IRENA
International Renewable Energy Agency

WORLD ENERGY TRANSITIONS OUTLOOK 2022

1.5° C PATHWAY

EXECUTIVE SUMMARY

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ABOUT IRENA

The International Renewable Energy Agency (IRENA) serves as the principal platform for international co-operation, a centre of excellence, a repository of policy, technology, resource and financial knowledge, and a driver of action on the ground to advance the transformation of the global energy system. A global intergovernmental organisation established in 2011, IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security, and low-carbon economic growth and prosperity.

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IRENA
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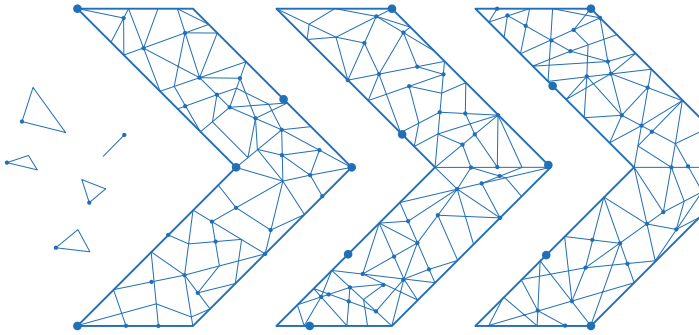


FOREWORD

Given the ongoing pace and scope of the energy transition, anything short of radical and immediate action will diminish – and may possibly eliminate – the chance of staying on the 1.5°C or even 2°C path. And the surge of net zero commitments shows that we understand the gravity and complexity of the situation.

The past couple of years have exposed the weaknesses and vulnerabilities of a system heavily reliant on the fuels of the 20th century. To this, the current crisis in Ukraine brings new levels of concern and uncertainty, crystalising the costs to economies that remain profoundly intertwined with fossil fuels. Many aspects of everyday life feel the repercussions from turmoil in the energy sector. In the absence of alternatives, high fossil fuel prices inflict energy poverty and loss of industrial competitiveness, while citizens worldwide worry about their energy bills and climate impacts as warned by the recent report of the Intergovernmental Panel on Climate Change.

We do not have the luxury of time to deal with each of these challenges separately. We can ill afford to invest in outdated ways of producing, distributing and consuming energy that are neither economical nor future proof. We have seen time and again that energy that is unreliable causes uncertainty; energy that is too costly alienates and isolates; and energy that pollutes incapacitates and kills. In all cases, poor energy choices mean slower economic growth and potentially irreparable damage to the ecosystems that sustain us all. Efficient and decentralised renewable technologies, by contrast, can create a system less prone to market shocks and improve resilience and energy security through the diversity of supply options and actors. The same resilience can be embedded in the evolving global hydrogen market, which requires investment in the coming years to move away from fossil gas and build up the infrastructure needed for the long term.

But knowing and acting are two different things. IRENA's ***World Energy Transitions Outlook*** (WETO) shows that progress across all energy uses has been woefully inadequate. Enhanced National Determined Contributions and commitments made at COP26 showed a promising trend but still fell short of what is required. The United Nations High-Level Dialogue on Energy in 2021 highlighted how far we are from realising our pledge to ensure universal access to energy. And the danger of pursuing false short-term solutions – such as turning back to coal, intensifying gas extraction and engaging in new oil drilling – is palpable.

WETO charts the fastest path to emissions reduction, consistent with the 1.5°C goal. It prioritises existing solutions and those with the most chance of becoming viable in the coming years. The Outlook positions efficiency and electrification as primary drivers, enabled by renewable power, green hydrogen, and sustainable modern bioenergy. WETO also shows that, with a holistic policy framework, serious investment and co-operation, the energy transition can be a means for job creation, an inclusive economy and a more equal world.

This year, WETO examines the steps needed by 2030 to deliver climate and near-term energy solutions simultaneously and urgently. Prioritising energy efficiency and electrification based on renewables is the safest way to reconcile multiple agendas. As in the 2021 edition, the Outlook places significant focus on policies and socio-economic implications to provide the necessary nuance for diverse circumstances of individual countries and regions. Crucially, WETO 2022 positions justice and fairness at the heart of planning and action so that the energy transition will have a truly positive impact. And it shows that even in the short period from 2019 to 2030, this course of action will boost global GDP and create 85 million energy transition-related jobs.

WETO provides several topical deep dives to explore specific challenges of the energy transition. It tackles the issue of ensuring the system flexibility necessary for the integration of high shares of solar and wind, superseding the outdated concept of baseload and related market structures. It also analyses sustainable biomass, which is an essential part of the energy mix but requires careful management and a long-term strategy. Finally, this year's WETO considers the rising importance of critical minerals and the avenues for their markets' proper functioning, while containing the risks of new dependencies.

This must be a defining year for the transformation of the global energy system and WETO can help guide the next steps at this crucial moment. The world faces fundamental choices that will determine whether the 1.5°C path, or even the 2°C path, will remain within reach. A renewables-based energy transition is the most realistic avenue to avoid the worst effects of climate change. And that same avenue promises greater energy security, national resilience, and a more inclusive, equitable and climate-proof global economy.

