

G-20 Zero- Carbon Policy Scoreboard

Issue 2023:
Abridged Report

May 17, 2023



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Executive summary

72%

Average score for Group-of-Seven countries

64%

Average score for OECD countries

36%

Average score for non-OECD countries

In the year since BloombergNEF last scored G-20 nations on their decarbonization policy regimes, Russia's invasion of Ukraine has disrupted global supply chains, boosted commodity prices, strained international alliances and prompted governments to take unprecedented steps to bolster their energy security and affordability. During that same period, the world's largest economy, the US, at long last made a major federal commitment to cleaner energy.

Circumstances certainly changed dramatically in just 12 months, but a simple fact remains: governments must substantially ratchet up support for low-carbon policies if the world is to have any chance of achieving net-zero CO2 emissions by mid-century. This applies even to those countries that rank highly in BNEF's 2023 Policy Scoreboard. Among virtually all the nations, there is particular room for improvement in sectors other than power and transport, which policymakers have historically focused the most on.

This is BNEF's third annual evaluation and ranking of each G-20 country's policy regimes. For the first time, the assessment includes agriculture and a special chapter on how governments have responded to the global energy crisis.

How countries scored

- In total, the G-20 countries achieved an average score of 54% - up two percentage points on last year's assessment. To compare apples with apples, the 2022 scores in Figure 1 use the nations' agriculture score for 2023 because the sector was not included in last year's report.
- As in 2022, European Union member states and the UK top this year's Scoreboard. France came close to taking the overall crown thanks to a strong performance across the board, especially in buildings and industry. But due to its own improvements in those two sectors, Germany retained the top spot again. Italy shot up to third, leaving the UK in fourth.
- The US achieved by far the biggest increase in score, climbing four places to fifth. The main driver was the Inflation Reduction Act, which is set to bring at least \$370 billion in direct support for low-carbon technologies across the economy.
- It is too early to tell how close these policies will take the US toward its 2030 emissions target. Ultimately it will depend on the appetite of developers, financiers and consumers for the new incentives. A key challenge now is implementation, with many new programs effectively unusable until policymakers provide clearer guidance.
- The main reason why the US has not cracked the top four is that European nations have more "policy sticks", including carbon pricing, coal-power bans and tough standards on energy efficiency. These are meant to force decarbonization and thus gain more points in the Scoreboard methodology, while financial and fiscal support can only incentivize change.

Figure 1: Total 2022 score

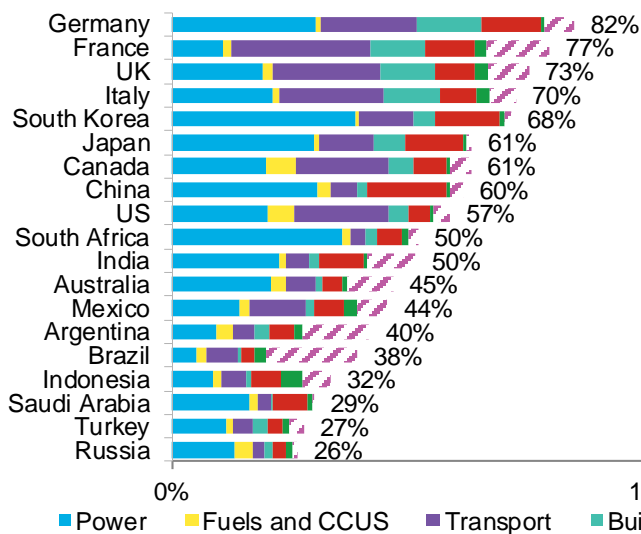
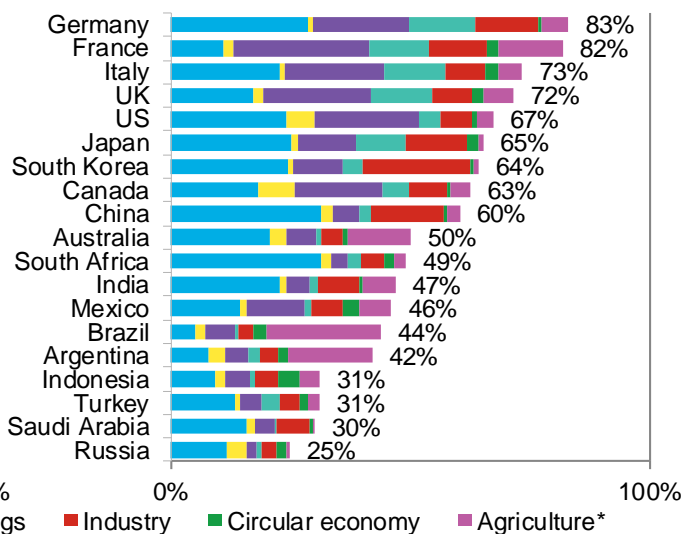


Figure 2: Total 2023 score



Source: BloombergNEF. Note: Each country's total score is weighted by each sector's share of national greenhouse gas emissions. Where possible, the 2023 scores have been recalculated using the 2022 methodology and may differ from those in the published 2022 report. * In particular, Figure 7 includes the 2023 score for the agriculture sector (shaded purple) to make a like-for-like comparison. Fuels and CCUS are hydrogen, biofuels and carbon capture, utilization and storage.

- Overall, developed countries scored better on average for their low-carbon policies: G-20 countries in the OECD had an average score of 64% in this year's assessment, compared with 36% for non-OECD nations. This is concerning because the gap between the two groups expanded another two percentage points relative to the 2022 report.
- In addition, the non-OECD group includes large emerging economies with a rapidly growing carbon footprint. The greenhouse gas emissions of these countries increased by 5.4% over 2015-2019, compared with a 2.4% reduction by the OECD group.
- Many governments have prioritized decarbonizing their power sector, which is responsible for roughly a third of global emissions. It therefore remains the highest-scoring sector in this assessment, averaging 61% across the G-20 countries – 1.3 percentage points above the 2022 report. The nearest contender, transport, also climbed 1.4 percentage points.
- However, G-20 policymakers are starting to pay closer attention to harder-to-abate sectors. As a result, the average score for buildings, the circular economy and industry rose by 1.7, 1.8 and 2.7 percentage points, respectively, compared with last year.
- Nonetheless, more policy support is needed, especially outside power and transport, as these sectors average 47%. In particular, policymakers could implement concrete financial incentives for clean hydrogen, carbon capture utilization and storage, and sustainable agricultural practices, tougher energy-efficiency standards for buildings and rules on waste, and carbon pricing.

