Clean Energy--Decarbonization and Clean Energy Pathways and Progress 2023 - 2019

Full delivery of COP28 pledges by around 130 nations tripling renewables and doubling energy efficiency, and by 50 companies zeroing-out methane emissions and eliminating flaring **would result in global energy-related GHG emissions in 2030 being around 4 gigatonnes of CO2 equivalent lower than would be expected without them**, according to analysis by the International Energy Agency.**This reduction represents around 30% of the emissions gap** that needs to be bridged to get the world on a 1.5°C pathway. (Dec 2023)
PR » **ENVIRONMENT + ENERGY LEADER »**

2030 Climate Solutions: Implementation Roadmap (UN Climate Change High-Level Champions and the Marrakech Partnership for Global Climate Action) —**Provides a set of climate solutions that can be scaled up and replicated over the next seven years (until 2030)**, as well as current gaps that need to be addressed to halve global emissions, respond to adaptation gaps, and increase resilience. The report is divided into eight sections: energy; transport; industry; land-use; ocean and coastal zones; water; human settlements; and finance. (Dec 2023)
PR »

Most national net zero targets do not include plans to phase out fossil fuels, says the first global benchmark of fossil fuel phase out plans, conducted by Net Zero Tracker. The benchmark covers commitments by 1,525 companies, cities, regions and countries to phase-out the exploration, production, and/or use of coal, oil or gas. The absence of phase out plans runs counter to the International Energy Agency (IEA)'s Net Zero pathway, which calls for no new fossil fuel development from now on, as coal, oil and gas must fall by 95%, 60% and 45%, respectively, by 2050 to keep the 1.5°C limit in range. **The study also finds that the lack of plans is encouraging the expansion of fossil fuels.** (Dec 2023)
PR » **EDIE »**

Global renewable energy capacity is on track to reach 7.3 Terawatts (TW) based on current national targets, according to a**new report by Ember.** This is 2.1 times the current global renewable capacity, but to triple renewables by 2030, the world would need to **increase renewables deployment by 17% every year**, from 500 GW in 2023 to 1.5 TW in 2030.**A parallel report by Bloomberg NEF** also finds the goal of tripling renewable energy by 2030 "hard but achievable," and would require an average investment in renewable energy of **$1.175 trillion per year until 2030** (up from $564 billion in 2022), and investment in power grids to rise to $777 billion in 2030. (Dec 2023)
AXIOS »

Global temperatures are on track to increase between 2.0 and 4.0˚C by 2100, with a likely range of 2.3 to 3.4˚C and a mean of 2.8˚C, according to the Rhodium Climate Outlook. The report also projects that while fossil fuels peak this decade,**there is a strong chance (83%) that the decline in fossil fuel consumption plateaus after 2060 at 60% of today's levels.** The report also finds there is a 50% chance that after mid-century, fossil fuels begin to rise again, driven by natural gas demand, slowing use of coal in industry, and a rebound in oil consumption for aviation, shipping, and plastic demand. (Dec 2023)
PR »

Fossil Fuels in Transition: Committing to the phase-down of all fossil fuels (Energy Transitions Commission (ETC)) — **Presents scenarios to dramatically reduce oil, gas and coal emissions from production, transport and processing of fossil fuels (scope 1 and 2 emissions), with CO2 emissions cut by 50% and methane 75% by 2030, reaching near-zero by 2050.** This requires reducing demand and supply, of 80-85% for coal, of 55-70% for natural gas; and of 75-95% for oil by 2050. The report also finds that carbon capture and storage cannot "justify business as usual for fossil fuel production." Rather, **65% of oil and gas reserves and 90% of coal reserves must remain untapped.** Thus, investments in fossil fuel supply should decline 30-35% by 2030 and 45-65% by 2040, and **exploration of new oil and gas fields should be ceased**. The report concludes with recommendations for governments, fossil fuel companies, and financial institutions. (Nov 2023)
PR »

Production Gap Report 2023: Phasing down or phasing up? (SEI, Climate Analytics, E3G, IISD, and UNEP) —**Governments, in aggregate, still plan to produce more than double the amount of fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C,** according to this new assessment of the world's 20 largest energy-producing countries (making up 82% of production and 73% of consumption).**Government plans would lead to an increase in global coal production until 2030 and oil and gas production until at least 2050.** While major producer countries have pledged to achieve net-zero emissions and launched initiatives to reduce emissions from fossil fuel production,**none have committed to reduce coal, oil, and gas production in line with limiting warming to 1.5°C.** And all the initiatives, including signing the Global Methane Pledge and launching the Net Zero Producers Forum, "while important, are also deeply insufficient," according to the report.**The report calls for a near total phase-out of coal production and use by 2040 and a combined reduction in oil and gas production and use by a minimum of 75% by 2050 from 2020 levels.** The second half of the report includes two-page summaries of the 20 governments' plans and policies for fossil fuel production. (Nov 2023)
AXIOS »

The State of Climate Action: Major Course Correction Needed from +1.5% to -7% Annual Emissions (Alliance of CEO Climate Leaders) —**Finds that in order to limit global warming to 1.5°C, emissions must be cut back by 7% each year from now until 2030.** This will require "**dramatic action**," including shorter-term net zero national and corporate commitments, faster deployment and funding of green technologies, and stronger global collaboration. As the report notes, only 35% of global emissions are covered by net-zero targets for 2050, and**fewer than 20% of corporate targets of the world's 1,000 largest companies align with a 1.5°C target**. Additionally, the report points to a $2 trillion gap in yearly climate funding, with critical gaps in early technologies and infrastructure. To shift this trajectory,**the report proposes a series of actions** including: bolder national and corporate commitments; carbon pricing; strengthened incentives for technology and infrastructure; and increased climate financing for the Global South. (Nov 2023)
PR »

Building a Nature-Positive Energy Transformation (World Wildlife Fund (WWF) and the Boston Consulting Group (BCG)) —**Estimates the energy transition's overall impact through 30 key metrics across eight impact areas:** air quality, water quality, ecosystems and biodiversity, area footprint, water use, free flowing rivers, society and human wellbeing, and mining. The results demonstrate that across those metrics,**a Rapid Transition is 2-16 times better for nature and society as the business-as-usual scenario.** This is especially pronounced with air and water quality, biodiversity loss, and land lost and degraded from climate impacts, among other indicators. Additional benefits of a Rapid Transition include: twice as many jobs projected to be created; and $2 trillion will be avoided in infrastructure damage by reducing climate disaster frequency and intensity. **The report notes that in a fossil fuel-powered future, land lost to flooding, fires, and desertification will be "considerably larger" than the footprint for renewable energy development.** It also identifies ways to prevent additional demands on water use, rivers, and land from renewable energy development. (Nov 2023)
PR »

World Energy Outlook 2023 (International Energy Agency) — **Forecasts energy developments and projects in 2030 where clean technologies play a "significantly greater role than today."** Already in 2023, more than $1 billion a day is being spent on solar development, more than 500 GW of renewables generation capacity is set to be added, and one in five cars sold globally was electric (up from 1 in 25 in 2020). **Based on current policy settings of governments, in 2030** (Oct 2023)**:**

- There will be almost 10 times as many electric cars on the road worldwide.
- Solar PV will generate more electricity than the entire U.S. power grid currently generates.
- **Renewables' share of electricity will near 50%, up from around 30% today.**
- Heat pumps and other electric heating systems will outsell fossil fuel boilers.

- There will be three times the investment into new offshore wind projects as coal- and gas-fired plants.
- **And fossil fuels will have peaked, with the share of fossil energies declining from 80% to 73% by 2030, with global energy-related CO2 emissions peaking in 2025.**

PR » **EDIE »**

The world may have crossed an "irreversible solar tipping point" where solar energy gradually "comes to dominate global electricity markets," even without further climate policies, according to a new study in **Nature Communications.** Based on a model using data from 70 regions, 72% of simulations found that solar made up the majority of power generation in 2050. Uncertainties do arise from grid-stability, availability of finance, supply chain capacities, and political resistance, though policies could resolve these. (October 2023)
BLOOMBERG »

Electricity Grids and Secure Energy Transitions (International Energy Agency (IEA)) — **The world must add or replace 80 million km (50 million miles) of grids by 2040 to meet national climate targets and support energy security, according to this first-of-its kind analysis.** This is an amount equal to the entire existing global grid. **Annual investments needs to double to more than $600 billion a year by 2030**, and significant changes to how grids are operated and regulated are also essential. The report includes a new scenario, the "Grid Delay Case," that explores what would happen if grid investment and regulatory reforms fail to keep up with the energy transition. **This finds that CO2 emissions between 2030 and 2050 would be 60 billion metric tons higher due to a slowed rollout of renewables.** The report recommends governments updating regulation, backing large-scale transmission projects and strengthening interconnections between countries; and for developers and operators to embrace grid digitalization to enable increased grid resilience and flexibility. (October 2023)
PR » **AXIOS »**

Energy Transition Outlook 2023 (DNV) — **Global energy-related CO2 emissions will be 46% lower in 2050 and in 2030 only 4% lower than today, putting the world on track for 2.2°C of warming by 2100, according to DNV's seventh edition Energy Transition Outlook.** Other forecasts include:

- **Global energy-related emissions are still climbing and are only likely to peak in 2024.**
- From 2017-2022 renewables met 51% of new energy demand and fossil sources 49%, but in absolute terms, fossil-fuel use is still growing.
- **By 2050, the current energy mix of 80% fossil, 20% non-fossil will shift to a 48%/52% ratio.**
- From 2025 on, almost all net new capacity added will be non-fossil, with new fossil production in low- and medium-income countries largely being nullified by reductions in high-income countries.

AXIOS »

Net Zero Roadmap: A Global Pathway to Keep the 1.5°C Goal in Reach (2023 Update)(International Energy Agency (IEA)) — **This updates IEA's 2021 Net Zero Roadmap, factoring in new trends, including the energy crisis triggered by Russia's invasion of Ukraine, growing energy sector CO2 emissions, and progress in renewable energy development and deployment.** The report maps out a pathway to reach Net Zero Emissions by 2050 (NZE Scenario). It projects that fossil fuel demand will peak this decade, even without new climate policies due to rapid expansion of cleaner energy technologies. It also finds that **the world already has the technologies needed to get 80% of the way to Net Zero**, specifically energy efficiency, electrification, and methane emissions reductions (which alone could reduce emissions 20%). The report also calls for a tripling of renewables capacity by 2030 to 11,000 GW, and concludes **clean energy funding would need to grow from $1.8 trillion in 2023 to $4.5 trillion annually by the early 2030s to be aligned with its NZE pathway.**
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The world achieved a decarbonization rate of 2.5% in 2022, meaning a year-on-year decarbonization rate of 17.2% is now required to limit average global warming to 1.5°C above pre-industrial levels, according to PwC's Net Zero Index 2023. That's nearly seven times faster than the current rate, and up from the Index's previous decarbonization rate of 15.2%. (Sept 2023)
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No country is progressing adequately toward transitioning from fossil fuels to renewable energy generation, according to a new assessment of 16 countries by Climate Action Tracker. The report does point to some positive steps, such as the UK being on track to phase out coal by 2024. (Sept 2023)
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Technical dialogue of the first global stocktake. Synthesis report by the co-facilitators on the technical dialogue (United Nations Framework Convention on Climate Change (UNFCCC)) — **The UNFCCC published a technical report on the first global assessment of collective progress toward achieving the Paris Agreement, and found that "the world is not on track to meet the long-term goals of the Paris Agreement."** The report, which will play a role in setting countries' next Nationally Determined Contributions (NDCs) in 2024-25, summarizes 17 key findings from the discussions, covering topics that include mitigation and adaptation, sustainable development, renewable energy and cleaner technologies, just transitions, and climate finance. It finds that while there are challenges, there are "many actionable solutions and creative suggestions…ready to be implemented." (Sept 2023)
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The Energy Transition Blueprint (Boston Consulting Group (BCG)) **— Finds that financing for the energy transition and to put the world on course for net-zero emissions is $18 trillion short of the $37 trillion needed**. The report notes that renewables and low-carbon applications need to increase from 12% of the global energy supply in 2021 to 50-70% by 2050, which is about three times faster than previous energy transitions. The report examines five technology levers that can help deliver the transition: increasing energy efficiency; electrifying end uses, decarbonizing the power supply; using lower carbon fuels in hard-to-abate use cases; and deploying carbon capture and sequestration technologies. (Sept 2023)
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Energy-related CO2 emissions will be 25 billion metric tons in 2050, more than twice the 11 billion tons needed to meet the Intergovernmental Panel on Climate Change's 2°C scenario, according to the ExxonMobil Global Outlook. That is a 25% reduction from the more than 34 billion ton peak expected sometime this decade, but not enough to reach Paris Agreement goals. **The outlook also projects the global economy to double, wind and solar to increase to 11% of the global energy supply (five times its current level) and that oil and natural gas will continue to meet 54% of the world's energy needs in 2050.** (Sept 2023)
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Shaping a Living Roadmap for Energy Transition (International Energy Forum (IEF) and S&P Global Commodity Insights) — **The report summarizes findings from 11 dialogues with a wide spectrum of stakeholders around the Global South and the Global North, to engage with more diverse voices about the trajectory of the energy transition.** The dialogues revealed that expectations of a linear global transition of the energy system following a single net-zero path globally will be very difficult to achieve. Instead, **a multidimensional approach is required that is inclusive of different situations in different parts of the world, reflecting varied starting points, diversity of policy approaches; and is equitable.** The report also explores five potential avenues for solutions, including: greening finance; affordability and energy security; infrastructure and supply chain bottlenecks; the need for new policy frameworks and tools; and collaboration, partnerships, and engagement. (Aug 2023)
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Cross currents: charting a sustainable course for offshore wind (Wood Mackenzie) — **The global offshore wind supply chain will require $27 billion of secured investment by 2026 if it is to meet a fivefold growth in annual installations (excluding China) by 2030.** This forecasts annual capacity additions of 30 GW by 2030, ten times the annual additions between 2015 and 2021 (and five times 2023 additions). Governments globally have announced 135 offshore targets requiring annual additions of 77 GW by 2030 (an unrealistic amount according to the report and one requiring $100 billion of investment). **Even 30 GW/year will prove unrealistic**

"if more immediate investment in the offshore wind supply chain doesn't happen soon." However, low offshore margins (made worse by inflationary pressures and higher commodity input costs) make the investment case more challenging. (Aug 2023)
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Accelerating the Energy Transition (Bureau Veritas) — **Explores the major barriers to accelerating the energy transition and practical solutions to removing them,** based on a survey of over 800 market experts and industry leaders from the global energy sector. Key insights (Aug 2023):

- **98% say regulatory issues are among their top three barriers**; 50% point to a lack of available and feasible project sites as a major barrier; and 34% say a lack of supply chain resilience.
- 90% say geographical concentration of supply chains is among their biggest challenges.
- 70% say they are struggling to recruit skilled engineers, technical staff, and construction managers.
- 50% cite supplier quality issues as their top supply chain issue and say they lack resources to monitor components in their supply chain.
- **85% believe effective government policy has the greatest potential to accelerate the transition.**
- 36% say fast-tracking of development and permitting is the policy initiative that would have the biggest impact on accelerating the energy transition. 26% say harmonizing the regulation of emissions and carbon.