Accelerating the energy transition is an urgent and daunting task. It will require farsighted choices, discipline and wise investments. But, most of all, it will require radical action and extraordinary levels of international co-operation. Will we, as an international community, be able to deliver? I really hope so, and we at IRENA will do everything in our power to bring it about.

Francesco La Camera
Director-General, IRENA

IN 2022, THE NEED FOR THE ENERGY TRANSITION HAS BECOME EVEN MORE URGENT

Compounding crises underscore the pressing need to accelerate the global energy transition. Events of recent years have accentuated the cost to the global economy of a centralised energy system highly dependent on fossil fuels. Oil and gas prices are soaring to new highs, with the crisis in Ukraine bringing new levels of concern and uncertainty. The COVID-19 pandemic continues to hamper recovery efforts, while citizens worldwide worry about the affordability of their energy bills. At the same time, the impacts of human-caused climate change are increasingly evident around the globe. The Intergovernmental Panel on Climate Change (IPCC) warns that between 3.3 and 3.6 billion people already live in settings highly vulnerable to climate change.

Short-term interventions to ameliorate immediate challenges must be accompanied by a steadfast focus on a successful energy transition in the medium and long term. Governments today shoulder the challenging task of tackling seemingly opposing agendas of energy security, resilience, and affordable energy for all. In the face of uncertainty, policy makers must be guided by the overarching goals of arresting climate change and ensuring sustainable development. Any other approach, notably investing in new fossil fuel infrastructure, will only perpetuate the existing risks and raise the long-established threats of climate change.

Acceleration of the energy transition is essential for long-term energy security, price stability and national resilience

Given the inadequate pace and scope of the transition, anything short of radical and immediate action will diminish – possibly eliminate - the chance of staying on the 1.5°C or even 2°C path. In 2021, IRENA stressed the importance of a wide-ranging shift in the current trajectory across all energy uses. While some progress has been made, it falls woefully short of what is required. The stimulus and recovery efforts associated with the pandemic have also proved a missed opportunity, with only 6% of the G20's[1] USD 15 trillion in recovery funding in 2020 and 2021 being channelled towards clean energy (Nahm *et al.*, 2022).

Acceleration of the energy transition is also essential for long-term energy security, price stability and national resilience. Some 80% of the global population lives in countries that are net energy importers. With the abundance of renewable potential yet to be harnessed, this percentage can be dramatically reduced. Such a profound shift would make countries less dependent on energy imports through diversified supply options and help decouple economies from wide swings in the prices of fossil fuels. This path would also create jobs, reduce poverty, and advance the cause of an inclusive and climate-safe global economy.

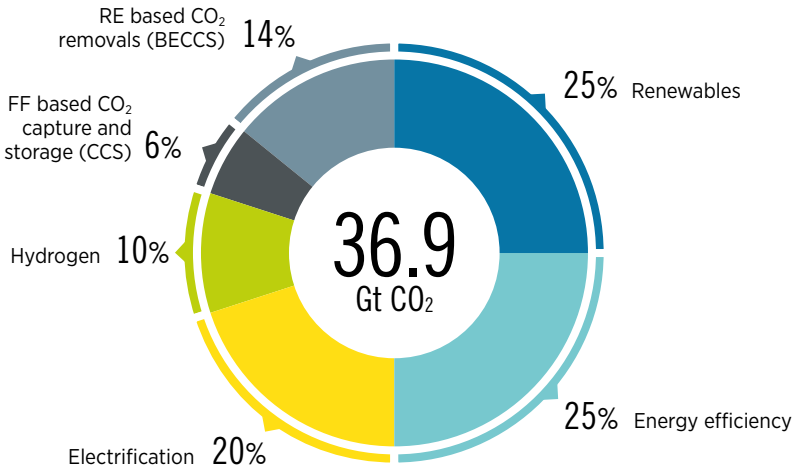
Overhauling the plans, policies, fiscal regimes and energy sector structures that impede progress is a political choice. With each passing day the cost of inaction pulls further ahead of the cost of action. Recent developments have demonstrated that high fossil fuel prices, in the absence of alternatives, result in energy poverty and loss of industrial competitiveness. But in the end, it is political will and resolve that will shape the transition path and determine whether it will lead to a more inclusive, equitable and stable world.

