REPORT

NEW CLIMATE INSTITUTE

FIVE MAJOR SHIFTS SINCE THE PARIS AGREEMENT THAT GIVE HOPE IN A JUST, PARIS-COMPATIBLE TRANSITION

A look back

NOVEMBER 2023

FIVE MAJOR SHIFTS SINCE THE PARIS AGREEMENT THAT GIVE HOPE IN A JUST, PARIS-COMPATIBLE TRANSITION

A look back

Authors

Frauke Roeser	NewClimate Institute
Niklas Höhne	NewClimate Institute
Leonardo Nascimento	NewClimate Institute
Markus Hagemann	NewClimate Institute

Design

Yogee Chandrasekaran	NewClimate Institute
Polina Korneeva	NewClimate Institute

Editing & Communications

Aman Gill-Lang	NewClimate Institute

Acknowledgement

This paper greatly benefitted from the inputs and comments of several colleagues in reviews and brainstorms to capture the collective knowledge at NewClimate Institute, in particular Aki Kachi, Swithin Lui, Hanna Fekete, Frederic Hans, Gustavo de Vivero, Louise Jeffery, Juliette de Grandpré, Catrina Godinho, Carsten Warnecke and Thomas Day.

We would like to thank the Ambition Partnership of ClimateWorks Foundation and Bezos Earth Fund for providing the necessary funding for this work. A special thanks goes to Alex Fisher (ClimateWorks Foundation) for the inspiration to write this paper in the first place and support along the way.

Download the report

https://newclimate.org/resources/publications/five-major-shifts-since-the-paris-agreement

NEW CLIMATE INSTITUTE

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

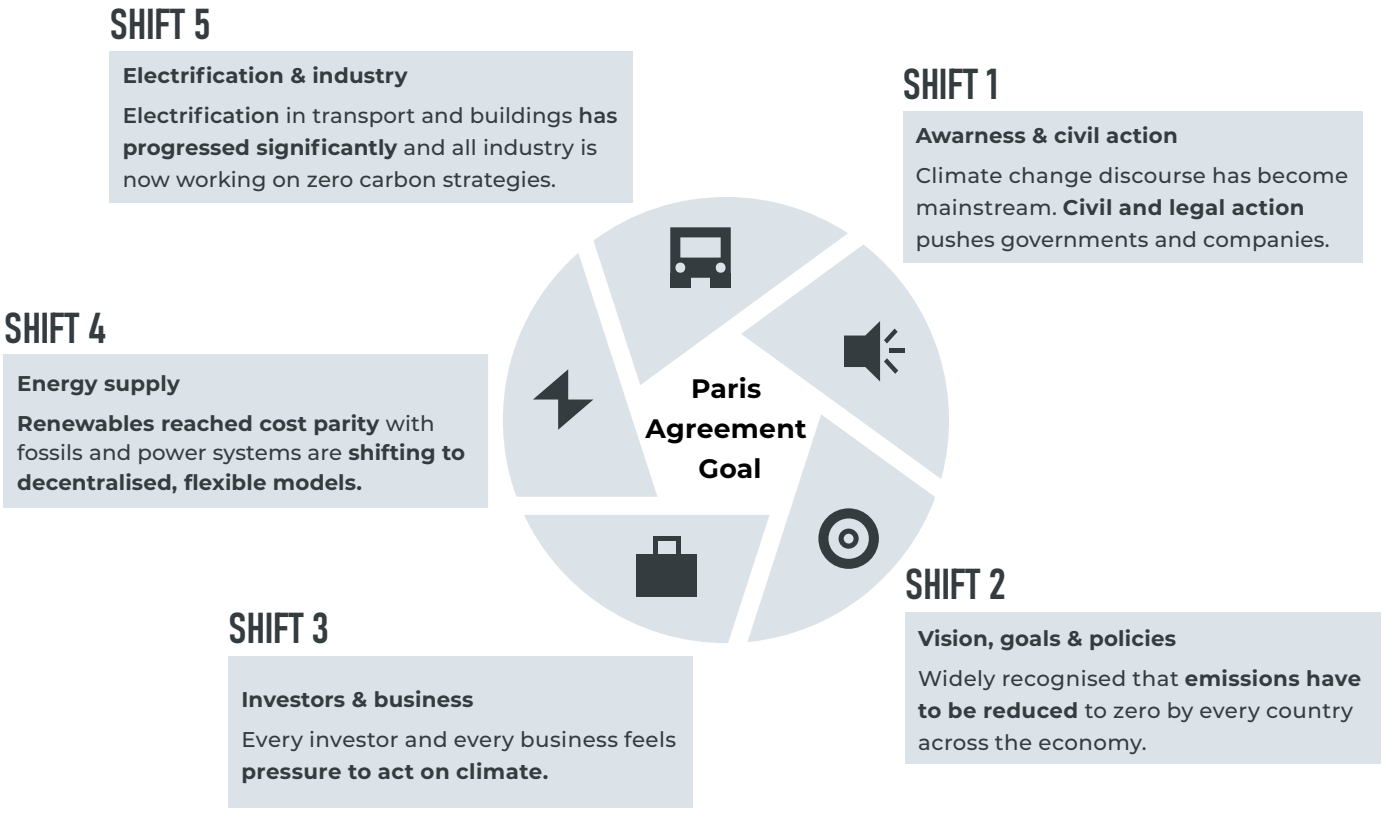
Nearly ten years have gone by since the groundbreaking Paris Agreement was signed in 2015. At the international level, the Agreement was hailed as a turning point of collective global action to combat climate change after many rounds of negotiations under the UNFCCC umbrella. For the first time, all countries agreed to keep global average temperature increase to "well below 2°C aiming for 1.5°C" with each contributing their part at a self-determined speed and scale. The so-called ambition mechanism with the Nationally Determined Contributions at the centre was born, embedded in a framework of processes and milestones to enable assessment of progress towards the collective goal.

Since then, the implementation of the ambition mechanism has proven slower than what is needed to meet the goals of the Paris Agreement. At the same time, the scientific community's warnings have grown in urgency and alarm. Indeed, in many parts of the world the impacts of climate change can already be felt, in numerous natural disasters, heat waves, droughts, floods, which threaten the livelihoods of millions.

Against a backdrop of multiple global crises, rising geopolitical tensions and increasing disinformation campaigns, it is important to not only reflect on the gaps of what hasn't happened but also what has been achieved over the last decade. A closer look at progress will provide important insights into the dynamics of change that we can build on as well as nurture a sense of purpose for the climate community to prepare itself for the next crucial – and undoubtedly difficult – decade.

This paper gives an overview of what has been achieved in the last years of international climate policy at the global level along different dimensions of the transition towards a zero emissions world. The focus is deliberately on the positive shifts that can be observed, recognising that these are insufficient to move us to where we need to be but remind us that not all is lost yet. The paper is structured along five thematic areas, covering awareness and civil action, policy and governance, investors and business, as well as the energy and industry sectors. In all of these areas positive shifts are under way. In some cases the shifts are only small and need significant acceleration and scaling. Some have positively surprised us and are already past positive tipping points and "simply" need continuation. All show that change is possible and is happening, sometimes faster than was previously expected or thought even possible.

Under each theme we highlight the main positive trends that have been observed in the last decade. It is not meant as a comprehensive compendium but rather a collection of evidence underpinned by data where possible, sometimes anecdotal. The intention is to provide a perspective of change at the global level and not to zoom into specific geographies. However, there are of course significant regional and local differences in many of the observed trends which cannot be considered in depth within the scope of this exercise.



SHIFT 1

AWARENESS & CIVIL ACTION

BEFORE

Only parts of society were meaningfully aware and concerned about climate change.

Climate change is now central in the public and political discourse in many parts of the world. Knowledge and awareness on the causes and impacts of climate change has increased across many parts of the population. This is the result of growing media coverage, mainstreaming climate change into education and curricula and not least because the effects of climate change are increasingly felt by many. The decade also saw climate protests and social movements growing in strength, influencing the political debate and keeping businesses and societies on their toes. Advances in attribution science made climate litigation possible.

NOW

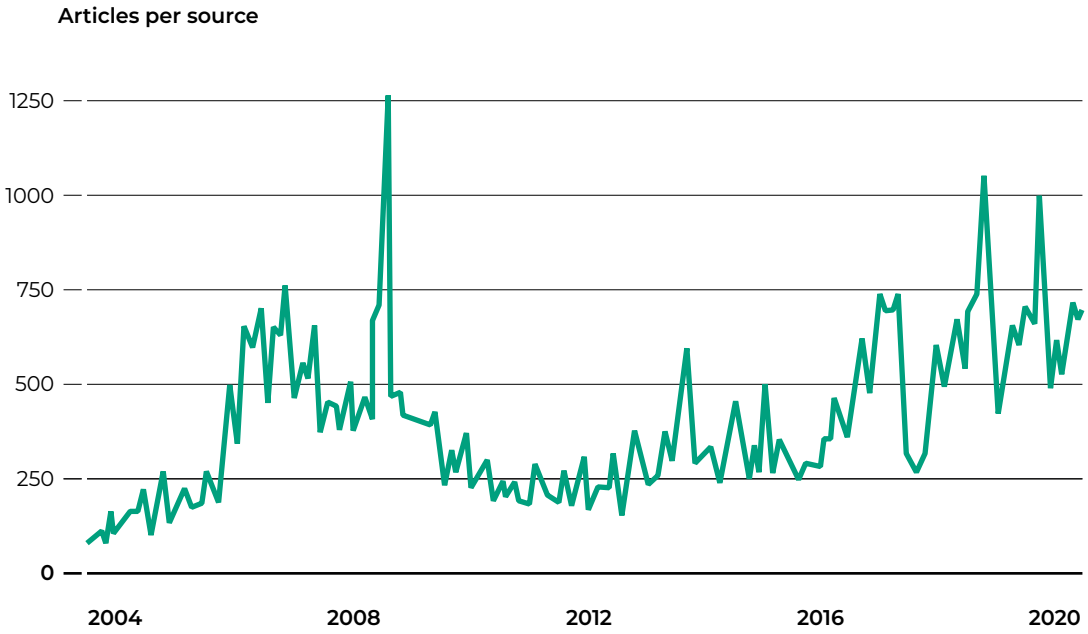
Climate change discourse **has become mainstream** and is a subject of debate **in all parts of society**, driving social movements and civil action.

THE MEDIA NOW COVERS REGULAR STORIES RELATED TO CLIMATE CHANGE AND REACHES PEOPLE THROUGH DIVERSE CHANNELS, INCLUDING MAINSTREAM AND SOCIAL MEDIA AS WELL AS SPECIALISED NEWS CHANNELS.

The Media and Climate Change Observatory tracks newspaper coverage of climate change in seven regions around the world **(→ Figure 1)**. While coverage goes up and down, there is a clear growth trend since 2015. There are peaks around times of specific events, political, scientific or climatic, as well as dips where other issues (i.e., the COVID-19 pandemic in 2020, Russian invasion of Ukraine in 2022) grabbed front pages. An all-time high was observed in 2010, following the disappointing outcomes of the UNFCCC COP in Copenhagen in late 2009, when the costs of the international community's failure to set binding mitigation commitments was underscored by a slew of extreme weather events not seen in almost 100 years (WMO, 2013).

Figure 1

2004 – 2022 World Newspaper Coverage of Climate Change or Global Warming



Note: Articles per source refers to the average number of articles in a given month across 127 newspaper, radio and TV sources in 58 countries and seven different regions around the world.

Source: MeCCO, 2023; Re-produced by NewClimate Institute.

The IPCC's Sixth Assessment Report notes that climate change media coverage across 59 countries has increased from 47,000 articles in 2016 to 2017 to about 87,000 in 2020 to 2021 (IPCC, 2022a). There are of course significant regional differences. While coverage in the Global North is generally more frequent and focusses more on climate science, coverage in the Global South more frequently features links to development, societal changes and impacts on humans and the associated challenges (Hase et al., 2021).

However, there is also a noticeable increase in the level of fake news around climate change related topics. Research on Twitter data during the international climate negotiations between 2014 and 2021 investigated the links between climate change and political polarisation and found a four-fold increase in ideological polarisation since COP21 driven by right wing populist activity (Falkenberg et al., 2022). Also false balance reporting or "bothsideism" that is common in media reporting on climate change leads audiences to doubt the scientific consensus and affects people's ability to distinguish fact from fiction (Imundo and Rapp, 2022). News fatigue on climate change may also lead to people turning away from the topic.

→ **AN INCREASING NUMBER OF PEOPLE ARE AWARE OF CLIMATE CHANGE AND HOW IT WILL IMPACT THEIR LIVES.**

Coupled with an increased awareness and understanding of the causes and impacts of climate change and in particular the role that individuals play, there is rising concern that climate change will cause personal harm. In several major economies the number of people who have expressed intense concern that climate change will harm them personally within their lifetime has increased sharply to an average of 37% of people surveyed sharing the concern (Bell et al., 2021).

Results from a BBC survey (BBC, 2021) covering 17 countries across the world shows that people increasingly perceive climate change as a serious issue. Where in 2014 only around 40% of respondents voiced concern, the share increased to over 60% in 2020. Similarly, the 2021 "Peoples Climate Vote" (UNDP and University of Oxford, 2021) uncovered that the majority of surveyed people across 50 countries considered climate change to be a global emergency. In Eastern Europe and Central Asia this was the case for 85% of respondents, and for 72% of Western Europeans and North Americans, 64% in Arab states, 63% in Latin America, Caribbean and Asia Pacific and 61% in Sub Saharan Africa.