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Of 50 energy system components critical for the clean energy transition, three were evaluated as fully "on track" with the International Energy Agency's Net Zero by 2050 Scenario trajectory, according to the IEA's Tracking Clean Energy Progress 2023 report. These include solar PV, electric vehicles, and lighting. Solar was upgraded to this category this year as it now aligns after annual growth in generation reached 26% in 2022. In 2022, electric vehicle sales grew by 55% reaching a record of 10 million. 2022 also saw progress in deployment of LEDs, with about 50% of global residential lighting sales using LED technology. **The buildings sector also saw significant progress, supported by new adoption of supportive technologies and policies, upgrading this component from "not on track" to "more efforts needed."** (July 2023)
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Fostering Effective Energy Transition 2023 (World Economic Forum) — **While the global average score in the Energy Transition Index** (which benchmarks countries on their current energy system performance and provides a measure of transition readiness) **continues to grow, growth has plateaued over the past three years, due to rising challenges to the equity and**

inclusiveness of the transition. Energy market volatilities from macroeconomic and geopolitical developments have led to extreme price shocks, exacerbating energy poverty and stalling energy access. Low-income countries have been disproportionately affected. **Nordic countries continue to lead the index (with Sweden, Denmark, Norway, and Finland taking the top four spots), scoring high on both system performance and transition readiness.** China, the world's largest energy producer, gained 43% in the past decade in its transition readiness score, more than double the global average of 19%. **Only 41 countries have made steady progress in the past decade.** (July 2023)
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The oil and gas sector has made "almost no progress" toward the Paris Agreement goals since 2021, according to the Oil and Gas Benchmark. Of the 99 companies included, only 12% of assessed Scope 1 and 2 emissions have decreased on track to limit global warming to 1.5°C. **With methane emissions, only 29% of companies have even disclosed targets to reduce emissions by 2030.** Companies continue to commit money toward drilling and extraction, which are predicted to increase total production by 9% from 2021, peaking in 2028. **Over half of companies still link executive compensation or incentives to the growth of fossil fuels.** Only 18% have Scope 3 emission targets. 25% of companies report how much of their capital expenditure is invested in low-carbon technologies, with these companies, on average, dedicating around 18% to decarbonization. (July 2023)
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Tracking SDG7: The Energy Progress Report 2023 (International Energy Agency et al.)
— **Despite some progress, the world is not on track to achieve the Sustainable Development Goal (SDG) 7 for ensuring access to affordable, reliable, sustainable and modern energy by 2030.** Key findings include (June 2023):

- **91% of the world's population had access to electricity in 2021, up from 84% in 2010;**
- 567 million people in sub-Saharan Africa did not have access to electricity in 2021, accounting for 80% of the global population without access;
- Renewable electricity use has grown from 26.3% in 2019 to 28.2% in 2020, the largest single-year increase since tracking the SDGs;
- Up to 2.3 billion people still use polluting fuels and technologies for cooking (down from 2.9 billion in 2010), contributing 3.2 million premature deaths a year;
- Energy intensity improved 1.8% annually between 2010 and 2020, higher than previous decades. However, improvement slowed in recent years and dropped 0.6% in 2020;
- **International public financial flows in support of clean energy were $10.8 billion in 2021, 35% less than the 2010 to 2019 average, and only about 40% of the 2017 peak of $26.4 billion.**

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Progress in global energy efficiency reached 2.2% in 2022, twice the average of the previous five years, according to the International Energy Agency (IEA). The report credits new or strengthened efficiency policies; surging sales of energy efficient technologies such as heat pumps, sales of which increased by over 10% globally in 2022, and EVs, which constituted 14% of global car sales in 2022; and burgeoning efficiency investments, which are expected to reach more than $600 billion in 2023, a record. Doubling efficiency, to align with the IEA's Net Zero Scenario would lower CO2 emissions from fuel combustion by almost 11 Gigatons by 2030, almost a third of current emissions. (June 2023)
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The Effect of Multinational Enterprises on Climate Change (World Bank) — **157 multinational enterprises (MNEs) jointly account for up to 60% of global industrial emissions, with 10% coming from MNEs' direct activities and 50% from their supply chains.** The report finds that most of these 157 are insufficiently committed to decarbonizing production and supply chains. Only 25% have a Net Zero by 2050 commitment, 20% have a long-term strategy, 13% a medium term strategy, 5% a short term strategy, and none have a capital allocation strategy that aligned to Net Zero by 2050. **However, MNEs are shifting their new investments to green sectors and avoiding polluting sectors.** Foreign direct investment (FDI) in green sectors has increased 700% while FDI in polluting sectors declined 80% between 2003 and 2021. The report concludes with **5Ps to shape MNEs' impact on climate change**: patrolling (monitoring emissions); prescription (regulate); penalties (taxes); payments (incentives); and persuasion (corporate commitments). (May 2023)
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The State of Clean Technology Manufacturing (International Energy Agency (IEA)) — **Clean energy technology manufacturing is expanding rapidly, with the projected output in 2030 for solar PV projects increasing by 60% and for batteries by 20% since late 2022.** The report found that if all announced solar projects come to fruition the capacity would exceed deployment needs of IEA's Net Zero Emissions (NZE) Scenario by 2050 scenario for 2030. **For the first time, announced battery projects could cover virtually all of the 2030 global deployment needs for the NZE Scenario.** Wind, however, reaches only 30% of NZE deployment levels. **Though only around 25% of announced PV projects and 30% of battery projects can be considered committed (having already started construction or reached a final investment decision).** The report also found that manufacturing operations are highly geographically concentrated with China making up 60-80% of global manufacturing for solar PV, batteries, and wind, percentages that do not change significantly with announced projects. (May 2023)
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Global Energy Outlook 2023 (Resources for the Future (RFF)) — **Provides a unique "apples-to-apples" comparison of energy projections by top institutions around the world.** The outlook

unifies metrics and baselines allowing for comparison between energy reports from BP, ExxonMobil, IEA, OPEC, Bloomberg NEF, and others. Key findings include (April 2023):

- **Global energy demand has rebounded from the COVID-19 pandemic. Demand for all fuels, including coal, oil, and natural gas, has met or exceeded all-time highs;**
- There is a record level of investment in clean energy technologies ($1.1 trillion in 2022, up 31% from 2021). But investment will need to accelerate, and fossil fuel use will need to decline, to meet climate goals.
- National ambition and policy developments are laying the foundation for a global energy transition. However, it's unclear how quickly, and at what scale, public- and private-sector ambition will result in tangible changes at a global scale.

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At least $21.4 trillion needs to be invested in the electricity grid by 2050 to support a net-zero trajectory for the world, according to a new report from BloombergNEF (BNEF). This includes $4.1 trillion to sustain the existing grid and $17.3 trillion to expand the grid for new electricity consumption and production. This would mean annual investment growing from $274 billion in 2022 to $871 billion from 2040 to 2050, which will require significant policy intervention, including streamlining the permitting process. (April 2023)
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Global investments in energy transition technologies must grow from $1.3 trillion to around $5 trillion annually for global temperature to stay on the 1.5°C pathway agreed to in the Paris climate accord, says the **International Renewable Energy Agency** (IRENA). By 2030, cumulative investments should reach $44 trillion, with 80% ($35 trillion) prioritizing efficiency, electrification, grid expansion and flexibility. **Renewable energy deployment must grow from 3,000 GW to over 10,000 GW in 2030, an average of 1,000 GW each year.** (April 2023)
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AR6 Synthesis Report: Climate Change 2023 (IPCC) — **This synthesis report of the IPCC's sixth assessment report (AR6) finds that while climate change is "a threat to human well-being and planetary health," mainstreaming effective and equitable climate action now will reduce losses and damages for nature and people.** There are multiple, feasible, and effective options available to reduce greenhouse gas (GHG) emissions and adapt to climate change — including in ways that provide co-benefits, such as improving health and livelihoods, reduce poverty and hunger, and provide clean energy, water, and air. **The report finds that governments must aim for cutting GHG emissions 60% by 2035 compared to 2019 levels (and that emissions must peak before 2025) to sustain a 50% chance of meeting the 1.5°C target.** However, implemented policies "fall short of the levels needed to meet climate goals across all sectors and regions." As the **Summary for Policymakers** notes, "There is a rapidly closing window of

opportunity to secure a livable and sustainable future for all." And **"The choices and actions implemented in this decade will have impacts now and for thousands of years."**
To read more: **Short slide deck overview; Headline findings; and key report graphic.** (March 2023)
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Risk of the Hydrogen Economy for Atmospheric Methane (Nature Communications) — **Modeling the effect of hydrogen emissions on atmospheric methane, this research finds that the same molecule primarily responsible for breaking down methane (OH) reacts to hydrogen. This means if hydrogen emissions exceed a certain threshold, this shared reaction will likely lead to methane accumulating in the atmosphere, with significant and long-term climate consequences.** The risk for harm is compounded for hydrogen production methods using methane as an input, highlighting the critical need to manage and minimize emissions from hydrogen production. In that case, leakage rates would have to be kept under 0.5% for methane and 4.5% for hydrogen to avoid increasing atmospheric methane concentrations. (March 2023)
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National Transmission Needs Study (U.S. Department of Energy) — **This draft report finds that U.S. transmission capacity will need to increase by 57% by 2035, a total of 47,300 GW-miles, to accommodate clean energy growth (moderate load with "high clean energy assumptions").** In a high-load, high clean energy scenario, the U.S. transmission system would need to double by 2040 (with a median 115,000 GW-mile projection). While not offering solutions, the report reviews historical transmission system data from 2011 to 2020 to demonstrate national and regional needs for additional capacity. **Comments on the draft report are due 20 April and can be submitted here.** (March 2023)
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BP Energy Outlook 2023 (BP) — Assesses three energy system scenarios to 2050: Accelerated; Net Zero; and New Momentum, with the last reflecting current system trajectory. **All three include reductions in total CO2 emissions of 75%, 95%, and 30% respectively (relative to 2019 levels). The Accelerated and Net Zero scenarios also see significant drops of 15% and 30% in total energy consumption, while in New Momentum consumption grows 10%. The share of fossil fuels also falls from 80% (in 2019) to between 20% and 55% in 2050, while renewables grow from 10% to between 35% and 65%.** Electrification of the energy system also grows, from about a fifth in 2019 to between a third and half by 2050. This 2023 edition is based primarily on the 2022 report but factors in the Russia-Ukraine War and the Inflation Reduction Act. (Feb 2023)
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A Supply Chain Road Map for Offshore Wind Energy in the United States (National Renewable Energy Laboratory) — **Deploying 30 GW of offshore wind energy (more than 2,100 turbines) by 2030, as the Biden Administration aspires to, requires domestic supply chains to be rapidly scaled-up and at least $22.4 billion in infrastructure investments.** This report by NREL describes how a fully domestic offshore wind energy supply chain could develop in the U.S., including examining the major barriers that could prevent or delay supply chain expansion and the potential solutions that could help overcome these challenges. The report also presents a scenario for developing a domestic supply chain estimating the number of required manufacturing facilities, ports, and vessels that would need to be developed by 2030 to support an annual deployment of 4–6 GW of wind capacity, which would put the U.S. on a pathway to installing 110 GW by 2050. (Jan 2023)
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Securing the Energy Transition (World Economic Forum) — **Proposes 10 key actions to align immediate responses to the current energy crisis with long-term goals and a framework to prioritize energy security for a just and sustainable energy transition.** Rather than increasing coal-based production or broad consumption subsidies to address the energy crisis, responses should prioritize: increasing renewable energy investments; plugging methane leaks; maximizing electrification; driving consumption efficiencies; nudging consumers to use energy more responsibly; and leveraging the excess profits made by energy companies in 2022 to bridge the clean energy investment gap. (Jan 2023)
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Oil and Gas Project: Expert Advisory Group Review Evaluation Report (Science Based Targets initiative (SBTi)) — **As part of its ongoing development of sector-specific decarbonization methodologies for the oil and gas (O&G) sector, SBTi summarized input received from a specially-convened expert advisory group (EAG).** The report details key findings from the EAG, including issues that required no changes, ones where improvements were suggested, and those that need further evaluation. (Jan 2023)
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2022 was the fifth warmest year on record (after 2016, 2020, 2019, and 2017 respectively), with average global temperatures 1.2°C higher than pre-industrial times, according to Copernicus Climate Change Service. 2022 was Europe's second warmest year and warmest summer on record, which contributed to drought and resultant disruptions in agriculture, transport, and energy production. The UK also had its warmest year on record since 1884. Measurements also reached a record on the UK's **Central England Temperature series,** the world's longest, which started in 1659. (Jan 2023)
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New Energy Outlook 2022 (BloombergNEF) **— Examines two scenarios in which the world's energy system may evolve between now and 2050.** In the **Economic Transition Scenario,** in which no new policy accelerates the clean energy transition, renewable energy and transport electrification eliminates about half of the world's energy-related emissions in 2050, driven by dramatic cost reductions in renewable technologies. Wind and solar make up about two-thirds of the world's power generation by 2050. However, in this scenario, emissions have fallen only 29% bringing the world 2.6°C in warming. In the **Net Zero Scenario,** the world can peak at 1.77°C and achieve net zero by 2050. Half of this emissions reduction comes from shifting from fossil fuels to renewables (with wind making up 48% of generation and solar 26%). Electrification of transport and industrial processes, buildings and heat plays the next largest role in emissions reductions, abating about a quarter of emissions. However, **achieving this Net Zero Scenario will take an accelerated deployment of mature climate solutions, managing the phase-out of carbon-intensive actions, scaling up the supply of critical material, and other key actions.** (Dec 2022)
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Coal in Net Zero Transitions (International Energy Agency) — **Provides comprehensive analysis of what it would take to bring down global coal emissions rapidly enough to meet international climate goals while supporting energy security and economic growth, and addressing the social and employment consequences of the changes involved.** The report looks at total coal-generating capacity (9,000 power plants generating 2,185 GW) and the relatively young age of coal power plants in the Asia Pacific region (less than 15 years old on average). To achieve net zero by 2050 and limit warming to 1.5°C, coal use will need to fall 90% by 2050. As the report finds, **stopping the addition of new plants is key, but far from sufficient, nor are favorable conditions for renewables, as coal plants are often shielded from market competition.** (Nov 2022)
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92% of developing countries have set long-term, time-bound renewable energy targets, up from 82% in 2021 and 67% in 2019, according to BloombergNEF's 2022 **Climatescope** survey. Of 107 developing countries and emerging markets surveyed, BloombergNEF found that at least 56% of emerging markets now have policies to hold reverse auctions for clean power delivery (where multiple sellers bid, typically lowering the price), 53% have put net metering policies in place, and 30% have established feed-in tariffs, all up from 2021. (Nov 2022)
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Fifth National Climate Assessment (U.S. Global Change Research Program) — **This new draft report finds that the U.S. cut greenhouse gas emissions by 12% from 2007 to 2019, driven by renewable energy and increased energy efficiency.** However, to achieve net-zero by 2050, **the U.S. will need to reduce emissions 6% every year.** The report also detailed the climate impacts