How governments have responded to the energy crisis



- Energy policymakers must juggle a trilemma of sometimes conflicting priorities: affordability and access; security of supply; and environmental sustainability. Over 2015-2021, many governments focused on how to achieve a 'cleaner' energy mix. However, the global energy crisis of the last 18 months has elevated reliability and affordability on the political agenda.

- In some – but not all – cases policymakers have responded by implementing measures that prioritize energy security, often over decarbonization.
- Broadly speaking, government responses have varied along two parameters: first, they targeted energy consumers or producers. Second, they sought to protect market participants from the effects of the crisis, or they aimed to tackle the energy shortage directly.
- Efforts to protect players mainly took the form of financial incentives (such as grants and loans) and regulations (like price caps). Governments provided \$482 billion in funding for energy affordability in 2022, based on International Energy Agency data. The G-20 countries accounted for 69% of this total. Some of it was targeted at energy producers but most was aimed at consumers.

Figure 3: Examples of government responses to the energy crisis and the potential impact on elements of the energy trilemma

Target	Intervention objective	
	To protect consumers and producers	To ensure adequate supply
Demand side	Retail price caps Grants, loans, tax cuts Windfall tax/clawbacks <i>Clean:</i> ● <i>Secure:</i> ●● <i>Cheap:</i> ●●●	Demand response and energy efficiency incentives (eg, grants, loans, vouchers, points systems) Mandated energy rationing <i>Clean:</i> ●●● <i>Secure:</i> ●●● <i>Cheap:</i> ●●
	Wholesale price caps Loans, guarantees and other subsidies Corporate bailouts <i>Clean:</i> ● <i>Secure:</i> ●●● <i>Cheap:</i> ●●	Incentives for low-carbon energy supply Incentives for new fossil-fuel energy supply <i>Clean:</i> ●● <i>Secure:</i> ●●● <i>Cheap:</i> ●

Source: BloombergNEF

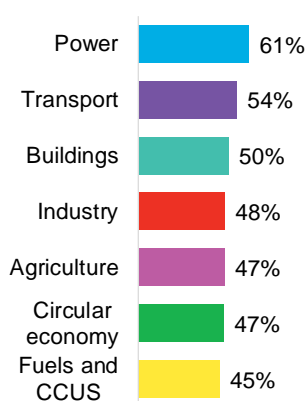
Legend: **Focus** – ● Low ●● Mixed ●●● High **Type** –  Incentive  Regulation

- Various governments intervened in the energy markets by imposing price caps, for example. In some cases, their effectiveness was limited because they only applied to a subset of consumers or low energy prices kept the mechanism from being triggered.
- If such financial support is not temporary and designed carefully, it has the potential to over-compensate recipients. This can encourage wasteful consumption of energy and fuels, which can mean unnecessary greenhouse-gas emissions.
- This is less of a risk if – as has been the case in many markets – energy prices have risen. But the risk rises if a government also implements generous price caps to weaken the price signal to consumers.
- Such mechanisms can also weaken investment signals to low-carbon power generators and flexibility providers. This applies to measures limiting energy producers’ revenues and profits. Such policies may only impact a subset of market players and may not lead to lower retail energy bills.
- In addition, governments have introduced policies to mitigate pressure on the energy system. These includes targets, mandates or funding to encourage consumers to improve energy efficiency or take part in demand-response programs. Designed effectively, these can address all three components of the energy trilemma, including decarbonization.

- Policymakers have also taken steps to promote switching energy sources – that is, alternatives to natural gas. Such measures can also promote decarbonization depending on the alternative technologies chosen.
- However, such policies have been less common than policies to promote energy savings, with one reason being that the latter have a more immediate impact on tackling energy shortages than the former.

How different sectors are being addressed

Figure 4: Average G-20 sector score 2023



Source: BloombergNEF

- The Scoreboard takes into account how nations pursue decarbonization policies for seven sectors: power, transport, buildings, industry, agriculture, the circular economy, and fuels & carbon capture, use and storage.
- Looking at how the G-20 compare solely in addressing **power**, European nations retain their lead from last year’s survey. These countries have historically backed renewables and the energy crisis prompted them to roll out further support.
- China set new records for renewables capacity procurement by auction in 2022. But many countries reduced auction volumes due to the pandemic, economic crises, supply-chain constraints and changes in political administration.
- Auctions under which renewable project developers bid to win power-delivery contracts were more frequently undersubscribed in 2022. This may have been because policymakers set price caps too low, failing to account for higher capital and financing costs. Some developers also opted for more lucrative contracts directly with corporate offtakers.
- Governments have approved millions in subsidies and schemes to promote energy storage. These boost deployment but highlight the underlying challenge that batteries are not yet economically viable in most parts of the world. Policymakers and regulators must take steps to ensure that batteries can compete fairly with other technologies.
- Regarding policies to promote **low-carbon fuels and carbon capture, utilization and storage (CCUS)**, the US is back in pole position, with an eight-percentage-point rise from last year’s survey. While IRA tax credits may require more government outlay than anticipated, they could well make hydrogen produced using zero-carbon energy competitive. The revamped 45Q credit could also make CCUS viable for hard-to-abate industries.
- Canada boosted its low-carbon fuels score by an even more impressive 12 percentage points due to its new CCUS tax credit and new market-based system to reduce the carbon intensity of liquid fuels. Its carbon-pricing policy also helps to create demand for low-carbon fuels.
- Along with CO2 programs, European countries are rolling out sizeable funding for clean hydrogen and have progressed on their new contract-for-difference schemes. Their strategies to replace Russian gas imports include bolder targets and funding for biomethane.
- Developing countries have also made progress on low-carbon fuels: South Africa boosts its score five percentage points largely due to a new hydrogen plan. India increases its score by four percentage points with a new CCUS tax credit, and release of the second part of its hydrogen strategy (albeit without the previously mentioned demand-side mandates).
- Germany and France rank the highest for **road transport** decarbonization policy this year. With both still offering robust support for EVs – ranging from demand-driving purchase subsidies, to charging infrastructure deployment support, to fuel economy targets – they proved difficult to beat.
- The gap to the runners-up is relatively wide, at 10 percentage points, principally because the UK falls down on charging policy and scrapping its EV grant scheme. Italy has had a slower

start to incentivizing EV uptake and so lags on sales. But its score rose after it announced plans to ban sales of new internal combustion vehicles from 2035.