At least in principle people also seem to be willing to act on climate change even if it comes at a personal financial expense. For example, over 80% of people in Nigeria and Kenya stated that they would be willing to pay an extra tax to support climate action. In fact, in many emerging and developing economies the vast majority of people surveyed shared this view. At the lower end were some countries in the

Global North where numbers dropped to as low as 38% (Leiserowitz et al., 2022) arguably influenced by the fact that in many of these economies measures have already been implemented that affect peoples' finances. People in the Global North and South see that responsibility for addressing climate change lies mostly with government with an increasing number of people supporting propositions that their governments set ambitious climate targets; concretely 43% of people surveyed in 2015 versus 58% in 2021 (BBC, 2021).

On the flipside it is noticeable in public debates that while people theoretically support climate action it is proving rather difficult to introduce concrete measures that would affect the lifestyle of individuals, not least because populist actors use climate change to divide society in the political debate. In some cases, even where public demand for climate action is strong political decision makers follow a few loud or influential actors (see for example (Kinnunen, 2021)). People may be more aware and more knowledgeable about the problem, but at the same time it remains very difficult to channel this into the rapid and far-reaching transitions necessary to not only combat climate change but also prepare for it.

CLIMATE MOVEMENTS, PROTESTS AND CIVIL DISOBEDIENCE HAVE KEPT CLIMATE CHANGE HIGH ON THE POLITICAL AGENDA AND IN PEOPLES' MINDS PUSHING GOVERNMENTS TO ACT.

Driven by a growing perception of climate change as a threat to our society, several climate movements have emerged, took to the streets and made headlines. Youth are at the forefront of many of these movements, as young people tend to have a more acute sense of their future being at risk. A highly politized youth contributes to a perception of climate change as a generational conflict, beyond North – South and social divides. Prominent movements, such as Fridays for Future, have originated in the Global North but have sparked protests and climate strikes around the world **(→ Figure 2)**.

Civil disobedience movements, such as Extinction Rebellion, Just Stop Oil or Last Generation, have drawn attention to the climate crisis in recent years. This contributes to keeping the climate agenda high on people's perception and also forces political decision makers to address the topic.

As a result, governments and societies are permanently reminded of the need for action. In many instances they have started to change course. For example, spurred by climate protests, the German government was sued in constitutional court on the grounds that its 2019 Climate Change Act was an insufficient response to the impending climate crisis. The Constitutional Court found in favour of the plaintiffs and directed the government to revise the law to cut emissions more rapidly in 2030, which it subsequently did (Bundesverfassungsgericht, 2021).

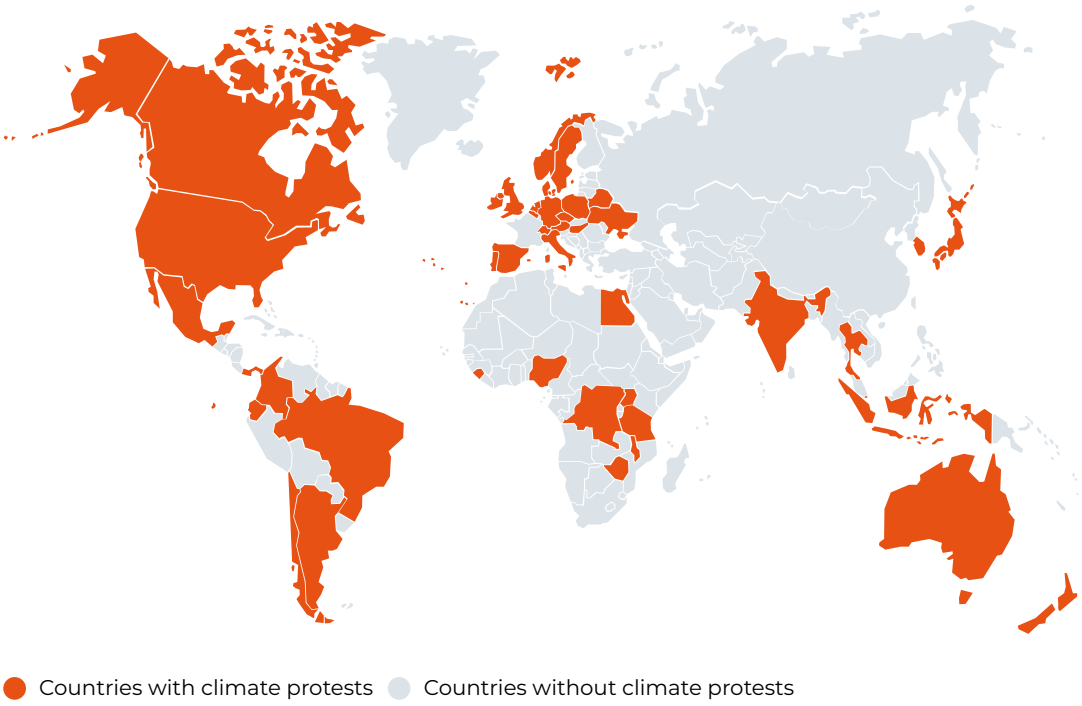


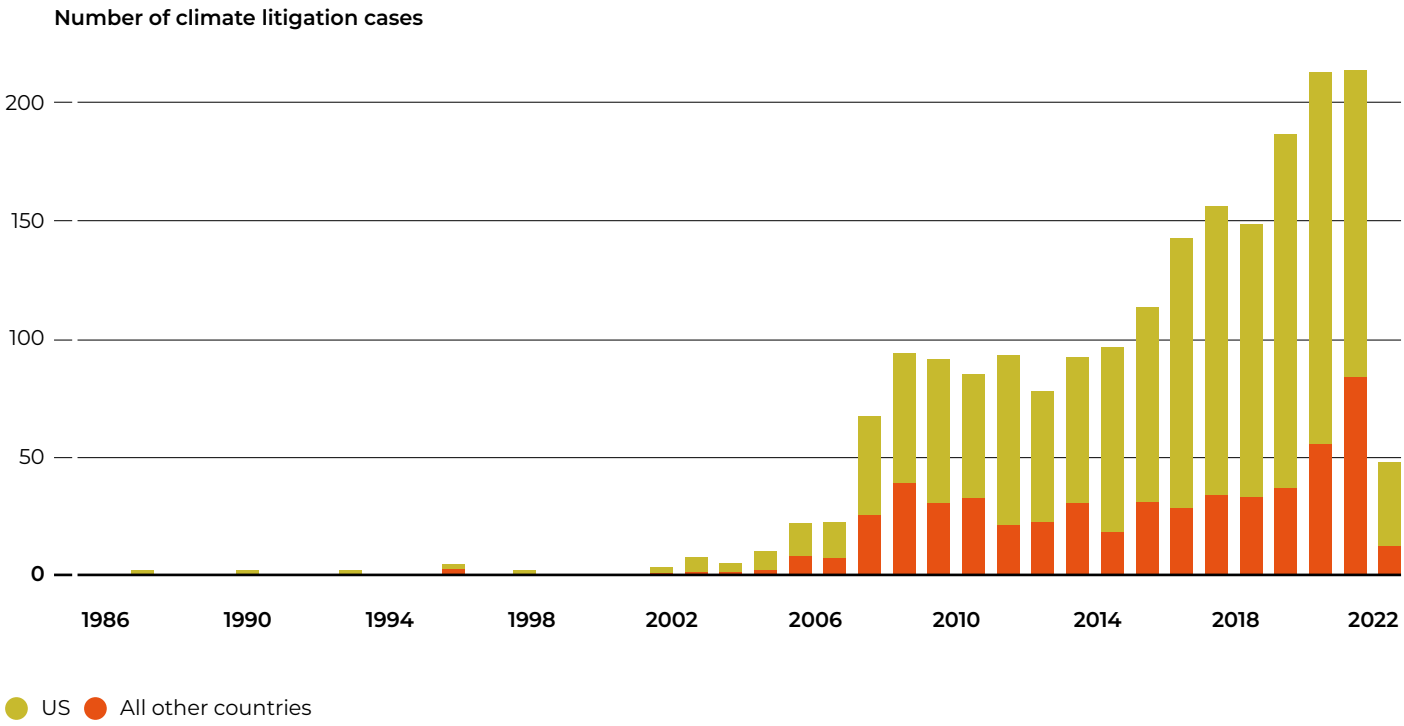
Figure 2
Countries with climate policy protests since 2022

Source: Carnegie, 2023; Re-produced by NewClimate Institute.

At the same time there are noticeable counter protests by specific groups which fear negative impacts from climate action (see for example the protests by Dutch farmers (Al Jazeera, 2022)). These counter movements are often spurred by populist actors which use civil action and in particular civil disobedience to further polarise people on the topic. In some countries civil spaces are being closed down specifically targeting climate protests (for example, the UK Public Ordinance Act (Laville, 2023)).

ADVANCES IN ATTRIBUTION SCIENCE SUPPORTS CIVIL ACTION IN A GROWING NUMBER OF CLIMATE LITIGATION CASES.

A growing body of scientific literature and evidence on the causes and impacts of climate change as well as solutions is laying the foundation for a better informed political and public discourse. The advances in attribution science in particular have paved the way for an increasing number of climate lawsuits brought against governments and companies **(see also → Shift 3)**. As policymakers and companies are slow to adopt the necessary regulatory frameworks and change their practices to address the climate crisis, individuals and organisations are increasingly challenging their insufficient climate action in court **(→ Figure 3)**.



Source: Setzer and Higham, 2022; Re-produced by NewClimate Institute.

Figure 3

Total climate change litigation cases in US and in other countries

Attribution science looks into the relationship between climate change, natural weather patterns and climate variability. It helps to understand how climate change affects weather events as well as how emissions drive climate change and its impacts. Advances in climate source attribution mark significant progress in being able to understand better the direct links between sources and impact to inform policy and strategies to reduce emissions (Merner, 2023). In particular a publication in 2014 that identified the 90 companies most responsible for global carbon and methane emissions between 1751 and 2010 (Heede, 2014) provided the scientific grounds for legal action (Sato et al., 2023).

Although the knowledge and evidence on climate change, its drivers, impacts and solutions with regard to how to address the crisis, is increasing, such evidence, however, is not sufficiently entered into the political and public debate. The scientific discourse often remains in a silo, and a growing number of political actors and their supporters reject it outright.

SHIFT 2

VISIONS, GOALS & POLICIES

BEFORE

Policy debate centred on **incremental emission reductions and trade-offs** between sectors and countries.

A fully decarbonised economy is now a mainstream vision guiding climate targets of governments, regions and cities. Where previously discussions focussed on specific sectors and the trade-offs between them, a zero emissions economy perspective is now the norm including in economies in the Global South. Whilst aspirational targets have not yet translated into global emission reductions or aligned mid-term targets, the projected emissions curve has flattened. Climate policies now cover most if not all relevant sectors leading to a significantly improved outlook on the estimated temperature rise albeit not yet aligned with the needed 1.5°C.

NOW

Widely recognised that **emissions have to be reduced to zero** by every country across the economy.

THE LONG-TERM GOAL OF A ZERO GREENHOUSE GAS EMISSION ECONOMY HAS BECOME THE ACCEPTED NORM AROUND THE WORLD.

The global agreement to keep temperature increase to well below 2°C or 1.5°C enshrined in the Paris Agreement, means that CO_2 emissions need to be halved by 2030 and reach net zero by 2050 (IPCC, 2018, 2022b). Prior to the Paris Agreement and the ensuing IPCC Special Report on Global Warming of 1.5°C in 2018, emission targets were typically set at sectoral levels and aggregated to national targets. Often sectors were pitched against each other. A common notion was that reductions would happen sector by sector sequentially in an incremental way. A zero emissions world was not part of the policy discussions.

Bhutan was the first country to set a net-zero target in 2015. Other countries, regions, and cities followed quickly. By end 2021 90% of the global economy was covered by a net zero target stimulating a policy discourse on full decarbonisation that was previously politically not acceptable.

The new framing of full decarbonisation has also propagated into sectoral policy making. Coal phase out, 100% zero emission vehicles and zero-emission steel are now considered part of the required policy packages of countries. This transformed the policy toolkit from incentivising incremental change to supporting the 100% transformation.

Although the widespread adoption of long term zero emissions targets represents a significant shift in the climate policy discourse, many targets are so far aspirational and not underpinned by sufficient action. The Climate Action Tracker analysed the quality of net zero targets of 41 key emitters and concluded that 74% of global emissions were covered by targets of insufficient or poor quality (Climate Action Tracker, 2022a). Other risks include the assumption of the role of carbon dioxide removal (CDR) technologies for both natural and technological approaches given issues of space and permanence of the former and feasibility and scalability of the latter.

EXPECTATION OF GLOBAL GREENHOUSE GAS EMISSIONS FOR THIS DECADE FLIPPED FROM "EVER INCREASING" TO "AT LEAST FLAT".