1 The Group of Twenty comprises of 19 countries and the European Union.

Towards the 2050 goal

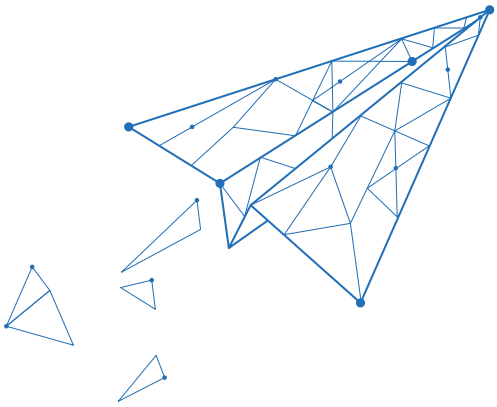
IRENA's 1.5°C pathway positions electrification and efficiency as key drivers of the energy transition, enabled by renewables, hydrogen, and sustainable biomass. This pathway, which requires a massive change in how societies produce and consume energy, would result in a cut of nearly 37 gigatonnes of annual CO_2 emissions by 2050. These reductions can be achieved through 1) significant increases in generation and direct uses of renewables-based electricity; 2) substantial improvements in energy efficiency; 3) the electrification of end-use sectors (*e.g.* electric vehicles and heat pumps); 4) clean hydrogen and its derivatives; 5) bioenergy coupled with carbon capture and storage; and 6) last-mile use of carbon capture and storage (see Figure ES.1).

FIGURE ES.1 Reducing emissions by 2050 through six technological avenues



Note: Abatement estimates include energy and process-related CO_2 emissions along with emissions from non-energy use. Renewables include renewable electricity generation sources and direct use of renewable heat and biomass. Energy efficiency includes measures related to reduced demand and efficiency improvements. Structural changes (*e.g.* relocation of steel production with direct reduced iron) and circular economy practices are part of energy efficiency. Electrification includes direct use of clean electricity in transport and heat applications. Hydrogen and its derivatives include synthetic fuels and feedstocks. CCS describes carbon capture and storage from point-source fossil fuel-based and other emitting processes, mainly in industry. BECCS and other carbon removal measures include bioenergy coupled with CCS in electricity, heat generation, and industry.

CCS = carbon capture and storage; BECCS = bioenergy with carbon capture and storage; $GtCO_2$ = gigatonnes of carbon dioxide; RE = renewable energy; FF = fossil fuel.



End-use decarbonisation needs to be given greater priority to reduce reliance on fossil fuels in industry, transport and domestic heating

Renewables-based electricity is now the cheapest power option in most regions. The global weighted-average levelised cost of electricity from newly commissioned utility-scale solar photovoltaic (PV) projects fell by 85% between 2010 and 2020. The corresponding cost reductions for concentrated solar power (CSP) were 68%; onshore wind, 56%; and offshore wind, 48%. As a result, renewables are already the default option for capacity additions in the power sector in almost all countries, and they dominate current investments. Solar and wind technologies have consolidated their dominance over time and, with the recent increase in fossil fuel prices, the economic outlook for renewable power is undeniably good.

Decarbonisation of end uses is the next frontier, with many solutions provided through electrification, green hydrogen and the direct use of renewables. Despite good global progress in deployment of renewables in the power sector, the end use sectors have lagged, with industrial processes and domestic heating still heavily reliant on fossil gas (see Table ES.1). In the transport sector, oil continues to dominate. In these sectors, deeper penetration of renewables, expanded electrification and improvements in energy efficiency can play a crucial role in alleviating concerns about prices and security of supply.

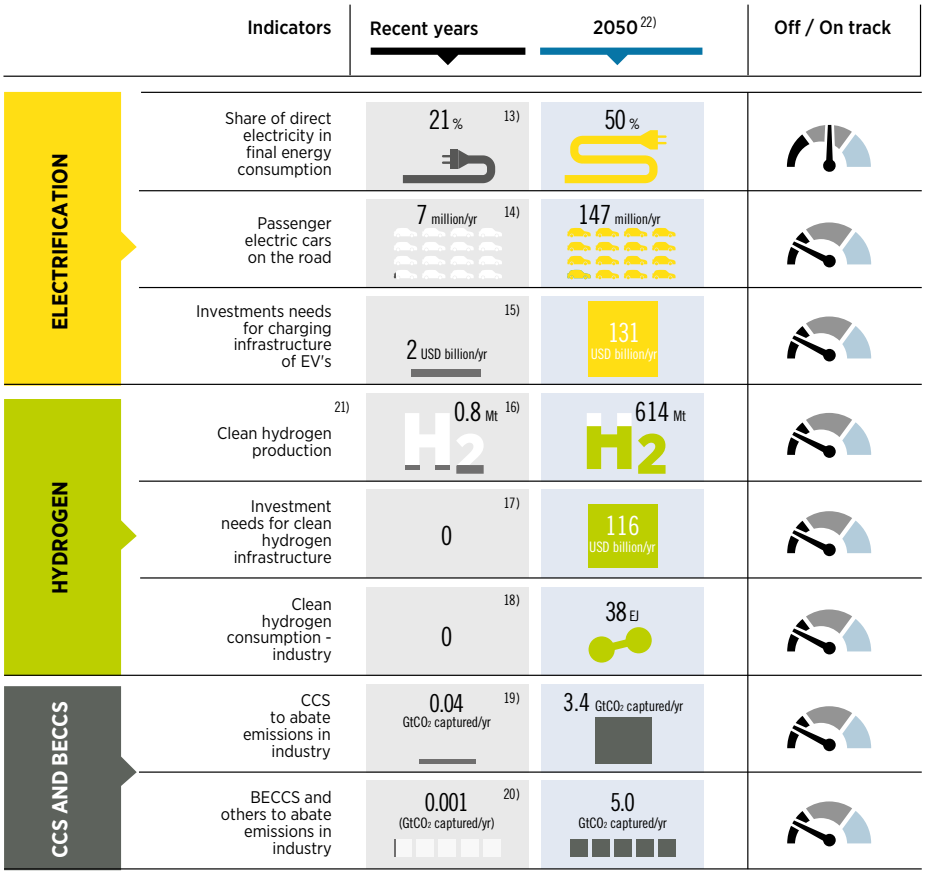
Despite some progress, the energy transition is far from being on track, and radical action is needed to change its current trajectory. Achieving the 2050 climate target depends on sufficient action by 2030, with the coming eight years being critical for accelerating the renewables-based transition. Any near-term shortfall in action will further reduce the chance of staying on path for the 1.5°C climate goal. Accelerated action is a no-regrets strategy and, when carefully implemented, allows the realisation of the benefits of a just and inclusive energy transition.