- Three other countries follow the top four closely: 23% of cars sold in China in 2022 had a plug due to a last-minute surge before national-level subsidies ended. The US improved its transport score on the back of the IRA and a higher EV share of sales, while in South Korea more government funding spurred EV deployment.
- The EU countries top the ranking for **buildings**, expanding their lead over the runners-up to 12 percentage points. This is due to strong policy support, including on the regulatory side, as well as the effectiveness of incentives for low-carbon heating technologies.
- The UK raised its buildings score nine percentage points due to the Coal Fuel Sales Restriction legislation and greater subsidy support for heat pumps. The government has begun to improve policy predictability in the form of low-carbon heat targets and discussions for fossil-fuel bans in new homes from 2025.
- China records the joint largest buildings score increase of all G-20 nations (12 percentage points). A key reason was the enforcement of the energy performance standards outlined in 2016, which now apply to new residential and public buildings. Existing policies have also helped it reduce buildings emissions.
- Governments, especially in OECD countries, are beginning to implement concrete low-carbon support for **industry**. France increased its score by 13 percentage points due to a new strategy, targets and funding.
- But the US achieved the biggest industry score boost (20 points), thanks to the IRA and Infrastructure Investment and Jobs Act. The Biden administration has also taken steps to promote clean public procurement of industrial materials.
- A total of 10 G-20 countries have nationwide carbon prices on at least some industrial players, although they benefit from concessions reducing the impetus to cut emissions. Both Australia and the EU are introducing policies to reduce these concessions, although they will take time to take effect.
- Relatively few governments have implemented measures to increase industrial demand for low-carbon fuels and electrification. As a result, the G-20 – indeed most countries worldwide – have made limited progress in switching away from fossil fuels in industry.
- France jumps three places in the ranking for **circular economy** policy due to its waste reduction and recycling mandates. All six of the top performers pioneered such policies such as extended producer responsibility schemes, which force companies to pay for waste recycling upfront. These countries also tend to have limited space available for landfill.
- Countries like Australia, Turkey, Mexico and India, are enforcing single-use plastics bans and recycling targets in response to the mounting public pressure to manage waste. But they lose points for only treating a small share of municipal solid waste. Others such as India perform poorly on implementation and enforcement of waste regulations.
- For countries with some of the lowest scores, such as Saudi Arabia, Argentina and Russia, a circular economy is on the government agenda, but there is little momentum or funding for infrastructure. Where they have implemented programs to promote a circular economy, they are fairly basic and form policy patchworks with little coordination or enforcement.
- This year's Scoreboard includes for the first time policies to decarbonize the **agriculture** sector. Its share of total greenhouse-gas emissions is relatively modest, at 12% globally in 2019 (excluding land use and forestry). But this share varies significantly across the G-20 – from 1% in Saudi Arabia to 48% in Brazil.

- The quantity and quality of low-carbon agriculture policies also vary significantly. Indeed, most governments are only starting to consider how to decarbonize the sector, which brings as many challenges as those more commonly referred to as “hard-to-abate” (heavy industry).
- The top four performers have progressed less on implementing policies to cut emissions from agriculture relative to other sectors. The EU’s recently reformed Common Agricultural Policy (CAP) allocates a share of the substantial funding to green initiatives. Yet two-thirds of France’s and Italy’s total CAP budgets and half for of Germany’s are for interventions that are unlikely to help the environment.
- In third place, Australia’s agriculture score is 17 percentage points higher than its average for the other sectors in this report. The government has financed the development of a policy framework to promote corporate sustainability in agriculture, and has one of the most extensive ranges of funding programs targeted at tackling livestock emissions.
- Unlike many G-20 nations, Japan has a strategy for greening its food system, with ambitious targets on pesticide and fertilizer use, organic farming, and food waste, among others. In 2022, the government implemented various programs to achieve these goals and improved its direct payment program, including support targeted at cutting livestock emissions.
- In the US, the IRA also includes support for sustainable agriculture, with billions for emissions-cutting farming techniques. However, the US lacks firm penalties or regulations for those that follow unsustainable practices, limiting the potential scope of change.

Section 1. Introduction

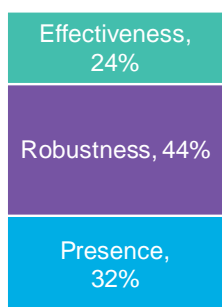
All of the G-20 countries have pledged to reach net-zero emissions by mid-century, or have a target under discussion. Achieving such goals will require substantive government support across the economy. In this context, BNEF’s Policy Scoreboard evaluates the quantity and quality of low-carbon policy implemented by the G-20 countries, which account for around three-quarters of global greenhouse gas emissions.

1.1. Metric categories

Each G-20 country is scored out of 100% based on more than 100 metrics, which can be broken down into three categories: presence, effectiveness and robustness

Each G-20 country is scored out of 100% based on more than 100 metrics, which can be broken down into three categories: presence, effectiveness and robustness (Figure 5). The ‘presence’ metrics focus on what types of policy have been implemented in each sector – such as renewable energy auctions to decarbonize the electricity mix or purchase subsidies to promote electric vehicles. The types of policy needed to spur climate action change as markets mature. To reflect this, policy types are weighted differently depending on their sophistication and level of ambition or stringency. Broadly speaking, policies forcing a change – in other words, ‘sticks’ such as mandates or carbon-pricing schemes – are weighted higher than ‘carrots’ like feed-in tariffs or grant and loan programs.