the U.S. is already experiencing, from drought, wildfires, heatwaves, and other extreme events. **The draft report is open for public comment until January 27th.** (Nov 2022)
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Net-Zero 2050: U.S. Economy-Wide Deep Decarbonization Scenario Analysis (Low-Carbon Resources Initiative (LCRI)) — **Affordably and reliably achieving net-zero across the U.S. economy by 2050 could require significant growth of new electricity generating capacity, from 160% to 480% of current levels, according to a new modeling study.** That represents an increase of 1,650 GW to 4,860 GW, with 1,140 GW to 1,450 GW of firm capacity (such as natural gas with CCS, nuclear, hydrogen, geothermal, bioenergy and bulk energy storage), and 800 GW to 3,700 GW of variable capacity (such as wind and solar), **up from the current 200 GW.** (Nov 2022)
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Global Energy Transformation Guide: Electricity (RMI) — **Provides a comprehensive review of the clean electricity transformation in 50 countries**, showing that a mix of policies, market innovations, technology advances, and financial solutions are succeeding globally to accelerate the energy transition while expanding energy access and promoting sustainable development. **The guide consists of three reports: Points of Progress, Fossil Fuel Transition Strategies, and Market Structures.** (Nov 2022)
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SystemsChangeLab.org (Systems Change Lab) — **An open-source data platform to track global progress on key transformational changes across major systems, including power, industry, transport, finance, and carbon removal.** The platform identified more than 70 shifts within these five systems, and offers a data-rich "virtual situation room" that showcases research, analysis, interactive dashboards and data visualizations based on System Change Lab's State of Climate Action 2022 report. (Nov 2022)
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An Investor's Guide to Net Zero by 2050 (BNY Mellon Investment Management / Fathom Consulting) — **Finds that $100 trillion in capital investment is needed to achieve net-zero global emissions by 2050.** This is about a fifth of total anticipated investments over that period. Much of these investments will add to the world's existing capital stock (supporting future economic growth) or replace existing assets as they depreciate. Thus this investment will mostly take the place of otherwise planned investment, according to the report. However, **this $100 trillion includes about $20 trillion of stranded assets that may need to be scrapped or retrofitted before the end of their useful life.** About half of all corporate investment required for net-zero will need to be spent by firms in the energy and utilities sector. (Oct 2022)
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Emissions Gap Report 2022 (United Nations Environment Programme (UNEP)) — **Finds that climate pledges are bringing the world to a temperature rise of 2.4-2.6°C by 2100 and that updated pledges have shaved less than 1% of projected 2030 emissions.** A 45% reduction is needed to keep temperature increases to 1.5°C. Urgent sector and system-wide transformations — in the electricity supply, industry, transport and buildings sectors, and the food and financial systems — would help avoid climate disaster. **The report finds that in the best-case scenario, full implementation of unconditional NDCs and additional net-zero emissions commitments could limit the global temperature rise to 1.8°C. However, this scenario is not currently credible based on the discrepancy between current emissions, short-term NDC targets and long-term net-zero targets.** (Oct 2022)
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State of Climate Action 2022 (Systems Change Lab) — **Provides an assessment of the gap in efforts to keep global warming within 1.5°C by analyzing sectors that make up roughly 85% of global greenhouse gas emissions.** The report assesses 40 indicators of climate progress and found that none are on track to achieve their 2030 targets, with six "off track" but moving in the right direction at a promising but insufficient speed, 21 "well off track," moving in the right direction but well below the required pace. The report points to the positive signs of increasing adoption of zero-carbon power and electric vehicles. However, coal power must be phased out six times faster, cement must emit 10 times less CO2 per metric ton, and annual deforestation rates must be reduced 2.5 times faster. **Five indicators are also heading in the wrong direction entirely: the share of fossil gas in electricity generation is increasing, as are total kilometers traveled in passenger cars, mangrove loss, GHG emissions from agricultural production, and the carbon intensity of global steel production.** (Oct 2022)
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Projected investments in new oil and gas fields by 2030, incompatible with limiting global warming to 1.5°C, could fully finance the wind and solar energy ramp-up required to stay within meet this target, according to **a new report** by the International Institute for Sustainable Development (IISD). $570 billion will be spent on new oil and gas exploration and development each year by 2030, which could more than cover the $450 billion annual investment gap for wind and solar needed to displace oil and gas production in line with the 1.5°C target. (Oct 2022)
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A new UN report found that, collectively, Nationally Determined Contributions (NDCs) only modestly improved during the past year and, while bringing about a peak of global emissions by 2030 if implemented, would still bring the world to a global temperature increase of between 2.1 and 2.9°C by 2100. To achieve the 1.5°C Paris target, emissions would need to

decline by about 45% by 2030 compared to 2010 levels. Rather, they are likely to rise by 10.6% through 2030, down from 15.9% in earlier expectations. (Oct 2022)
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Atmospheric levels of CO2, methane and nitrous oxide all reached record highs in 2021, according to a new report by the World Meteorological Organization (WMO). The CO2 increase of 2.5 ppm (parts per million) was larger than the average annual increase over the past ten years. **The 18 ppb (parts per billion) increase in methane concentrations was the largest since systematic measurements began almost 40 years ago.** Methane concentrations are now 262% higher than pre-industrial levels. (Oct 2022)
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By the end of this century, permafrost in the rapidly warming Arctic will likely emit as much carbon dioxide and methane into the atmosphere as a large industrial nation, and potentially more than the U.S. has emitted since the start of the industrial revolution, according to a new study in the **Annual Review of Environment and Resources**. **Under a low warming scenario (<2°C), permafrost could release 55 billion metric tons (MTs) by 2100. Under a BAU scenario, this could increase to 232 billion MTs.** This research goes beyond previous forecasts, incorporating new factors in hydrological and biogeochemical dynamics and permafrost zone tipping points. **As the Arctic is not regulated by any one state, the report argues that international emission reduction efforts must account for this "country of permafrost" in climate targets and actions moving forward.**(Oct 2022)
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Energy Transition Outlook 2022 (DNV) — **This report, which forecasts the energy transition until 2050, finds that the world is heading for 2.2°C of warming, as emission reductions aren't keeping pace with Paris goals.** Specific highlights include (Oct 2022):

- The war in Ukraine isn't slowing down the long-term transition in Europe, though high energy and food prices may reduce the prioritization of decarbonization;
- While the report forecasts that 83% of electricity will come from renewables, **fossil fuels will still account for just below 50% of the overall energy mix in 2050;**
- Hydrogen will only supply 5% of global energy demand in 2050, a third of what is needed for net zero;
- A quarter of net decarbonization will require CCS and nature-based efforts;
- **To achieve net zero, leading regions will have to accelerate efforts, with OECD regions being net zero by 2043 and negative after that.**

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In 2021, members of the Oil and Gas Climate Initiative (OGCI) reduced absolute upstream methane emissions by 8% since 2020, and by 40% since 2017. CO2 emissions from

downstream operations fell 3% since 2020, and 11% since 2017. Investments in low carbon technologies and R&D also increased, totaling $40 billion from 2017-2021. **While promising, as an article in Axios notes, "industry-wide methane emissions have not fallen nearly that much and are not on a pathway consistent with Paris Agreement goals."** (Oct 2022)
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Climate Action 100+ released an interim set of Net Zero Company Benchmark assessments of 159 companies. The results found that while companies examined continue to make progress on net zero commitments, this is not matched by the development and implementation of credible decarbonization strategies. **Climate Action 100+ also opened public consultation on a set of proposals to enhance the Net Zero Company Benchmark for the next phase of the initiative in 2023. Responses can be submitted here until November 11, 2022.** (Oct 2022)
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Investment Requirements of a Low Carbon World: Energy Supply Investment Ratios (BloombergNEF) — **Between 2021 and 2030, the ratio of investment in low-carbon energy supply needs to be four times that of fossil fuel energy supply in order to reach net zero by 2050.** For 2031-2040, this ratio will need to increase to 6:1, and 10:1 for 2041-2050. This is up from the 0.9 to 1 low-carbon to fossil fuel ratio in 2022 and the 0.5:1 ratio from 2016-2022. (Oct 2022)
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Decarbonisation Tracker: Progress to Net Zero Through the Lens of Investment (Swiss Re) — **The world still needs to invest cumulatively more than $270 trillion in decarbonization actions if net-zero 2050 ambitions are to be met, according to new research by Swiss Re.** This only aggregates four sectors — energy, transport, buildings, and industry — so accounts for 70% of global greenhouse gas emissions at most. Of these, transport needs the most investment at $114 trillion, energy $78 trillion, buildings $65 trillion, and industry $14 trillion. **The report also found that if investments were to continue at the current pace, the 2050 net zero targets would be missed by nearly 20 years.** (Oct 2022)
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The International Energy Association's Tracking Clean Energy Progress (TCEP) assessed recent developments for 55 components of the energy system that are critical for clean energy transitions. Of the components tracked, two are fully "on track" with the Net Zero by 2050 Scenario trajectory: electric vehicles and lighting. 18 were rated as "not on track" (the lowest rating), including carbon capture, heavy industries, aviation, shipping, biofuels, and others. (Oct 2022)
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The Breakthrough Agenda Report 2022 (International Energy Agency (IEA)) — **This inaugural report** by IEA, the International Renewable Energy Agency, and the UN Climate Change High-Level Champions **assesses progress on reducing emissions in five key sectors: power, hydrogen, road transport, steel, and agriculture.** It notes an increase in practical international cooperation in recent years and sets out **25 collaborative actions** to help make clean power, EVs, low-carbon steel and hydrogen, and sustainable farming the most affordable options as soon as possible, including increasing investment, improving standards, and increasing R&D. (Sept 2022)
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Empirically grounded technology forecasts and the energy transition (Oxford Martin Programme on the Post-Carbon Transition) — **Finds that a transition to nearly 100% clean energy by 2050 will result in a savings of at least $12 trillion compared to continuing our current levels of fossil fuel use.** The study, published in the journal Joule, **factors in only the economics of different energy technologies, not the costs of climate damages or climate adaptation that would be avoided from this transition.** The research, based on a probabilistic model, shows that the probability of further cost reductions in key green energy technologies is very high, as are dramatic reductions in costs for energy storage technologies. (Sept 2022)
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Most companies in G7 countries are far off track from meeting the Paris Climate Agreement 1.5°C target according to new analysis by CDP and global management consultancy Oliver Wyman. **On average, corporate emissions targets are currently aligned with a 2.7°C warming trajectory.** Companies in Germany and Italy had the most ambitious targets, averaging 2.2°C each. Canada had the least ambitious, at 3.1°C, with the U.S. and Japan the next least, at 2.8°C each. More broadly, **Europe is on track for a 2.4°C increase** and has the most ambitious power generation sector (at 1.9°C vs. 2.1°C in North America and 3.0°C in Asia). (Sept 2022)
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Developed countries have fallen short on their 2009 COP15 commitment to mobilize $100 billion a year by 2020 for developing countries to enact climate mitigation and adaptation measures. The **actual 2020 figure**, as reported by the Organization for Economic Co-operation and Development (OECD), **was $83.3 billion**. Other key takeaways from the report include (Aug 2022):

- Of the 2020 total, **$48.6 billion (71%) was in the form of loans**.
- From 2016–2020, the **main recipient groups, per capita, were Small Island Developing States** ($81), **Least Developed Countries** ($14), and **Fragile States** ($11)
- Since 2016, the share of **funds going toward adaptation has steadily increased** from 10.1% to 28.6%.

