Risk management & ESG: the key issues for the renewable energy industry

Introduction: the energy, money and supply trilemma

Renewable energy can be said to be the current star of the show, given its role at the heart of the energy transformation. Every system, from how we grow our food, transport goods, build our cities and power our lives, is in transition and so electrification has become the key driver of the energy industry.

However, the conflict in Ukraine, global supply shortages, and the COVID-19 pandemic have led to an evolving energy and food security crisis. Surging inflation and the resultant costs of living increases add further instability. As a response to the energy crisis, powering up the transition away from fossil fuels has never had quite so much momentum.

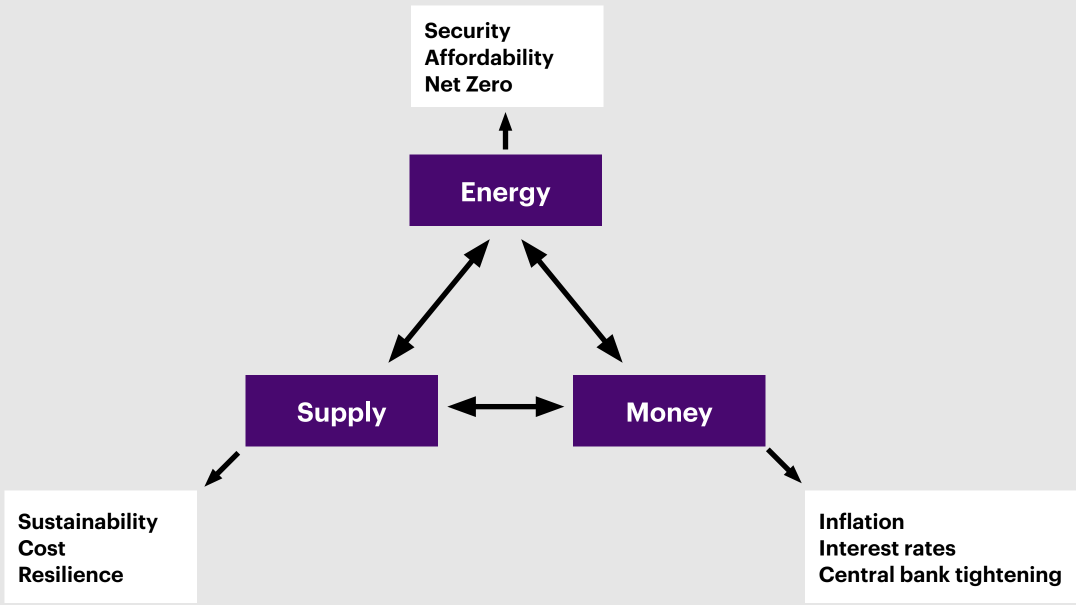
The market is responding. The global energy crisis is propelling renewable power installations, with the world set to as add as much renewable power in the next 5 years as it did in the past 20, according to a report published in December 2022 by the International Energy Agency (IEA)[1].

The macro events and trends that are impacting the renewable energy industry – ranging from geopolitical events to the war in Ukraine, grid challenges, changes to how goods and services move across borders, along with capital pressures and data – make the current business environment a challenging one for risk managers.

So with the renewable energy market in choppy waters, how does a renewable energy risk manager navigate this sea of volatility? There are landmarks to examine, including developments in environmental, social, and corporate governance (ESG) that will impact business operations.

[1] https://www.iea.org/news/renewable-power-s-growth-is-being-turbocharged-as-countries-seek-to-strengthen-energy-security

Figure 1: **The trilemma of energy, money and supply**



This article is designed for renewable energy risk managers. What do they need to consider over the next six to twelve months? Essentially, a trilemma of energy, money and supply (see Figure 1 above).

- **Energy** – how to ensure secure, reliable energy that is affordable and clean? Energy security is now at the forefront of business agendas and needs to be able to withstand system shocks without such current price volatility; it also needs to be in line with Net Zero emissions.
- **Money** – how to deal with rising inflation, higher interest rates, and central banks tightening money supply? Large parts of the global economy and our financing structures, household budgets, and business plans have been signed around very low interest rates. The global economy is moving away from that.
- **Supply** – how to respond to consumer and regulatory demands for more sustainable energy with the supply squeeze? The increased costs of materials, labour, and transport highlight the need for more resilience to manage supply chain, trade, logistics, and geopolitical issues.

Part I: Energy

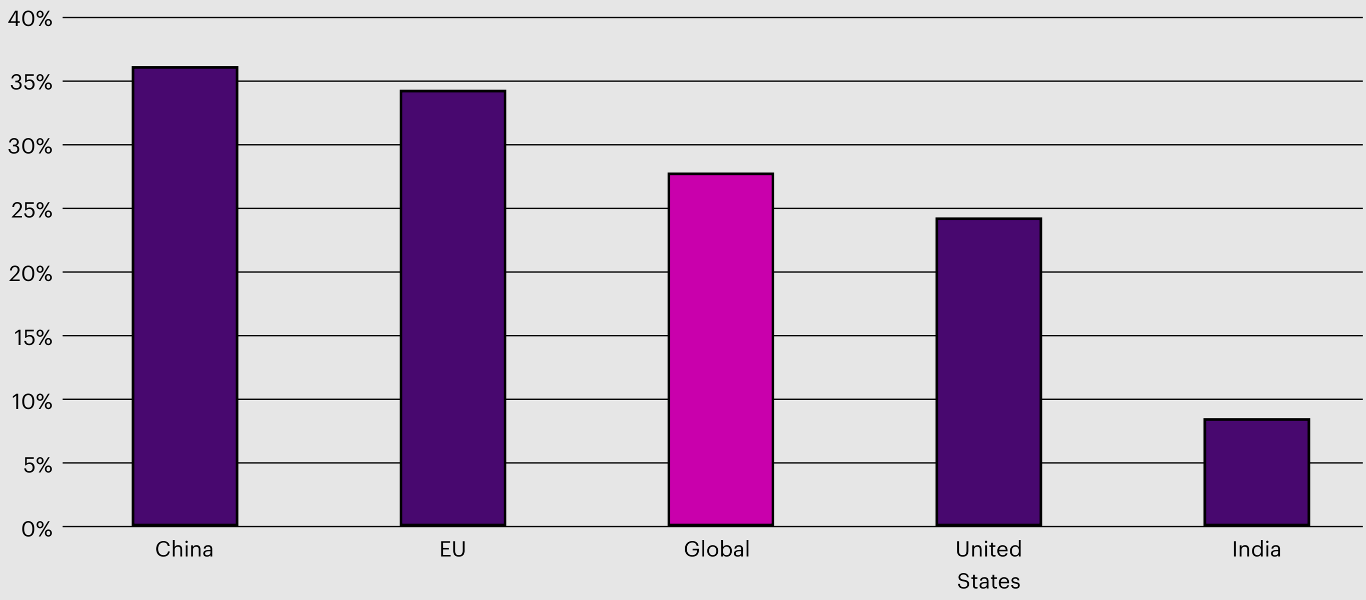
State of the renewable energy market

Let's start with where we are now regarding renewable energy capacity. Prior to the Russia-Ukraine conflict, renewable capacity was expected to increase over 8% in 2022 compared with the previous year[2]. However energy security concerns, caused by the commencement of the conflict in February 2022, sparked a surge in renewable energy development. In May 2022 the European Commission presented their REPowerEU Plan, designed to make Europe independent from Russian fossil fuels well before 2030, in response to the hardships and global energy market disruption[3]. Accelerating the clean energy transition and diversifying alternative energy supplies to reduce Europe's need for energy imports are at the forefront of REPowerEU's objectives.

The spike in fossil fuel and electricity prices brought about by the energy crisis have shown renewable power technologies to be more attractive and highlighted renewable energy's energy security benefits. Countries have reacted and as a result, the IEA now forecasts that global renewable capacity is expected to increase by almost 2400 GW between 2022 and 2027, which is equal to the entire installed capacity of China[4].

[2] https://www.iea.org/reports/renewable-energy-market-update-may-2022/renewable-electricity
[3] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en
[4] https://iea.blob.core.windows.net/assets/64c27e00-c6cb-48f1-a8f0-082054e3ece6/Renewables2022.pdf pg 17

Figure 2: **IEA upward revisions to renewable capacity expansion forecasts from Renewables 2021 to Renewables 2022**



Source: https://iea.blob.core.windows.net/assets/64c27e00-c6cb-48f1-a8f0-082054e3ece6/Renewables2022.pdf pg 17

The IEA's increased forecast of renewable capacity by almost 30% from last year comes from existing policies, market and regulatory reforms and new policies implemented to combat the energy crisis.[5] The most significant policy reforms include the US Inflation Act, the REPowerEU plan, and China's Five-Year Plan, which includes market changes. The EU has been the region that has been most impacted by the energy crisis and has doubled down on renewables to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition[6]. Figure 2 above shows the forecasted upward revisions from the IEA's Renewables 2021 to Renewables 2022.

Energy price rises

Russia's curtailment of its natural gas supply to Europe has caused supply shortages and exposed consumers to higher energy bills. All fuel prices have been impacted, while natural gas prices continue to spike. Coal prices have hit record levels, oil rose to above US$100 per barrel before falling back, and Europe is set to import an extra 50 billion cubic meters of proposed liquified natural gas (LNG) compared to the previous year[7].

What this shows is that the energy crisis has taken over the climate crisis and there is a push to expand fossil gas - however, this could cause global emissions to threaten the 1.5°C warming limit. For example, the CO_2 emissions from all the approved LNG construction projects between 2021 and 2050 blow up the IEA 2022 Net Zero scenario, as shown in Figure 3 overleaf by Carbon Action Tracker[8]. Furthermore, these expansion plans far exceed what's needed to replace Russian gas.