Figure 5: Policy Scoreboard metric categories



Source: BloombergNEF

The assessment of the EU member states (France, Germany and Italy) incorporates policies implemented at the national and bloc level. For the US and Canada, climate action is driven both by the federal and subnational governments. As such, their scores are a weighted average of the scores for their states and provinces, as well as any relevant federal-level policies. The weighted average is calculated based on emissions for the latest year available.

Simply introducing a certain type of policy is not necessarily enough to drive decarbonization. These programs must be designed carefully through transparent processes and, if changes are necessary, these should be implemented with advance warning and should not result in a retroactive reduction in support. Targets and regulations should be tough enough to spur change but not too ambitious so as to be unrealistic. A market needs government support in a given sector targeted at a range of technologies and solutions, using a range of policy types. The Scoreboard takes these factors into account through the ‘robustness’ metrics.

The final category comprises quantitative metrics assessing the ‘effectiveness’ of the policies in place. For example, the Scoreboard considers whether a country has increased the share of renewable power generation or EV sales in recent years, or if it has decreased volumes of municipal solid waste or the share of fossil fuels used for industrial heat.

1.2. Sector weightings

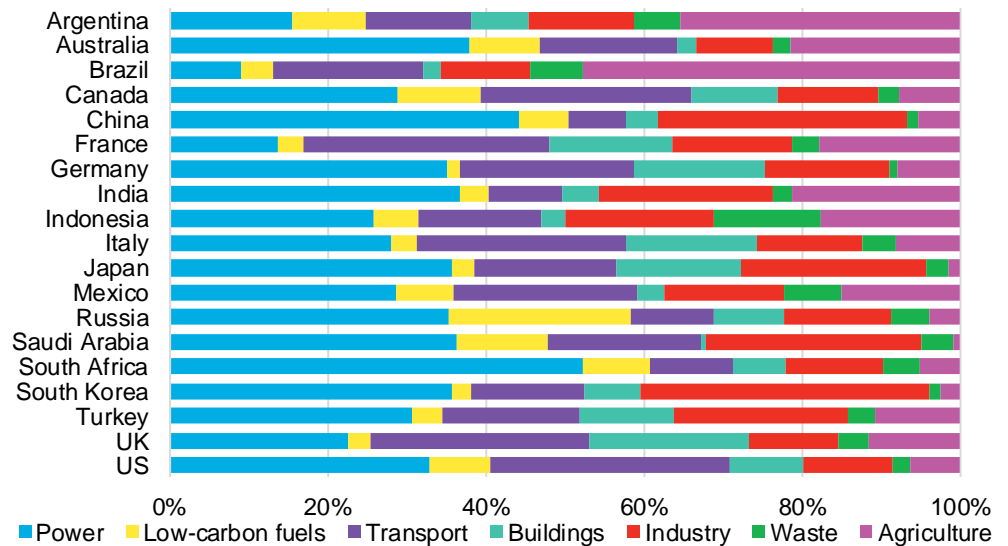
The G-20 countries vary in the breakdown of greenhouse gas emissions by sector: power accounts for the largest share in most nations, especially emerging economies, rising to as much as 52% of total emissions (excluding land use and forestry) in South Africa and South Korea. However, some countries – such as France, the UK and US – have made progress toward

decarbonizing the electricity mix and now see transport taking an equal or larger share. Some emerging economies have experienced recent growth in industrial production, causing a surge in the sector's share of emissions: it comprises 32% for China and 22% for India. Agriculture plays an important role in certain countries' economies and thus emissions, such as 48% in Brazil and 35% in Argentina. Meanwhile, major oil and gas producers like Russia and Canada have significant fugitive emissions, accounting for 23% and 10% of those countries' totals, respectively.

To take account of the varying breakdown of countries' emissions, the G-20 nations' scores for each sector in this report are weighted by its share of emissions covered by the assessment

To take account of these different breakdowns, the G-20 nations' scores for each sector in this report are weighted by its share of emissions covered by the assessment. The weighting means that, for example, South Africa's score for the power sector makes a bigger contribution to its total score compared with France, which has a higher weighting for transport.

Figure 6: G-20 countries' emissions covered by Policy Scoreboard split by sector



Source: World Resources Institute CAIT database, BloombergNEF. Note: Uses emissions from 2019. Excludes land use and forestry. Low-carbon fuels refers to fugitive emissions and 'other fuel combustion'.

1.3. Report structure

The next two sections of this report present the main results for each country and consider policy issues spanning multiple sectors, such as international climate negotiations, government support for fossil fuels and sustainable finance. Section 4 discusses how the G-20 countries have been affected by and responded to the global energy crisis.

This is an abridged version of the G-20 Zero-Carbon Policy Scoreboard published on BNEF's public website. The full report, available to BNEF clients, includes deep dives into individual sectors,

Section 2. Score overview

This year’s assessment reinforces the trend that richer nations are more likely to have more and better low-carbon policy support to date: G-20 countries in the OECD have an average score of 64% (72% for the G-7), compared with 36% for non-OECD members. This is concerning for two reasons. First, the gap between the two groups is growing, having expanded two percentage points relative to the 2022 Scoreboard. Second, the non-OECD group includes large emerging economies with a rapidly growing carbon footprint. These countries increased greenhouse-gas emissions by 5.4% over 2015-2019, compared with a 2.4% reduction by the OECD group.