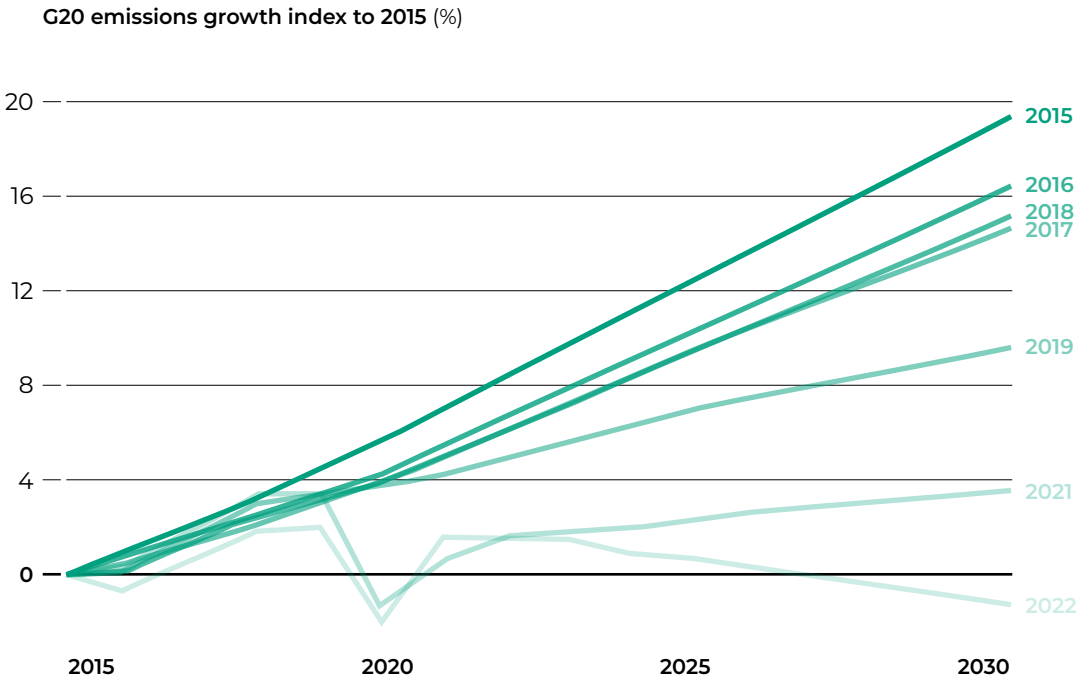
With the introduction of the ambition mechanism of the Paris Agreement, for the first time all signatory countries submitted Nationally Determined Contributions (NDCs) to outline their mitigation commitments. Previously, many emerging and developing economies had not set any emission reduction target at all, and many rejected the notion of (binding) mitigation targets considering development needs and the historic responsibility of industrialised countries. The NDCs led to higher ambition in 2030 targets globally.

In many countries emissions are starting to decline. Emissions projections associated with current policies for the G20, for example, significantly improved since the adoption of the Paris Agreement **(→ Figure 4)**. The projected emissions for 2030 are about 15% lower in absolute terms compared to 2015 (Nascimento, Kuramochi and Höhne, 2022). Emissions in 2020 were temporarily low due to the COVID-19 crisis, but a suite of implemented policies, fast uptake of renewable energy and the price shock of gas leads to an outlook of at least flat global emissions from now on. The ever-increasing trend is reversed.

Peaking global emissions is critical, because with rising annual emissions, temperature increase accelerates each year. With stable emissions, temperature continues to increase but in an almost linear manner. Only with zero emissions, temperature stops to increase.

Figure 4

G20 projected emissions growth from 2015



Note: Different time series correspond to the middle of the range of emission projections developed in different years by the Climate Action Tracker.

Source: Own elaboration.

Although the emissions projections for 2030 are successively more promising, they are still far from what would be considered Paris aligned (Höhne et al., 2020; den Elzen et al., 2022). Besides, projections are expectations on how the future develops. In a politically and economically volatile world things may turn out quite differently.

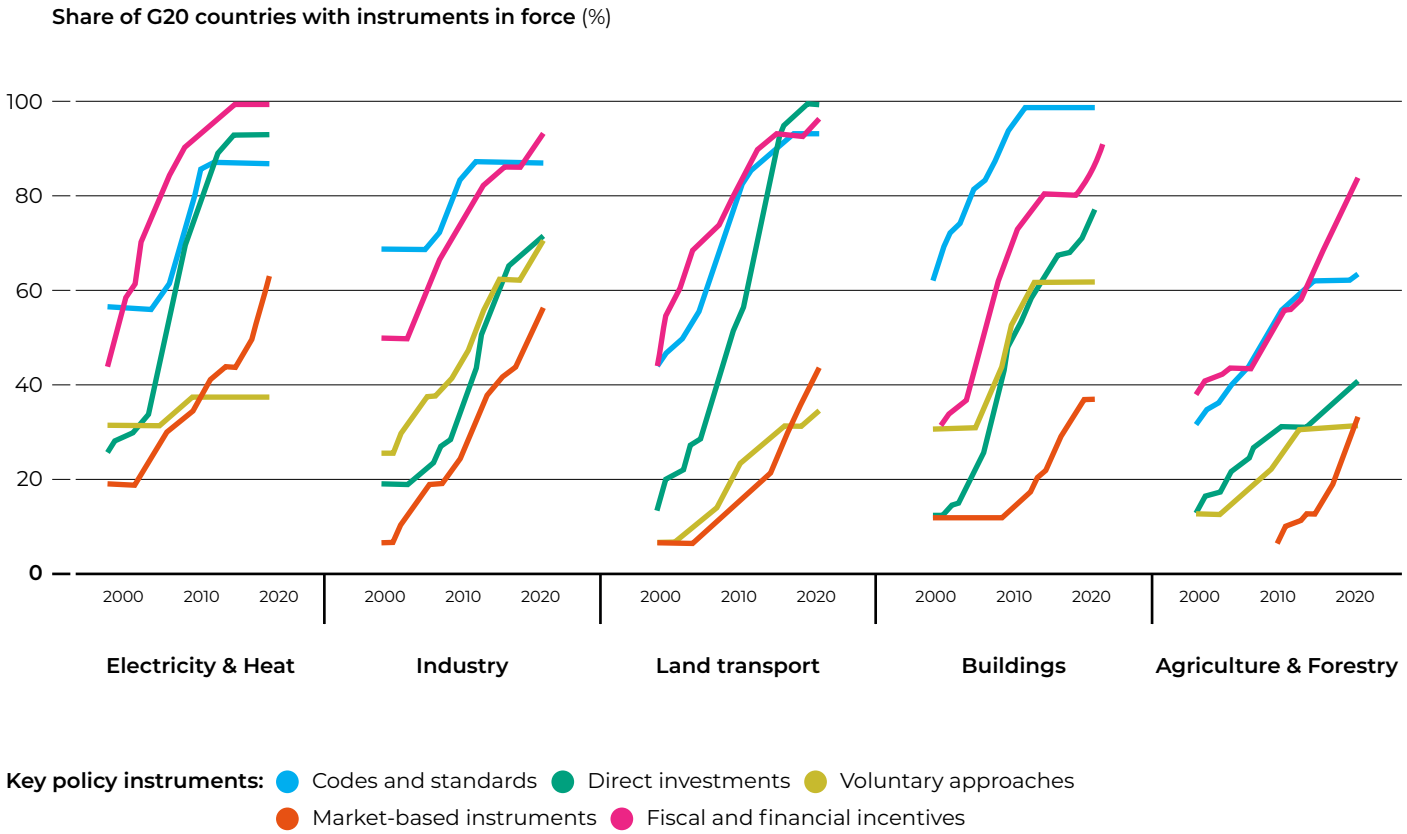
CLIMATE POLICIES HAVE SIGNIFICANTLY INCREASED IN SCOPE AND NOW COVER ALL RELEVANT SECTORS IN MOST COUNTRIES.

In the past decade the number and coverage of climate policies has increased significantly (Eskander and Fankhauser, 2020; Nascimento et al., 2022). The expansion of climate policies can be seen on the national level: where previously typically only industrialised and more advanced economies had climate policies in place, this is now the case in many more countries. Expansion also happened at sectoral level, with policies being discussed or in place for all climate relevant sectors. For many years the focus had been on the energy supply, in particular the power sector.

In G20 countries the use of various policy instruments has increased steadily over the past two decades (Nascimento et al., 2022). The share of countries that had mitigation policy instruments in place rose across all sectoral categories, albeit to different extents in different sectors and for different policy instruments **(→ Figure 5)**. Among G20 countries electricity and heat generation has the greatest number of policies in place, and the agriculture and forestry sector the fewest.

Figure 5

Climate policy coverage in different sectors over time



Source: Nascimento et al., 2022; Re-produced by NewClimate Institute.

An increasing number of countries are phasing out or at least plan to phase out fossil fuels in electricity. A total of 75 countries had agreed to phase out coal or not develop new unabated coal power plants in 2022 (IEA, 2023a). In particular outside of China the coal pipeline is shrinking.

At the same time many countries are still expanding coal capacity. Globally the coal fleet is still growing albeit at a rate of less than 1% (Global Energy Monitor et al., 2023). The recent energy crisis prompted a switch from gas to coal (Wiatros-Motyka, 2023) and at the same time significant investments into LNG infrastructure.

Overall, despite the observed increase in the number and coverage of climate policies, slow progress towards reducing global emissions and meeting the collective Paris climate goals calls for more comprehensive climate change mitigation policies to be adopted and implemented. Several countries have not yet adopted policies to meet their original NDCs, which were set more than seven years ago. Coverage is still incomplete in particular in countries with fast growing emissions (Nascimento and Höhne, 2023). For the Paris Agreement ambition raising mechanism to work, countries need to adopt sufficient policies to meet their targets. Increasing the ambition of targets alone widens the credibility gap between international targets and national action and undermines the Paris Agreement (Nascimento et al., 2023).

→ THE OUTLOOK OF TEMPERATURE INCREASE BY 2100 HAS IMPROVED SIGNIFICANTLY.

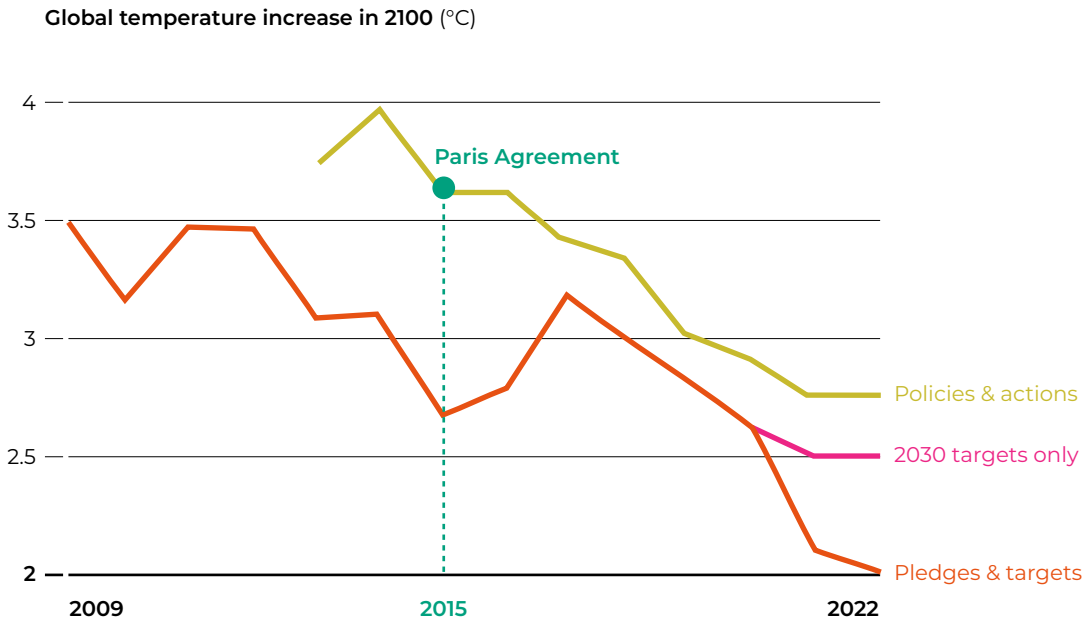
Temperature projections have continuously improved our outlook. At the time of the adoption of the Paris Agreement, temperature increases by the end of the century from implemented policies of 3.6 to 3.9°C were thought to be likely. Today these high levels are thankfully no longer likely, but a full degree lower: 2.7°C **(→ Figure 6)**. The effect of Paris targets led to a significant downward adjustment of projected temperature.

The recent wave of national net zero emission targets could, if fully implemented, substantially reduce best estimates of projected global average temperature increase bringing the Paris Agreement goal within reach (Höhne et al., 2021). The most optimistic interpretations of these targets lead to temperature increase as low as 1.7–1.8°C by the end of the century (Höhne et al., 2021; Meinshausen et al., 2022; Rogelj et al., 2023). Although the pathways to these low temperature levels are currently not underpinned by concrete policies, they for the first time give hope that the global temperature increase can indeed be kept to below 2°C.

The flipside is clear. Although the projected temperature increase associated with our current policy trajectory is progressively improving, we are still far from the required 1.5°C. If the world continues on its current path the impacts of climate change will be catastrophic. On current emission levels the remaining carbon budget to stay within a 1.5°C increase will be depleted in a few years.

Figure 6

Climate Action Tracker's estimates of global temperature increase has improved over time



Source: Climate Action Tracker, 2020; Re-produced by NewClimate Institute.

SHIFT 3

INVESTORS & BUSINESSES

BEFORE

Climate change is one of many considerations of investors and businesses and **still rather a niche topic.**

Driven by societal pressure, investors and businesses increasingly recognise the climate crisis as a threat to their business models and investment portfolios. Corporate reporting and disclosure on climate has become mainstream – in many cases a legal requirement. At the same time, investors and corporate boards are increasingly actively seeking out business opportunities associated with the low carbon transformation. New business models and innovations are driving change in several markets and shake up traditional players.

NOW

Every investor and every business feels the **pressure to act on climate.**

CLIMATE IS NOW FIRMLY ON THE AGENDA OF THE FINANCE WORLD. RETAIL INVESTORS ARE DEMANDING AND ASSET MANAGERS ARE INCREASINGLY PROVIDING "SUSTAINABLE" INVESTMENT OPTIONS.

Retail investors are increasingly demanding "sustainable options". For instance, a 2020 survey found that two thirds of French and German retail investors want to invest sustainably (Dupre, Bayer and Santacruz, 2020). Despite scandals, accusations of greenwashing, outflows in the wake of the COVID-19 pandemic, and diverse definitions of what can be considered "sustainable", asset managers are responding to this demand: according to the Financial Times as of July 2023, net assets of global sustainable funds, are nearly back to pre-pandemic levels at USD 2.834 trillion (Ross, 2023), while the sector as a whole is experiencing outflows. The growth is driven by both retail as well as institutional investors, including pensions funds and insurance companies, who respond to increasing awareness and perception of climate change risks of their clients. Nine of ten asset managers believe that the integration of environmental, social and governance (ESG) criteria into their investment strategy will improve returns, and a majority claims this has already proven to be the case. In 2021, 84% of asset owners globally reported to be implementing or evaluating sustainable investment strategies compared to about 53% three years earlier (PwC, 2022).