TABLE ES.1 **A roadmap to 2050 – tracking progress of key energy system components to achieve the 1.5°C target**

	Indicators	Recent years	2050 [22]	Off / On track
RENEWABLES	**ELECTRIFICATION WITH RENEWABLES**			
	Share of renewables in electricity generation	26 % [1]	90 %	
	Addition of renewable energy technologies	264 GW/yr [2]	836 GW/yr	
	Annual solar PV additions	126 GW/yr [3]	444 GW/yr	
	Annual wind energy additions	115 GW/yr [4]	248 GW/yr	
	Investment needs for RE generation	0.3 USD trillion/yr [5]	1 USD trillion/yr	
	DIRECT RENEWABLES IN END USES			
	Share of renewables in final energy consumption	16 % [6]	79 %	
	Solar thermal collector area	25 million m²/yr [7]	165 million m²/yr	
	Modern bioenergy consumption [23]	18 EJ [8]	58 EJ	
	Geothermal consumption	0.9 EJ [9]	4 EJ	
	District heat generation - buildings	0.4 EJ [10]	7.3 EJ	
ENERGY EFFICIENCY	Energy intensity improvement rate	1.2 %/yr [11]	2.9 %/yr	
	Investment needs for energy efficiency	0.3 USD trillion/yr [12]	1.5 USD trillion/yr	

▸ continued

TABLE ES.1 A roadmap to 2050 – tracking progress of key energy system components to achieve the 1.5°C target (continued)



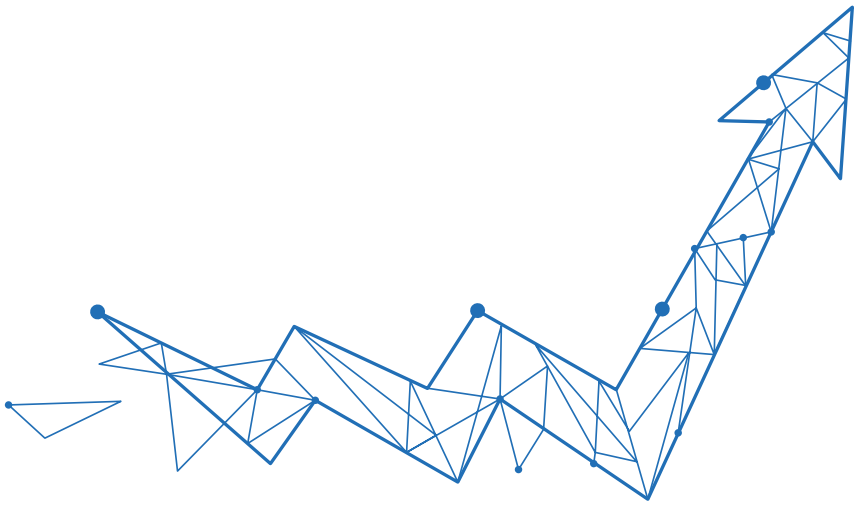
Note: The particulars of recent year for the indicators are [1]Share of renewables in electricity generation (2019), [2]Addition of renewable energy technologies (2020), [3]Annual solar PV additions (2020), [4]Annual wind energy additions (2020), [5]Investment needs for RE generation (2019), [6]Share of renewables in final energy consumption (2019), [7]Solar thermal collector area (2020), [8]Modern bioenergy consumption (2019), [9]Geothermal consumption (2019), [10]District heat generation (2019), [11]1.2%/yr represents the average energy intensity improvements from 2018 (1.2%), 2019 (2.0%), and 2020 (0.5%), [12]Investment needs for energy efficiency (2019), [13]Share of direct electricity in final energy consumption (2019), [14]Passenger electric cars on the road includes the sales of both plug-in hybrids and battery electric vehicles (2021), [15]Investments needs for charging infrastructure of EV's (2019), [16]Clean hydrogen production (2020), [17]Investment needs for clean hydrogen infrastructure (2019), [18]Clean hydrogen consumption - Industry (2018), [19]CCS to abate emissions in industry (2020), [20]BECCS and others to abate emissions in industry (2020), [21]Clean hydrogen here refers to the combination of hydrogen produced by electrolysis powered from renewables (green hydrogen) and hydrogen produced from natural gas in combination with CCS by steam methane reforming (blue hydrogen), [22] Parameters in column 2050 with per annum values, represent the annual average during the period 2020-2050 to reach the 1.5°C target, [23]Modern bioenergy consumption includes the use of both modern biomass and biofuels. The detailed version of the technological avenues and its implications can be found in the respective KPI's in section 2.2.