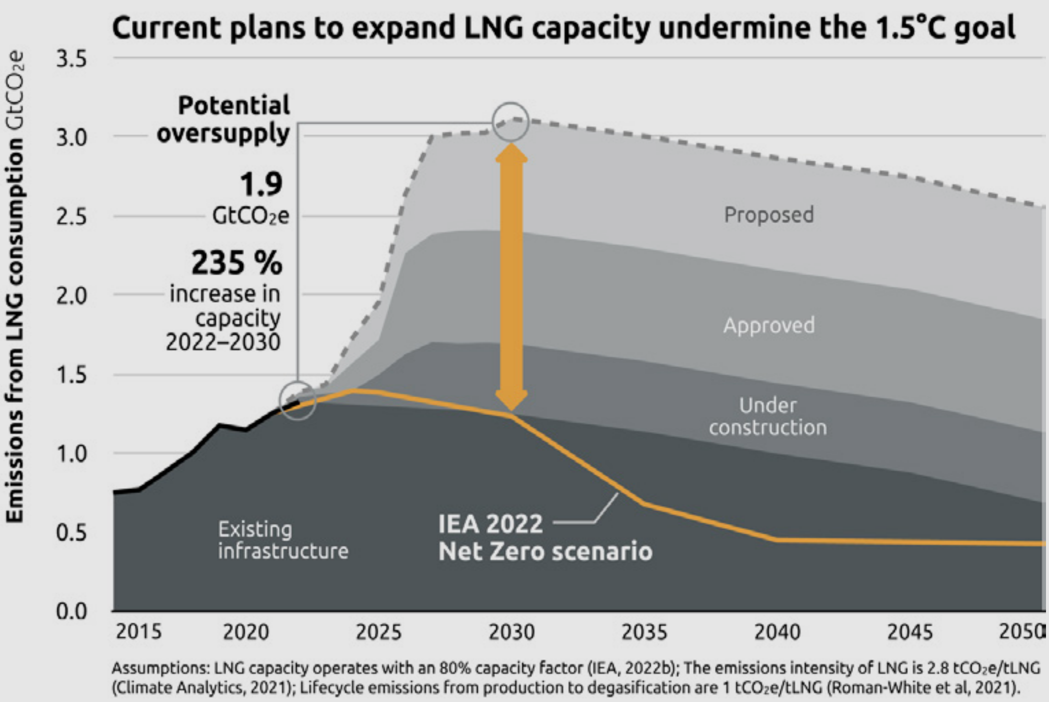
We are not on track for 1.5°C!

Expanding fossil fuel production undermines the 1.5°C warming limit target by the mid-century, as set out in the Paris Agreement (see separate breakout box for a snapshot of Paris Agreement & COP27). Yet the world is currently not on target to meet this 1.5°C goal and there have been no substantial improvements of existing Net Zero pledges since COP26. While policy implementation has progressed, it remains too slow, and the world is heading for 2.4°C of warming under current 2030 targets as shows in Figure 4 overleaf.

However, it will be interesting to see how the more ambitious clean energy policies introduced in response to the energy crisis impact global emissions. For example, the new US Inflation Reduction Act approves more than US$370 billion in spending for technologies ranging from wind turbines, solar panels, electric vehicles and electric heat pumps. Even nuclear generators and clean hydrogen tax credits are included.

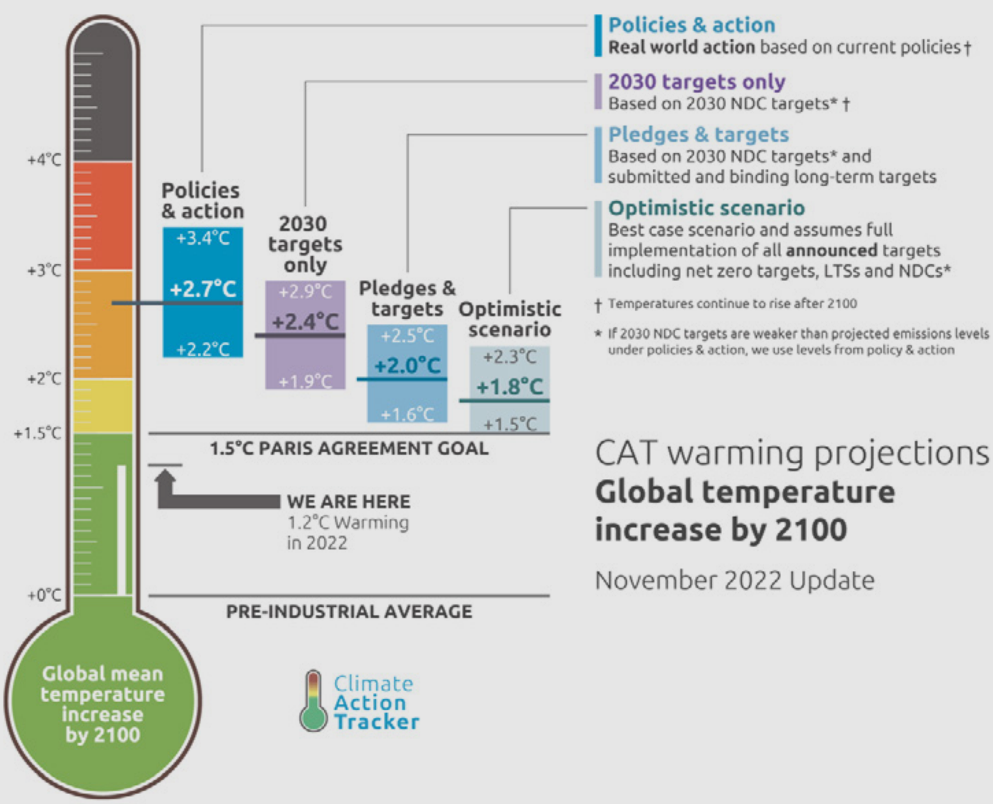
[5] https://iea.blob.core.windows.net/assets/64c27e00-c6cb-48f1-a8f0-082054e3ece6/Renewables2022.pdf pg 17
[6] https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131
[7] https://www.iea.org/reports/world-energy-outlook-2022/executive-summary
[8] https://climateactiontracker.org/press/dash-for-gas-a-serious-threat-to-the-paris-agreements-warming-limit/

Figure 3: **Dash for gas poses a serious threat to the Paris Agreement's warming limit**



Source: https://climateactiontracker.org/press/dash-for-gas-a-serious-threat-to-the-paris-agreements-warming-limit/

Figure 4: **Climate policies: limited progress since COP26 in Glasgow**



Source: https://climateactiontracker.org/press/dash-for-gas-a-serious-threat-to-the-paris-agreements-warming-limit/

Net Zero: a conundrum

Countries and companies around the world have been setting Net Zero targets. In 2019, the UK was the world's first major economy to set a legally binding target of being Net Zero by 2050. Since then, more than seventy countries have set a Net Zero target, covering about 76% of global emissions.[10]

Science is the rationale behind Net Zero targets - the science clearly shows that global temperature increase needs to be limited to 1.5° Celsius above pre-industrial levels to avert the worst impacts of climate change.

It's no secret that coal is the single largest source of carbon dioxide emissions from energy, yet analysis by the IEA shows that over 95% of global coal consumption is occurring in countries that have pledged to achieve Net Zero emissions[11]. Furthermore, far from declining, global coal demand has been stable, at near record highs for the past decade. Countries are saying one thing and doing another.

The example of GFANZ

On the corporate side, it's no better. In 2021 at COP26 in Glasgow, a fifth of the world's 2,000 largest companies, representing over US$130 trillion of private capital, had made Net Zero commitments with a pledge through the Glasgow Financial Alliance for Net Zero (GFANZ). Just one year later at COP27 in Sharm El Sheikh, more than a third of the largest companies had a Net Zero target.

While that is all good and well in principle, research by Accenture states that unless companies decarbonise, 93% will miss their Net Zero targets[12]. This means that companies need to reduce their Scope 1, 2, and 3 emissions by almost 90% by 2050, by using less energy and using energy more intelligently from renewable sources. In addition, these companies will need to permanently neutralise the emissions they cannot abate by removing carbon from the atmosphere. They cannot look to buy themselves out with cheap carbon credits that lack integrity.

Companies are making voluntary new Net Zero pledges; however, putting into place practical plans to fulfil those commitments is proving challenging. Environmental claims which are not backed by substantial action are toted as greenwashing; Catherine McKenna, a former Canadian Minister and Chair of the High-Level Expert group on the Net Zero Emissions Commitments of Non-State Entities report, states: "It's time to draw a red line around greenwashing"[13].

And while GFANZ's membership has grown from 160 members in April 2021, to more than 550 member institutions as of December 2022, the alliance is being called into question for not having strong enough rules on fossil fuel financing. The UN High-Level Expert Group's report released at COP27 makes it clear that "Net Zero is entirely incompatible with a continued investment in fossil fuels"[14].

Financial institutions can join GFANZ by joining one of seven sector-specific alliances and cracks are starting to show in its membership. GFANZ has already lost some members, but it was big news when Vanguard Group announced in December 2022 that it is pulling out of the Net Zero Asset Managers (NZAM) initiative, which is part of GFANZ. Vanguard has over US$7 trillion in assets and was among its largest signatories; it cited confusion regarding the applicability of Net Zero approaches to the broadly diversified index funds their investors prefer[15].