From its niche existence over more than a decade ago, sustainable investing has now become a standard model in the finance world, and climate change has firmly arrived on the agenda of financial institutions. A growing number of asset owners and managers are joining international climate initiatives and are setting dedicated climate targets. 90% of the assets of the 50 largest asset managers are now under a net zero or carbon/climate neutrality target (Kachi and Marquardt, 2022). The Glasgow Financial Alliance for Net Zero (GFANZ) was founded in 2021 and rapidly increased its membership, now representing USD130 trillion in assets (Kachi and Marquardt, 2022). Also the risks of stranded fossil fuel assets is increasingly on the radar (Semieniuk et al., 2022). As a result of these trends, fewer and fewer banks are willing to finance coal mining or coal fired power plants making the financing of new fossil fuel projects increasingly difficult (Green and Vallee, 2022).

However, despite these promising trends and declarations, trillions of USD are still flowing into projects and activities that are not aligned with the goals of the Paris Agreement sometimes directly undermining climate objectives. In particular, the recent energy crisis prompted profits of oil and gas companies to soar in some cases sparking new investor interest (Bousso, 2023). Unfortunately, many fund managers tend more towards reducing their portfolio's potential downside risk resulting from climate change rather than directly towards having an actual impact on reducing emissions. In many cases they fail to fund the potentially

riskier breakthrough technologies that are key for decarbonisation. Moreover, the sustainability labels of investments do not always exclude harmful activities as for example, some ESG funds were found to be invested in fossil assets (Inman, 2023). In any case, much more needs to be done to tighten up definitions of "sustainable" and to take advantage of the opportunities that decarbonisation offers. This will be critical in order for the trillions in invested assets to provide momentum and fund the trillions needed to decarbonise the global economy.

CLIMATE LITIGATION IS A GROWING RISK TOWARDS DIRTY BUSINESS MODELS AND COMPANIES ARE STARTING TO WAKE UP TO TRANSITION RISKS.

Climate litigation, supported by improved attribution science **(see → Shift 1)**, is increasingly recognised as an effective way to hold companies accountable. The first corporate climate litigation case was recorded in 1995, and from 2000 a growing number of lawsuits were filed against oil, gas and electricity companies in the US (Sato et al., 2023).

According to research by Grantham Institute, since 2015 the number of climate change related lawsuits against governments and companies has more than doubled to a total number of 2000 cases globally, a quarter of which in the last three years (Setzer and Higham, 2022). In 2022, legal action was filed in particular against fossil fuel corporations outside the US. Increasingly also companies in other sectors are targeted, including in food and agriculture, transport, plastics and finance. The claims particularly focus on "climate washing" of providing false or misleading information on climate commitments, failure to disclose climate risks or making false product claims (Sato et al., 2023).

Climate litigation is increasingly considered an additional transition risk by investors. For some years financial markets have already been considering climate related risks, physical and transitional, and started to integrate these into their evaluation and decision processes. Evidence suggests that litigation can affect company performance. Even filing a lawsuit can make a difference. One recent study found that being brought to court – even before an unfavourable judgement can reduce the firm value of carbon majors on average by 0.57%, increasing to 1.5% following unfavourable judgements (Sato et al., 2023).

While climate litigation led to some positive outcomes that prominently exposed companies' responsibility for climate change, for example the ruling against RWE or Shell Netherlands (Weller and Tran, 2022) and contributes to an increased risk awareness of companies as well as diversification of business towards more sustainable activities (Böff, 2023), it has not yet led to a significant shift away from dirty business models of affected companies or their peers. More needs to be done to change the trajectory of whole sectors – not only in selected jurisdictions but

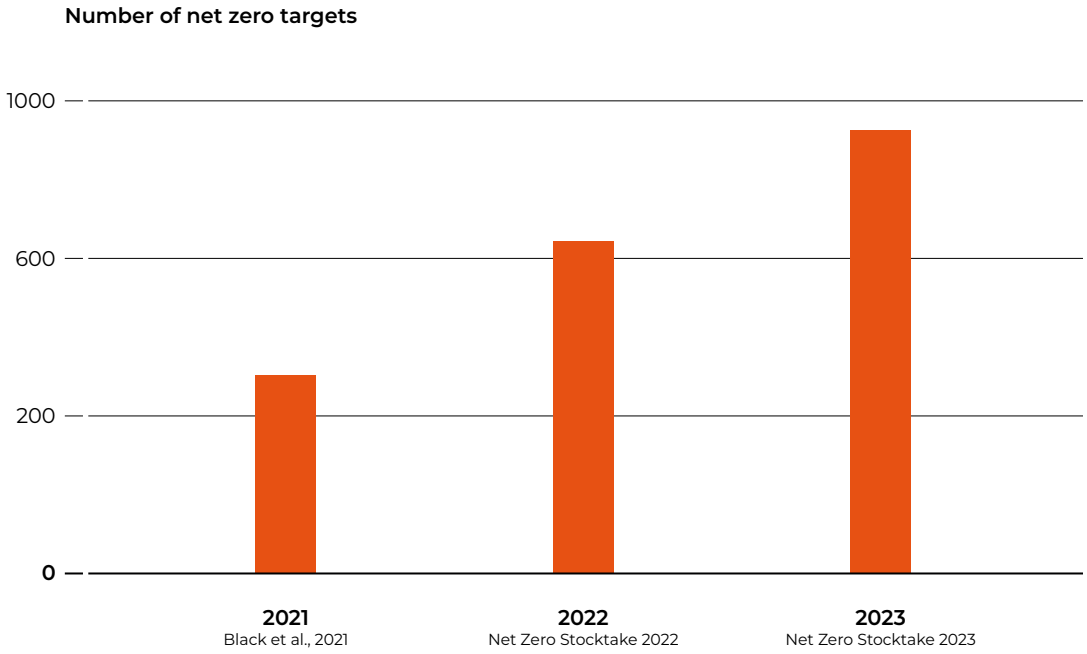
also around the world. And although climate risks are increasingly understood, such risks remain in the shadow of continued promising (short term) returns of high carbon investments.

AS A RESULT OF EXTERNAL PRESSURE, COMPANIES INCREASINGLY PREPARE CLIMATE PLANS AND IMPROVE THEIR CLIMATE GOVERNANCE AND DISCLOSURE.

The interest of investors in climate risks as well as an increasingly aware public pushed companies to talk about climate impacts and risks of their activities. A growing number of companies is setting climate targets, mainly emission reduction targets as well as increasingly net zero targets. In 2015 only 30% of companies had set emission reduction targets and only 2% net zero targets. More recent data shows that currently of the world's largest 2000 publicly listed companies by revenue nearly half have set or in the process of setting a net zero target (Hale et al., 2021).

Figure 7

Decarbonisation targets set by publicly listed companies globally



Source: Net Zero Tracker, 2023; Re-produced by NewClimate Institute.

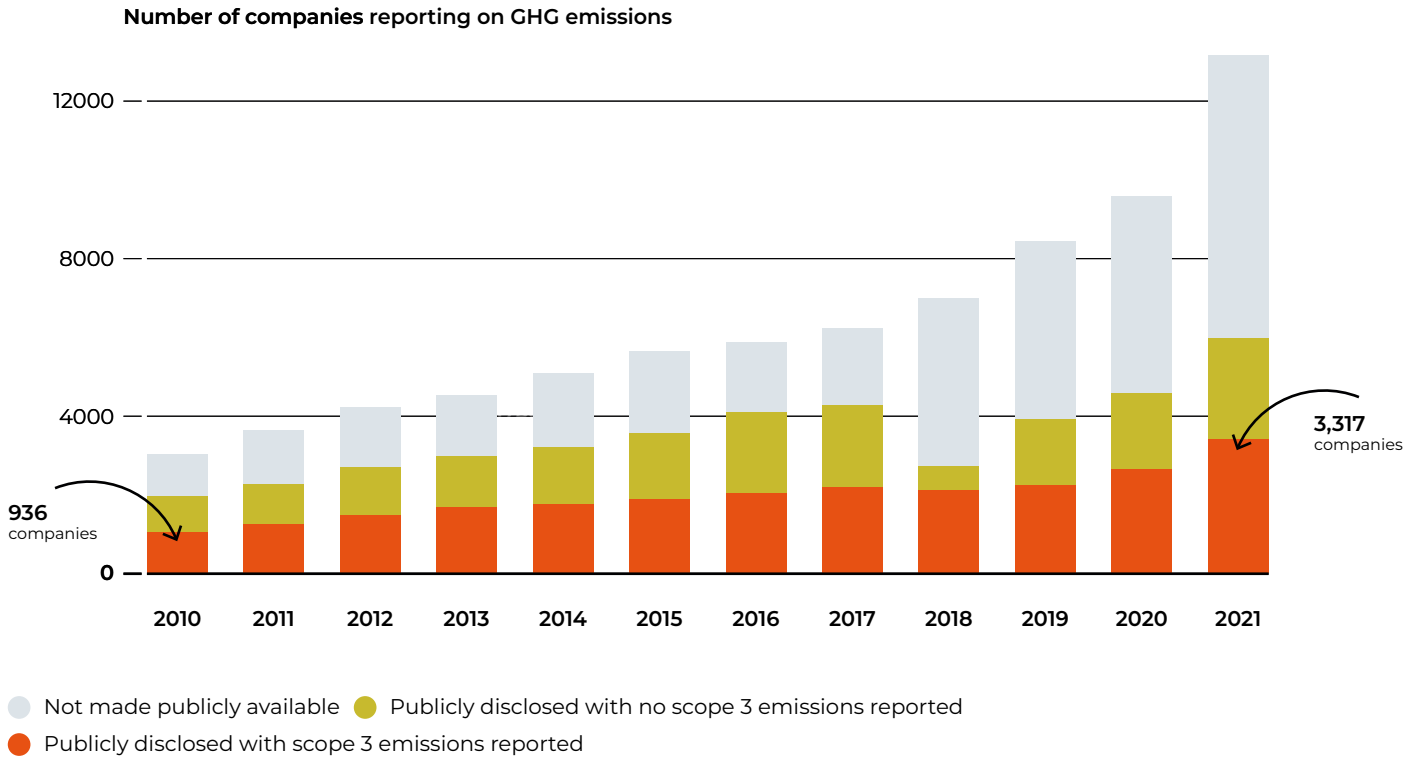
Reporting on climate change performance and risks is also increasingly mainstream for companies. Among the Standard&Poors 500 companies more than half have started to disclose climate risks in annual reports, 71% disclose carbon emissions data in other reports or on their websites (Conference-board.org, 2022). The Financial Stability Board created the Task Force on Climate-related Financial Disclosures

(TCFD) driving standardisation and scrutiny in this area. Increasingly countries are moving towards legally mandating reporting on environmental and climate related risks such as the EU (European Commission, 2023). The climate litigation cases, which particularly target misleading disclosure and information provided by companies, are forcing more scrutiny on reporting practices and corporate claims and are helping to call out greenwashing. Competition among companies, in particular within the same sector, increases pressure on peers. Although not yet a race to the top, competition on climate performance is mounting.

Reporting on greenhouse gas emissions has moved from typically reporting on only scope 1 (direct) and 2 (purchased energy) emissions to increasingly include scope 3 emissions covering the entire value chain of products and services. This is particularly relevant as on average scope 3 emissions account for 75% of companies' greenhouse gas emissions (Hadziosmanovic, Rahimi and Bhatia, 2022a). According to CDP data, the number of companies reporting on scope 3 emission increased from 936 in 2010 to 3,317 companies in 2021 **(→ Figure 8)**. Interestingly in 2021, the majority of companies appeared to track scope 3 emissions but did not agree to publicly report on them.

Figure 8

Number of companies that publicly disclose Scope 3 emissions



Source: Hadziosmanovic, Rahimi and Bhatia, 2022b; Re-produced by NewClimate Institute.

Corporate greenwashing is however still ubiquitous. The majority of net zero targets are not aligned with the 1.5°C goal of the Paris Agreement and are not underpinned by sufficient action. Climate Action 100+, an investor-led initiative on corporate climate action, found that despite long term targets, there continue to be major gaps in companies' medium term rapid reduction targets, a lack of accounting for scope 3 emissions, and "only 5% of focus companies explicitly commit to align their capex plans with their long-term GHG reduction targets" (Climate Action 100+, 2022). Further, the role of carbon offsets in companies' decarbonisation strategies is problematic as offsetting one's own emissions detracts from stopping high carbon activities and rethinking harmful business models.