2030 priorities

This 2022 edition of the World Energy Transitions Outlook sets out priority areas and actions to reach the 2030 milestone using presently available solutions that can be deployed at scale. Progress will depend on political will, well-targeted investments, and a mix of technologies, accompanied by policy packages to put them in place and optimise their economic and social impact. The top priorities are discussed below; they will have to be pursued simultaneously to put the energy transition on track to the 1.5°C goal.

Resolutely replacing coal power with clean alternatives, notably renewables, is vital. In recent months, gas scarcity and high prices have resulted in a slowdown of the global coal phase out, making an even stronger case for more aggressive deployment of renewables. It is evident that phase out is a complex task for countries heavily reliant on coal, especially given the imperative of a just and fair transition for affected workers and communities. Concerted action and international co-operation are therefore essential for timely progress. Replacing coal in industry must be tackled as well, as almost 30% of all coal is used in iron and steel, cement, and other industries. The coming years will be decisive for innovation, industry action, and international co-operation in these sectors.

Phasing out fossil fuels assets should be done in tandem with measures to eliminate market distortions and incentivise energy transition solutions. This will involve phasing out fossil fuel subsidies and ensuring that the full costs (environmental, health and social) of burning fossil fuels are reflected in their prices, thereby eliminating existing market distortions. Fiscal policies, including carbon pricing, should be implemented and adjusted to enhance the competitiveness of transition-related solutions. Such interventions should be accompanied by a careful assessment of their social and equity impact, particularly on low-income populations, to ensure that they do not exacerbate energy poverty or have other socially regressive effects.

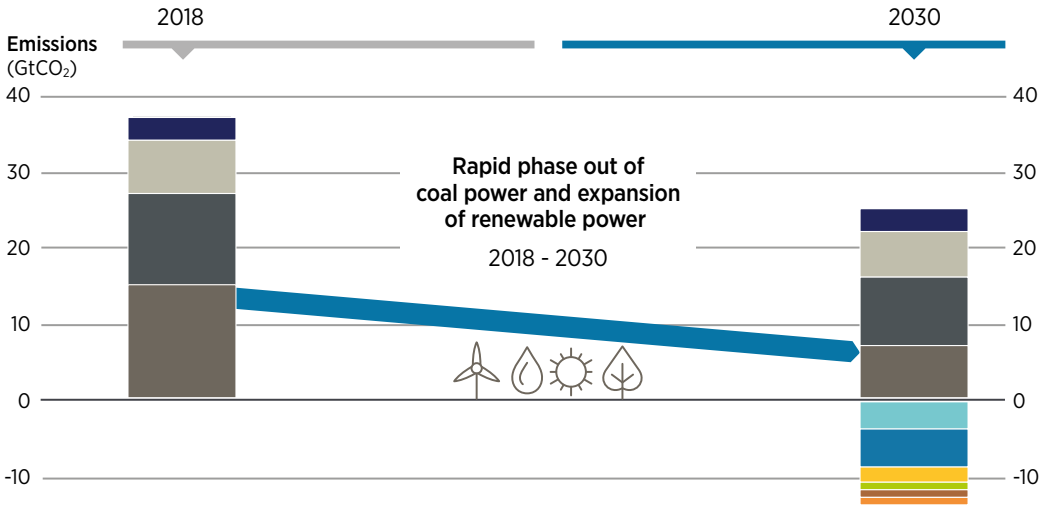


To fulfil the 1.5°C Scenario, the electricity sector will have to be thoroughly decarbonised by mid-century, with solar and wind leading the transformation

Ramping up renewables, together with an aggressive energy efficiency strategy, is the most realistic path towards halving emissions by 2030, as recommended by the IPCC (see Figure ES.2). In the power sector, renewables are faster and cheaper to deploy than the alternatives. But to meet the IPCC goal, annual additions of renewable power capacity will have to be three times the current rate of deployment. Such an increase is possible if the right conditions are in place. Technology-specific targets and policies are especially needed to support less mature technologies, such as ocean energy and CSP.

Infrastructure upgrades, modernisation, and expansion are needed to increase system resilience and build flexibility for a diversified and interconnected system capable of accommodating high shares of variable renewable energy. The idea that fossil gas alone will be required to integrate higher shares of variable solar and wind is being fast overtaken by the improved economics of alternative sources of flexibility. But in addition to many technological solutions, markets will need to be adapted, both in liberalised and regulated systems. The current structure was developed during the fossil fuel era, to reduce operational costs of large, centralised power plants with differing fuel and opportunity costs. In the age of variable renewable energy, electricity should be procured considering the characteristics of decentralised generation technologies, with no fuel or opportunity cost.