Figure 7: Total 2022 score

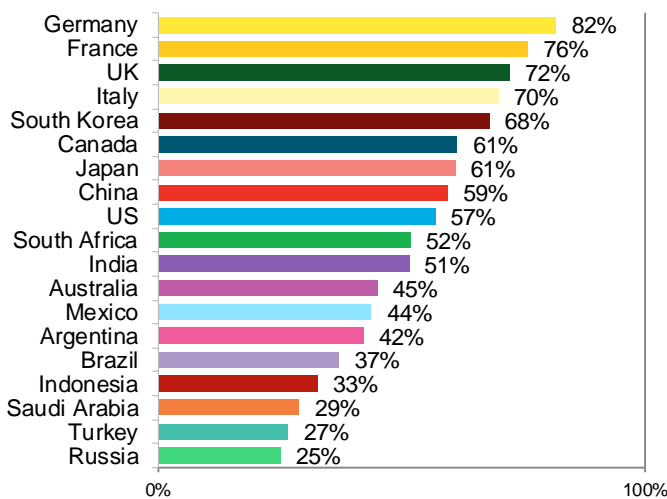
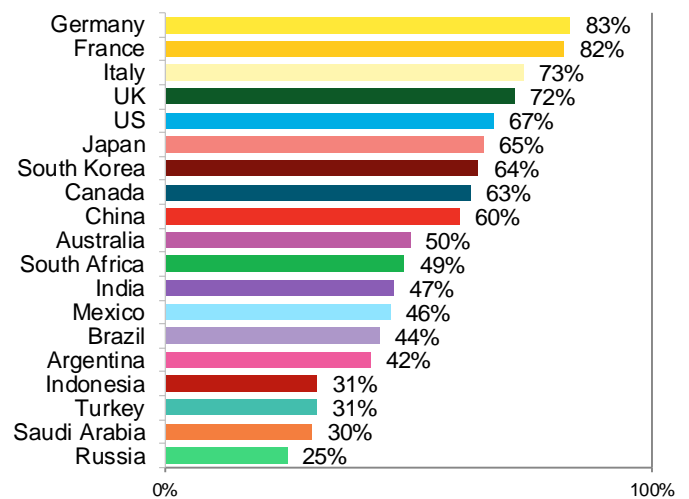


Figure 8: Total 2023 score



Source: BloombergNEF. Note: Each country’s total score is weighted by each sector’s share of national greenhouse-gas emissions. Where possible, the 2023 scores have been recalculated using the 2022 methodology and may differ from those in the published 2022 report. In particular, Figure 7 includes the 2023 score for the agriculture sector to make a like-for-like comparison.

2.1. Quartile 1

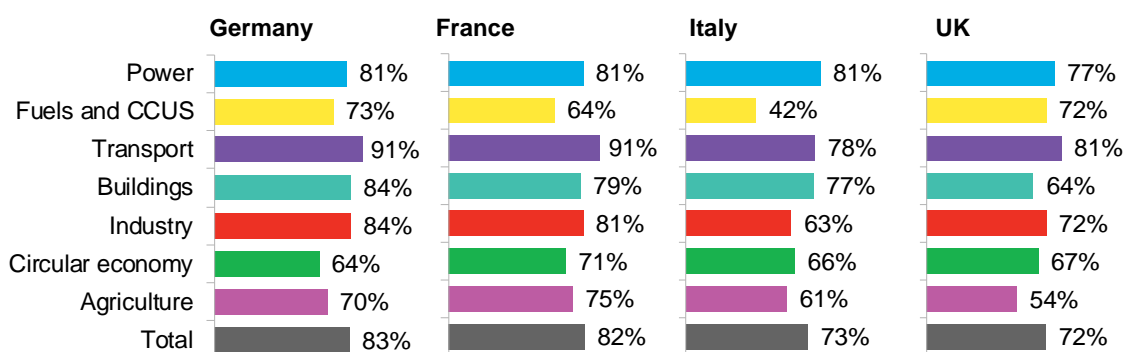
Germany retains top spot in this year’s survey by a whisker, followed by France

Germany retains top spot in this year’s survey by a whisker. Raising its total score by 0.8 percentage points from last year, Germany ranks first for policies to decarbonize power, buildings and industry, and shares first place for transport. In second place is France, which also finished second last year but has closed the gap considerably by boosting its total score by 5 points. France achieved the highest scores out of the G-20 countries for its circular economy and agriculture policy frameworks, as well as for transport. But the nation did not boost its total score enough to overtake Germany in the overall ranking. Italy also improved its performance, rising 3 percentage points to third overall, to the detriment of the UK – the only G-7 country to see its total score fall (by 1.2 points).

More broadly, what differentiates the top four countries from those in the second quartile is that they have implemented a wider and bolder range of ‘policy sticks’

More broadly, what differentiates the top four countries from those in the second quartile is that they have implemented a wider and bolder range of ‘policy sticks’. These include mandates to phase out fossil fuels for power and building heat or to ban internal combustion engine vehicles. They also include requirements to use recycled content in packaging, limits on the use of nitrogen fertilizers for farming and stringent standards for energy efficiency in buildings. The countries also put a price on carbon emissions for most sectors covered in this report – whether through the European Union Emissions Trading System (EU ETS), or national schemes. Policy sticks are awarded more points in the Scoreboard methodology because they are meant to force decarbonization, whereas financial and fiscal support can only incentivize change.

Figure 9: Quartile 1 – 2023 scores



Source: BloombergNEF. Note: Each country’s total score is weighted by each sector’s share of national greenhouse-gas emissions

All four countries at the top of the Scoreboard have spent much of the last year seeking to mitigate the domestic fallout from Russia’s invasion of Ukraine and the broader energy crisis

All four countries at the top of the Scoreboard have spent much of the last year seeking to mitigate the domestic fallout from Russia’s invasion of Ukraine and the broader energy crisis. In response, EU member states have committed to more ambitious targets on renewables, biomethane, clean hydrogen and energy efficiency, among others. At the national level, Germany, France, Italy and the UK have each rolled out funding to promote energy savings and renewables. However, they will need to work harder on accelerating permitting for clean power projects and expediting grid connections. The renewables market in France and Italy in particular has suffered from delays, and build levels in the two nations have trailed the global average. An unfavorable planning regime has also helped slow deployment in the UK, particularly outside of Scotland. However, renewables generated 40% of UK power in 2021 – similar to production in Germany and Italy. Among the full G-20, only hydropower-heavy Brazil and Canada have higher shares of renewable power generation.

In terms of decarbonizing transport, Germany and France have for several years offered generous EV purchase subsidies to consumers, required that vehicles sold meet emission performance standards and provided charging infrastructure support. In 2022, nearly one in three cars sold in Germany had a plug. In France, sales of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) totaled 22%. A quarter of vehicles sold in the UK last year were fully or partly electric, but the country’s transport sector score fell after it scrapped its EV scheme. Italy only introduced such subsidies for private consumers and companies in 2022 – hence its EV share is smaller, at 12%.