→ **NEW TECHNOLOGIES, NEW PLAYERS AND INNOVATIVE BUSINESSES HAVE LED TO A GREATER RECOGNITION THAT MAIN POLLUTERS, IN PARTICULAR, NEED TO CHANGE THEIR BUSINESS MODELS TO SURVIVE.**

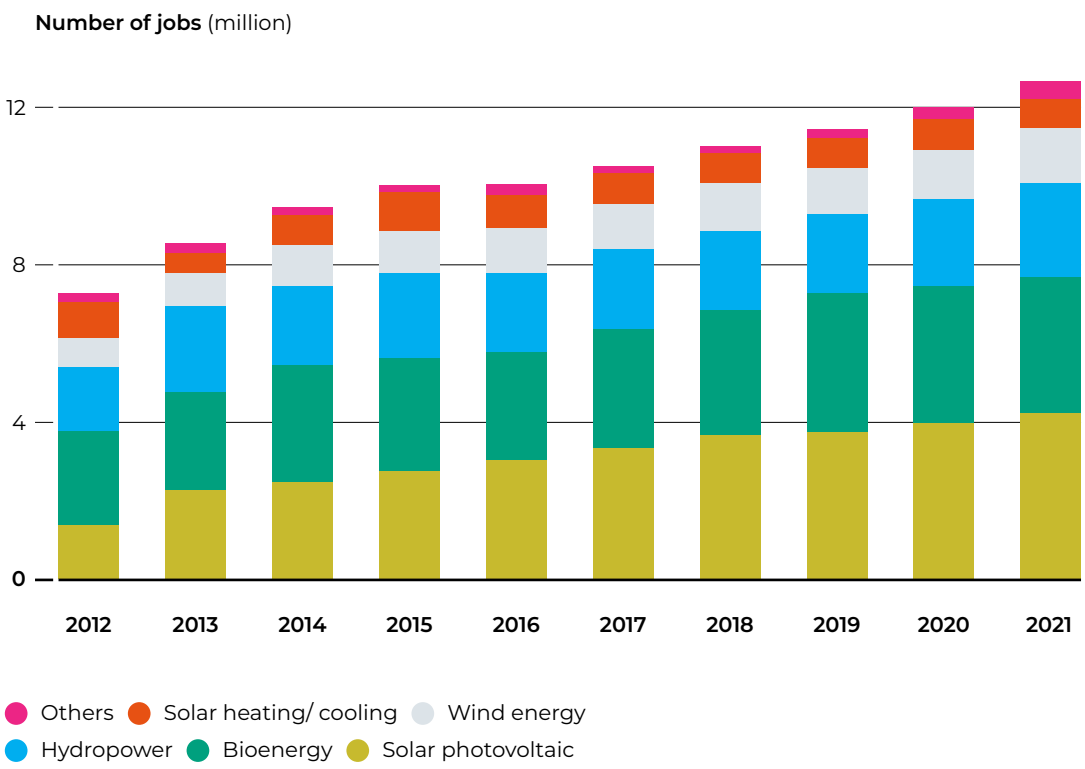
In the past decades many smaller green industry players have actively pushed the development and commercialisation of technologies and services, in particular in the energy sector. The perseverance of these companies, which often battled against unfavourable regulations, bureaucratic hurdles and skewed markets, led to the establishment of green industry across the world. In some cases this happened by forming green advocacy alliances with different actors that eventually pushed governments to change the rules (Jacobsson and Lauber, 2006).

The growth in green businesses resulted in an increasing number of green jobs. While the majority of these jobs are associated with the energy sector **(→ Figure 9)** such jobs have emerged across other sectors including finance, fashion and transport (Kimbrough, 2021).

In many sectors, new players or visionary incumbent companies have pushed the introduction of climate friendly technologies, and in some cases this has led to a shift in the market where others are forced to follow to remain competitive. This can be seen, for example, in the automotive industry with e-mobility, as well as with clean steel, and heat pumps.

Another shift indicator is the amount of investment flowing into green or climate technologies. For example, venture capital investment into climate technologies globally has increased sharply since 2015 **(→ Figure 10).**

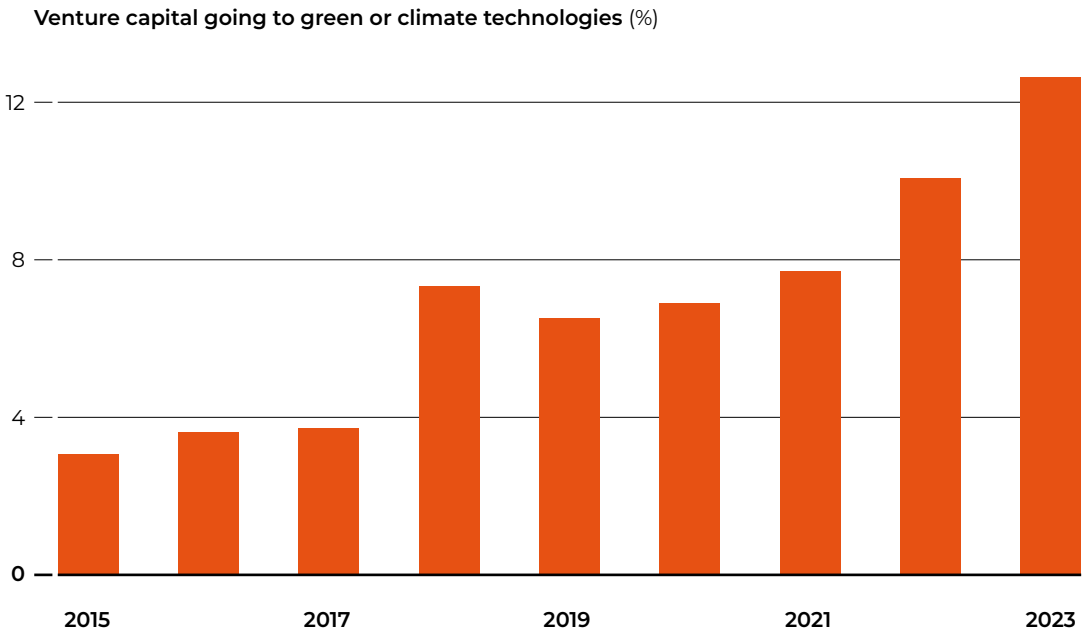
Despite noticeable positive trends and shifts, the majority of the economy has not shifted to a climate aligned model. High carbon activities remain profitable and continue to attract investments, and radical changes in business models are not happening at the necessary scale. Active lobbying by companies and their sector representatives has successfully stalled ambitious climate policies in many jurisdictions (Waldersee, 2022).



Source: IRENA and ILO, 2022; rRe-produced by NewClimate Institute.

Figure 9

Evolution of global renewable energy employment



Source: Dealroom.co, 2023; Re-produced by NewClimate Institute.

Figure 10

Value of venture capital investment in climate technology worldwide

SHIFT 4

ENERGY SUPPLY

BEFORE

Renewables were **not cost competitive** and with low to medium penetration in base load capacity driven markets.

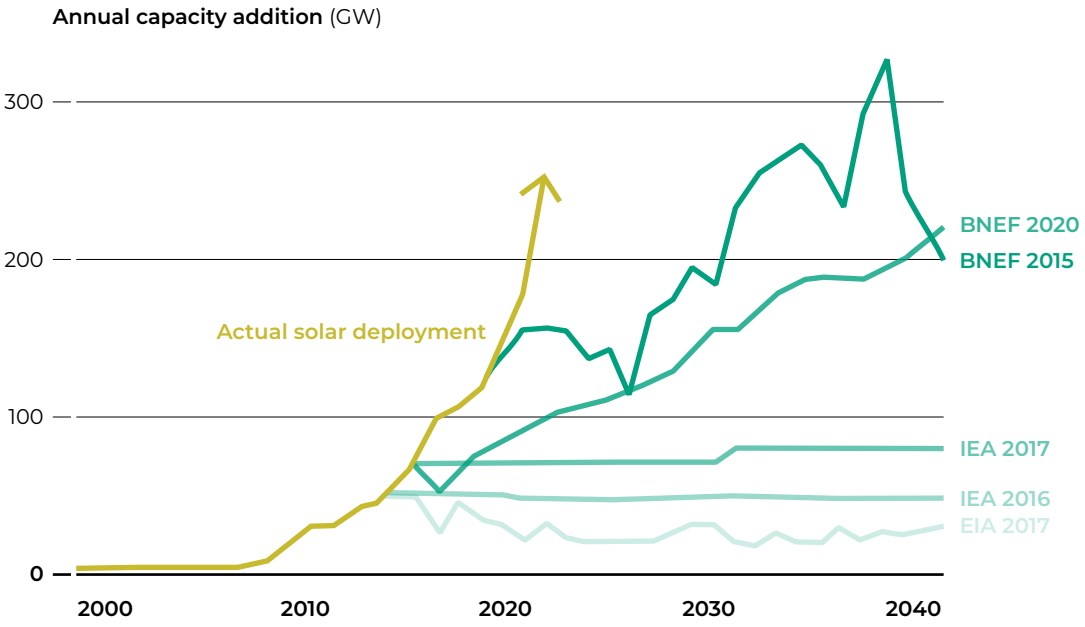
Renewable energy as the backbone of the energy transition has become the new normal, and the question of phasing out fossil fuels is no longer a question of “if” but “when”. Energy systems with large shares of wind and solar are increasingly the reality on the ground in many parts of the world and improving energy access for many.

NOW

Renewables reached cost parity with fossils, and **power systems are shifting to decentralised**, flexible models.

PREDICTIONS ON GLOBAL RENEWABLES DEVELOPMENT WERE CONTINUOUSLY OUTSTRIPPED BY THE ACCELERATED REAL UPTAKE OF WIND AND SOLAR AS THEY REACHED AND BLEW PAST COST PARITY WITH FOSSILS.

Over two decades ago, renewables, specifically solar and wind, were associated with high costs limiting their accessibility in particular in finance constrained economies in the Global South. Since then, costs have decreased much faster than what had been predicted or thought realistic. The cost of solar, onshore and offshore wind fell by 60-90% in the last ten years (IPCC, 2021; RMI, 2023). New renewables are now cheaper than new fossils in 90% of the world and the cheapest source of bulk electricity generation. Despite temporary cost increases for renewables in some contexts, the gap to fossil based power generation continues to grow as prices of fuel and carbon rise even faster. New build onshore wind and solar projects are now 40% cheaper than the global benchmark for new coal and gas fired power (BloombergNEF, 2022). This has resulted in significant investments into renewable energy which surpasses fossil fuel investments by a factor of five (IEA, 2023e). New renewables are also cheaper than running existing coal or gas fire plants in half of the world which means that, on balance, shutting down fossil plants and building new renewables would save the world trillions (Allen, 2023).



Source: RMI, 2023; Re-produced by NewClimate Institute.

Figure 11

Projected global solar deployment

Past predictions on the uptake of renewables were repeatedly outstripped by reality. Nobody had been able to predict how fast these technologies would grow, especially solar energy. For 20 years the International Energy Agency predicted linear growth of solar when in reality growth happened exponentially **(→ Figure 11)**.

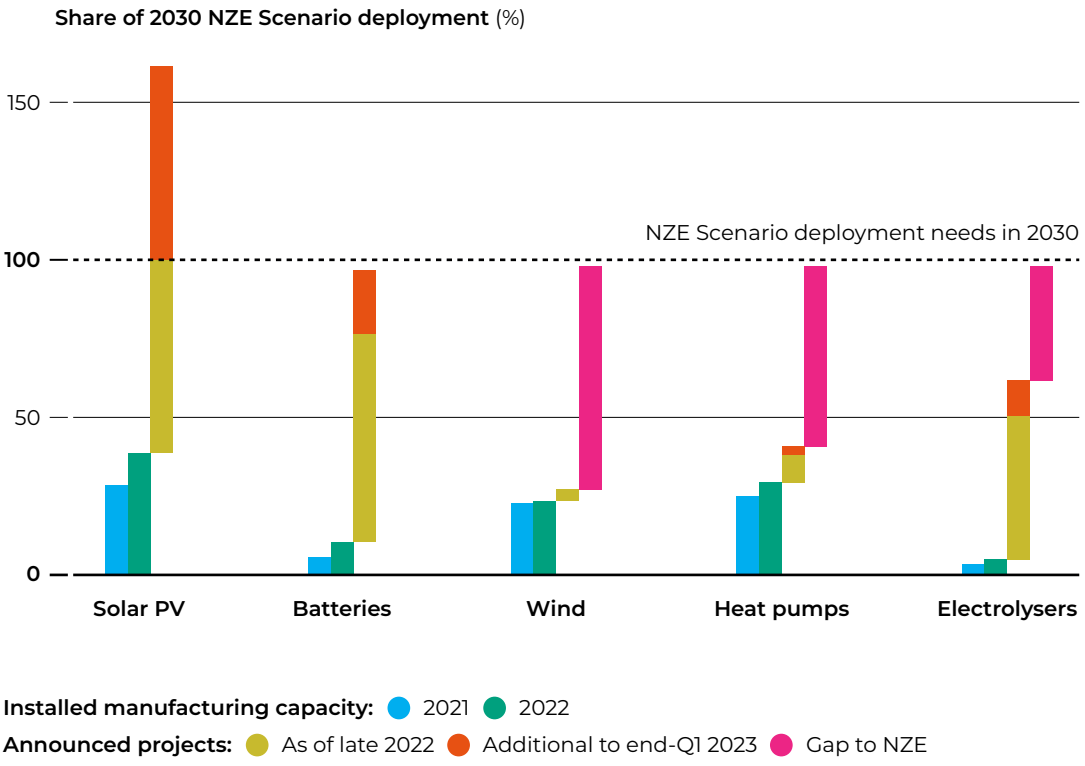
At the same time, renewables continue to be constrained by grid and system limitations in many parts of the world, where investments and reforms lag behind potential deployment rates. From a systems balancing perspective developing wind and solar capacities in parallel is critical. The development of wind, however, has stagnated in many countries often related to barriers, such as permitting issues, that drive up the costs of projects. Overall, despite the positive technology developments investment into fossil-based power generation continues. In particular the recent energy crisis prompted a shift back to coal and new investments into fossil infrastructure and exploration, including coal, gas and oil (Climate Action Tracker, 2022b).

A PARADIGM SHIFT ON MULTIPLE LEVELS TOWARDS RENEWABLE ENERGY HAS STARTED THAT CANNOT BE REVERSED. THE ENERGY SYSTEM HAS CHANGED AND SO HAVE THE ACTORS.

With the incorporation of increasing variable renewable sources, especially wind and solar, the energy system is transforming itself from one dominated by base load power plants to one with increasing decentralisation and flexibility. This shift is underpinned by the adoption and readiness of flexibility options, including demand response measures, large scale batteries and dispatchable renewable energy. Fears of intermittent renewables especially during peak load hours are gradually being overcome as renewables-based power systems prove to be reliable (Quak et al., 2018).