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The Net-Zero Industry Tracker 2022 Edition (World Economic Forum) — Presents a **tracking platform for heavy industries to transparently measure progress toward a net-zero-by-2050 scenario**. The report is predicated on the dual premises that a) industrial sectors account for nearly **40% of global energy consumption and more than 30% of GHG emissions**, and b) ***no*industry is currently on track to achieve decarbonization levels necessary for a 2050 net-zero target**. In that context, the authors **highlight sector-specific "accelerators" and priorities** for the steel, cement, aluminum, oil, natural gas, and ammonia sectors, and **outline seven cross-sectoral recommendations** for immediate action (see pages 5–6). (Aug 2022)

Mission Possible Partnership (MPP) — Added energy transition strategies for the aviation, trucking, and shipping sectors—which together account for about **10% of global carbon emissions**—to its suite of decarbonization pathway reports for hard-to-abate sectors. Key takeaways include (July 2022):

- In **aviation**, the amount of sustainable aviation fuel (SAF) needed **will require a 5–6-fold increase in the current SAF project pipeline** by 2030.
- To compensate for a **projected doubling of trucking demand** in major industrialized countries by 2050, MPP forecasts a need for about **10 million zero-emission trucks, 1.8-2.5 million EV chargers, and 1,000-19,000 hydrogen stations** in service by 2030.
- Projected increases in **demand for zero-emission fuels in shipping could de-risk business cases for investment in green hydrogen production**.

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Rhodium Group's **annual assessment of US greenhouse gas (GHG) emissions and progress towards achieving the country's climate goals** shows t**he US can reduce emissions 24% to 35% below 2005 levels** by 2030, absent any additional policy action - a "rosier outlook" than the assessment showed in 2021. This **falls significantly short of the US's pledge under the Paris Agreement** to reduce emissions by 50-52% below 2005 levels by 2030. The report attributes the improvement to slower macroeconomic growth projections and higher fossil fuel prices, not policy changes. (July 2022)

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Climate solutions nonprofit **Project Drawdown has released an updated edition of its 2017 hallmark publication**, *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Climate Change*. The book detailed 100 available technologies and achievable practices that, according to its authors, collectively represent a **"credible path forward" to bring climate change under control**. The new and updated edition **applies new modeling data to 16 of the original "drawdown solutions" and adds 11 new ones** related to ocean resources, food production, methane management, and materials manufacturing and use. It also **models**

adoption scenarios that roughly correspond to limiting warming to 2°C and 1.5°C, respectively. Fiscal highlights of the modeling include (July 2022):

- An **initial investment of $15.6 trillion to achieve a 2°C** warming scenario would avoid or sequester more than 1,000 gigatons of carbon dioxide equivalent greenhouse gases between 2020 and 2050 and **save nearly $98 trillion in total operating costs** over the lifetime of the solution.
- **Increasing the investment to $23.6 trillion to achieve a 1.5°C warming scenario** would avoid or sequester more than 1,600 gigatons of gases and **save more than $140 trillion** in lifetime costs.

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World Energy Investment 2022 (IEA) — **Reviews global investment trends across all areas of fuel and electricity supply, efficiency, and research and development from 2021 and offers projections for 2022.** Finds record clean energy spending, driven by renewables and energy efficiency, is expected to increase global energy investment by 8% in 2022; however, most investments are being made in advanced economies and China. **The report, for the first time, also includes a detailed review of investment trends for critical minerals**, finding that "higher and more diversified investment is needed to curb today's price pressures and create more resilient clean energy supply chains." (June 2022)

The Value of Urgent Action on Energy Efficiency (International Energy Agency (IEA) — Highlights the **centrality of energy efficiency and energy saving measures in mitigating climate change, improving human health, strengthening energy security, and lowering costs**. The report was released in conjunction with the IEA's *7th Annual Global Conference on Energy Efficiency*, held in Denmark from June 7–9. Key takeaways include (June 2022):

- **Decreasing global energy intensity** (energy per unit of GDP) **by 4% per year**—double the current rate—through 2030 would provide about **a third of the total emissions abatement needed be achieve net zero** emissions by 2050 while serving an economy 40% larger than today's. This high efficiency scenario **would depend on**accelerated deployment of energy **efficiency measures in buildings and transport, material efficiency in industry, digitalization, and changes in consumer behavior**.
- Without the global energy intensity gains of the last two decades, emissions growth would have been almost double, or about 8 Gt per year higher in 2019.
- In terms of **strengthening energy security**, saving 95 exajoules (EJ)—the annual energy consumption of China—per year by 2030 would avoid: a) almost 30 million barrels of oil per day—triple Russia's average rate of production in 2021; and b) an annual volume of natural gas 4 times the amount imported from Russia by the EU in 2021.
- **Providing clean and efficient cooking and heating to those who lack them would avoid over 20 EJ** demand for the traditional use of biomass—such as wood and charcoal - in 2030 compared with current policies, **dramatically improving the lives of billions of**

people. Household air pollution is currently linked to around 2.5 million premature deaths a year.

- Overall, these total energy savings can contribute to **lowering total household energy bills** globally by at least **$650 billion a year** by 2030 compared with current policies.
- Scaling up investment to achieve these energy savings can support an extra 10 million jobs by 2030 in efficiency-related fields such as in new construction and building retrofits, manufacturing and transport infrastructure.

In an analysis of government responses to the Russia–Ukraine war and the resulting "global energy shock", nonprofit climate progress watchdog **Climate Action Tracker describes how planned expansion of fossil gas production and infrastructure meant to replace Russian supplies could "lock the world into irreversible warming."** (June 2022)

- Domestic fossil fuel production has increased in the US, Canada, Norway, Italy and Japan
- New planned LNG import facilities in the EU could supply a quarter more gas to the EU than before
- In Africa, old gas pipeline projects are being revived and countries with previously no fossil gas exports are now encouraged to supply gas to Europe.

The report makes **recommendations for effective energy crisis response, suggesting that governments could drive down emissions if they** act swiftly when energy prices come down **to reduce fossil fuel subsidies or increase carbon pricing**, and that **taxing fossil fuel company profits** could help compensate those in need, or expand renewables and energy efficiency. (June 2022)
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A 3°C increase in global average temperatures compared to preindustrial levels **would cost $178 trillion** in net present value terms over the next 50 years, according to a **new study from the Deloitte Center for Sustainable Progress**. Unchecked climate change would hinder economic growth in every region, but the Asia-Pacific region would be hardest hit. Alternatively, the report finds, **if countries act quickly to reach net-zero by 2050 and hold warming below 2°C, the global economy would see an expansion of $43 trillion** in net present value over the same time frame. (May 2022)
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The Carbon Bankroll: The Climate Impact and Untapped Power of Corporate Cash (Climate Safe Lending Network / The Outdoor Policy Outfit / BandFWD) — Reveals that **companies' investments and cash positions in banks are an overlooked and significant source of emissions**, sometimes exceeding traditional Scope 1, 2, and 3 emissions combined. The **first-of-its-kind report** tracked publicly available data from 10 major corporations. Accounting for emissions from their cash and investments **increased their total reported emissions by**

anywhere from 11% to 5,512%, undermining their sustainability efforts. Just one-third of the largest publicly traded financial institutions have set reliable 2030 goals, and the **60 largest commercial and investment banks invested $742 billion in the fossil fuel industry in 2021**. The good news, according to the report, is that the data **"also reveals one of the most powerful levers companies possess to realize their climate ambitions: using their clout as major cash managers and investors as a catalyst for climate progress."** The authors urge companies to (May 2022):

- **Select** financial institutions and products that are environmentally sustainable and socially equitable from the existing landscape.
- **Engage** their existing finance providers in their financial supply chain on climate and sustainability, making clear requests and incentivizing good practice.
- **Innovate** new products, mechanisms, incentive schemes, data insights, behavioral drivers, etc., that enable companies to accelerate the decarbonization of their financial supply chains.
- **Advocate** for climate-aligned financial regulation and policy that will increasingly drive the financial system toward progressive sustainable products and services.

Climate Change 2022: Mitigation of Climate Change (UN Intergovernmental Panel on Climate Change (IPCC), Working Group III) — Provides **a comprehensive global assessment of emissions mitigation pledges, progress, and urgent additional action—across all sectors and systems—to limit global temperature rise to 1.5°C**. This historic report is the third and final installment of the IPCCs overall climate assessment, following publications from Working Group I (**the science of climate change**) and Working Group II (**impacts, adaptation, and vulnerability**). Highlights (April 2022):

- Limiting warming to 1.5°C would require that **total global GHG emissions must peak no later than 2025 and must decrease at least 43% from current levels by 2030**. **Current actions do not track to hit either milestone**. "It's now or never, if we want to limit global warming to 1.5°C," said IPCC Working Group III Co-Chair Jim Skea. "Without immediate and deep emissions reductions across all sectors, it will be impossible."
- Many **necessary steps are being held up by social, political, and financial obstinance, not technology**. In remarks about the launch of the report, UN Secretary-General António Guterres said, "[High-emitting governments and corporations] are choking our planet, based on their vested interests and historic investments in fossil fuels, when cheaper, renewable solutions provide green jobs, energy security and greater price stability."
- A **good news/bad news breakdown** is captured succinctly on **pages 12–14 of the technical summary,** in a table entitled "Signs of Progress and Continuing Challenges."
- The report also includes a **chart featuring 43 leading emission reduction options, their effectiveness potential for *this decade*, and the economics of deploying them.**

Global Wind Energy Council (GWEC) has released **Global Wind Report 2022**. Key findings include (April 2022):

- **Nearly 94 GW of wind capacity were added globally in 2021**, marking the second-best year recorded. **Three times more offshore wind was commissioned in 2021 than the previous year, signaling the best year ever for offshore**.
- Europe, Latin America, Africa, and the Middle East added record levels of new onshore capacity, but **gains were offset by slowdowns in the U.S. and Chinese onshore markets.**
- **China showed an "astounding level of growth," representing 80% of new offshore capacity**.
- **Urgency around energy security is driving a positive market outlook** for the global wind industry, and current policies support the **addition of 557 GW of new capacity in the next five years**.
- GWEC analysis predicts that **wind power will need to quadruple by 2030** to achieve a 1.5°C scenario by 2050.

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World Energy Transitions Outlook 2022: 1.5°C Pathway (International Renewable Energy Agency (IRENA)) — Details **priority focus areas, actions, key performance indicators, and estimated investment costs to achieve 2030 climate and energy milestones** essential to reaching net zero emissions by 2050. In keeping with the report's overarching assessment that "…anything short of radical and immediate action will diminish—and may possibly eliminate—the chance of staying on the 1.5C or even 2C path.," priority actions include (April 2022):

- **Estimated annual global investments of**: $1.5 trillion in the energy efficient renovation and electrification of buildings; $86 billion in charging infrastructure for EVs; $124 billion to quintuple the supply of biofuels; $88 billion for clean hydrogen development.
- **Installation of at least 800GW of new renewables-based generating capacity each year**—almost triple the current rate

An increase in the share of renewable energy in the overall primary energy supply from 14% in 2019 to 40% by 2030

The **U.S. Energy Information Administration's (EIA)** ***Annual Energy Outlook 2022*** provides new modeled **projections of U.S. energy trends through 2050**, incorporating a range of assumptions and methodologies. Key takeaways include (April 2022):

- Energy-related carbon dioxide **(CO2) emissions dip through 2035** before climbing later in the projection years; Increased energy consumption and population and economic growth outweigh efficiency gains.

- Renewable electricity generation increases more rapidly than overall electricity demand through 2050, but **petroleum and natural gas remain the most-consumed sources of energy in the U.S. through 2050**.
- **Wind and solar incentives**, along with falling technology costs, **support robust competition with natural gas** for electricity generation, while the **shares of coal and nuclear power decrease** in the U.S. electricity mix.