The top four performers have improved their support for low-carbon fuels, with significant funding and new contract-for-difference schemes for clean hydrogen. The EU strategy for replacing Russian gas imports included bolder targets for biofuels and biomethane, together with financial incentives. In addition, their carbon-pricing policies should create demand for low-carbon fuels in

industrial sectors. France also improved its industry score substantially after announcing more ambitious commitments and funding. The country has also accelerated the reduction in greenhouse-gas emissions per unit of industrial output, as have all four top performers. The UK scored extra points for its progress in cutting industrial energy intensity – that is, energy consumed for each unit of industrial output.

In the buildings sector, France's MaPrimeRenov is one of the best incentive programs for promoting low-carbon heating, helping the country achieve the highest number of heat-pump sales relative to population size in Europe. The UK did not score as highly on heat-pump uptake but has reduced unpredictability surrounding its policies in this area in recent years. It also enforced regulations on coal fuel sales and introduced more support under its Boiler Upgrade Scheme.

The four European countries in the top quartile have strong circular economy policy regimes, which treat high shares of municipal solid waste and cut waste-related emissions. All have comparatively high landfill fees or, in the case of Germany, an outright ban.

The top four performers have progressed less on implementing policies to cut emissions from agriculture. Italy, Germany and France have devised a strategy under the EU Common Agricultural Policy (CAP) to allocate a certain share of funding to green initiatives. While the reformed CAP is meant to deliver more effective climate action than the preceding program, two-thirds of France's and Italy's total CAP budgets and half of Germany's are for interventions that are unlikely to help the environment.

The top four performers have progressed less on implementing policies to cut emissions from agriculture

2.2. Quartile 2

The US is the standout performer in this year's report, increasing its total score by 10 percentage points, in large part due to the passage of the Inflation Reduction Act

The US is the standout performer in this year's report, increasing its total score by 10 percentage points and climbing four places in the overall ranking. In large part, this improvement has been due to the passage of the Inflation Reduction Act (IRA), the country's most substantive climate policy to date, which provides over \$370 billion in direct support for renewables, electric vehicles and other low-carbon technologies. The US continues to score highest in its efforts to support lower-carbon fuels and CCUS, but it has also closed the gap with other nations above it on the table for its power and transport policies. The new design for the well-established 45Q tax credit should help the US reinforce its strong position in the CCUS market, as will increased funding through the 2021 Infrastructure Investment and Jobs Act. New, potentially quite lucrative tax credits supporting clean hydrogen production add yet another clean fuel policy to the US's substantial repertoire.

On the power and buildings sector side, the IRA extends, refines and expands wind and solar tax credits, as well as introducing support for energy storage and efficiency. New tax credits for commercial and used clean vehicles, as well as EV chargers and other clean refueling infrastructure, more than compensate for new supply-chain restrictions on consumer EV credits, improving transport scores as well. Nonetheless, some of the most important details that determine how effectively the US supports clean energy will be determined over the next 18 months as the US Treasury and other federal agencies issue key regulations.

The US made the most progress in improving its score on industrial decarbonization. Thanks to the IRA, its policy mix is now more impactful and complete, with more funding through the Department of Energy loan and grant programs and the Advanced Energy Project Tax Credit. The Biden administration has shed more light on its decarbonization plan for this sector and improved

its public procurement strategy toward materials. The US has also accelerated efficiency gains for industry.

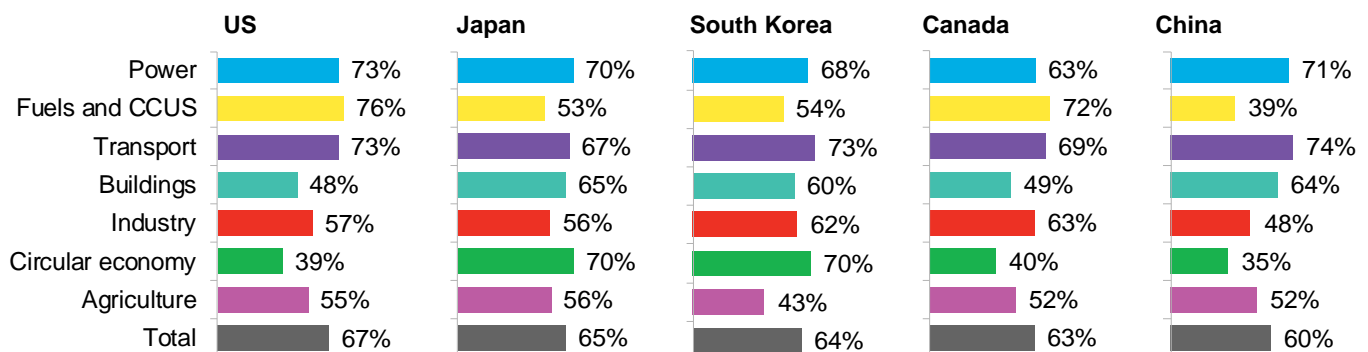
On agriculture, the IRA offers billions for emissions-cutting farming techniques. However, the US lacks firm penalties or regulations for those that follow unsustainable practices, limiting the potential scope of change. In terms of cross-sector policies, the US has made progress in sustainable finance with the Securities and Exchange Commission proposal to require environmental, social and governance (ESG) disclosures from companies and investors. There has been substantial backlash at the state level, however. Some 28 states have enacted anti-ESG-related bills or policies or have similar proposals under discussion. A federal carbon price is not on the cards for the foreseeable future, though the last year has seen more states introduce emissions trading.

As a result of its improved score, the US pushes Japan and South Korea down to sixth and seventh in the ranking

As a result of its improved score, the US pushes Japan and South Korea down to sixth and seventh in the ranking. Japan performs especially well on circular economy, spurred in part by limited space for landfills and its Plastic Resource Circular Act, which offers incentives to companies that move toward a circular business model. The country also improves its score for transport policy, which is slowly starting to drive EV deployment. Sales of electrified models doubled in 2022, although Japan remains well behind on the EV share of vehicle sales when compared with other G-7 countries, as well as with China and South Korea. Japan’s biggest score increase was for clean power: the government ramped up incentives for energy storage and corporate power purchase agreements. It would have scored even higher were it not for its reliance on – and plans to add more – coal-fired electricity.