FIGURE ES.2 Emission reductions 2018-2030



Renewable energy share in electricity generation must increase to 65% by 2030.

- An additional 8 000 GW of renewable capacity in this decade.
- Installed capacity of onshore wind of 3 000 GW, four times that of 2020.
- Offshore wind to scale up to 380 GW, 11 times more than in 2020.
- Installed capacity of solar PV to reach 5 200 GW, more than seven times that of 2020.
- Hydropower capacity to increase to 1 500 GW, 30% more than in 2020.
- Other renewable technologies to reach 750 GW, up six-fold from 2020.

The share of direct electricity in total final energy consumption (TFEC) must rise from 21% to 30%; deployment of energy efficiency measures must increase 2.5 times.

- A drop in TFEC from ca. 390 EJ today to 370 EJ.
- Expanded electrification of energy services, especially in transport sector.
- Improved energy efficiency standards and retrofitting of existing buildings.
- Process changes in industry, relocation of industries, and circular economy practices.

Direct renewables in end use sectors must grow from 12% in 2019 to 19% by 2030.

- Hydrogen consumption to reach a minimum of 19 EJ by 2030.
- Total consumption of bioenergy and feedstock in industry to increase to 25 EJ, 2.5 times more than in 2019.
- Solar thermal, geothermal and district heating solutions to be scaled up to 60 EJ, 1.3 times the 2019 levels.
- Biofuel's share for energy consumption in transport to increase from 3% in 2019 to 13%.
- Increase ambition on biojet to reach 20% of total fuel consumption by 2030.

- Process and non-energy
- Natural gas
- Oil
- Coal
- Energy conservation and efficiency
- Renewables (power and direct uses)
- Electrification of end uses (direct)
- Hydrogen and its derivatives
- CCS in industry
- BECCS and other carbon removal measures

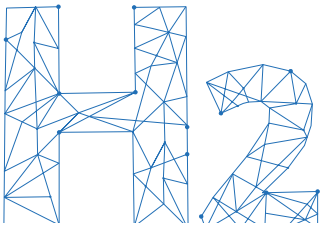
Note: GW = gigawatt; Gt = gigatonne; CCS = carbon capture and storage; BECCS = bioenergy combined with carbon capture and storage.

Green hydrogen should move from niche to mainstream by 2030. In 2021, only 0.5 GW of electrolysers were installed; cumulative installed capacity needs to grow to some 350 GW by 2030. Hydrogen commands a great deal of policy attention, so the coming years should bring concrete actions to develop the global market and reduce costs. In this regard, the development of standards and guarantees of origin, along with support schemes to cover the cost gap for green solutions, will ensure that hydrogen offers a meaningful contribution to climate efforts in the long term.

Modern bioenergy's contribution to meeting energy demand, including demand for feedstock, will have to triple by 2030. At the same time, the traditional use of biomass (such as firewood) needs to be replaced by clean cooking solutions. There is scope for biomass supply to expand, but the expansion will need to be managed carefully to ensure sustainability and minimise adverse outcomes. Policies that promote the wider use of bioenergy need to be coupled with strong, evidence-based sustainability procedures and regulations.

The majority of car sales by 2030 should be electric. Electromobility is a bright light of the energy transition progress, with EVs already at 8.3% of global car sales in 2021 (EV-Volumes, 2022). This share will rise rapidly in the coming years. Annual battery manufacturing capacity is set to quadruple between 2021 and 2025, to approximately 2 500 GWh. However, EV growth ultimately depends on a massive ramp-up of recharging infrastructure in the coming decade, as well as financial and fiscal incentives to promote the uptake of EVs, charger mandates, and bans on combustion engine vehicles. In addition, greater efforts should be made to reduce travel demand and to promote a switch to public transport and cycling where possible.

All new buildings must be energy efficient, and renovation rates should be significantly increased. Improving the measures and regulations for buildings can make an immense difference in the near term. Decarbonising heating and cooling will require changes to building codes, energy performance standards for appliances, and mandates for renewables-based heating and cooling technologies, including solar water heaters, renewables-based heat pumps and geothermal heating. The effort to decarbonise heating and cooling will have to be sustained over the coming decades, but the measures just mentioned should be put in place without delay.



