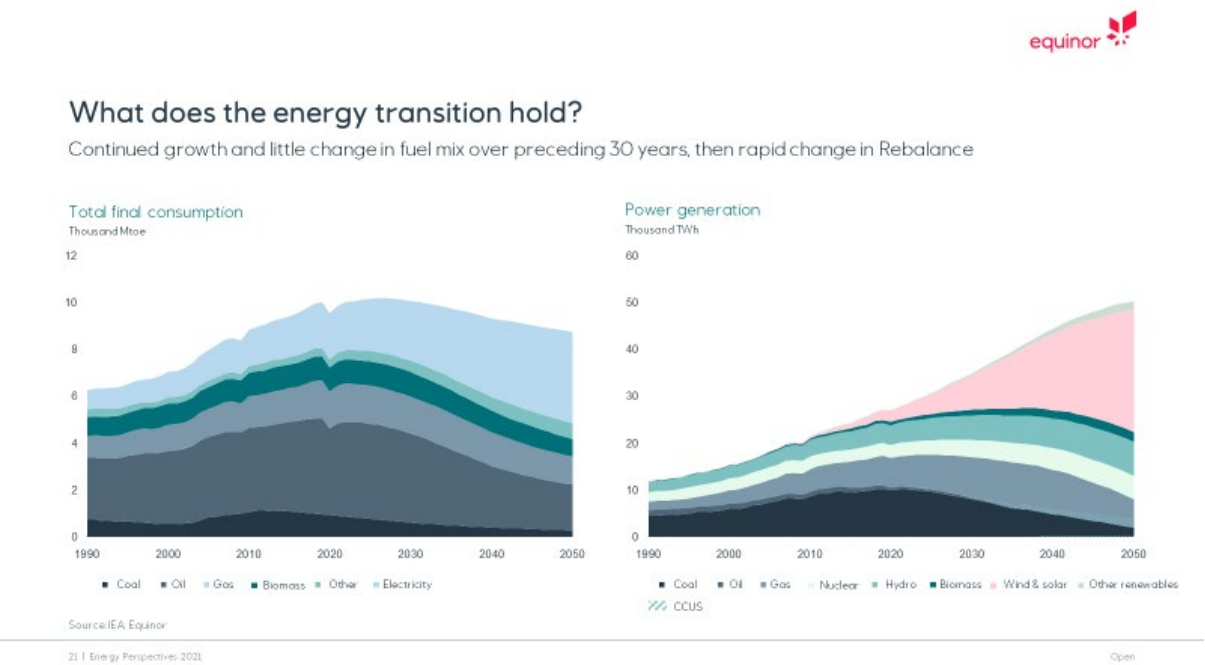
Here we show, as an example, investments in IEA's Net Zero Emissions scenario, which is even more ambitious than and with accelerated change relative to Rebalance.

Key messages are that investments in fossil fuels will gradually have to fall and shift towards low-emission fuels, combined with a massive increase in investments in electricity, infrastructure and end-user sectors. Designing market incentives and signals to facilitate all of these changes will be another challenge. Note for example that investments in the end-use sectors must be twice as high the rest of this decade as it was the last 5 years, and double again in the 2030s and 40s.

IEA has also pointed out the changing, but important role of oil and gas players in the energy transition. Players that can adapt will continue to invest in oil and gas, but gradually less than before, and must take responsibility for driving the energy transition through significant and growing investments in new areas. See the requirement for more than 200 bn in investments in CCS, Hydrogen, Bioenergy and offshore wind every year already this decade.



The energy transition required to put us on a sustainable path will be unlike any that has gone before. Here we see the small changes that have taken place over the last 30 years, in terms of total final energy consumption and electricity generation mix – we note the moderate growth in use of electricity and notice the recent growth in new renewables in the electricity sector.



To deliver on the Rebalance scenario, energy demand must gradually be completely decoupled from economic growth. Something that has never happened.

If it happens, we will see a much more rapid change in our energy mix – with fossil fuels declining in importance, electricity growing, and the electricity sector being completely remade.

It can happen, but it is not a given. Not at all.

Thanks for listening.