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The UK's total pipeline of offshore wind projects has grown by 60% in the last year, according to **RenewableUK**. Spurred by massive new leasing announcements, that pipeline capacity now stands at 86 gigawatts (GW), the largest in the world and eight times the UK's current operating capacity. **Globally, an additional 200GW of pipeline capacity has been added in the last year, for a current total of 517GW.** (March 2022)
Press Release

Global Energy Review: CO2 Emissions in 2021 (International Energy Agency) **— Examines carbon emissions across the global energy sector in 2021**. It reports that global energy-related **emissions grew by over 2 gigatons (the largest-ever year-on-year increase in absolute terms) to a record 36.3 gigatons in 2021.** Coal emissions reached an all-time high, but renewables and nuclear power provided a higher share of electricity generation, with renewables-based generation reaching an all-time high. (March 2022)
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Climate Action 100+ — Published an updated aviation sector strategy: "Global Sector Strategies: Investor Actions to Align the Aviation Sector With the IEA's 1.5°C Decarbonisation Pathway." It concludes that **emissions must peak by 2025,** and 18% of the sector's energy consumption must come from sustainable aviation fuel (SAF) by 2030 (up from less than 0.1% in 2020). (March 2022)
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Global Methane Tracker 2022 (International Energy Agency) **— Provides country-by-country estimates of energy-related methane emissions and examines the state of major emitters' methane-reduction policies.** It finds that **energy-related methane emissions grew by almost 5% last year and are 70% higher than government figures.** It also finds that over 40% of oil and gas methane emissions could be reduced at no net cost using existing technologies. (Feb 2022)
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The US pipeline of offshore wind projects has reached 30.7 gigawatts—enough to meet President Biden's target of 30 gigawatts by 2030, according to S&P Global Market Intelligence analysis. (Feb 2022)

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Corporations bought a record 31.1 gigawatts of clean energy through PPAs in 2021,up nearly 24% since 2020 and equivalent to over 10% of renewable energy capacity added globally, according to BloombergNEF. Technology companies bought the most clean energy, and the **top 10 corporate buyers overall** include CEF members **Amazon** (#1), **Microsoft** (#2), **Meta** (#3), **BASF** (#4), and **Google** (#6). (Feb 2022)
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2022 Energy Transition Investment Trends (BloombergNEF) **— Assesses global investment in the low-carbon energy transition, climate-tech corporate finance, and low-carbon investment trends from 2020-2021. Key findings** (Jan 2022)**:**

- Global investment in low-carbon energy grew 27%, reached a record $755 billion, and reached record levels in the AMER, APAC, and EMEA regions in 2021
- Clean power and electrification accounted for $731 billion of total investment, including $366 billion for renewables and $273 billion for electrified transport (with a 77% growth rate for EVs)
- Hydrogen, CCUS, and sustainable materials investment reached $24 billion.
- Climate-tech corporate finance reached $165 billion
- To get on track for net zero by 2050, investment levels must roughly triple from 2022-2025 and then double from 2026-2030, to an average of $4.2 trillion

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The Net-Zero Transition: What It Would Cost, What It Could Bring (McKinsey Global Institute) **— Examines the global economic transformation needed to enable a net-zero transition by 2050, with a focus on demand, capital allocation, costs, and jobs.** To support the transition, the world must manage shifts in demand and near-term cost increases, establish mechanisms to address socioeconomic impacts, and catalyze effective capital allocation and financing structures. **Key findings** (Jan 2022)**:**

- Oil and gas production volumes would decrease by 55% and 70%, respectively (2022 baseline), and coal production for energy use would nearly end
- $275 trillion of cumulative global capital must be spent on physical assets, about 7.5% of global GDP from 2021-2050
- Spending on energy and land-use physical assets would reach $9.2 trillion annually by 2050—$3.5 trillion more annually than is currently being laid out
- Electricity costs would likely increase as countries shift to renewables, though the amount and duration of the spike largely depends on how the transition is managed

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RE100 2021 Annual Disclosure Report (Climate Group's RE100 initiative) **— Assesses changes in RE100 membership, member companies' renewable energy claims, and trends in renewable energy sourcing, disclosure, and impact.** 45% of RE100 members' reported electricity consumption was renewable, a 4% increase over 2020, and 62% of new RE100 membership is headquartered in the Asia-Pacific region. **The top three challenges members faced in procuring renewable energy include:** a lack of available renewable electricity, lack of procurement opportunities, and prohibitive cost. (Jan 2022)
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Electricity Market Report—January 2022 (International Energy Agency) **— Reviews changes in global electricity demand, supply, and emissions during 2021 and presents forecasts through 2024.** It projects moderate demand growth through 2024, with fossil fuel generation leveling off and renewables meeting the majority of increasing demand. It also **expects emissions to level off but notes that a 55% decline is needed by 2030** to meet the IEA's Net Zero by 2050 Scenario. **Key findings** (Jan 2022)**:**

- Global power demand grew by over 6% in 2021, the highest absolute amount ever and the highest percentage rise since 2010.
- Coal-fired electricity generation met over half of the demand growth. Generation grew by 9% and reached an all-time peak.
- Carbon emissions from electricity rose by close to 7% in 2021, to a record high.

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Electrification of Boilers in U.S. Manufacturing (Lawrence Berkeley National Laboratory and Global Efficiency Intelligence) **— Analyzes the electrification of boilers in all US industrial subsectors and all 50 states,** including barriers to electrification and policy and technology implications. It projects that **boiler electrification will reduce annual CO2 emissions by over 195 million tons by 2050.** (Dec 2021)
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Net-Zero Power: Long Duration Energy Storage for a Renewable Grid (Long-Duration Energy Storage Council, McKinsey & Co.) **— Demonstrates how long-duration energy storage (LDES) systems can be deployed to store renewable power and help global power systems reach net zero by 2050.** By 2040, LDES deployment could avoid 1.5-2.3 gigatons of CO2 equivalent annually—equivalent to 10-15% of today's power sector emissions—and cut the annual cost of decarbonizing the US power sector by around $35 billion. (Dec 2021)
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Renewables 2021 (International Energy Agency) **— Forecasts the deployment of renewable energy technologies in the electricity, transport, and heat sectors through 2026, including barriers to faster growth and potential trends. Key findings** (Dec 2021)**:**

- To reach net zero by 2050, global renewable power capacity additions from 2021-2026 would need to "average almost double the rate of the report's main case."
- Additions are expected to reach a record-high 290 gigawatts by year-end, led by solar
- Global renewable electricity capacity is expected to grow over 60% by 2026 (2020 baseline)—to over 4,800 gigawatts—and to account for almost 95% of the global power capacity increase during that time

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2021 Electric Utilities Benchmark (CDP, the World Benchmarking Alliance, ADEME) **— Assesses 50 global electric utility companies' progress against the 1.5°C Paris Agreement goal. Key findings** (Nov 2021)**:**

- 98% of companies are set to exceed their carbon budget by 2035
- Three have 1.5°C-aligned emission-reduction targets
- To align with a 1.5°C pathway, 78% of the companies' electricity-generating capacity must come from renewables by 2030. Only eight companies are investing at these levels
- No company has a zero-carbon portfolio

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If coal, oil and gas, power generation, and automotive companies align their actions with what's needed for a net-zero transition by 2026, the transition will likely cost the financial sector $2.2 trillion through 2035, according to an analysis of nearly 600 public companies by the 2 Degrees Investing Initiative and the Oxford Sustainable Finance Group. **The cost is estimated to increase $150 billion for each year the transition is delayed beyond 2026.** (Nov 2021)

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"Even with all new Glasgow pledges for 2030, we will emit roughly twice as much in 2030 as required" for 1.5°C of warming, according to a new Carbon Action Tracker analysis. (Nov 2021)

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BUSINESS AMBITION FOR 1.5°C CAMPAIGN — The UN Global Compact and the SBTi released a **status report** announcing that **1,045 companies representing over $23 trillion in market capitalization, 60 countries, 50 sectors, and over 32 million employees have joined the campaign** and are thereby setting 1.5°C-aligned science-based targets. Over half of the companies have committed to reaching net zero across their value chain by 2050. (Nov 2021)

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How to limit global warming to 1.5°C (University of Technology Sydney scientists) **—** Outlines science-based **carbon budgets for 12 sectors** (including hard-to-abate ones) **to limit global warming to 1.5°C by 2050 and implement the Paris Agreement.** They created a One Earth Climate Model (OECM) for developing science-based industry net-zero pathways, including KPIs for investment decisions. The UN-convened Net-Zero Asset Owner Alliance (which partially

financed the research) is now using the OECM to inform target-setting and reporting protocol. (Nov 2021)
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The Paris Effect – COP26 Edition (Systemiq) **—** Reports that **investment flows into low-carbon solutions could result in market tipping points in sectors representing 90% of emissions by 2030 and 100% of emissions by 2035,** "with **all major sectors well capable of developing cost-competitive green solutions by 2030."** Identifies low-carbon solutions to target for policy and investment (e.g., heat pumps, direct carbon removal, nature-based solutions). The report builds on the Paris Effect report published last year. (Nov 2021)
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Emissions Gap Report 2021 (UNEP, UNEP DTU Partnership) **—** Assesses **new and preexisting Nationally Determined Contributions** (NDCs) to **compare where global GHG emissions are predicted to be in 2030** against **where they must be to meet Paris Agreement goals.** Reports that new **NDCs would only cut an additional 7.5%** from predicted emissions in 2030 but **meeting the 1.5°C target would require at least a 55% cut by 2030**. (Nov 2021)
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State of Climate Action 2021 (UN High-Level Climate Champions, Climate Action Tracker, ClimateWorks Foundation, Bezos Earth Fund and World Resources Institute) — **Identifies 40 targets with measurable indicators across key sectors that must transform to address the climate crisis**, and **assesses how current trends will impact how much work will be required by 2030 and 2050** to deliver a zero-carbon world in line with the Paris Agreement. **Of the 40 indicators assessed**, spanning the power sector, heavy industry, agriculture, transportation, finance and technology, **none are on track to reach 2030 targets.** (Nov 2021)
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The Climate Confidence Barometer (WBCSD and Freuds) — **Examines the confidence global business community leaders have in the world's ability to combat climate change.** Finds **59% of businesses believe meeting net zero is not sufficient** and progress must be made faster to combat climate change and **only 25% of businesses feel confident that political leaders are doing enough** to combat climate change. (Nov 2021)
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BLOOMBERG — Launched a new, public NetZero Pathfinders platform and an accompanying report to help policymakers, financiers, and business leaders create and implement decarbonization strategies. The platform includes **50 policy ideas that have proved effective worldwide, including post-2030 solutions for hard-to-abate sectors.**BloombergNEF, Bloomberg LP, and Bloomberg Philanthropies created the platform along with several partner organizations. (Nov 2021)
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Pathways to Paris: A Policy Assessment of the 2030 US Climate Target (Rhodium Group) — Analyzes **policy combinations that could close the gap between the United States' current emissions trajectory and President Biden's target of halving emissions by 2030.** Concludes that **Congress is "critical"** and that meeting the target is **"within reach" so long as** "leaders in the White House, key agencies, state capitals, and corner offices **have the political will to act ambitiously**, and **both the congressional infrastructure bill and budget package become law."** Also concludes that **power-sector decarbonization** represents some of the biggest transition opportunities this decade. (Oct 2021)
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The Decarb America Research Initiative released a **new research report exploring 4 US net-zero scenarios and how significant technological breakthroughs might affect the cost and speed of the transition.** The research was conducted by **Evolved Energy Research** and commissioned by the **Clean Air Task Force, Third Way,** and the **Bipartisan Policy Center**. **Key insights** (Oct 2021)**:**

- Significant tech innovation could lower net-zero transition costs by more than 60%, saving up to $250 billion a year by 2050, compared with incremental tech innovation
- All scenarios require clean energy to be deployed at twice the rate it's ever been deployed
- Hydrogen demand is forecasted to be 9 to 22 times higher than today's demand by 2050

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Climate Action 100+ — The group of **615 investors managing $60 trillion** in assets released a new **report through IIGCC detailing their expectations for electric utility companies' net-zero transitions.** They called on utilities to target **net-zero emissions by 2035 in developed countries and by 2040 in developing countries,** as well as a minimum 50% emission reduction by 2030. They also expect companies to **commit to providing a "just" net-zero transition.** Climate Action 100+ investors include CEF members **BlackRock, Fidelity Investments, J.P. Morgan Asset Management** (JPMorgan Chase & Co.'s asset management division), and **TD Asset Management** (of TD Bank Group)**.** (Oct 2021)
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World Energy Outlook 2021 (International Energy Agency) **—** Provides **5-year projections of national and regional price points and volumes for electricity generation and fuel production through 2050.** Presents **4 scenarios,** which notably **exclude a "business as usual"** option. **Key findings** (Oct 2021)**:**

- If nations were to meet their current Paris Agreement pledges and set longer-term targets, energy-related emissions would fall 40% by 2050
- Investment in clean energy infrastructure and projects would need to triple by 2030—to almost $4 trillion annually—to get on a 1.5°C-aligned emission-reduction pathway

- Under the net-zero emissions scenario, the market for 5 clean technologies would grow over $1 trillion per year by 2050

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Curtailing Methane Emissions from Fossil Fuel Operations (International Energy Agency) **—** Explores **cost-effective ways companies and governments can achieve a 75% reduction in methane emissions from fossil fuel operations by 2030,** as envisioned in the **Net Zero by 2050 Roadmap**. Asserts that **the oil and gas sector can "avoid more than 70% of current emissions with existing technology"** and "around 45% could be avoided at **no net cost."** (Oct 2021)
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Global Hydrogen Review 2021 (International Energy Agency, via the **Clean Energy Ministerial Hydrogen Initiative**) **—** Presents **global progress in hydrogen supply, demand, regulation, investments, trade, innovation,** and **infrastructure development,**as well as **policy trends across 5 key areas** for hydrogen deployment. Provides **policy recommendations** and asserts that **$1.2 billion of investment is needed by 2030** for the hydrogen sector to align with a path to net-zero global emissions by 2050. (Oct 2021)
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If the U.S. were to triple wind and solar capacity (2020 baseline) and **reach 90% zero-carbon power by 2035, most regions** of the country could generate **tens of billions** of dollars, including **$65.3 billion in Appalachia,** according to new regional-level projections by clean energy think tank RMI. (Sept 2021)
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42.8% of Russell 1000 companies have publicly disclosed an emission-reduction target, and only 10.6% have disclosed a 2050 net-zero target, according to JUST Capital. **6.7% of company commitments meet SBTi's 1.5°C scenario,** and 9.3% meet SBTi's 2°C scenario. (Sept 2021)
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RE100 LEADERSHIP AWARDS – Four companies were honored by Climate Group's RE100 initiative for "pioneering work in accelerating the global transition to 100% renewable electricity" (Sept 2021):