Accelerated deployment of green hydrogen and sustainable biomass are key solutions to decarbonise hard-to-abate sectors while also contributing to energy security

It is time for urgent action; countries need to set more ambitious targets and implement measures to ramp up energy efficiency and deployment of renewables

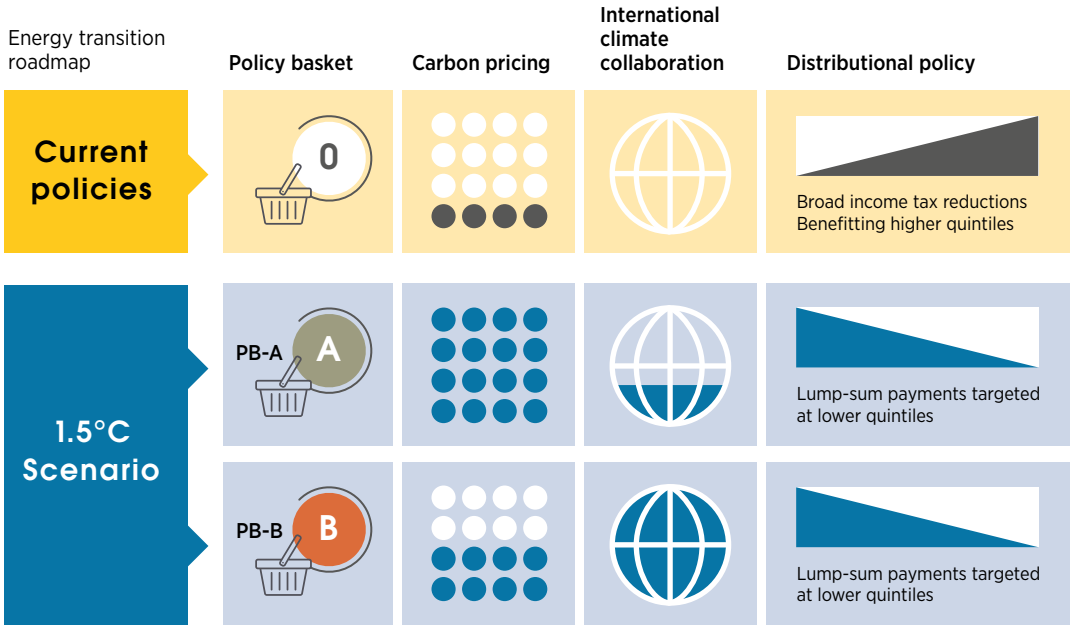
Demand-side management would help alleviate multiple challenges in the short term while contributing to the long-term security of energy and materials supply. Transforming the energy system is not simply about switching energy sources; it extends to ensuring the efficient use of energy across sectors. Innovation, recycling, and the circular economy will play significant roles in the pursuit of efficiency over the medium and long term. The coming years should see increased investment in research and development (R&D) and pilot projects along the value chains of all six of the technological avenues described above. This should be accompanied by efforts to cut unnecessary consumption and to move away from a system based on continuously increasing consumption.

Increasing ambition in national energy plans and in the Nationally Determined Contributions made under the 2015 Paris Climate Agreement must be firm enough to provide certainty of direction and guide investment strategies. The agreement on the Glasgow Climate Pact requested that parties revisit and strengthen the 2030 targets in their NDCs by the end of 2022 in line with the 1.5°C goal set out in the Paris Agreement. In addition to increasing ambition in their revised NDCs, Parties need to develop national implementation plans that include clearly defined targets, including efficiency, renewables and end uses.

A comprehensive set of policies covering all technological avenues is needed to achieve the necessary levels of deployment by 2030. Deployment policies should support market creation, thus facilitating reductions in technology costs and their scale up and increases in investment levels aligned with energy transition needs. Strong institutions will be needed to co-ordinate structural and just transition policies and manage potential misalignments. Only a holistic global policy framework can bring countries together to orchestrate a just transition that leaves no one behind and strengthens the international flow of finance, capacity and technologies.

IRENA's socio-economic analysis shows that progressive policy and regulatory measures generate greater benefits from the energy transition. To gain insights about the impact of different policy baskets, a sensitivity analysis examines how the more ambitious energy transition pathway, 1.5°C Scenario, can result in different socio-economic outcomes depending on variations in international collaboration, carbon pricing, progressive fiscal measures and other government programmes (distributional policy). Figure ES.3 illustrates the main differences between the current Policy Basket (PB-O) and those used for the 1.5°C Scenario in this sensitivity analysis (Policy Baskets A and B).

FIGURE ES.3 Conceptual differences across the policy baskets considered in this analysis



Policy Basket A (PB-A) entails a relatively high carbon tax and low international collaboration (*i.e.* limited flows, although still higher than current pledges).

Policy Basket B (PB-B) on the other hand, imposes a lower carbon tax (but still higher than today's real-world levels), combined with stronger international collaboration.

Policy Basket O (PB-O) current policies

Distributional policy: An additional key difference between the 1.5°C Scenario and current policies lies in the extent to which fiscal revenues and expenditures address distributional issues. Both PB-A and PB-B include more progressive within country distributive policies. The key impact of moving from Policy Basket A to B under the 1.5°C Scenario is the significant improvement in the distribution of socio-economic benefits because of the combined effect of higher international collaboration (between country-distributional policy), lower carbon pricing and improved within-country distributional policies. Under the more progressive PB-B, a clear majority of the world's population would be better off.