The power system has become increasingly democratised and decentralised allowing new actors to become part of the solution. Feed-in schemes or net metering, amongst others, have enabled millions of households to actively participate in the energy transition by installing solar panels or other smaller scale renewable technologies. The digitalisation is supporting this market transformation turning more and more people into prosumers to support the transition.

At the industry level, the last years have seen a surge in new manufacturing capacities for renewable energy technologies. For solar energy as well as batteries, the existing and announced projects are now sufficient to align with the IEA's net zero scenario in 2030. Gaps remain for wind, heat pumps and electrolysers where growth has been more stagnant (IEA, 2023d).



Source: IEA, 2023d; Re-produced by NewClimate Institute.

Figure 12

Manufacturing capacity for renewable technologies

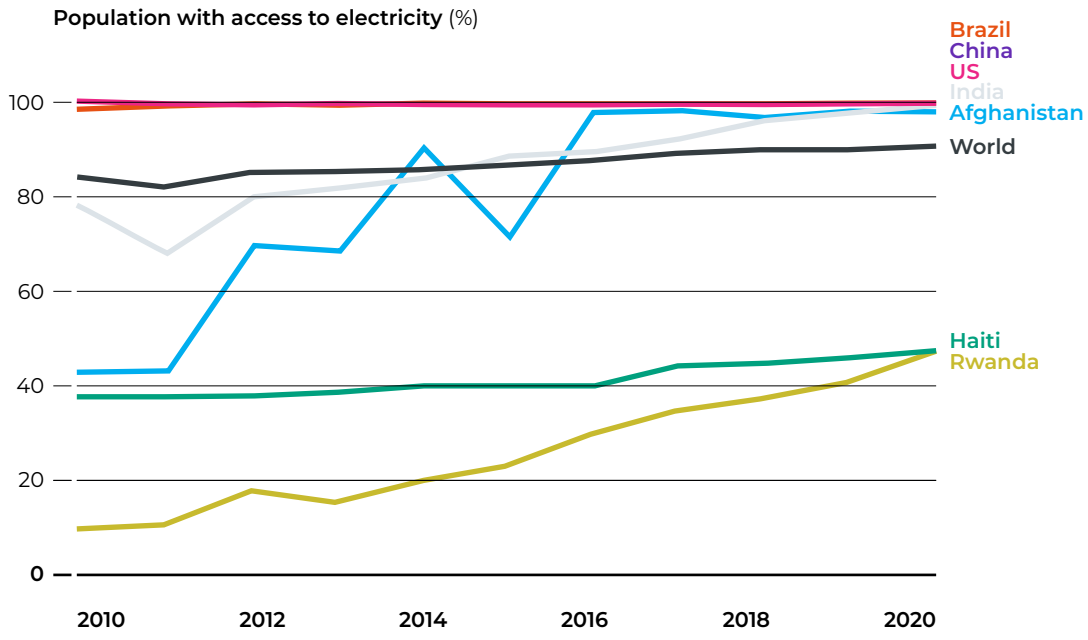
However, there are still a significant number of powerful players in the energy markets world-wide that actively resist or delay the energy transition to maximise gains from current business models. This includes in particular fossil fuel dependent countries and large energy cooperations which use their respective powers to block or delay action. And whilst manufacturing capacity for renewable technologies is ramping up, critical gaps in manufacturing capacities and raw materials to enable the zero-carbon transformation remain (IEA, 2021). Broader sustainability issues associated with the production of technologies and raw materials make reconciliation of climate and sustainability goals difficult.

→ **DUE TO WIDE AVAILABILITY OF DECENTRALISED RENEWABLES ENERGY ACCESS HAS GROWN SUPPORTING ACHIEVEMENT OF IMPORTANT SDG GOALS.**

The energy transition has not only delivered cleaner electricity but has also enabled a larger share of the population to have access to electricity. Back in 1990, around 71% of the world population had access to electricity, increasing to 83% in 2010. The last decade saw a jump almost twice as fast as the previous decade reaching over 90% in 2020 **(→ Figure 13)**.

Figure 13

Percentage of population with access to electricity



Note: Electricity defined as an electricity source that can provide very basic lighting and charge a phone or power a radio for 4 hours per day.

Source: World Bank, 2023; Re-produced by NewClimate Institute.

Electricity access through decentralised renewable energy systems has played a significant role by providing 59 million people access to tier 1 (energy access, including lighting and phone charging) systems and 15 million to tier 2 (additionally power energy-efficient household appliances such as TV electricity) by the end of 2022 (Reynolds and Paixão, 2022a). The number of people with "improved energy access through an off-grid solar product" has also bounced back from 101 million in 2021 to 104 million by the end of 2022 (Reynolds and Paixão, 2022b). The number had declined between 2019 and 2021 due to COVID-19 and supply chain issues (IEA et al., 2023a).

However, we are not there yet. In order to reach the goal of universal access by 2030 the annual growth rate must increase further from the 0.6% percentage points seen in recent years to 1% point per year until 2030 (IEA et al., 2023b). As recognised by the UN, a significant effort will be needed to provide stable energy access to people living in least developed and in fragile and conflict-affected countries (UNSD, 2022).

SHIFT 5

ELECTRIFICATION & INDUSTRY

BEFORE

Energy demand and hard to abate sectors **hid behind the energy supply sector** to decarbonise first.

Actors across all economic sectors are beginning to realise that electrification through electric vehicles, heat pumps, and electric heat in industry is central to the decarbonisation and start to act accordingly. Innovation and investment has advanced significantly in the so-called “hard to abate” sectors like shipping and heavy industry.

NOW

Electrification in transport and buildings **has progressed significantly** and all industry is now working on zero carbon strategies.

ELECTRIFICATION OF VEHICLES HAS GROWN EXPONENTIALLY AND IS SET TO BECOME THE NEW NORMAL.

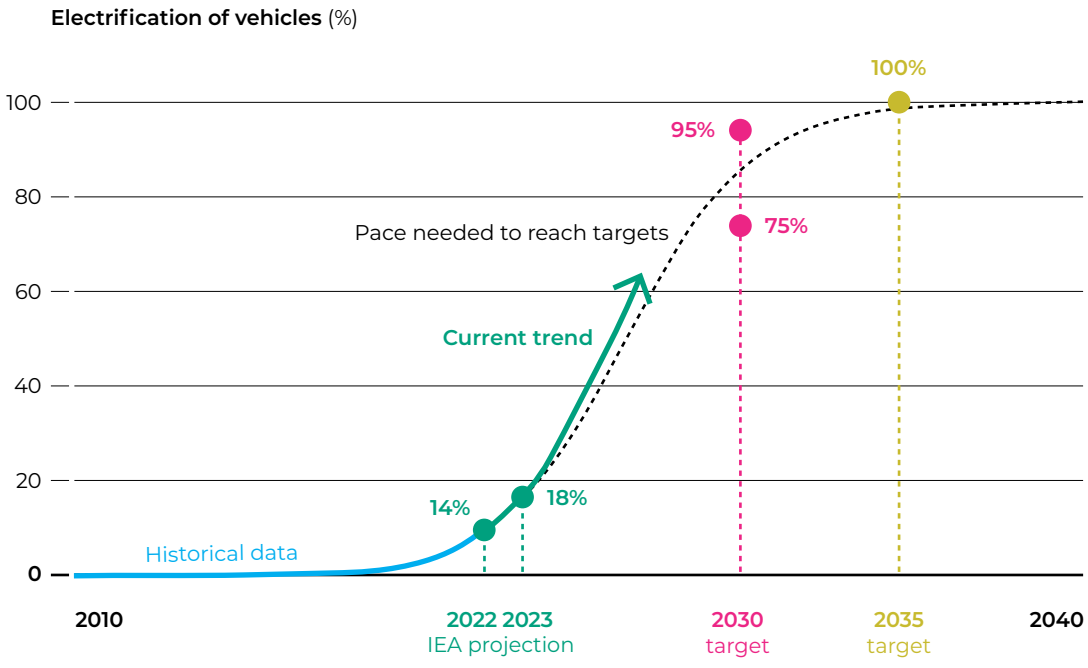
Electric passenger cars have started to displace the internal combustion engine (ICE) and are now the new standard in some parts of the world. Major car manufacturers have made the decision to move to 100% electrified cars. The shift happened despite fierce lobbying by parts of the industry in particular in the traditional automotive base of Germany, eventually pushed by the success story of new players such as Tesla among others.

Several countries have now set targets and dates to phase out combustion engines including the European Economic Area (EEC), Canada, Chile and several US states (ICCT, 2023). Compared to the situation ten years ago this policy commitment, driven by a fast-changing market, was not conceivable.

The growth of electric vehicles has surpassed all expectations. The latest IEA Stated Policies Scenario (STEPS) changed their global outlook of the share of electric car sales under existing policies and targets from a previous 25% to 35% in 2030 (IEA, 2022c). The growth is set to be exponential **(→ Figure 14)** with the share of electric cars in new registrations at 14% in 2022, an expected 18% in 2023 (IEA, 2023b). Past growth is in line with what is needed for 1.5°C in the sector (Boehm et al., 2023).

Figure 14

Share of electric in light-duty vehicles



Source: Boehm et al., 2023; Re-produced by NewClimate Institute.

Other vehicles, such as buses and trucks, are also moving towards electrification albeit at a slower pace. In 2022 840 different battery electric buses and trucks were available in the market, which is dominated by China (60%), the USA (20%) and the EU (15%) and which seems to outpace hydrogen alternatives (IEA, 2023b).

However, the shift to electric vehicles is not yet global but limited to advanced economies, mainly in the global North as well as China. In many countries the widespread adoption of electric vehicles still faces significant cost barriers, in particular in places where second hand markets dominate. Also, investment in charging infrastructure is lagging behind market developments. Beyond that, the necessary shift towards less car use, i.e., a reduction in the overall number of vehicles, is not yet happening across the board.

BATTERY STORAGE SAW SIGNIFICANT PRICE DECREASE AND IS NOW COMMERCIALLY VIABLE.

Battery storage technologies are critical for the renewable energy transition. They are needed as stationary solutions to solve the intermittency issues of variable renewable sources in the power and industry sector; mobile battery storage is of course critical for the electrification of the transport sector. For the latter the discussion on battery storage, costs and ranges has long been a major barrier for the wider uptake of electric vehicles.

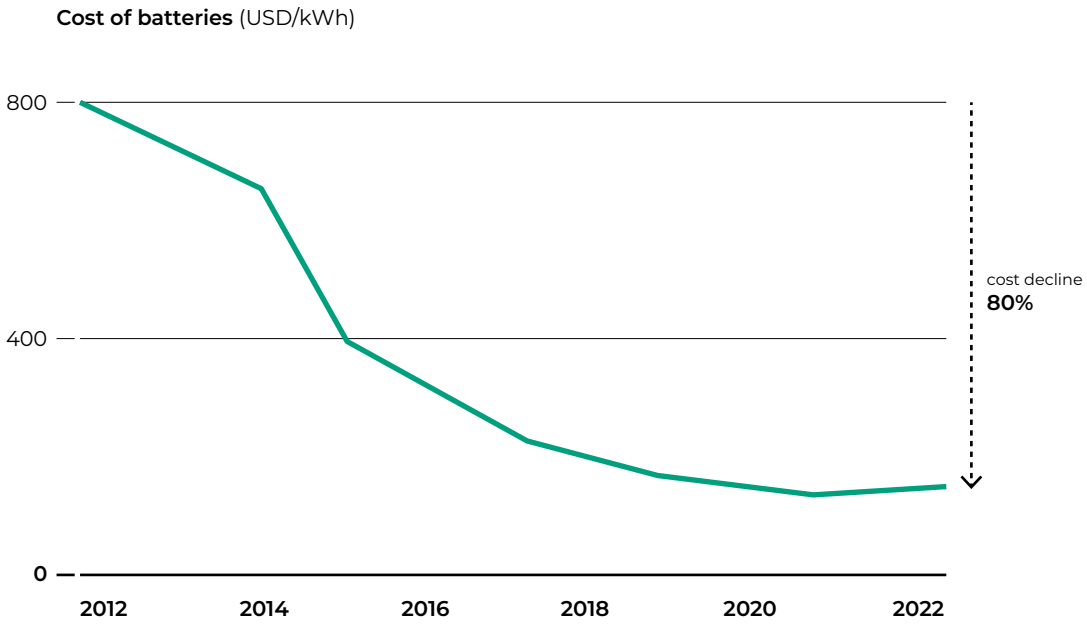
In the last decade, lithium-ion batteries, the dominant battery technology, have become commercially viable with a cost decline of 80% **(→ Figure 15)**. Battery prices are the main driver of EV costs and hence an important, if not the most important, factor for consumers. The recent price levels of batteries have pushed total cost of ownership to comparable levels with internal combustion engines (ICE).

New developments in battery technology are expected to reduce costs even further. Alternatives could include solid-state batteries or sodium-ion batteries which have the advantage to rely on more widely available materials than lithium-ion based technologies. The development of new batteries is accelerated by policies in many parts of the world to incentivise investments into technology development and manufacturing capacity. In addition, concerns about supplies of important battery materials – including cobalt and lithium – are driving the search for alternatives (Crownhart, 2023).

Whilst the recent developments and trends are promising the availability of long-term storage remains a key barrier to the deep decarbonisation of the energy sector. In addition, environmental and human rights concerns associated with the sourcing of raw materials, including lithium, nickel, and cobalt, are critical issues yet to be solved.