In the buildings sector, the energy crisis spurred Japan’s government to roll out more efficiency support, while its mature subsidy scheme for heat pumps means it has the highest sales relative to the size of its population. Japan also released an updated CCUS strategy, although it lacks a concrete incentive commercialize the solution, as seen in other markets like the US and Canada. Unlike many G-20 countries, Japan has a strategy on greening the food system, with ambitious targets on pesticide and fertilizer use, organic farming, and food waste, among others. In 2022, the government implemented various programs to achieve these goals and improved its direct payment program, including support targeted at cutting livestock emissions.

Figure 10: Quartile 2 – 2023 scores



Source: BloombergNEF. Note: Each country’s total score is weighted by each sector’s share of national greenhouse-gas emissions.

South Korea’s biggest sectoral change was a four-percentage-point decline in its power score: the government has wound down its energy storage support and changed focus to nuclear power, weakening investment signals for renewables. New build of coal-fired power plants has slowed in recent years, but South Korea has the biggest coal project pipeline of the OECD countries in the

G-20. Nearly three-quarters of national emissions are covered by a carbon price, although its impact is weakened by generous volumes of permits provided for free. Security-of-supply concerns prompted the government to increase energy-efficiency support, including new targets and funding for industry. Its best sector score is for transport: the government ramped up funding for EVs and roll-out of charging infrastructure. This helped boost the EV share of new vehicle sales to 10% in 2022 – up from 8% in the previous year. European countries' higher scores for their circular economy efforts push South Korea down to third place for that sector. Nonetheless, South Korea's policies are among the most ambitious in the G-20, and the country performs well on waste recovery and recycling.

Canada achieved the biggest improvement (12 percentage points) for low-carbon fuels and CCUS thanks to progress on its Clean Fuel Regulations and a new CCUS tax credit

Canada is unusual in that its best scores do not come from its actions to address decarbonization in the power sector. Compared with other G-20 countries, Canada offers relatively little federal, provincial and territorial policy support for renewables, since these already account for 70% of the country's overall power mix. Its score for power dips slightly this year, as over 2017-2021 Canada's renewables capacity (excluding hydropower plants over 50MW) grew least among the G-20 countries. It achieved the biggest improvement (12 percentage points) for low-carbon fuels and CCUS thanks to progress on its Clean Fuel Regulations and a new CCUS tax credit. In addition, Canada introduced a new national scheme to increase energy efficiency in the buildings sector, helping to increase its score by three percentage points. The country's carbon-pricing policy has yet to drive significant change but has an ambitious planned trajectory. However, the government continues to provide considerable funding to support domestic fossil fuels. In agriculture, Ottawa and the provinces are only beginning to implement the recently agreed Sustainable Canadian Agriculture Partnership, including both new subsidies for regenerative farming and ambitious targets to voluntarily reduce fertilizer use and emissions.

China is the highest-scoring nation in the survey that does not belong to the OECD. However, a mixed performance across the sectors netted out to suggest little overall progress in expanding support for decarbonization

China is the highest-scoring nation in the survey that does not belong to the OECD. However, a mixed performance across the sectors netted out to suggest little overall progress in expanding support for decarbonization. Improvements by other G-20 countries – notably the US – caused China to fall one place, to ninth spot. China has its lowest score for its efforts related to promoting a circular economy, followed by low-carbon fuels and CCUS. Circular economy policies are mainly at the province or city level, and municipal solid waste generation continues to rise. The central government does not prioritize biofuels, and its blending mandate is not strictly enforced. China remains a renewables giant, procuring a further 125GW of wind and solar in 2022 – more than Canada's total power plant fleet. However, it loses points for increasing its power-sector emissions and the government's commitment to coal. In industry, the government has committed to decarbonization targets and implemented policy carrots and sticks to achieve the (albeit now weaker) steel commitments. It also has bold goals for industry energy use on an absolute level and per unit of output. China has already seen improvements in its energy intensity.

Transport remains China's strongest sector for low-carbon policy: it nearly doubled EV sales in 2022, achieving the third-highest share of EVs in vehicle sales out of the G-20 countries. However, the last-minute surge in sales was driven by the imminent expiration of national subsidies.

2.3. Quartile 3

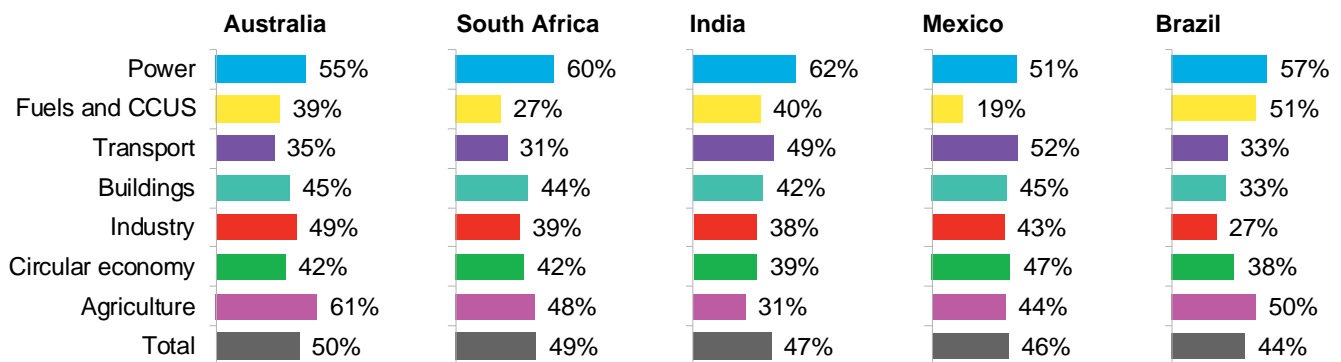
Australia climbed two places in the overall ranking – the second-biggest jump after the US - to reach 10th position. Australia offers relatively weak federal support for renewable power, although it has improved support for battery storage, and the country has begun to (slowly) reduce coal-

fired power capacity. EV sales rose 91% in 2022, spurred by federal and state-level incentives, but Australia’s slow start means such models only accounted for around 5% of vehicle sales last year.