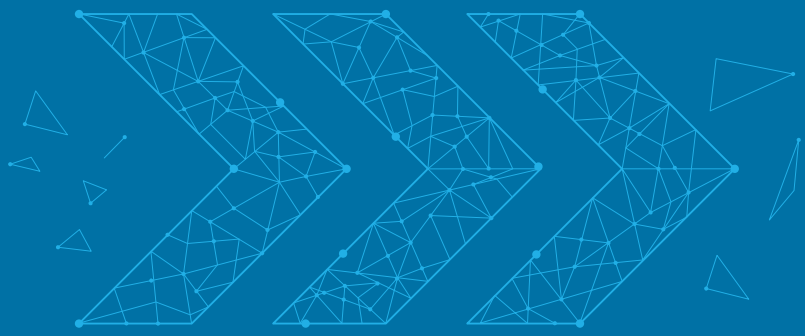
The way forward

The 1.5°C Scenario will require investments of USD 5.7 trillion per year until 2030. Investment decisions are long-lived, and the risks of stranded assets are high, so decisions should be guided by long-term logic. IRENA estimates that USD 0.7 trillion in annual investments in fossil fuels should be redirected towards energy transition technologies. Measures to eliminate market distortions, coupled with incentives for energy transition solutions, will facilitate the necessary changes in funding structures. Most of the additional capital is expected to come from the private sector. But public financing will also have to double in order to catalyse private finance and create an enabling environment for speedy transition with optimal socio-economic outcomes.

By 2030, the 1.5°C-aligned energy transition promises the creation of close to 85 million additional energy transition-related jobs compared to 2019 and support a boost in global gross domestic product (GDP). The additional 26.5 million jobs in renewables and 58.3 million extra jobs in energy efficiency, power grids and flexibility, and hydrogen more than offset losses of 12 million jobs in the fossil fuel and nuclear industries. Meeting the human resource capacity necessary to fill these newly created jobs requires a scaling up of education and training programmes as well as measures aimed at building an inclusive and gender-balanced transition workforce. While global GDP is boosted under the 1.5°C pathway, the analysis presented in this report reveals that regional- and country-level variances will depend highly on policy and regulatory measures and international co-operative flows of financial assistance and knowledge.

The largest energy consumers and carbon emitters will have to implement the most ambitious plans and investments by 2030. This will require going beyond long-term decarbonisation commitments and setting out concrete operational targets, plans and policies for the short and medium term. G20 and G7 countries have a critical role in leading the global energy transition effort at the international level. Funds and knowledge must be made available to less wealthy nations to advance the quest for an inclusive and more equitable world.

Globally and in most countries, higher socio-economic benefits are obtained under the 1.5°C pathway than under the business-as-usual scenario. To support these positive outcomes, however, progressive policies and programmes will be essential. As analysed in this report, their key impact is the significant improvement in the distribution of the socio-economic benefits of the transition across societies and geographies.



A renewables-based energy transition can help solve multiple issues at the same time: energy affordability, energy security and the climate crisis

IRENA's Energy Transition Welfare Index shows that the 1.5°C pathway improves global welfare significantly. The Index, with its five dimensions,[2] provides a holistic vision of the transition's socio-economic impacts. The following insights deserve particular attention:

- Assessing the impact of policies on the socio-economic footprints of transition roadmaps conveys a better understanding of the lived experience of the transition. Policy makers should explore these impacts and adjust their plans to ensure maximum shared benefits of climate policies.
- Implementing more progressive fiscal and regulatory measures and programmes, both domestically and internationally, will temper the regressive impacts of carbon taxes while improving the distribution of transition benefits and burdens.
- Enabling a rapid transition that complies with climate goals requires political commitment to support higher levels of international co-operation. By 2030, international climate collaboration should dramatically increase from current levels. Introducing these higher levels of international co-operation and more progressive distributional policies will ensure a fair and just transition.

Achieving universal access to modern energy by 2030 is a vital pillar of a just and inclusive energy transition aligned with the 1.5°C goal. Despite advances, the universal energy access goals of the United Nations Sustainable Development Goal 7 are in jeopardy. An estimated 758 million people were living without electricity globally in 2019; 2.6 billion had no access to clean cooking fuels and technologies. On the current trajectory, the world is set to miss the target of universal access by a wide margin. Decentralised renewable energy solutions can play a crucial role in solving the access problem while supporting the delivery of essential services and income-generating activities across sectors.

The year 2022 is presenting new challenges, with concerns about rapidly rising energy prices and energy security. At the same time, the 1.5°C climate goal is slipping farther out of reach; short of dramatic and immediate action, it will slip away for good. This edition of the World Energy Transitions Outlook sets out how both agendas can be addressed through an accelerated energy transition, with the deployment of renewables scaled up across sectors. The business case for more renewables is becoming stronger, and the benefits will be wide-ranging. But clear plans and strategies are needed. The time to act is now. The rest of the decade to 2030 is a critical milestone to ensure that 1.5°C remains a viable target for 2050.

2 Economic, social, environmental, distributional and energy access.

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