Risk managers need for awareness of company decarbonisation plans

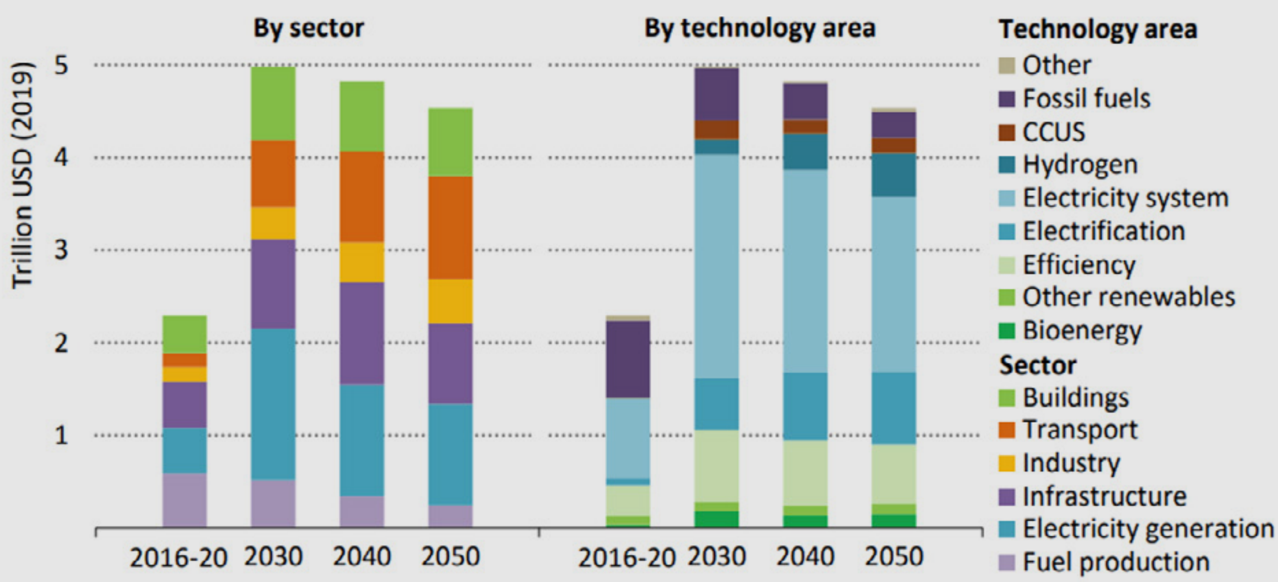
Vanguard is just the start. And even though they are an investment firm and not a renewable energy company, risk managers across all industries must be aware of the targets, promises, and progress their companies are making to decarbonise. This is because proclaiming an intention to reach Net Zero by a given date could potentially result in investigation, litigation, and negative publicity if not managed appropriately. New regulations coming in around sustainable finance are intended to provide guardrails that companies say and act accordingly and renewable energy risk managers need to be aware of these types of market developments.

All this talk of Net Zero requires a fundamental transformation of common business practices with reliable and safe renewable energy. And global transformation requires data-driven solutions in renewable energy and investment at scale.

> **Far from declining, global coal demand has been stable, at near record highs for the past decade. Countries are saying one thing and doing another.**

[9] https://www.nytimes.com/2022/10/27/climate/global-clean-energy-iea.html
[10] https://www.un.org/en/climatechange/net-zero-coalition
[11] https://www.iea.org/news/achieving-a-swift-reduction-in-global-coal-emissions-is-the-central-challenge-for-reaching-international-climate-targets
[12] https://www.accenture.com/us-en/insights/sustainability/reaching-net-zero-by-2050
[13] https://www.un.org/sites/un2.un.org/files/high-level_expert_group_n7b.pdf, pg 6
[14] https://www.un.org/sites/un2.un.org/files/high-level_expert_group_n7b.pdf, pg 7
[15] https://www.esgtoday.com/vanguard-drops-out-of-net-zero-asset-managers-initiative/

Figure 5: **Annual average capital investment in the Net Zero Economy**



Capital investment in energy rises from 2.5% of GDP in revent years to 4.5% by 2030; the majority is spent on electricity generation, networks and electricity end-user equipment

Notes: Infrastructure includes electricity networks, public EV charging, CO_2 pipelines and storage facilities, direct air capture and storage facilities, hydrogen refuelling stations, and import and export terminals for hydrogen, fossil fuels pipelines and terminals. End-use efficiency investments are the incremental cost of improving the energy performance of equipment relative to a conventional design. Electricity systems include electricity generation, storage and distribution, and public EV charging. Electrification investments include spending in batteries for vehicles, heat pumps and industrial equipment for electricity-based material production routes.

Source: https://www.iea.org/reports/net-zero-by-2050, pg 81

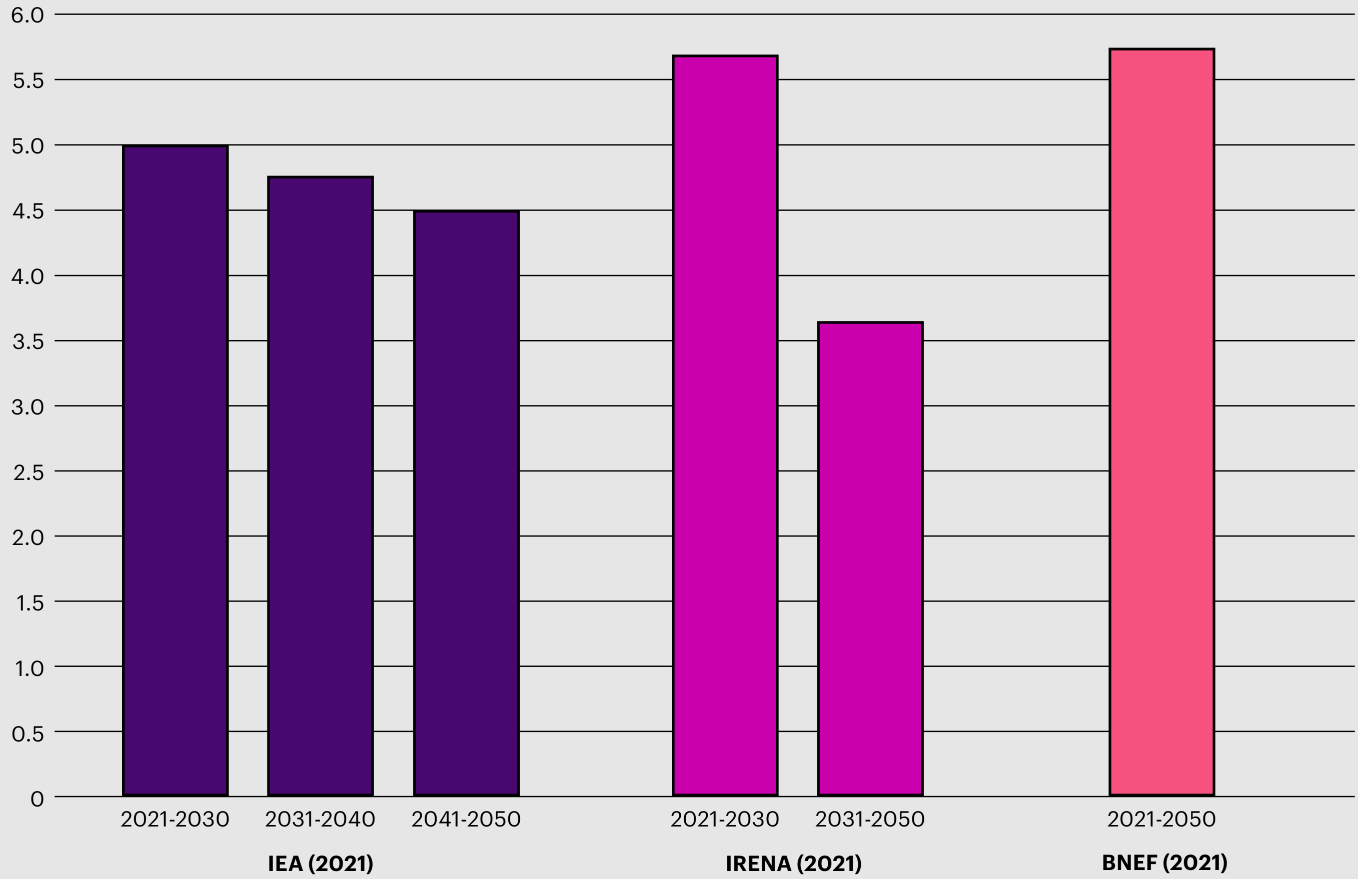
Part II - Money

Global energy investment trends

Let's consider the money side of the equation and start with investment. Global energy investments currently stand at around US$2 trillion per year or 2.5% of global GDP, according to the IEA. The IEA estimates that US$3-5 trillion in annual clean energy investment is needed by 2030 and stay there until at least 2050 to reach Net Zero emissions. Figure 5 above breaks this down into sectors and by technology area; the majority is spent on electricity generation, networks, and electric end user equipment.

Bruegal, a European economic think tank, reviewed the multiple estimates of the investment required to reach climate goals and compared the IEA's estimates with the International Renewable Energy Agency (IRENA) and Bloomberg New Energy Finance (BNEF) as show in Figure 6 overleaf. While the IEA uses an illustrative pathway, IRENA frontloads the required investments to 2030, resulting in US$5.7 trillion per year, then dropping off to approximately US$3.7 trillion per year until 2050. BNEF estimates average investment needed vary between US$3.1 trillion and US$5.8 trillion per year until 2050.

Figure 6: **Average yearly global investment needs in order to reach net zero CO2 emissions from energy by 2050, different estimates (US$ trillions)**



Source: https://www.bruegel.org/blog-post/how-much-investment-do-we-need-reach-net-zero OR Lenaerts, K., S. Tagliapietra and G.B. Wolff (2021) 'How much investment do we need to reach net zero?', Bruegel Blog, 25 August 2021

What each of these estimates highlight is that additional investments in energy and transport will need to be roughly 2 percentage points more of current GDP.