- **3M** - *Market Trailblazer Award*
- **The Estée Lauder Companies Inc.** - *Enterprising Leader Award*
- **Google** - *Changemaker Award*
- **Novo Nordisk** - *Key Collaborator Award*

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Closing the Gap: The Impact of G20 Climate Commitments on Limiting Global Temperature Rise to 1.5°C (WRI, Climate Analytics) **—** Reports that **G20 countries' current Paris Agreement pledges and legally binding net-zero commitments are insufficient to meet the 1.5°C goal but**

that warming could be limited to 1.7°C if they were to set 1.5°C-aligned 2030 targets and reach net-zero emissions by 2050. It also reports that **many G20 countries haven't announced accelerated emissions reductions or formally agreed to any net-zero targets.** (Sept 2021)
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Realizing the Potential of Customer-Sited Solar: Policy and Economics for a Decentralized Energy Future (BloombergNEF, Schneider Electric) **—** Reports that **23 million businesses and 167 million households worldwide could host their own clean power generation, with the potential to produce over 2,000 gigawatts of solar energy and 1,000 gigawatt-hours of energy storage by 2050.** Explains that the **design of policies and tariffs** are crucial to enable deployment and uptake. Includes **case studies of 5 solar markets** at different stages of development. (Sept 2021)
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Studies Agree 80 Percent Clean Electricity by 2030 Would Save Lives and Create Jobs at Minimal Cost (Energy Innovation) — An updated **meta-analysis of 11 studies** from think tanks, academics, and activists finds that the **U.S. can achieve 80% carbon-free power by 2030, with modest effects on pricing.** Several studies conclude that ambitious clean energy policies would lead to **500,000-1 million annual net job increases,** and 8 studies conclude **85,000-317,000 premature deaths could be avoided by 2050**. *Axios* notes that this achievement rests on "major new policies, investments and incentives that face large political hurdles." (Sept 2021)
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Roughly 60% of oil and natural gas reserves, and roughly 90% of coal reserves, would have to be left in the ground for the world to have a 50% chance of limiting global warming to 1.5°C, according to a new study from University College of London researchers. All undeveloped Arctic oil and gas resources would have to be untouched. (Sept 2021)
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The Final Warning Bell (**Climate Crisis Advisory Group**) — Claims, based on findings in the recent IPCC report, that **there will only be a 50% chance of the global temperature increase stopping at 1.5° Celsius even if the world reaches net-zero emissions by 2050.** Argues that **"climate repair"** (e.g., slowing ice melt, stabilizing sea levels), in addition to cutting emissions, **will be essential climate action.** (Sept 2021)
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Energy Transition Outlook 2021 (DNV) — Provides a **global and regional forecast of the energy sector through 2050.** Key predictions (Sept 2021):

- Global energy-related emissions will decline 9% by 2030, by which time the 1.5˚C carbon budget will have been emptied
- Fossil fuels will comprise 50% of the global energy mix in 2050, while hydrogen and e-fuels will cover 5% of global energy demand

- Due to emerging work patterns stemming from the pandemic, workspace demand will shrink by 5% in developed regions, including China, and residential energy demand will increase 4%. Workspace demand will fall 2.5% in developing economies
- Global annual passenger flights will grow 130%, to 10.2 billion flights

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State of the Climate in 2020 (U.S. NOAA) — Analyzes **climate indicators to identify trends, patterns, and changes in the global climate system**. Reports that **atmospheric CO2 levels reached record highs in 2020, despite an estimated 6-7% emissions reduction due to the economic downturn from the pandemic.** (Aug 2021)
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Climate Change 2021: The Physical Science Basis (United Nations IPCC) — Reports there is an **"unequivocal" connection between human GHG emissions and global warming.** Warns that **the planet could cross the 1.5° Celsius warming threshold by 2030.** Asserts the world can emit only about 400 billion metric tons of CO2—10-11 years of current (2020) emissions—after Jan. 1, 2021, before it is set to 1.5°C of warming through 2100. Summary for policymakers here. (Aug 2021)
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The MSCI Net-Zero Tracker (MSCI) — Offers **a quarterly gauge of 9,300 public companies' contribution to total GHG emissions and their net-zero progress.** Warns that the companies collectively emit nearly 11 billion tons of emissions annually and **will deplete their share of the global emissions budget in less than 6 years.** (Aug 2021)

Renewables were the second-most prevalent U.S. electricity source in 2020, the first time more electricity was generated from renewables than coal, according to a U.S. Energy Information Administration report. (Aug 2021)
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The Case for Negative Emissions: A Call for Immediate Action (Coalition for Negative Emissions, McKinsey & Co.) **— Warns that the world will not meet the 1.5°C Paris Agreement target unless it delivers 1 gigaton of negative emissions globally by 2025.** It also highlights 3 negative-emissions solutions—BECCS, DACS, and NCS—proven to provide at least 1 gigaton of negative emissions each. The coalition includes 20 companies, NGOs, trade associations, and investors, including **Bank of America, Natural Capital Partners,** and Enviva, that will give key stakeholders a platform to advance and deploy negative-emissions solutions. (July 2021)

Taking Stock 2021: US Emissions Outlook Under Current Policy (Rhodium Group) — Presents an **outlook on U.S. GHG emissions under current state and federal policy,** which **can be used as a baseline to assess where additional state, federal, or corporate action is needed** to

achieve long-term emission-reduction goals. Breaks down key **forward-looking trends by sector.** (July 2021)

Climate Policy Factbook (Bloomberg Philanthropies, BloombergNEF) — **Outlines each G20 member country's progress in the transition to a low-carbon economy**. Reports that **countries gave over $3.3 trillion in subsidies for oil, coal, gas, and fossil fuel power from 2015 to 2019** and highlights 3 areas needed for immediate government action to limit global warming to 1.5° Celsius. (July 2021)

Oil and Gas Benchmark: Insights Report (World Benchmarking Alliance in partnership with CDP and ADEME) — **Ranks 100 oil and gas firms' performance against the 1.5° Celsius Paris Agreement goal.** Concludes that without immediate, decisive action, the **firms' combined emissions will take up nearly 80% of the total global carbon budget and consume the sector's allocated carbon budget (from 2019 to 2050) by 2037.** (July 2021)

New Energy Outlook 2021 (BloombergNEF) — Argues the **world will need to invest $92 trillion to $173 trillion in energy infrastructure and supply over the next 30 years to achieve net-zero emissions by 2050.** Outlines **3 long-term scenarios** that each achieve net zero through relying on a blend of technologies. (July 2021)

Fossil fuel electricity generation has peaked worldwide as emerging markets seize opportunities for low-cost renewables, according to a report by financial think tank Carbon Tracker and India's Council on Energy, Environment and Water. (July 2021)
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Technology Progress Report (DNV) — **Focuses on how 10 key energy transition and decarbonization technologies will develop, compete, and interact in the coming 5 years**. Demand expectations, policy issues, key drivers, and costs are broken down for each technology. (July 2021)

Renewable Power Generation Costs in 2020 (International Renewable Energy Agency) **— The cost of new and some existing coal-fired power plants is being undercut by that of renewable energy sources.** The operating costs of 77% to 91% of existing coal-fired capacity in the U.S. is estimated to be greater than the cost of new solar or wind power capacity. (June 2021)

Building and operating new large-scale solar or wind plants is now cheaper than running existing coal- or gas-fired power plants in nearly half the world (countries with 46% of the global population), according to BloombergNEF. (June 2021)
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Fossil fuels comprised 80.2% of the global energy mix in 2019, compared with 80.3% in 2009, while **renewables such as solar and wind were 11.2% of the mix in 2019 and 8.7% in 2009,**

according to REN21. (June 2021)
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World Energy Investment 2021 (IEA) — **Concludes global clean energy investment is on a moderate upswing**—roughly $750 billion expected to be invested in 2021—**but will need to more than triple by 2030 to keep a 1.5 °C warming scenario possible.** (June 2021)

Countries globally raised $53 billion from carbon pricing schemes in 2020, up 18% from 2019, according to the World Bank. 64 global carbon pricing instruments are currently underway covering over 21% of global GHG emissions (compared to 58 in 2020 covering 15.1%). (May 2021)
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On Target: How to Succeed with Carbon-Reduction Initiatives (McKinsey & Co.) — **Reviews industry climate ambitions, detailing who's on track and the approaches they've taken**. Key findings based on the review of 4,500 companies globally who self-reported GHG emissions in 2020 (May 2021):

- **Companies with more aggressive targets appear to overperform on the path toward achieving those targets**, including carbon-intensive industries such as materials, manufacturing, and power generation
- **44% have short-term targets** (emissions reductions by 2025), **27% have medium-term targets** (reductions by 2026 to 2040), **2% have long-term goals** (reductions by 2031 to 2050 or later), and **27% have targets across all three-time horizons**
- **74% have Scope 1 and 2 emissions targets,** while only **26% also have Scope 3 emissions targets**

Assessing China's Efforts to Pursue the 1.5 °C Warming Limit (Science Magazine) **— Concludes China's current pledge to achieve carbon neutrality before 2060 is "largely consistent" with a 1.5 °C global warming scenario, however, it will need to accomplish "deep" emission reductions in the near term.** China needs to reduce its carbon emissions by over 90% and energy consumption by 39% by 2050, compared to a "no policy" case, to achieve a 1.5 °C scenario. (May 2021)

Patents and the Energy Transition (IEA and European Patent Office) — **Finds that patenting of low-carbon energy (LCE) technologies is outpacing fossil fuel-related patenting worldwide, but warns that the pace is insufficient to achieve net-zero goals:** "*[T]echnologies still currently at the prototype or demonstration phase represent around 35% of the cumulative CO2 emissions reductions needed to shift to a sustainable path consistent with net-zero emissions by 2070.*" **Additional coverage by Axios.** (May 2021)

TPI State of Transition Report 2021 (The Transition Pathway Initiative) — Reviews the low-carbon transition progress of 401 companies representing approximately 16% of global market

value from 16 sectors. **Finds only 15% of companies align with a below 2 °C in 2050 benchmark, 47% do not align with any global temperature benchmark, and 16% provide insufficient disclosure.** (April 2021)

Halfway to Zero: Progress Towards a Carbon-Free Power Sector (Berkeley Lab) — Compares the business-as-usual projections from Energy Information Administration's (EIA) 2005 Annual Energy Outlook to the power sector's actual emissions. **Finds the US power sector's 2020 emissions were roughly 50% below the EIA's projections** (authors noted the EIA baseline scenarios didn't assume policy changes). **The report highlights drivers for the differences between the actual and projected period and discusses possible implications for further power-sector decarbonization efforts.** (April 2021)

2021 Global Electricity Review (Ember) — **Analyzes electricity data from every country in the world and aggregates generation data by fuel by country dating back to 2000. Key findings** (April 2021)**:**

- Global electricity demand fell slightly (-0.1%) in 2020, the first fall since 2009
- Wind and solar generation rose by 15%, producing a tenth of global electricity
- Coal fell a record 4% (-346 TWh), similar to the rise in wind and solar (+314 TWh)
- Coal generation rose in China by 2% in 2020, while falling elsewhere
- Coal generation has only fallen 0.8% since 2015, while fossil gas has risen 11%

Pathways to Build Back Better: Investing in 100% Clean Electricity (Rhodium Group) — Presents legislative pathways to steeply cut power sector emissions to achieve the Biden administration's goal of 100% carbon-free U.S. power by 2035. **Concludes that a combination of investments and regulations could achieve U.S. CO2 emission reductions of 69-76% below 2005 levels in 2031** without imposing new costs on households. (March 2021)

Designing the 21st Century Electricity System (REBA Institute & Grid Strategies) — Outlines why and how the U.S. should evolve its national power system, featuring a common baseline of challenges for technical discussions among energy experts, key focus areas for policy proposals, and a refined set of market design priorities for electricity customers to engage stakeholder groups at the state, regional, and federal levels. **Finds that 90% of the power system could be decarbonized reliably and affordably using today's technologies, with crucial high-impact market design elements.** (March 2021)

Vision 2050: Time to Transform **— WBCSD and over 40 of its members—including 3M, BASF, Microsoft, and Unilever—released an action agenda based on 9 "transformation pathways" essential to a sustainable and prosperous future.** The pathways cover business areas essential to society: energy; transportation and mobility; living spaces; products and materials; financial products and services; connectivity; health and wellbeing; water and sanitation; and food. Each pathway includes 10 action areas for companies to take over the next decade. (March 2021)
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"**Running Hot: Accelerating Europe's Path To Paris**" (CDP) analyzes the **decarbonization trajectory of European companies** compared to the 2015 Paris Agreement's target of 1.5°C. The research is based on nearly 1,000 European companies worth around 80% of Europe's market value who completed CDP disclosures in 2020. Key findings (March 2021):

- **Capping global warming at 1.5°C would take an 8x increase** in the current **ambition level of European corporates** on emissions
- Based on reported emissions targets – if achieved - **European companies are in line with a 2.7 °C increase in global warming by 2100**
- **95% of banks' lending to European companies have a Paris-alignment ambition**, but only **1 in 10 European companies currently have targets aligned with the** "well-below 2°C" goal
- **56% of companies reported having a sustainable transition plan**, including **over 75% in the energy sector**. More than **50% of European companies** by market value have now **joined the Science Based Targets Initiative**
- The **top European companies by decarbonization reported a 15% drop in emissions last year** – equivalent to the annual emissions of the Netherlands.