Figure 15

Cost of lithium-ion batteries between 2021 – 2022



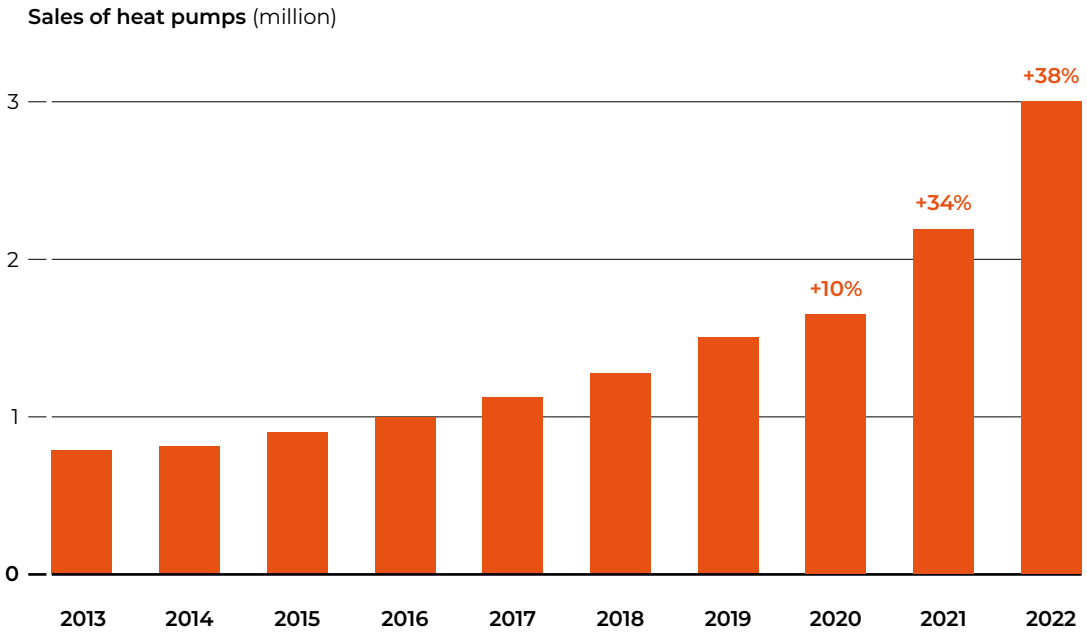
Source: BloombergNEF, 2021; Re-produced by NewClimate Institute.

DEPLOYMENT OF HEAT PUMPS IN THE BUILDING SECTOR IS SOARING.

In the building sector electrification has also been progressing with heat pumps as a key technology for the decarbonisation of heating demand. Globally, the sale of heat pumps saw double digit growth in 2021 and 2022 driven by increased policy support and incentives (IEA, 2023c) . Financial incentives for heat pumps are now available in over 30 countries which account for more than 70% of the current global heating demand (IEA, 2022a). Particularly in Europe sales of heat pumps have been soaring in the last decade with annual growth rates of 34% and 38% in 2021 and 2022 respectively **(→ Figure 16).**

Beyond buildings, large-scale heat pumps are increasingly being tested for district heating systems (Energiewendebauen, 2023). Also, for industrial heat applications, in particular in the paper, food and chemicals industries, heat pumps are discussed as viable decarbonisation options (IEA, 2022b). About 50% of industry's heat demand could already be electrified with existing low temperature heat technology, new electric high temperature heat technology is emerging (Kavanagh, 2022).

At the same time the building as well as industry sectors are nowhere near alignment with the 1.5°C temperature goal and lagging far behind the energy supply sector. New building regulations in most parts of the world are not climate proof, and renovation rates of existing building stock is far too slow.



Source: Rosenow and Gibb, 2023; Re-produced by NewClimate Institute.

Figure 16
Sales of heat pumps in Europe 2013 – 2022

DEEP DECARBONISATION MOVING INTO FOCUS IN HARD TO ABATE INDUSTRY AND TRANSPORT SECTORS.

A decade ago full decarbonisation of the hard to abate industry sectors or international shipping and aviation was not under discussion. The common assumption was that other sectors would decarbonise first and that incremental emission reductions would suffice in the meantime. The picture now has changed completely. In the emission intensive industry sector, the need to go to zero carbon is now recognised by many and several companies are now working towards this. For example, the number of hydrogen steel plants has been increasing in recent years with currently 60 plants being planned worldwide (Green Steel Tracker, 2023).

Noteworthy are also advances in the shipping sector where all-electric cruise (Doll, 2022) and container ships (The Maritime Executive, 2023) are hitting the oceans and waterways. Some major shipping companies have committed to zero carbon fuels in the future (e.g., Maersk) likely to push the competition in a similar direction as regulation is tightening in the sector.

Overall, decarbonisation solutions in the hard to abate sectors are still in their infancy and far from widespread adoption. Much more innovation for further electrification shifts is needed. The emissions impact of the fledgling climate action is not yet visible, and several sectors are lagging behind, including aviation, cement, chemicals and aluminium.

”

WELL, IN OUR COUNTRY,” SAID ALICE “YOU’D GENERALLY GET TO SOMEWHERE ELSE—IF YOU RUN VERY FAST FOR A LONG TIME, AS WE’VE BEEN DOING.”

“A SLOW SORT OF COUNTRY!” SAID THE QUEEN. “NOW, HERE, YOU SEE, IT TAKES ALL THE RUNNING YOU CAN DO, TO KEEP IN THE SAME PLACE. IF YOU WANT TO GET SOMEWHERE ELSE, YOU MUST RUN AT LEAST TWICE AS FAST AS THAT!”

CONCLUDING REMARKS

We are not running alongside Alice in Wonderland but our climate policy environment seems to follow similar principles. During the last decade many things shifted in the right direction. In some areas shifts happened at a very fast pace (electric mobility), often faster than had been predicted (solar deployment). Some involved deeper systemic shifts (power systems) that cannot be reversed anymore, yet others are rather fledgling but still noticeable (industry). Overall, whilst progress is happening and solutions to avert the climate crisis are being implemented globally, the climate crisis itself is accelerating at an ever-faster pace, threatening to cancel out the progress made. So we need to run faster.

On the positive side, the many shifts highlighted in the paper show that we can run fast, that change is possible and can happen unexpectedly, instigated by new actors (global youth), using new strategies (climate litigation) pushing governments and companies to act. All this gives hope that the Paris Agreement goal to keep global temperature increase to 1.5°C is still within reach. Temperature projections over the years underline this showing that under current policies temperature increase would reach 2.7°C. This is nowhere near where we need to be but at least a full degree lower than predictions a decade earlier.

Needless to say, it is critical to reinforce current trends and accelerate climate action on all levels. Change needs to happen everywhere, at the same time and very fast, in some areas a great deal faster than seems realistic today. Digitalisation and new technologies can help but come with their own set of issues that we need to deal with. Arguments about trade-offs, in particular when it comes to broader sustainability issues, cannot and should not be used to slow down action, rather more innovation and deeper change is needed to find equitable and sustainable solutions. We need to think out of the box, think the impossible, find new alliances and get all society behind the cause. There will be systemic questions that need answering not least as many of the positive shifts we have seen are based on a growth paradigm which far exceeds planetary boundaries. Consumption patterns have started to change in some areas and consumers in wealthier (and younger) parts of society are shifting to more sustainable habits, however, unhealthy consumption patterns remain strong and are continued to be reinforced by our economic systems.

There are many critical areas where shifts have not yet happened or have been reversed. Deforestation, biodiversity loss, societal equity and justice questions need urgent responses. And we need to build our resilience and adaptive capacity as climate

change is happening and most societies are wholly unprepared for it. It is prudent to, as far as this is even possible, hedge against the risk of sliding into an intensifying climate crisis as we are moving dangerously close to climate tipping points.

While the situation appears daunting and the high-level political agenda is not set for constructive cooperation, we can draw strength from the many positive developments. At the technical level cooperation is continuing, and globally our technical capacities and knowledge have been increasing. We know what to do and are ready to act where windows of opportunity arise and the geopolitical situation makes way. It is easy to feel disheartened about our current set of challenges but history has also shown that the future is not predictable and full of disruptive surprises.

REFERENCES

A

Allen, L. (2023) Green energy is cheaper than fossil fuels, a new study finds, SienceNewsExplores. Available at: https://www.snexplores.org/article/green-energy-cheaper-than-fossil-fuels-climate (Accessed: 25 October 2023).

B

BBC (2021) 'BBC-GlobeScan Poll on Climate Change'.

Bell, J. et al. (2021) 'In Response to Climate Change, Citizens in Advanced Economies Are Willing to Alter How They Live and Work', Pew Research Center [Preprint].

BloombergNEF (2021) Battery Pack Prices Fall to an Average of $132/kWh, But Rising Commodity Prices Start to Bite. Available at: https://about.bnef.com/blog/battery-pack-prices-fall-to-an-average-of-132-kwh-but-rising-commodity-prices-start-to-bite/ (Accessed: 2 November 2023).

BloombergNEF (2022) Cost of New Renewables Temporarily Rises as Inflation Starts to Bite. Available at: https://about.bnef.com/blog/cost-of-new-renewables-temporarily-rises-as-inflation-starts-to-bite/ (Accessed: 25 October 2023).

Boehm, S. et al. (2023) State of Climate Action 2023. Berlin and Cologne, Germany; San Francisco, CA; Washington, DC.

Böff, M. (2023) RWE steckt Milliarden in Erneuerbare Energien. Available at: https://www.tagesschau.de/wirtschaft/unternehmen/rwe-investitionen-erneuerbare-energie-100.html (Accessed: 25 October 2023).

Bousso, R. (2023) Big Oil doubles profits in blockbuster 2022. Available at: https://www.reuters.com/business/energy/big-oil-doubles-profits-blockbuster-2022-2023-02-08/ (Accessed: 25 October 2023).

Bundesverfassungsgericht (2021) Constitutional complaints against the Federal Climate Change Act partially successful. Available at: https://www.bundesverfassungsgericht.de/SharedDocs/Pressemitteilungen/EN/2021/bvg21-031.html (Accessed: 23 October 2023).

C

Carnegie (2023) Climate Protest Tracker. Available at: https://carnegieendowment.org/publications/interactive/climate-protest-tracker (Accessed: 23 October 2023).

Climate Action 100+ (2022) Climate Action 100+ Net Zero Company Benchmark shows an increase in company net zero commitments, but much more urgent action is needed to align with a 1.5°C future. 30th March 2022, Press release. Climate Action 100+. Available at: https://www.climateaction100.org/news/climate-action-100-net-zero-company-benchmark-shows-an-increase-in-company-net-zero-commitments-but-much-more-urgent-action-is-needed-to-align-with-a-1-5c-future/ (Accessed: 31 May 2022).

Climate Action Tracker (2020) Paris Agreement turning point: Wave of net zero targets reduces warming estimate to 2.1°C in 2100 - All eyes on 2030 targets. Climate Action Tracker (CAT). Available at: https://climateactiontracker.org/documents/829/CAT_2020-12-01_Briefing_GlobalUpdate_Paris5Years_Dec2020.pdf?fbclid=IwAR2e_SHEJes6bml9Y1l8I_dM1KEqrLTtSyfXxWB3QbPi5e3TCZ7XH0ph2Co.

Climate Action Tracker (2022a) CAT net zero target evaluations (update November 2022). Climate Action Tracker (Climate Analytics, NewClimate Institute). Available at: https://climateactiontracker.org/global/cat-net-zero-target-evaluations/ (Accessed: 1 June 2023).

Climate Action Tracker (2022b) 'Massive gas expansion risks overtaking positive climate policies: New CAT analysis shows LNG expansion plans threaten 1.5°C warming limit'.

Conference-board.org (2022) Report: Gap in Climate Disclosures Between Large, Small Cos Stark Gap in Climate Disclosures Exists Between Large & Small Public Companies. Available at: https://www.conference-board.org/press/climate-disclosures-gap#:~:text=More than half of S%26P,companies disclose their GHG emissions. (Accessed: 25 October 2023).

Crownhart, C. (2023) What's next for batteries, MIT Technology Review. Available at: https://www.technologyreview.com/2023/01/04/1066141/whats-next-for-batteries/ (Accessed: 25 October 2023).

D

Doll, S. (2022) 'World's largest electric cruise ship' makes maiden voyage in China with a whopping 7,500 kWh in battery power, Electrek. Available at: https://electrek.co/2022/03/31/worlds-largest-electric-cruise-ship-makes-maiden-voyage-in-china-with-a-whopping-7500-kwh-in-battery-power/ (Accessed: 25 October 2023).

Dupre, S., Bayer, C. and Santacruz, T. (2020) A Large Majority of Retail Clients Want to Invest Sustainably. Available at: https://2degrees-investing.org/resource/retail-clients-sustainable-investment/.

E

den Elzen, M. et al. (2022) 'Updated nationally determined contributions collectively raise ambition levels but need strengthening further to keep Paris goals within reach', Mitigation and Adaptation Strategies for Global Change, 27(6), p. 33. Available at: https://doi.org/10.1007/s11027-022-10008-7

Energiewendebauen (2023) Save CO2 with Large-Scale Heat Pumps. Available at: https://www.energiewendebauen.de/en/news/save_co2_with_large-scale_heat_pumps (Accessed: 25 October 2023).

Eskander, S.M.S.U. and Fankhauser, S. (2020) 'Reduction in greenhouse gas emissions from national climate legislation', Nature Climate Change [Preprint]. Available at: https://doi.org/10.1038/s41558-020-0831-z

European Commission (2023) Corporate sustainability reporting. Available at: https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en (Accessed: 25 October 2023).

F

Falkenberg, M. et al. (2022) 'Growing polarization around climate change on social media', Nature Climate Change, 12(12), pp. 1114–1121. Available at: https://doi.org/10.1038/s41558-022-01527-x.