Solar PV and wind power capacity

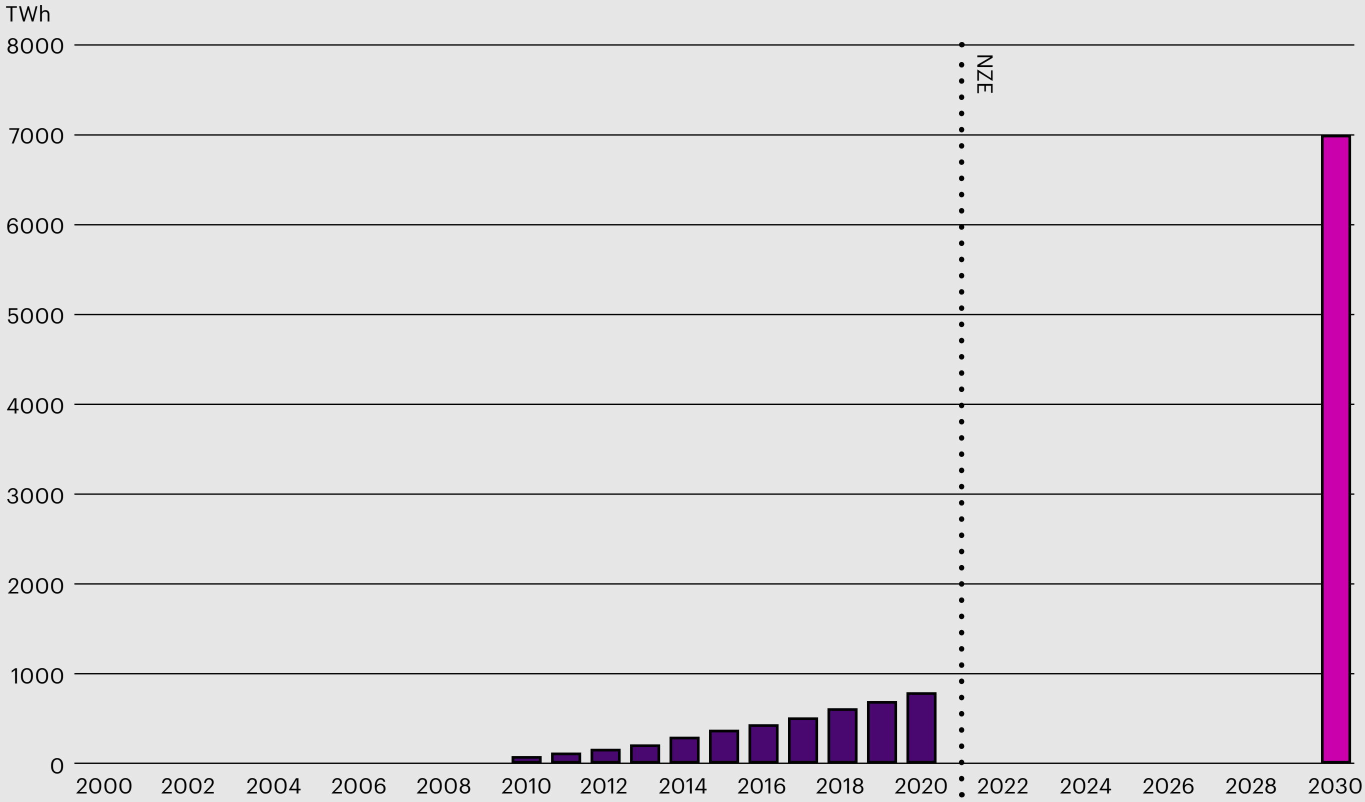
The cheapest options for new electricity generation in most countries are utility-scale solar PV and onshore wind. Global solar PV capacity is now estimated to almost triple over the 2022-2027 period, which will make it the largest source of power capacity in the world, surpassing coal[16]. However, even more capacity will need to be generated for the world to be on track to a Net Zero economy by 2030. In 2021, the IEA set out a "narrow but achievable pathway for the global energy sector to reach Net Zero emissions by 2050" and then updated it in 2022.[17] The updated graphics are used in this article to illustrate the gap between where we are now to where we need to be to reach Net Zero emissions; the first one shown in Figure 7 overleaf represents the solar PV capacity required for Net Zero Emissions (NZE).

Wind generation increased by a record amount in 2021, but like Solar PV, much faster growth is required to get on track for the net zero trajectory, as shown in Figure 8 overleaf.

In 2021, almost 70% of wind generation growth came from China, followed by the United States at 14%, and Brazil at 7%; onshore windfarms represent 93% of capacity and the remaining 7% represent offshore systems[18]. Growth is accelerating in wind power, and policy support from many countries, such as China, USA, the EU and India, is largely driving this.

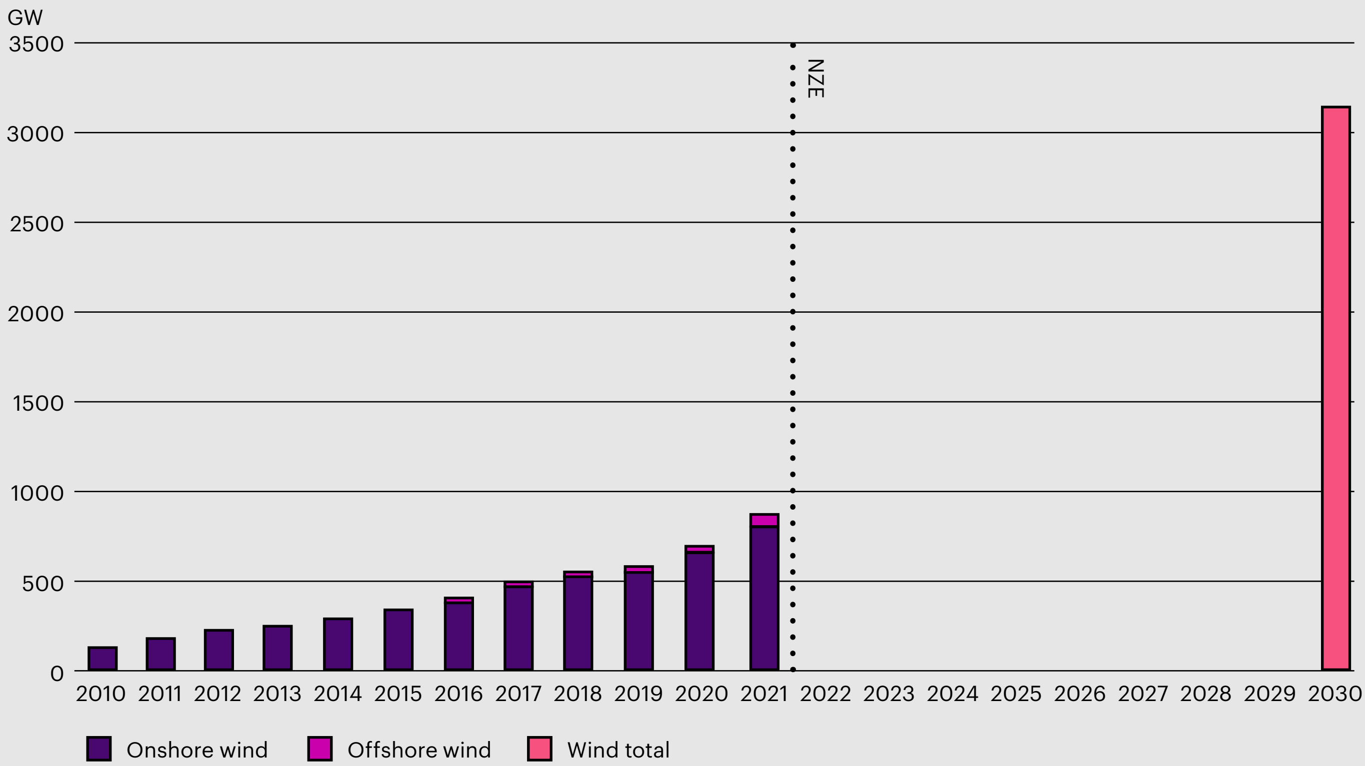
[16] https://www.iea.org/news/renewable-power-s-growth-is-being-turbocharged-as-countries-seek-to-strengthen-energy-security
[17] IEA (2022), World Energy Outlook 2022, IEA, Paris https://www.iea.org/reports/world-energy-outlook-2022 License: CC BY 4.0 (report); CC BY NC SA 4.0 (Annex A)
[18] https://www.iea.org/reports/wind-electricity

Figure 7: **Solar PV power capacity in the Net Zero Scenario, 2010-2030**



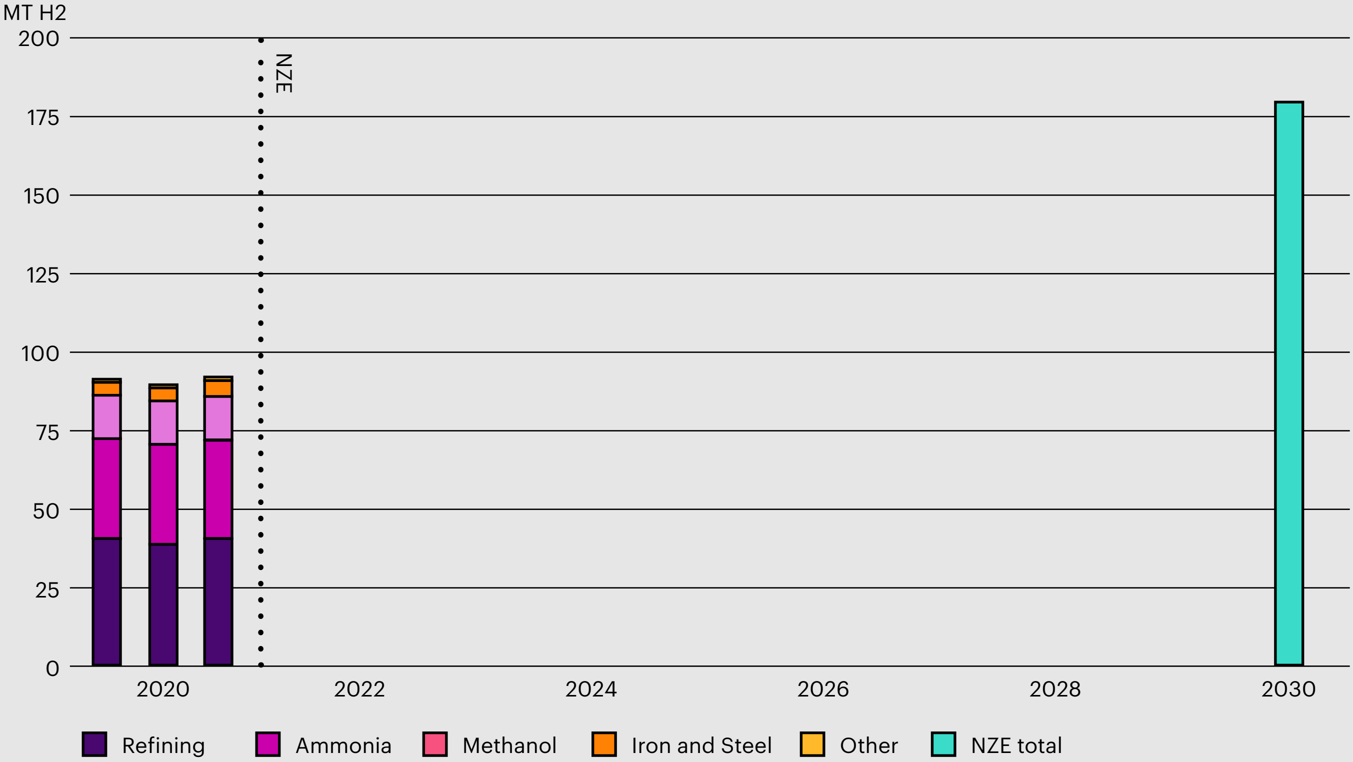
Source: IEA, Solar PV power generation in the Net Zero Scenario, 2010-2030, IEA, Paris (https://www.iea.org/data-and-statistics/charts/solar-pv-power-generation-in-the-net-zero-scenario-2010-2030)