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"**How Renewable Energy Jobs Can Uplift Fossil Fuel Communities And Remake Climate Politics**" (Brookings Institute) analyzes the **potential for U.S. regions rich in fossil fuel jobs to benefit from wind and solar development** and emphasizes the **need for targeted policies** to knock down barriers for successful transitions. The report finds "**a quarter of the counties in the U.S. with the greatest potential for both wind and solar electricity generation are also fossil fuel hubs.**" (March 2021)

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"**A 1.5 Celsius Pathway To Climate Leadership For The United States**" (Energy Innovation) shows a **small number of policies—including adopting immediate clean energy policies—can achieve the emission reductions required for a 1.5°C pathway**while generating large economic and health benefits. Researchers used the U.S. Energy Policy Simulator and found **transforming the economy in line with a 1.5°C target could** (March 2021):

- **Increase U.S. GDP $500 billion per year in 2030** and **$1 trillion in 2050** (a 2.6% annual GDP expansion)
- **Create more than 3.1 million new job-years by 2030** and **5.5 million new job-years by 2050**
- **Avoid more than 65,000 premature deaths** and **2 million asthma attacks by 2050**
- Build an **economy insulated from fossil fuel-price volatility**

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The **combined impact of nationally determined contributions (NDCs) currently submitted under the Paris Agreement** would only lead to a **1% drop in GHGs by 2030** over 2010 levels,

according to a new UN's NDC Synthesis Report. Several large countries, including the U.S. and China, have yet to submit their revised targets. (March 2021)
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Renewable resources showed resilience and growth in 2020 despite the overall economic decline, according to the Sustainable Energy in America Factbook from **BloombergNEF** and the **Business Council for Sustainable Energy**. **Wind and solar saw a record 33.6 gigawatts** of **capacity added to the grid**, helping **renewable energy account for one-fifth** (40% including nuclear) **of all electricity produced in the U.S. for the first time**. (February 2021)
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India, the world's third-largest emitter of GHG, is **entering a "solar-powered revolution"** that could see an **18-fold increase in solar generation by 2040** (more than any other nation), according to the **International Energy Agency** (IEA). The report also highlights that **India's emissions are primed to grow by 50% during this period**, **offsetting all emission reductions made in Europe**. The IEA covers a wide range of possible energy futures for the nation in its "India Energy Outlook 2021 report." (February 2021)
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"**Energy Infrastructure Needs for a Net-Zero Economy**" (Third Way, Clean Air Task Force, and the Bipartisan Policy Center) assesses the **infrastructural requirements to achieve a net-zero economy by 2050** by modeling **9 scenarios with different assumptions about policy and technology**. Findings underscore the **need for unprecedented development of clean energy infrastructure**. (February 2021)
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"**Race to Zero Breakthroughs: Transforming Our Systems Together**" (U.N. High-Level Climate Champions, COP26 President Alok Sharma, COP25 President Carolina Schmidt, UNFCCC) identifies **near-term "breakthroughs" in all 20 sectors of the global economy that will be required to achieve a** "**resilient, net zero world**" by 2050. The authors argue that **breakthroughs will be achieved if 20% of companies in each sector commit to them**, and they aim to "reach Breakthrough Ambition (20% of key actors committed) **for at least 10 sectors**" by **COP26** in November. (January 2021)
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"**From Ambition to Impact: How Companies are Reducing Emissions at Scale with Science-Based Targets**" (Science Based Targets Initiative 2020 Progress Report) finds that **338 companies with science-based targets have successfully reduced their combined GHG emissions by 25% since 2015**, while global emissions from energy and industrial processes grew 3.4% over the same period. The report estimates that **companies with SBTs will invest $25.9 billion in climate mitigation initiatives over the next decade**. (January 2021)
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"**Ten Predictions For The Energy Transition In 2021**" (BloombergNEF, January 2021) offers insight into **plausible outcomes that may occur in 2021 that will affect the global energy transition**. The **top ten predictions**:

1. Half a trillion dollars of investment again, but stock market bumps
2. Sustainable finance to roar on
3. Annual solar installations to pass 150GW in 2021
4. Wind additions to jump by 15%
5. A breakout year, with 4.4 million passenger EVs sold globally
6. Jump in heat pump sales
7. Battery metal prices firm, but battery prices fall
8. Global LNG trade to return to significant growth
9. Hydrogen electrolyzer additions to more-than-double in 2021
10. Oil supply toils to meet rebound in demand

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"**Choose Growth**" (Europe Delivers, Xynteo) proposes **three plausible futures for Europe in 2025** and **six specific leadership choices** relevant to those futures to **help business leaders deliver on net-zero goals** and **create just and competitive economic growth**. (January 2021)
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"**2020 Q4 And Annual Funding And M&A Report For Storage, Grid & Efficiency**" (Mercom Capital Group) finds that **corporate funding** — including venture capital, public market, and debt financing — **for the Battery Storage, Smart Grid, and Energy Efficiency sectors totaled $8.1 billion in 2020, a 112% increase** from 2019. (January 2021)
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"**Global Energy Perspective 2021**"(McKinsey) presents **four different potential long-term scenarios** for the **global energy transition** and concludes that **today's decarbonization efforts aren't sufficient to stay on a 1.5-degree pathway**. (January 2021)
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"**Preliminary US Greenhouse Gas Emissions Estimates for 2020**" (Rhodium Group) finds that the **United States experienced a 10.3% drop in GHG emissions in 2020**, falling below 1990 levels for the first time. (January 2021)
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"**Preliminary Monthly Electric Generator Inventory**" (U.S. Energy Information Administration) reveals that **wind and solar will make up 70% of the planned U.S. utility-scale electricity additions in 2021**, outpacing natural gas, which will only account for 16%. Battery storage will provide 11%, and nuclear power will provide 3% of new capacity. (January 2021)
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"**2020 Emissions Gap Report**" (UN Environment) finds that **a green recovery from the pandemic could slash predicted global GHG emissions for 2030 by up to 25%**. The report also finds that global GHG emissions reached a record high in 2019, and expects the **pandemiclinked reduction in 2020 emissions** to have a **negligible impact on climate change**. (December 2020)
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"**The Production Gap Report: 2020 Special Report**" (SEI, IISD, ODI, E3G, and UNEP) estimates that **the world will need to decrease fossil fuel production by roughly 6% annually between 2020 and 2030 to be consistent with the 1.5 degree limit**. However, the report finds that **countries are planning and projecting an average annual increase of 2%**, which by 2030 would result in more than double the production consistent with the 1.5 degree limit. (December 2020)
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"**Climate Risk and Response in Asia**" (McKinsey & Company, November 2020) quantifies the **physical risk from climate change** for **16 countries in Asia**. Select key findings included the following:

- Asia is expected to see an **increase in average temperature of more than 2 degrees Celsius by 2050**, compared with preindustrial levels.
- Large cities in parts of Bangladesh, India, and Pakistan could be among the first places in the world to experience **lethal heat waves that exceed the survivability threshold**.
- The likelihood of **extreme precipitation events** in these countries could **increase three- or fourfold by 2050**.
- The **likelihood of severe typhoon precipitation** is expected to **triple by 2040** in some parts of Asia, including coastal areas of China, Japan, and South Korea.
- The share of **time spent in drought in southwestern Australia could grow to more than 80% by 2050**, and the share in some parts of China could be 40-60%.

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The **world's total wind and solar PV capacity will surpass natural gas in 2023 and coal in 2024**, according to a new **International Energy Agency** report. As a result, renewables are set to become the largest source of electricity generation worldwide by 2025. (November 2020)
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The **World Green Building Council** released its "**Advancing Net Zero Status Report 2020**," which highlights the progress that Green Building Councils and the building and construction sector have made towards **achieving total sector decarbonization**. (November 2020)
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"**2030 Next Steps to Healthcare Climate Leadership**" (Mazzetti, Institute for Healthcare

Improvement, and Kaiser Permanente, November 2020) proposes a **series of actions that the U.S. health sector should take to tackle climate change and inspire the needed changes in human activity** that will lead the way to a healthier world. The report **calls on the health sector to reduce its carbon footprint by 50% by 2030** and to design systems that enable the delivery of needed health services in harmony with the environment.
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The **Sustainable Development Solutions Network USA** released its "**America's Zero Carbon Action Plan (ZCAP)**," a comprehensive policy **framework to create a carbon-neutral economy** for the United States **by 2050**. The plan includes proposed solutions for **reducing emissions in power generation; transportation; industry; buildings; food and land-use**; and **materials**, while generating millions of **new jobs** and **boosting the U.S. economy**. (October 2020)
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"**McKinsey on Climate Change**" (McKinsey & Co., September 2020) offers detailed analyses of climate risks across geographies and industries. The report also provides guidance on the technological and strategic solutions that are necessary to protect people and assets, build resilience, reduce exposure, and decarbonize.
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None of the largest, publicly-listed oil & gas and coal energy companies are **on track to align their emissions** with a **2 degree Celsius climate pathway by 2050**, according to a **Transition Pathway Initiative** report. In contrast, the report finds that **59% of electric utility companies are aligned with the Paris pledges**, with 33% achieving alignment with the most ambitious below 2 degree Celsius benchmark. (October 2020)
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"**CCUS in Clean Energy Transitions**" (International Energy Agency, October 2020) assesses the **state of play of carbon capture, utilization, and storage (CCUS) technologies** and maps out **how CCUS technologies will contribute to clean energy transitions**. The report argues that CCUS technologies will be particularly effective in the following areas: Tackling emissions from existing energy infrastructure; decarbonizing heavy industries; offering a cost-effective pathway for low-carbon hydrogen production; and removing CO2 from the atmosphere.
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"**Energy Transitions: The Framework for Good Jobs in a Low-Carbon Future**" (The Energy Futures Initiative and the American Federation of Labor and Congress of Industrial Organizations, October 2020) proposes a suite of **climate and labor policy actions** aimed at **accelerating the transition to a low carbon economy in the U.S.**, while also **creating and preserving access to quality energy jobs**.

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"**Net-Zero And Geospheric Return: Actions Today for 2030 and Beyond**" (Columbia University's Center on Global Energy Policy and the Global CCS Institute, September 2020) argues that **investment in carbon capture needs to increase** in order to meet net-zero emission objectives. The report makes the case for **government policies that support carbon pricing** and a **significant buildout of carbon capture infrastructure**.
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"**Fashion on Climate**" (McKinsey & Co. and Global Fashion Agenda, August 2020) finds that the fashion industry is **on pace to emit around 2.1 billion tonnes per year by 2030** — which is nearly double the maximum required for the industry to stay on the 1.5-degree pathway — and **lays out an accelerated abatement strategy** that would put the industry on track to align with the 1.5-degree pathway. The report estimates that **89% of the required emissions abatement could be achieved at a cost of less than $50 per tonne of GHG emissions** and around **55% of the measures would lead to net cost savings** for the industry.
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"**Transform to Net Zero**" is a cross-sector initiative launched in July 2020 that aims to "**develop and deliver research, guidance, and implementable roadmaps to enable all businesses to achieve net zero emissions**" no later than 2050. (July 2020)
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U.S. utility-scale battery storage power capacity could exceed 2,500 MW by 2023—up from **899 MW** in 2019, according to a U.S. Energy Information Administration report. (August 2020)
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"**Decarbonizing Shipping: All Hands on Deck**" (Shell and Deloitte, July 2020) presents perspectives from 80 senior shipping executives on **how to accelerate decarbonization within the shipping sector**. The report offers **12 solutions** to overcome the barriers to decarbonization in the sector.
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"**The 2035 Report**" (The Goldman School of Public Policy at UC Berkeley, July 2020) assesses the **technical and economic feasibility** of achieving **90% carbon-free electricity in the United States by 2035**. The report finds that achieving 90% carbon-free electricity in the United States would **reduce wholesale electricity costs by around 10%** in 2035, compared to current levels.
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"**Climate and Energy Benchmark**" (World Benchmarking Alliance, July 2020) measures and ranks the world's 50 most influential electric utilities companies on their transition to a

lowcarbon economy. The report finds that only **four of the companies analyzed** in the sector — Ørsted, Enel, The AES Corporation, and EDP — have **defined a clear target to provide clean energy aligned to the Paris Agreement**.
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"**Clean Energy Innovation**" (International Energy Agency, July 2020) finds that **around 75% of the cumulative reductions in carbon emissions needed** to achieve international energy and climate goals **will come from technologies that have yet to reach full maturity**. The report makes the case for significantly accelerating clean energy innovation and **analyzes the market readiness of more than 400 clean energy technologies**.
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"**Absolute Impact: Why Oil Majors' Climate Ambitions Fall Short of Paris Limits**" (Carbon Tracker, July 2020) **ranks the climate targets set by nine large oil and gas producers** (the 7 majors, plus Equinor and Repsol). The report **ranked Eni the highest**, stating that its**climate strategy is best positioned to comply with the Paris Agreement**.
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"**Tracking Clean Energy Progress**" (International Energy Agency, June 2020) finds that **only six out of 46 critical energy technologies and sectors** — solar PV, bioenergy power generation, electric vehicles, rail transport, lighting, and data centers — **are "on track" with the IEA's Sustainable Development Scenario**, which maps out a pathway to achieve the goals of the Paris Agreement, deliver universal energy access, and significantly reduce air pollution. The report also finds that **24 technologies and sectors showed some progress**, and **16 are "off track."**
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The **United States** was the **top-ranked country in EY's latest Renewable Energy Country Attractiveness Index** (June 2020). The top-10 nations included the following:

- United States
- China
- France
- Australia
- Germany
- United Kingdom
- India
- Denmark
- Netherlands
- Japan

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"**Fostering Effective Energy Transition**" (World Economic Forum, May 2020) **scores 115 countries on their energy system performance and energy transition readiness**. Key findings included the following:

- 94 countries — representing 70% of global CO2 emissions from fuel combustion — have improved their composite Energy Transition Index score over the past six years.
- **Sweden leads** the rankings table for the third consecutive year, followed by **Switzerland and Finland**.
- **France and the United Kingdom** are the **only G20 countries in the top 10**.
- Emerging demand centers like **India and China** show **strong and steady improvement**,
- **Brazil, Canada, Iran, and the United States are either stagnant or declining**.
- Colombia, the Czech Republic, Hungary, Kenya, Morocco, Thailand, and the United Arab Emirates have achieved substantial gains on their transition readiness.