G

Global Energy Monitor et al. (2023) Boom and Bust Coal 2023: Tracking the Global Coal Plant Pipeline. Available at: https://globalenergymonitor.org/report/boom-and-bust-coal-2023/.

Green, D. and Vallee, B. (2022) 'Can Finance Save the World? Measurement and Effects of Coal Divestment Policies by Banks', SSRN Electronic Journal, pp. 1–45. Available at: https://doi.org/10.2139/ssrn.4090974.

H

Hadziosmanovic, M., Rahimi, K. and Bhatia, P. (2022a) Trends Show Companies Are Ready for Scope 3 Reporting with US Climate Disclosure Rule. Available at: Trends Show Companies Are Ready for Scope 3 Reporting with US Climate Disclosure Rule (Accessed: 25 October 2023).

Hadziosmanovic, M., Rahimi, K. and Bhatia, P. (2022b) Trends Show Companies Are Ready for Scope 3 Reporting with US Climate Disclosure Rule.

Hale, T. et al. (2021) Net Zero Tracker. Energy & Climate Intelligence Unit (ECIU), Data-Driven EnviroLab (DDL), NewClimate Institute, Oxford Net Zero. Available at: https://www.zerotracker.net/.

Hase, V. et al. (2021) 'Climate change in news media across the globe: An automated analysis of issue attention and themes in climate change coverage in 10 countries (2006–2018)', Global Environmental Change, 70(August). Available at: https://doi.org/10.1016/j.gloenvcha.2021.102353.

Heede, R. (2014) 'Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854-2010', Climatic Change, 122(1–2), pp. 229–241. Available at: https://doi.org/10.1007/s10584-013-0986-y.

Höhne, N. et al. (2020) 'Emissions: world has four times the work or one-third of the time', Nature, 579(March), pp. 25–28. Available at: https://www.nature.com/articles/d41586-020-00571-x.

Höhne, N. et al. (2021) 'Wave of net zero emission targets opens window to meeting the Paris Agreement', Nature Climate Change, 11(10), pp. 820–822. Available at: https://doi.org/10.1038/s41558-021-01142-2.

I

ICCT (2023) ZERO-EMISSION VEHICLES PHASE-INS. Available at: https://theicct.org/zev-phase-ins/ (Accessed: 25 October 2023).

IEA (2021) The Role of Critical Minerals in Clean Energy Transitions. Available at: https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary.

IEA (2022a) The Future of Heat Pumps, Press release. Available at: https://www.iea.org/reports/the-future-of-heat-pumps (Accessed: 25 October 2023).

IEA (2022b) The Future of Heat Pumps, Press release.

IEA (2022c) World Energy Outlook 2022. Available at: https://www.iea.org/topics/world-energy-outlook (Accessed: 4 January 2023).

IEA (2023a) Coal. Available at: https://www.iea.org/energy-system/fossil-fuels/coal (Accessed: 24 October 2023).

IEA (2023b) Global EV Outlook 2023: Catching up with climate ambitions. Available at: https://iea.blob.core.windows.net/assets/dacf14d2-eabc-498a-8263-9f97fd5dc327/GEVO2023.pdf.

IEA (2023c) Heat Pumps. Available at: https://www.iea.org/energy-system/buildings/heat-pumps (Accessed: 2 November 2023).

IEA (2023d) 'The State of Clean Technology Manufacturing'. Available at: https://www.iea.org/reports/the-state-of-clean-technology-manufacturing.

IEA et al. (2023a) Tracking SDG 7: The Energy Progress Report. Washington D.C. Available at: https://mc-cd8320d4-36a1-40ac-83cc-3389-cdn-endpoint.azureedge.net/-/media/Files/IRENA/Agency/Publication/2023/Jun/Tracking_SDG7_energy_progress_2023.pdf

IEA et al. (2023b) Tracking SDG 7: The Energy Progress Report. Washington D.C.

IEA (2023e) World Energy Investment 2023. Available at: https://iea.blob.core.windows.net/assets/8834d3af-af60-4df0-9643-72e2684f7221/WorldEnergyInvestment2023.pdf.

Imundo, M. and Rapp, D. (2022) 'When fairness is flawed: Effects of false balance reporting and weight-of-evidence statements on beliefs and perceptions of climate change', Journal of Applied Research in Memory and Cognition, 11(2), pp. 258–271.

Inman, P. (2023) 'Green investment funds pushing money into fossil fuel firms, research finds', 2 May. Available at: https://www.theguardian.com/business/2023/may/02/green-investment-funds-pushing-money-into-fossil-fuel-firms-research-finds.

IPCC (2018) 'Summary for Policymakers', in V. Masson-Delmotte et al. (eds) Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change,. Cambridge, UK and New York, NY, USA: Cambridge University Press, pp. 3–24. Available at: https://doi.org/10.1017/9781009157940.001.

IPCC (2021) Figure: SPM.3. Available at: https://www.ipcc.ch/report/ar6/wg3/figures/summary-for-policymakers/figure-spm-3/ (Accessed: 25 October 2023).

IPCC (2022a) Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, NY, USA. Available at: https://doi.org/10.1017/9781009157926.

IPCC (2022b) 'Summary for Policymakers', in H.-O. Pörtner et al. (eds) Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, NY, USA: Cambridge University Press, pp. 3–33. Available at: https://doi.org/10.1017/9781009157926.002.

IRENA and ILO (2022) Renewable energy and jobs: Annual review 2022, International Renewable Energy Agency (IRENA) and International Labour Organization (ILO).

J

Jacobsson, S. and Lauber, V. (2006) 'The politics and policy of energy system transformation—explaining the German diffusion of renewable energy technology', Energy Policy, 34(3), pp. 256–276. Available at: https://doi.org/10.1016/j.enpol.2004.08.029.

Al Jazeera (2022) Thousands of Dutch farmers protest against emissions targets. Available at: https://www.aljazeera.com/news/2022/6/22/thousands-of-dutch-farmers-protest-against-emissions-targets#:~:text=22 Jun 2022 Thousands of farmers have gathered,the Netherlands and snarling traffic on major highways. (Accessed: 24 October 2023).

K

Kachi, A. and Marquardt, M. (2022) Making finance consistent with climate goals.

Kavanagh, M. (2022) 'Coolbrook heats metal to 1,700°C — while it also tackles global warming', Financial Times, 21 November. Available at: https://www.ft.com/content/0b25c941-fcc4-46aa-a81a-0cffb4d1be32.

Kimbrough, K. (2021) These are the sectors where green jobs are growing in demand. Available at: https://www.weforum.org/agenda/2021/09/sectors-where-green-jobs-are-growing-in-demand/ (Accessed: 25 October 2023).

Kinnunen, M. (2021) 'Weak congruence between public opinion and policy outcome in energy and climate policy – Is there something wrong with Finnish democracy?', Energy Research & Social Science, 79. Available at: https://doi.org/10.1016/j.erss.2021.102014.

L

Laville, S. (2023) 'Court restrictions on climate protesters "deeply concerning", say leading lawyers', The Guardian, 8 March. Available at: https://www.theguardian.com/environment/2023/mar/08/court-restrictions-on-climate-protesters-deeply-concerning-say-leading-lawyers

Leiserowitz, A. et al. (2022) 'International Public Opinion on Climate Change, 2022', Yale Program on Climate Change Communication and Data for Good at Meta, p. 123. Available at: https://climatecommunication.yale.edu/wp-content/uploads/2021/06/international-climate-opinion-february-2021d.pdf.

M

MeCCO (2023) 2004-2023 World Newspaper Coverage of Climate Change or Global Warming, Media and Climate Change Observatory. Available at: https://sciencepolicy.colorado.edu/icecaps/research/media_coverage/world/index.html (Accessed: 2 November 2023).

Meinshausen, M. et al. (2022) 'Realization of Paris Agreement pledges may limit warming just below 2 °C', Nature, 604(7905), pp. 304–309. Available at: https://doi.org/10.1038/s41586-022-04553-z.

Merner, L.D. (no date) 'From Research to Action: The Growing Impact of Attribution Science', The Equation.

N

Nascimento, L. et al. (2022) 'Twenty years of climate policy: G20 coverage and gaps', Climate Policy, 22(2), pp. 158–174. Available at: https://doi.org/10.1080/14693062.2021.1993776.

Nascimento, L. et al. (2023) 'Comparing the Sequence of Climate Change Mitigation Targets and Policies in Major Emitting Economies', Journal of Comparative Policy Analysis: Research and Practice, pp. 1–18. Available at: https://doi.org/10.1080/13876988.2023.2255151.

Nascimento, L. and Höhne, N. (2023) 'Expanding climate policy adoption improves national mitigation efforts', npj Climate Action, 2(1), p. 12. Available at: https://doi.org/10.1038/s44168-023-00043-8.

Nascimento, L., Kuramochi, T. and Höhne, N. (2022) 'The G20 emission projections to 2030 improved since the Paris Agreement, but only slightly', Mitigation and Adaptation Strategies for Global Change, 27(6), p. 39. Available at: https://doi.org/10.1007/s11027-022-10018-5.

Net Zero Tracker (2023) Net Zero Stocktake 2023. Cologne, Berlin, Oxford, London, North Carolina: NewClimate Institute, Oxford Net Zero, Energy & Climate Intelligence Unit; Data-Driven EnviroLab. Available at: https://ca1-nzt.edcdn.com/Reports/Net_Zero_Stocktake_2023.pdf?v=1689326892 (Accessed: 5 September 2023).

P

PwC (2022) ESG-focused institutional investment seen soaring 84% to US$33.9 trillion in 2026, making up 21.5% of assets under management: PwC report. Available at: https://www.pwc.com/gx/en/news-room/press-releases/2022/awm-revolution-2022-report.html (Accessed: 25 October 2023).

Q

Quak, N. et al. (2018) Afraid of the dark, next-kraftwerke. Available at: https://www.next-kraftwerke.com/energy-blog/reliable-supply (Accessed: 25 October 2023).

R

Reynolds, O. and Paixão, S. (2022a) Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data. Available at: https://www.gogla.org/wp-content/uploads/2023/05/gogla_sales-and-impact-report-h2-2022.pdf.

Reynolds, O. and Paixão, S. (2022b) Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data.

RMI (2023) 'The Renewable Revolution', The Renewable Revolution [Preprint]. Available at: https://doi.org/10.4324/9781849775281.

Rogelj, J. et al. (2023) 'Credibility gap in net-zero climate targets leaves world at high risk', Science, 380(6649), pp. 1014–1016. Available at: https://doi.org/10.1126/science.adg6248.

Rosenow, J. and Gibb, D. (2023) Guest post: How the energy crisis is boosting heat pumps in Europe, Carbon Brief. Available at: https://www.carbonbrief.org/guest-post-how-the-energy-crisis-is-boosting-heat-pumps-in-europe/ (Accessed: 25 October 2023).

Ross, A. (2023) 'ESG put to the test in a high-inflation world', 28 July. Available at: https://www.ft.com/content/7a98cba4-2977-40d6-bf99-dea74d479607.

S

Sato, M. et al. (2023) 'Impacts of climate litigation on firm value', 5709(421).

Semieniuk, G. et al. (2022) 'Stranded fossil-fuel assets translate to major losses for investors in advanced economies'. Nature. Available at: https://doi.org/10.1038/s41558-022-01356-y.

Setzer, J. and Higham, C. (2022) Global trends in climate change litigation: 2022 snapshot. London, United Kingdom, United Kingdom: Grantham Research Institute on Climate Change and the Environment; Centre for Climate Change Economics and Policy. Available at: https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2022/08/Global-trends-in-climate-change-litigation-2022-snapshot.pdf (Accessed: 16 December 2022).

Statista (2023) Value of venture capital investments in climate technology worldwide from 2010 to 2022, with a forecast for 2023. Available at: https://www.statista.com/statistics/1197389/global-climate-tech-venture-capital-investment/ (Accessed: 25 October 2023).

T

The Maritime Executive (2023) China Launches First 700 TEU Electric Containership for Yangtze Service. Available at: https://maritime-executive.com/article/china-launches-first-700-teu-electric-containership-for-yangtze-service (Accessed: 25 October 2023).

U

UNDP and University of Oxford (2021) The Peoples' Climate Vote. Available at: https://www.undp.org/publications/peoples-climate-vote.

UNSD (2022) Affordable and clean energy. Available at: https://unstats.un.org/sdgs/report/2022/goal-07/ (Accessed: 25 October 2023).

W

Waldersee, V. (2022) Investors file lawsuit against VW over climate-change related lobbying disclosures, Reuters. Available at: https://www.reuters.com/business/autos-transportation/investors-file-lawsuit-against-vw-over-climate-change-related-lobbying-2022-10-20/ (Accessed: 25 October 2023).

Weller, M.-P. and Tran, M.-L. (2022) 'Climate Litigation against companies', Climate Action, 1(1), p. 14. Available at: https://doi.org/10.1007/s44168-022-00013-6.

Wiatros-Motyka, M. (2023) Global Electricity Review 2023. Available at: https://ember-climate.org/insights/research/global-electricity-review-2023/ (Accessed: 24 October 2023).

WMO (2013) The Global Climate 2001-2010: a decade of climate extremes. Geneva. Available at: https://library.wmo.int/records/item/49934-the-global-climate-2001-2010-a-decade-of-climate-extremes.

World Bank (2023) Electricity access. Available at: https://ourworldindata.org/grapher/share-of-the-population-with-access-to-electricity?tab=chart&time=2010..2020&country=BRA~RWA~IND~CHN~HTI~AFG~USA~OWID_WRL (Accessed: 2 November 2023).

NewClimate – Institute for Climate Policy and Global Sustainability gGmbH

Cologne Office
Waidmarkt 11a
50676 Cologne, Germany

Berlin Office
Schönhauser Allee 10-11
10119 Berlin, Germany

Phone: +49 221 999 83 300
Email: info@newclimate.org
Website: www.newclimate.org