Figure 8: **Wind power generation in the Net Zero Scenario, 2010-2030**



Source: IEA, Wind power generation in the Net Zero Scenario, 2010-2030, IEA, Paris (https://www.iea.org/reports/wind-electricity)

Figure 9: **Global hydrogen demand by sector in the Net Zero Scenario 2019-2030**



Source: IEA, Global hydrogen demand by sector in the Net Zero Scenario, 2019-2030, IEA, Paris (https://prod.iea.org/data-and-statistics/charts/global-hydrogen-demand-by-sector-in-the-net-zero-scenario-2019-2030)

The hydrogen buzz

There is so much buzz about the benefits of clean hydrogen; it can potentially help decarbonise hard to abate sectors such as transport, heavy industries, and power generation. Hydrogen is a versatile energy carrier and while solar PV and wind renewables suffer from intermittency, low or no-carbon fuels such as hydrogen are gaining traction in the energy transition.

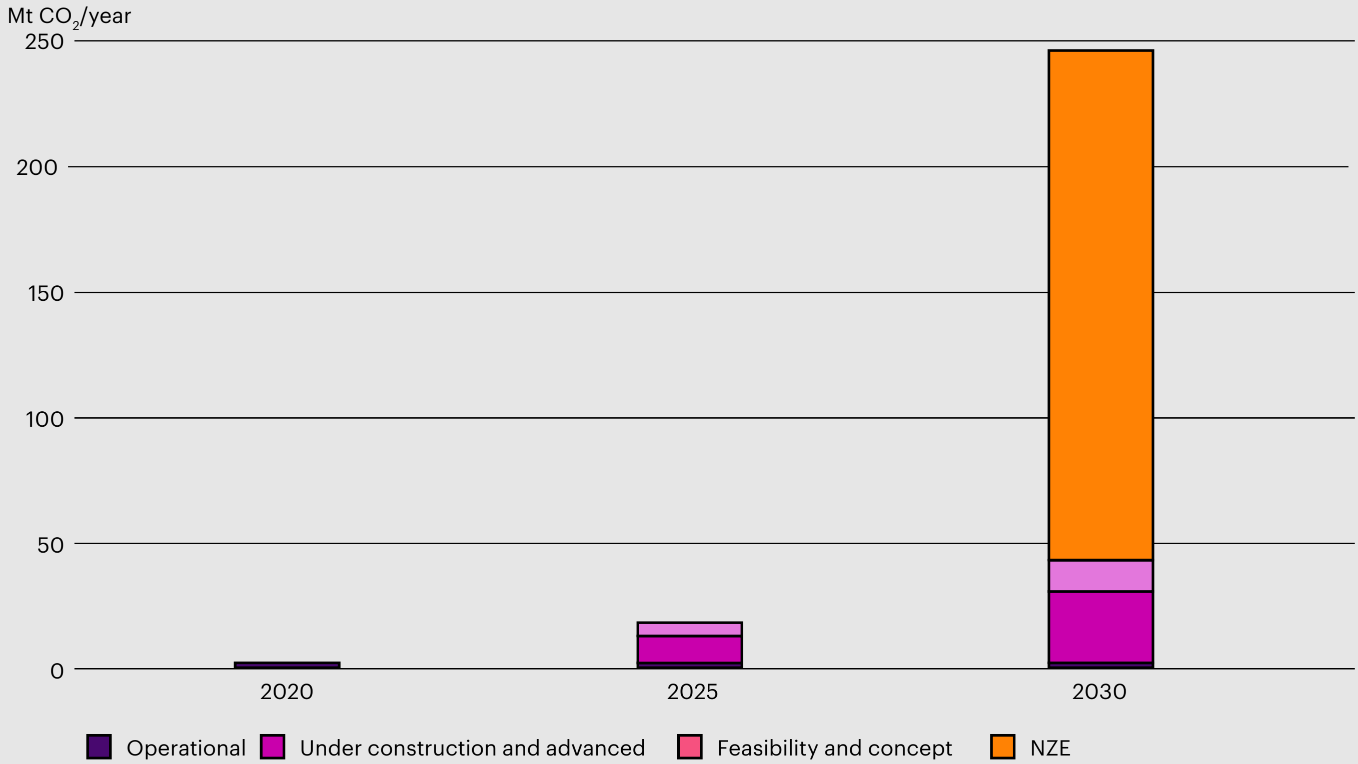
However, not all types of hydrogen are created equally and there is a rainbow of colours, representing a different method of production that generates more or less emissions. Grey hydrogen is produced by combusting natural gas, which emits CO_2 into the atmosphere. Blue hydrogen is produced combusting fossil fuels but has carbon capture, utilization, and storage technology to remove the CO_2 emissions from flue gases. Green hydrogen is produced using an electrolyser powered by renewable energy.

Demand for hydrogen reached 94 million tonnes in 2021 but the production of green hydrogen is only roughly 1% of this figure[19]. This is because the cost of using renewable electricity to produce hydrogen is significantly higher than producing hydrogen from fossil fuels. Furthermore, while the cost of renewable electricity is a key barrier, challenges associated with electrolyzers are another major issue.

Yet the momentum behind low-carbon hydrogen is strong, as policy makers across the globe release their national hydrogen strategies. However, Figure 9 above shows the demand behind current hydrogen demand, along with the production areas it is used for, and the massive gap to getting to the Net Zero scenario by 2030 with hydrogen[20]. Unlocking investment for low carbon or green hydrogen will be key; innovation continues, as researchers in China claim to have produced hydrogen by splitting seawater without the need to desalinate or purify it first, which could be significant in making green hydrogen more affordable[22].

[19] https://www.iea.org/fuels-and-technologies/hydrogen
[20] https://www.iea.org/fuels-and-technologies/hydrogen
[21] https://www.chemistryworld.com/news/water-splitting-device-solves-puzzle-of-producing-hydrogen-direct-from-seawater/4016645.article

Figure 10: **Operational and planned BECCS capture capacity by stage of development vs Net Zero Scenario, 2022-2030**



Source: IEA, Operational and planned BECCS capture capacity by stage of development vs Net Zero Scenario, 2022-2030, IEA, Paris (https://www.iea.org/data-and-statistics/charts/operational-and-planned-beccs-capture-capacity-by-stage-of-development-vs-net-zero-scenario-2022-2030)

BECCS: a solution for the energy transition?

Bioenergy with carbon capture and storage, or BECCS, is a utopian-like solution to deliver a Net Zero scenario; however, it is fraught with controversy around biomass feedstock, which calls into question BECCS's sustainability credentials.

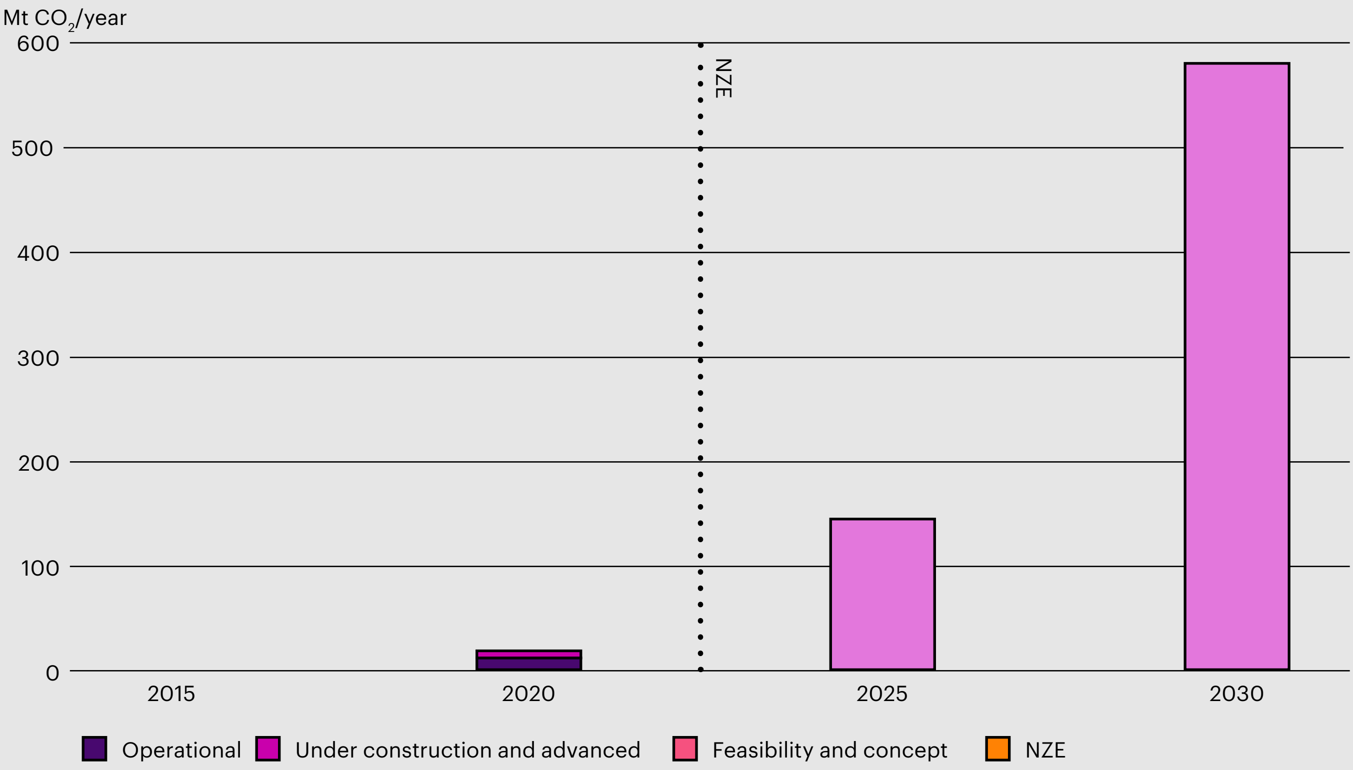
The concept is simple: BECCS plants extract bioenergy from biomass and then can capture and store the energy. The biomass can be converted into heat, electricity, or liquid or gas fuels; the CO_2 emissions are captured and stored in geological formations or embedded in long lasting products, such as cement produced by Carbon Cure[22]. Even with the criticism that growing bioenergy crops can compete with food production and thereby cause more deforestation, the momentum behind BECCS has grown substantially in recent years. There are plans for over 50 new facilities involving BECCS – totally biogenic capture capacity is around 20 Mt CO_2 per year – however, this falls very short of the 250 Mt/year required to reach the Net Zero scenario[23].