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U.S. emissions are projected to **rebound to pre-COVID-19 levels by 2025** and **declines in shortterm emissions from COVID-19 are not expected to have a material impact on annual emissions in 2030** or cumulative emissions through 2050, according to an Energy Innovation analysis. The analysis estimates that U.S. emissions will decline by 7-11% in 2020, compared to 2019 levels. (May 2020)

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"**State of Transition Report 2020**" (Transition Pathway Initiative, April 2020) assesses the state of the transition of **238 of the world's highest-emitting, publicly-listed companies** towards a **low-carbon economy**. Key findings included the following:

- **More than 80%** of the highest-emitting listed companies **remain off track for a 2°C world**.
- **29%** of companies have **improved their governance of climate-related risks**, but **9% have regressed** in the past year.
- Across all sectors, **average emissions intensity is falling by 1.9% annually**.
- **56%** of companies **disclose support for international climate efforts** such as the Paris Agreement, but **only 40%** have **incorporated climate change risks and opportunities in their strategy**.
- **31%** of companies **disclose an internal carbon price**.
- **26% disclose climate scenario planning**, as recommended by TCFD.
- **36%** of **European companies are aligned with 2°C or below**, compared with **16% of North American companies**, 10% of Japanese companies, 5% of Chinese companies, and 0% of Russian or African companies.
- **Read Detailed CEF Summary Here**

"**Global Renewables Outlook: Energy Transformation 2050**" (IRENA, April 2020) finds that **transforming the energy system could increase cumulative global GDP gains** above

businessas-usual by **$98 trillion between now and 2050**. The report also finds that transforming the energy system would nearly **quadruple renewable energy jobs to 42 million**, expand employment in energy efficiency to 21 million, and more.
Read Detailed CEF Summary Here

The **daily global average concentration of CO2 emissions reached a record high of 416.08 parts per million (ppm) on February 10**, according to National Oceanic and Atmospheric Administration data. (Feb 2020)
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"**The Drawdown Review**" (Project Drawdown, Feb 2020) provides an **update to Project Drawdown's assessment of climate solutions**, which aim to move the world toward "Drawdown"—the future point in time when levels of greenhouse gases in the atmosphere stop climbing and start to steadily decline. The Review also includes **10 key insights** to help make Project Drawdown's essential messages of work clear, direct, and easy for others to communicate.

Global energy-related emissions stalled in 2019 for the first time in two years, according to an **International Energy Agency** report. The report attributes this stall in global energy-related emissions to the expanding role of renewables, fuel switching from coal to natural gas, and higher nuclear power generation.
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"**Pathways to 2050: Alternative Scenarios for Decarbonizing the U.S. Economy**" (Center for Climate and Energy Solutions, May 2019) lays out **three pathways to reducing U.S. GHG emissions 80% below 2005 levels by 2050**. The three pathways — which were identified through **collaboration with more than 20 companies** — include:

- **A Competitive Climate:** Strong international pressure in the form of carbon tariffs and growing recognition of the competitive benefits of low-carbon innovation lead to a strong, U.S. federal response, including an economy-wide price on carbon.
- **Climate Federalism:** Responding to economic opportunities and intensifying climaterelated disasters, a growing number of U.S. states implement ambitious climate policies, leading to calls from business for a more harmonized national response.
- **Low-Carbon Lifestyles:** Increased urbanization, generational shifts, and technological breakthroughs lead to strong market demand for low-carbon consumption products and services, along with the emergence of innovative low-carbon business models. **MORE »**

"**Tracking SDG7: The Energy Progress Report**" (International Energy Agency, the International Renewable Energy Agency, the United Nations Statistics Division, the World Bank and the World Health Organization) assesses **progress against the four targets of SDG7**: Universal access to

electricity, universal access to clean fuels and technologies for cooking, deployment of renewable energy, and improvement of energy efficiency. Key findings included the following:

- Significant progress has been made on energy access in recent years, with the **number of people living without electricity dropping from 1.2 billion in 2010 to 840 million in 2017**.
- Access to **clean cooking** has **increased from 57% in 2010 to 61% in 2017**. To reach the target of universal access by 2030, the pace of recent progress would have to **accelerate six-fold**.
- Total final **energy consumption from renewables** reached **17.5% in 2016**—up from **16.6%** in 2010.
- Global **primary energy intensity** has been **falling at an accelerated annual rate of 2.3%** since 2010, up from **1.3%** between 1990 and 2010.

"**2019 Progress Report**" (Climate Action 100+, 2019) assesses the **progress** that **161 focus companies**, representing over **two thirds of global industrial GHG emissions**, have made on **climate-related topics**, as part of their engagement with the Climate Action 100+ initiative. Key findings included the following:

- **70%** have set **long-term emissions reduction targets**.
- **9%** have **emissions targets that are in line with (or go beyond)** the minimum goal of the **Paris Agreement**.
- **8%** of companies have policies in place to ensure their **lobbying activity is aligned with necessary action on climate change**.
- **40%** undertake and disclose **climate scenario analysis**, and **30%** of companies have **formally supported recommendations of the Task Force on Climate-related Financial Disclosures** (TCFD).
- **77%** have **defined board level responsibility for climate change**.

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"**This is how the U.S. gets to zero carbon emissions by 2050**" (Fast Company, 2019) Summary of analysis by Energy Innovation of policy changes in transportation, electricity, buildings, and industry that could dramatically reduce emissions.

"**Doubling Down: Europe's Low-Carbon Investment Opportunity**" (CDP, 2019) finds that **882 companies** — representing **approximately 76% of Europe's market capitalization** — reported **€124 billion in new low-carbon investments in 2019**. However, the report finds that **low-carbon capital investment must double** to put the European corporate sector on track for net-zero emissions by 2050.
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"**Ten Years to Deliver the Paris Agreement**" (GlobeScan and SustainAbility, 2019) finds that **49% of sustainability experts** surveyed believe that **global climate progress will not happen**

fast enough to avoid major, irreversible damage to human, social, and ecosystem health; **16%** believe that **major damage** to human, social, and ecosystem health **has already occurred**. Survey respondents identified **Unilever and Patagonia** as the **global corporate leaders in addressing climate change**, with Tesla, IKEA, Alphabet/Google also receiving recognition for their efforts.
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"**Completing the Picture: How the Circular Economy Tackles Climate Change**" (Ellen MacArthur Foundation) finds that switching to **renewable energy** would only **cut GHG emissions by 55%**. The report demonstrates how applying **circular economy strategies in five key areas** — cement, aluminum, steel, plastics, and food — could **eliminate the remaining 45% of emissions** that are not addressed through adoption of renewable energy. (Sep 2019) **MORE »**

"**Tracking Progress of the 2020 Climate Turning Point**" (World Resources Institute) assesses **progress against six milestones** in energy, transport, land use, industry, infrastructure, and finance that would **need to be met by 2020 to put the world on a pathway consistent with the Paris Agreement**. The report finds that in most cases **action is insufficient or progress is off track** across all six milestones.
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"**The Net-Zero Challenge: Global Climate Action at a Crossroads**" (World Economic Forum) assesses the progress **corporations, governments, and civil society** have made to **address climate change** in line with the Paris Agreement. The report finds that **climate action** needs to **move at a much greater scale and faster pace**, citing that **67 countries**— accounting for less than 15% of emissions — have **committed to achieving net-zero emissions** and only **one third** of the approximately **7,000 companies that report to CDP fully disclose their emissions**.
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The **Science Based Targets initiative** released its first-ever **progress report**, which assesses the initiative's impact since its launch in 2015. Key findings included the following:

- **285 companies** have set **approved science-based targets** to date.
- These companies will reduce their emissions by **265 million metric tons of CO2 equivalent**, representing a **35% reduction** in emissions compared to their base year emissions.
- These 285 companies will drive investment of **up to $18 billion in climate change mitigation** and spur **up to 90 TWh of annual renewable electricity generation**.
- **More than 90%** of the 285 companies have also set ambitious emissions reduction targets for their **value chain emissions**, which make up **3.9 billion metric tons** of CO2 equivalent emissions per year.

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The Climate Group and **CDP** released the "**RE100 Progress and Insights Annual Report**," which examines the progress its member companies have made against their **100% renewable electricity goals**. Key findings included the following:

- **One in three member companies** are already **sourcing more than 75% renewable electricity** for their operations, and **more than 30%** have already **achieved 100% renewable electricity**.
- **2028 is the average target year** for member companies to reach 100% renewable electricity; **3 in 4 companies** are **targeting 2030 at the latest**.
- **44%** of member companies are already **influencing suppliers on renewable electricity**.
- **1 in 2** member companies signaled **plans to engage stakeholders on renewables by 2020**.

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"**Management Quality and Carbon Performance of Transport Companies**" (Grantham Research Institute on Climate Change and the Environment) finds that **35% of transport companies** have **emission reduction plans consistent with the national pledges made under the Paris Agreement**. However, the report finds that only **19%** of transport companies have emissions reduction plans **in line with a path to keep warming to 2° Celsius or below**.
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"**Plastic & Climate: The Hidden Costs of a Plastic Planet**" (Center for International Environmental Law, Environmental Integrity Project, FracTracker Alliance, Global Alliance for Incinerator Alternatives, 5 Gyres, and Break Free From Plastic) finds that the **production and incineration of plastic** will **produce more than 850 million metric tons of GHG emissions in 2019**, **threatening our ability to meet global climate targets**. The report also finds that the production and disposal of plastic could generate **56 gigatons of emissions by 2050**, equivalent to **14% of the earth's entire remaining carbon budget.** (May 2019)
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"**2019 Emissions Gap Report**" (UN Environment) finds that **global temperatures are expected to rise by 3.2°C** even if all current unconditional commitments under the Paris Agreement are implemented. The report finds that **global GHG emissions must decrease by 7.6% each year between 2020 and 2030** in order to get on track towards the 1.5°C goal.
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"**Tracking SDG7: The Energy Progress Report**" (International Energy Agency, the International Renewable Energy Agency, United Nations Statistics Division, the World Bank, and the World Health Organization, 2018) provides an update on the **world's progress against global energy targets on access to electricity, clean cooking, renewable energy, and energy efficiency**. Select key findings include the following:

- 1 billion people — or 13% of the world's population — still live without electricity; an estimated 674 million people are projected to still live without electricity in 2030.
- 3 billion people — or more than 40% of the world's population — do not have access to clean cooking fuels and technologies.
- As of 2015, the world obtained 17.5% of its total energy consumption from renewable sources; the global renewable share is expected to reach 21% by 2030.

The Low Carbon Economy Index 2019 (PwC UK) estimates that the global economy needs to decarbonize at a rate of 7.5% per year to achieve a two thirds probability of limiting warming to 2 degrees Celsius by 2100. The report finds that the carbon intensity of the global economy fell by 1.6% in 2018, which is less than half the decarbonization rate achieved in 2015.

Melting Point (CDP, 2019) assesses the world's 20 largest steel companies based on their business readiness for a low carbon transition. The report gave the highest scores to SSAB, ArcelorMittal, Hyundai Steel, and Tata Steel.

Major Risk or Rosy Opportunity: Are Companies Ready for Climate Change? (CDP, 2019) examines disclosures from more than 7,000 companies worldwide to identify the business risks and opportunities related to climate change. Key findings included the following:

- The **215 biggest global companies report nearly $1 trillion at risk from climate impacts**, with many likely to hit within the next 5 years.
- Companies report a **potential $250 billion in losses due to the write-offs of assets**.
- **Climate business opportunities are calculated at $2.1 trillion**, nearly all of which are highly likely or virtually certain. Potential value of sustainable business opportunities are almost 7x the cost of realizing them ($311 billion in costs vs. $2.1 trillion in opportunities).
- **Over 80% of disclosing companies see major climate impacts**, including extreme weather patterns, rising global temperatures and increased pricing of GHG emissions.
- **Financial companies forecast $1.2 trillion in potential revenue from low emissions products and services**, followed by **manufacturing ($338 billion)**, **services ($149 billion)**, **fossil fuels ($141 billion)** and the **food, beverage & agriculture industries ($106 billion)**.
- The financial services industry represents almost 80% of the total potential financial impacts in the sample set.

Fast Moving Consumers (CDP, 2019) **assesses 16 publicly listed companies in the consumer packaged goods sector on their business readiness for the transition** to a low-carbon economy. Select key findings included the following:

- The sector's key carbon exposures exist in the value chain driving large Scope 3 emissions, which make up 90% of lifecycle emissions.
- **Unilever, Danone, Nestlé, and L'Oréal received high scores**.
- 56% of Food & Beverage companies have no Scope 3 emission reduction targets, with Household & Personal Care companies performing better at 29%.

- **63%** of companies are **investing to advance depolymerization and recycling infrastructure**.
- **Almost 60% of the top 10 revenue generating brands** for each company have **failed to deliver low carbon innovations** to market in the last 5 years.

75% of companies have **acquired smaller, environmentally conscious brands** to create strategic optionality.