More storage required

System flexibility and storage are required to integrate more variable renewable energy on electricity grids. According to the IEA, global installed storage capacity is forecast to expand by 56% in the next five years to reach over 270GW by 2026[24]. This increase in storage will help increase energy security and flexibility is also required from the grid, power plants and demand-side response. However, to meet the storage capacity required for a Net Zero scenario, significant growth will be required, as shown in Figure 11 overleaf.

[22] https://www.carboncure.com/
[23] https://www.iea.org/reports/bioenergy-with-carbon-capture-and-storage
[24] https://www.iea.org/articles/how-rapidly-will-the-global-electricity-storage-market-grow-by-2026

Figure 11: **Total installed battery storage capacity in the Net Zero Scenario, 2015 - 2030**

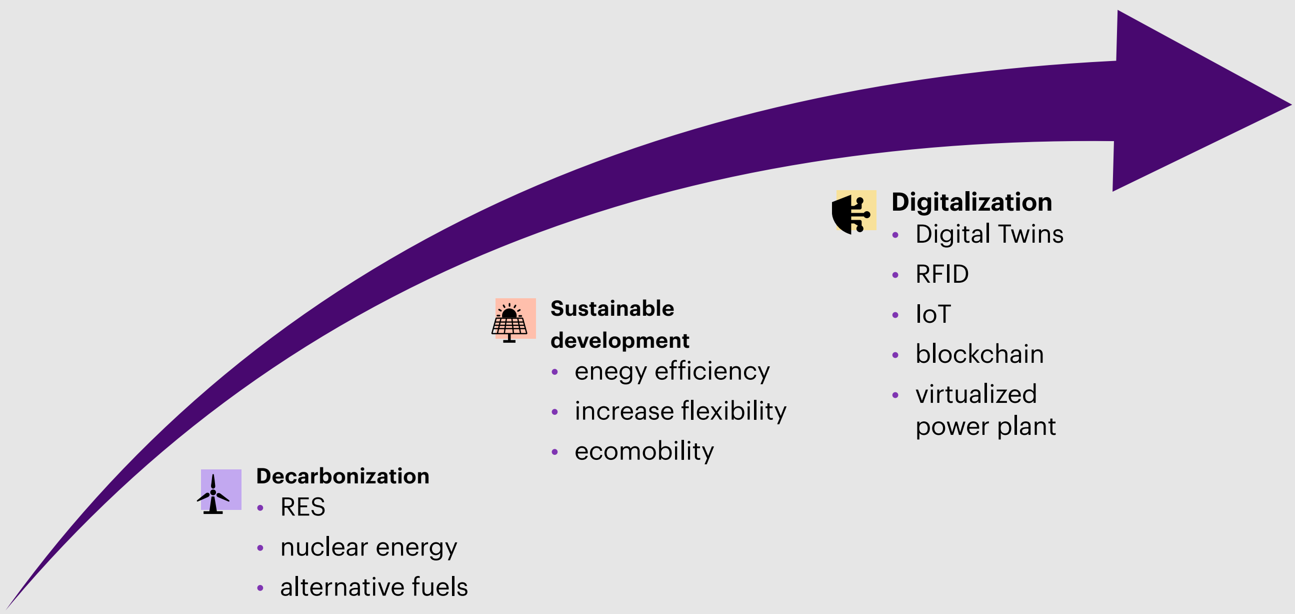


Source: IEA, Total installed battery storage capacity in the Net Zero Scenario, 2015-2030, IEA, Paris (https://www.iea.org/data-and-statistics/charts/total-installed-battery-storage-capacity-in-the-net-zero-scenario-2015-2030)

Grids need to be smart

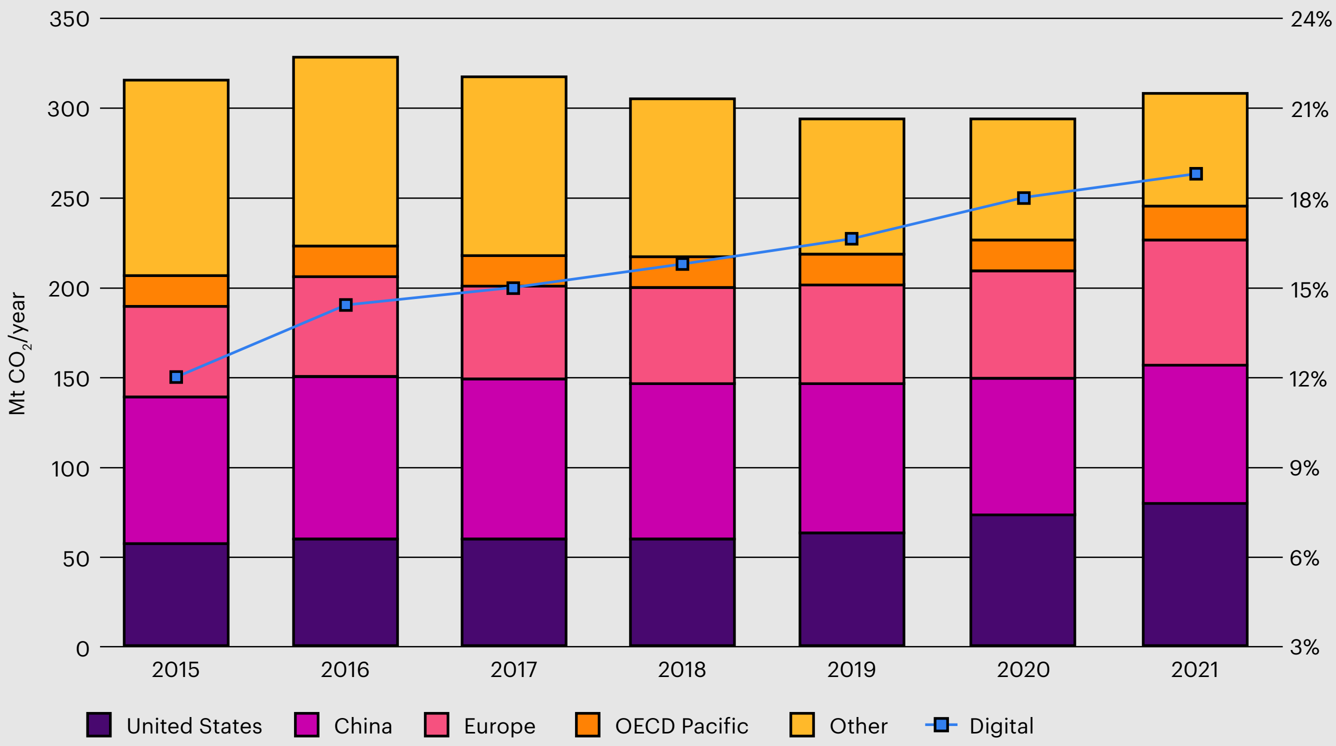
As society massively expands to renewables, grids need to be smarter. Supporting the electrification of buildings, industry, and transport means more investment of a proper development of networks. Distributed generation means having a much more complex and expanded network of generation and plants into smart grids, which are electricity networks that use digital, artificial intelligence and other advanced technologies to monitor and manage the transport of electricity. Smarter grids combine existing with newer technologies, as shown in Figure 12 below.

Figure 12: **Digitalisation, decentralisation, and decarbonisation are the direction of travel of the energy sector**



Source: https://www.mdpi.com/1996-1073/14/7/1885

Figure 13: **Investment spending on electricity grids, 2015-2021**



Source: IEA, Investment spending on electricity grids, 2015-2021, IEA, Paris (https://www.iea.org/data-and-statistics/charts/investment-spending-on-electricity-grids-2015-2021)

However, investment in electricity grids needs to nearly double to around US$600 billion (current investment is around US$300 billion) through to 2030 to correspond with the Net Zero scenario – and to almost triple in emerging markets and developing economies[25].

Of note in this chart is the growth of digital infrastructure, which range from (and are not limited to) smart meters, sensors, automation of substations, and monitoring devices. Digital investment in distribution also includes network digital twins, which are virtual models designed to accurately reflect a physical object or groups of assets, such as a wind turbine or wind farm. Sensors related to vital areas of operation are fitted to the object(s) and produce data about different aspects of performance. (See breakout box *Innovation: Ecological Digital Twin* for an example of digital twin innovation applied to wind farms.)

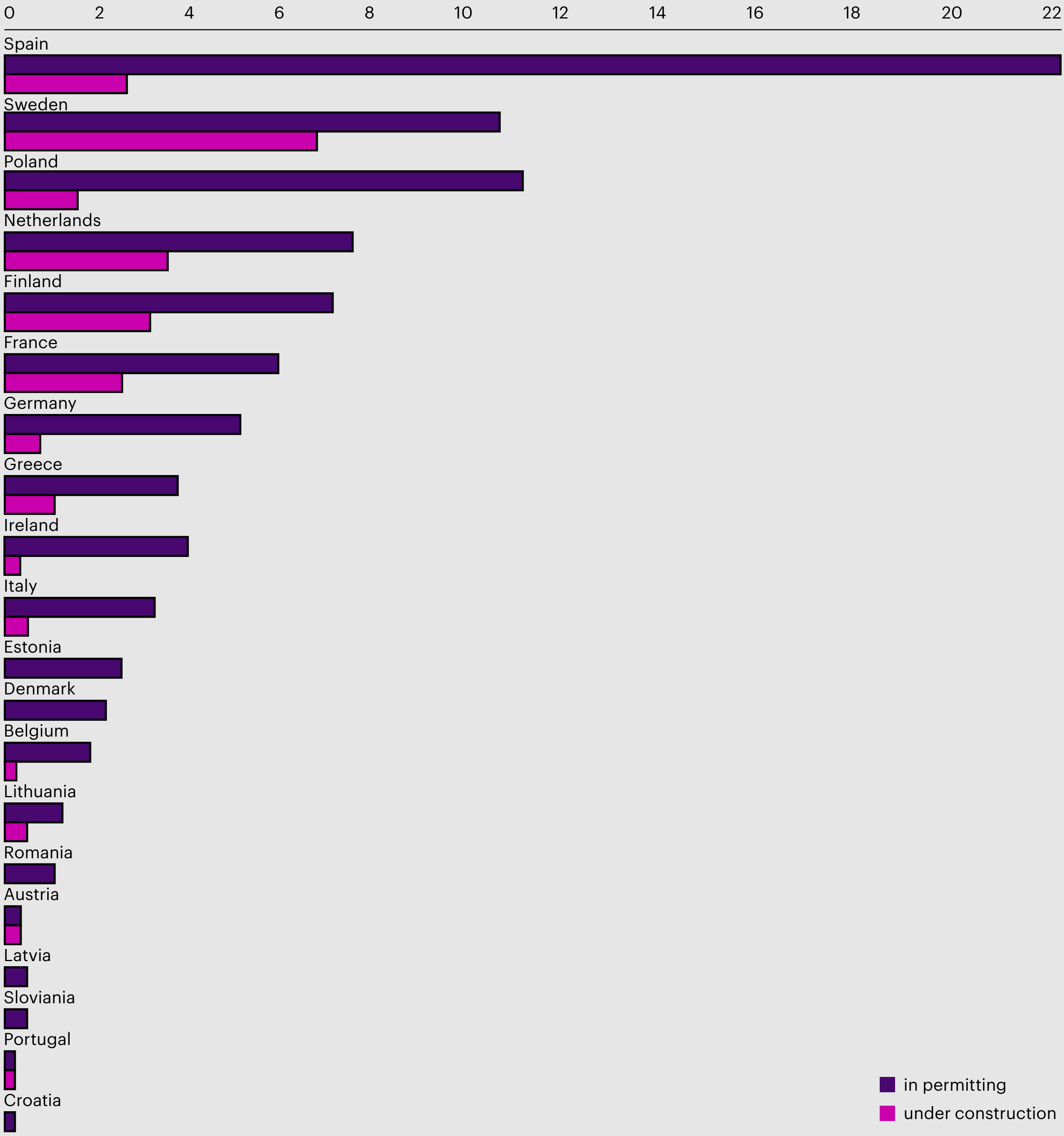
Permitting

Large clean energy infrastructure projects are complex; they require environmental impact assessments, spatial planning studies, and planning authorisations, along with grid connection assessments that need to be completed before any construction can begin. Additionally, legal challenges can delay projects further, to the point where such project lead times can take years.

Given the magnitude of renewable energy required, faster permitting for projects are needed as there is a serious backlog in permitting approvals; for example, Europe has four times as much wind capacity awaiting approval as it does under construction[26].

[25] https://www.iea.org/reports/smart-grids
[26] https://www.en-former.com/en/faster-permitting-cannot-come-quick-enough/

Figure 14: **Wind capacity in permitting and under construction**



Source: https://www.en-former.com/en/faster-permitting-cannot-come-quick-enough/

Europe is not alone, as permitting delays for large scale renewable energy projects are well known in the United States and other countries too. Environmental protection for wildlife, air, water, communities, and larger interest groups is, of course, incredibly important; however, the bureaucracy and procedures can take years – which the world doesn't have, given the urgency to transition to a Net Zero economy.

Permitting obstacles need to be addressed by authorities across the globe and the regulatory landscape for renewables remains fragmented. However, policy action is underway to address slow permitting, as seen in the EU's REPowerEU Plan. In addition, the US Senators backing the Inflation Reduction Act also agreed to push for reforms to speed up the permitting process[27].

Getting faster permitting for renewables is one big barrier - but money is another.

[27] https://www.progressivepolicy.org/wp-content/uploads/2022/09/Americas-Clean-Energy-Transition-Requires-Permitting-Reform-Bledsoe-Sykes-21.9.22.pdf, pg 3

Figure 15: **Global energy transition asset finance**

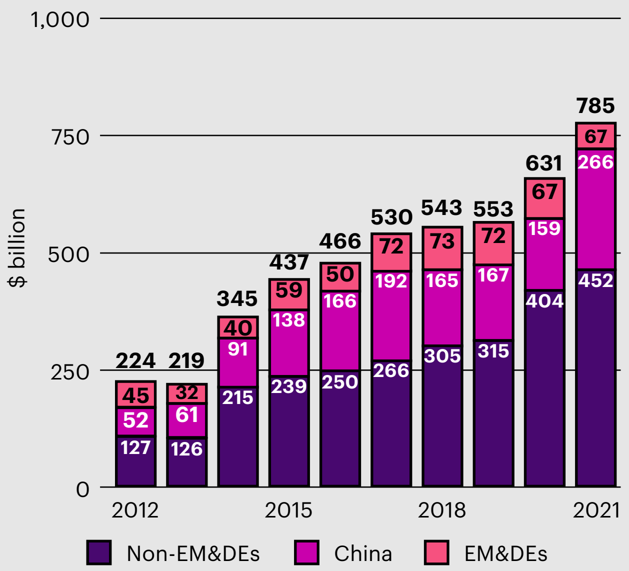
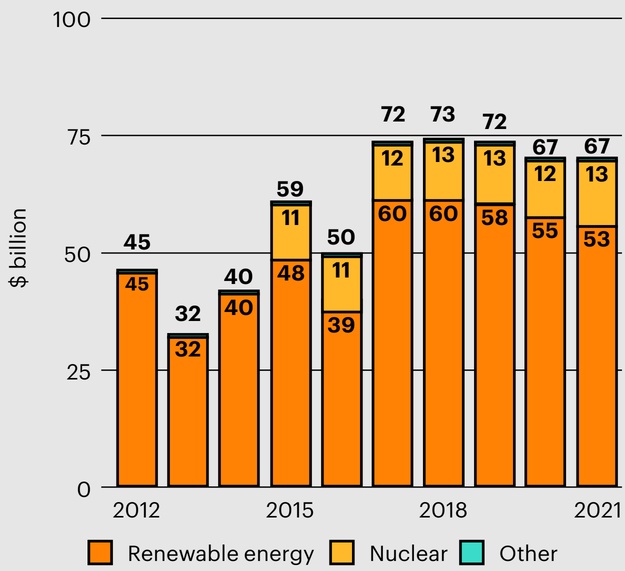


Figure 16: **Energy transition asset finance in EM & DEs**



Notes: Energy transition technologies include renewable energy, carbon capture and storage (CCS), electrified heat, electrified transport, energy storage, hydrogen and nuclear. investment numbers include both equity and debt.

Source: https://about.bnef.com/blog/mobilizing-capital-into-emerging-markets-and-developing-economies/

Where's the money?

After all, who is going to fund these investments for a cleaner world? What's been shown so far in this article is a strong momentum towards increased renewable energy capacity but also a massive gap, both in terms of investment and capacity, to produce the amount of renewable energy needed for a Net Zero world. This is a real crisis that countries must solve.

Yet watching them discuss climate finance - or rather the lack of enough of it - can sometimes feel like being in restaurant having dinner with a large group of people. All feel they have a right to be at the table, yet when the bill arrives at the end of the meal, suddenly many are shuffling around, patting their business suits or peering into their handbags, then announcing they've forgotten their wallet. The task ahead and the resources required to reach Net Zero are enormous. Countless reports and analysis show the estimated costs required, as well as the costs of inaction. Public sources are not enough to cover the scale of investment needed and the private sector will have to be mobilised by public policies that create incentives, appropriate regulatory frameworks, and reform energy taxes[28].

Climate finance is tricky and a contentious issue; nations pledged US$100 billion over 10 years ago to help developing nations but developed nations have yet to deliver this amount. This is an issue and will remain one; with the onset of the energy crisis, it risks being even harder to get climate funding for developing nations.

However, it's not all bad news. Investment in renewable energy capacity jumped 40% in the five years ending in 2021, compared to 2012-2016[29].And the IEA's most recent upward revisions on renewable capacity expansion forecasts are encouraging, even though short for Net Zero.

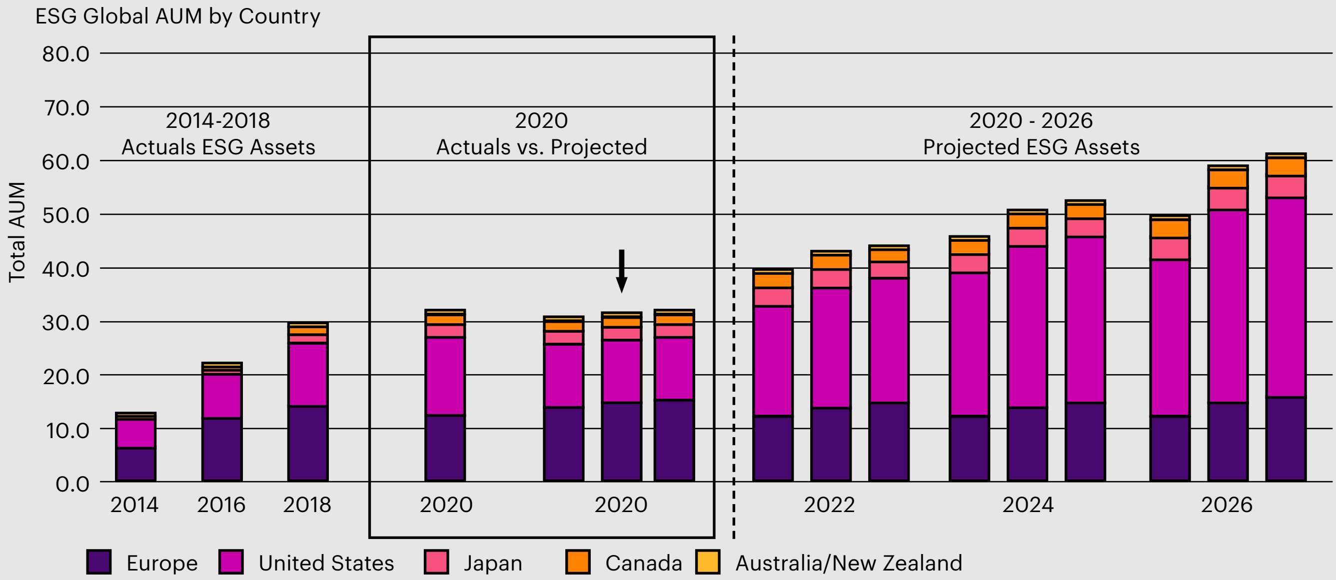
Much of this previous growth came largely from developed economies, where incentives, auctions, and feed-in tariffs fuel investment. However, in emerging and developing economies projects often rely on public finance, a stable policy environment and debt financing, as well as development and climate finance. While many emerging markets have clean energy targets, they can lack effective mechanisms to drive investment. The volume of capital being deployed to transition these countries is currently insufficient and the investment gap between developed and developing economies has widened[30].

Global investment in low-carbon energy technologies grew to US$785 billion in 2021, with much of this occurring in developed economies and China (see Figure 15 above), while energy transition asset finance in emerging markets and developing economies (EM & DEs) remained flat at US$67 billion (see Figure 16 above)[31].

In addition, it's not just mitigation that is required in emerging markets and developing economies.
The UNEP gap report estimates rising annual adaptation needs of US$340 billion required by developing nations by 2030[32].

[28] https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf pg 82
[29] https://about.bnef.com/blog/mobilizing-capital-into-emerging-markets-and-developing-economies/
[30] https://about.bnef.com/blog/mobilizing-capital-into-emerging-markets-and-developing-economies/
[31] https://about.bnef.com/blog/mobilizing-capital-into-emerging-markets-and-developing-economies/
[32] https://www.unep.org/resources/adaptation-gap-report-2022

Figure 17: **Total ESG assets**



Source: Global Sustainable Investment Alliance, Bloomberg Intelligence, https://www.bloomberg.com/news/articles/2022-02-03/esg-by-the-numbers-sustainable-investing-set-records-in-2021?leadSource=uverify%20wall

Part III: Supply

Supply chains

It is difficult to respond to consumer and regulatory demands for more sustainable energy with the supply squeeze in the market. There are cost increases of materials, freight, fuel and labour. Weak supply chains, in particular the soaring prices of raw materials with inflation, are biting into renewables profitability. Geopolitical tensions causing supply chain disruptions raises talk about creating supply chains that are closer to home in order to manage them better.

ESG Investments

At the same time, regulatory and consumer demand for ESG compatible investments include the supply chain. How and where materials are sourced, under what labour conditions, and at what level of carbon content is now of greater importance.

The financial sector plays a central role in directing funds towards sustainable development. For example, the private sector can help the energy transition through investments into low-carbon energy technologies and, for the most part, these are considered as ESG investments. Investors have increasingly shown interest in putting their money into more socially conscious companies and turn to companies or funds that follow ESG investing strategies. Green energy is a popular choice and investors are considering non-financial risks posed by problems from climate change, for example in the treatment of workers through the supply chain.

ESG investing is no longer a fad; ESG assets are due to climb to US$41 trillion by the end of 2022 and climb to US$50 trillion by 2025[33]. Bloomberg Intelligence charted out the total ESG global assets under management (AUM) by country and for the first time, the US took the lead from Europe in 2020 (see Figure 17 above).

One could question the accuracy of the data behind the asset estimates, as what exactly qualifies as ESG is not clear cut. However, the growth trend is clear and backed up with the ballooning of the sustainable debt market, sustainable funds, and revenue increases of the biggest ESG fund managers.

Ashwath Damodaran, professor of corporate finance and valuation at the NYU Stern School of Business, claims that it is the lure of marketing the E, S, and G together that is driving capital toward it and calls the whole ESG concept "fuzzy"[34].

Stopping greenwashing

Across the three ESG pillars, there is a mix of quantitative and qualitative data to assess. Quantitative data is easier to assess and report on but comparable metrics for qualitative information is subjective, and this is just one of the many reasons why the ESG ratings and scores of companies can vary so widely. However, ESG news has an impact and claims of greenwashing are growing. In addition, criticisms of ESG investing have only grown louder since the conflict in Ukraine began.

[33] https://www.bloomberg.com/news/articles/2022-02-03/esg-by-the-numbers-sustainable-investing-set-records-in-2021?leadSource=uverify%20wall
[34] https://www.realclearenergy.org/articles/2022/11/22/esg_doing_good_or_sounding_good_866297.html

Regulators are more actively scrutinizing ESG and climate-related corporate behaviors in an effort to stop greenwashing. At the same time, sustainable and climate-related reporting standards are becoming increasingly burdensome. For example, climate disclosure frameworks, such as the Taskforce for Climate Related Financial Disclosure (TCFD), have gone from best practice to industry standard. In some countries, such as the UK and New Zealand, the TCFD is now mandatory reporting.

Turbo-charged sustainability reporting

Mandatory sustainability reporting is about to be turbo charged - and standardized. The Corporate Sustainability Reporting Directive (CSRD), adopted by the European Commission in November 2022, will replace and build upon the Non-Financial Reporting Directive (NFRD). The CSRD requires more detailed sustainability reporting and more than quadruples the number of companies that must comply: 11,000 currently covered by the NFRD to nearly 50,000 that will be covered by the CSRD. The rules will start applying between 2024 and 2028; this will have global impacts, as the CSRD also applies to companies based abroad who have a presence in the EU.

Businesses will have to disclose not only the risks they face from climate change, but also the impacts they may cause to the climate and society – the notion of "double materiality". Reporting will be submitted in a standardized digital format to allow for easier comparison between companies.

Need to measure entire carbon footprint

What this means for renewable energy companies is that they need to get ready by measuring and managing their entire carbon footprint to comply with current and future reporting requirements as per the CSRD. Scope 3 emissions, being the indirect emissions resulting from a company's upstream and downstream activities, will be required to be reported as well. Scope 3 emissions are tricky and difficult to measure; indeed, many companies are not currently measuring them at all. Furthermore, it takes time to figure out Scope 3 emissions so getting a process in place, if a company does not already have one, is critical to get ahead of the CSRD mandates to be compliant and manage this risk.

Data is key

Sustainability (or ESG, depending on how readers see it) is a movement defined by data. Being transparent about the company's progress, its challenges, and its learnings are crucial to its credibility. But how can any progress be tracked without a baseline of sustainability data?

Companies need this data and as a result, they are increasing their investments in ESG data and sustainability reporting technology across the board. Deloitte commissioned an online survey and conducted interviews at publicly owned companies with revenues greater than US$500 million across a variety of sectors for their Sustainability Action Report and found that 99% of companies are somewhat or very likely to invest in more technology and ESG disclosure reporting tools[35]. Furthermore, 48% of participants cited risk reduction as a tangible benefit of integrating ESG within a company's strategy.

Trusted, integrated, and easy-to-implement technology solutions, combined with artificial intelligence and machine learning, can provide insights that spreadsheet tracking just cannot do. Because armed with the right data, companies can predict trends and proactively make changes to help them hit their sustainability targets faster.

> **"What this means for renewable energy companies is that they need to get ready by measuring and managing their entire carbon footprint to comply with current and future reporting requirements."**

[35] https://www2.deloitte.com/us/en/pages/audit/articles/esg-survey.html

Conclusion: important steps for risk managers

Renewables will remain the star of the show in the energy transition; however, the trilemma of energy money and supply is here to stay for a while. This means that current issues such as inflation, cost increases, security, and supply chains pose challenges for renewable energy risk managers. Furthermore, increasing complexity in the market makes it difficult to know how and where to increase value.

So, what is a renewable energy risk manager to do? There are important steps that they can take to transition to Net Zero, to assess their own vulnerabilities, and to protect themselves from current and future ESG and climate related risks.

- Firstly, **understand your own ESG and sustainability position**. How are you optimizing your own operations? What's your baseline for emissions?
- Secondly, **take a reactive risk-response view** by looking at your value chain, both up and down stream. Where are the risks? Where are the opportunities?
- Thirdly, **play a strategic role across the company** - build strong relationships from the C-suite to the ESG team. Where can you drive ESG impact through new business models?
- Finally, risk managers should **look to work with other relevant stakeholders**, such as lenders, insurers, and especially their intermediaries. What partnerships can be created with others to drive value?

So do be prepared to act now. Prudent risk management is critical to this process of physical and transition risk.

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