Australia climbed two places in the overall ranking – the second-biggest jump after the US - to reach 10th position

In industry, the government is implementing improvements to its historically ineffective baseline-and-credit scheme and offset program. This also helped Australia achieve a significantly higher score for its agriculture policy at 61%, or 17 percentage points higher than its average for the other sectors in this report. The federal government has funded development of a policy framework to promote sustainability in agriculture with notably ambitious decarbonization goals. It has one of the most extensive ranges of funding programs targeted at tackling livestock emissions, and the country performs well on fertilizer use and improvement in the emissions intensity for meat production.

Figure 11: Quartile 3 – 2023 scores



Source: BloombergNEF. Note: Each country’s total score is weighted by each sector’s share of national greenhouse-gas emissions

In South Africa, the government has implemented more and better support to decarbonize the power system – its biggest emitter – than in other sectors

In South Africa, the government has implemented more and better support to decarbonize the power system – its biggest emitter – than in other sectors. But the last year has seen some past problems rear their ugly heads again: some winners of the 2021 renewables auction round have yet to reach financial close, and no wind farms won support in the latest round on the grounds of inadequate grid capacity. South Africa has however seen a surge in the completion of privately owned solar projects after regulatory changes and tax breaks made it easier to deploy new capacity below 100MW. Still, South Africa remains heavily reliant on coal-fired power and faces major electricity supply shortages. The country has, however, made progress on kickstarting a domestic hydrogen sector by releasing an ambitious strategy. It will need significant financial support to come to fruition. Otherwise, South Africa lacks decarbonization policy outside the electricity sector beyond a carbon tax with considerable concessions.

Both South Africa and Mexico boosted their circular economy scores by eight percentage points over last year – the biggest increases in this sector among the G-20. But this was mainly due to reasonable performance on the survey’s effectiveness metrics (in this case, lower waste emissions and generation), rather than increased government support. A similar pattern was found in several of the sectors. For example, Mexico scored points for its use of renewable energy production and energy efficiency for buildings and industry. But it lacks dedicated low-carbon policies aside from a relatively ineffective carbon tax. Renewable power deployment has slowed, partly due to the scrapping of the auction program as the government seeks to reassert

Power remains India's strongest sector for decarbonization policy, although it has improved policy support for CCUS and EVs

state control over the energy sector. A dearth of incentives, except for modest tax breaks, constrained deployment of EVs to less than 1% of 2022 vehicle sales.

Power remains India's strongest sector for decarbonization policy: it was second only to China in auctioning renewables capacity in 2022 through a range of designs to ensure the grid can deal with growing variable generation. The country also began standalone energy storage auctions in 2022. On the downside, the government's efforts to shore up domestic solar manufacturing have been more hindrance than help to date. Its biofuel targets may also be overly ambitious, though production and consumption have ramped up in recent years. In transport, purchase and other subsidies, as well as rising fuel costs, have helped spark some EV uptake in recent years. EVs more than tripled in 2022, reaching 1.3% of new vehicle sales. Four-wheeled EVs remain too pricey for most Indians.

India has improved its CCUS policy support, releasing a new strategy with a bold target, subsidies and a tax credit on operating costs. The government also announced relatively modest funding for clean hydrogen but none of the anticipated demand-side measures. The government plans to expand the energy-efficiency mandate on industry, although it has seen little progress slowing industry energy use. The country took a step forward in 2022 by announcing a new national ban on single-use plastics, but compliance is uncertain. India's sustainable agriculture policy so far has focused on specific areas like organic farming, with limited effect due to a lack of funding. The government has also introduced energy-efficiency measures, but these have been hindered by generous fuel and electricity subsidies.

Brazil has seen minimal change in its decarbonization policies in the last year, with one reason being the presidential election in late 2022

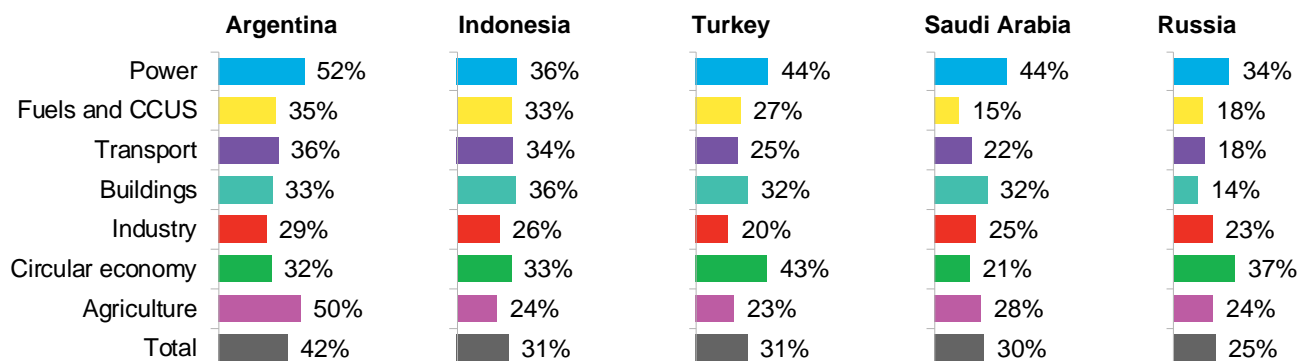
Brazil has seen minimal change in its decarbonization policies in the last year, with one reason being the presidential election in late 2022. Renewables auction volumes in 2022 were nearly a fifth below the preceding year, as new build is driven by the small-scale solar sector. Some rounds were also undersubscribed, while selling power under corporate offtake contracts could be more attractive. Outside power, Brazil lacks policy support. In industry, it lost points for increasing energy intensity, which was mitigated by a relatively high use of bioenergy. It has subnational regulations on single-use plastics, and while it generates relatively low volumes of municipal solid waste per capita per day, a relatively small share is treated and recycled. It remains a world leader for biofuels, though production and consumption have declined in recent years. Brazil has had mixed progress on the targets of the Low Carbon Agriculture Plan, partly due to modest allocated funding.

2.4. Quartile 4

Power is the highest-scoring sector for all countries in the fourth quartile, apart from Russia (which performs best on circular economy)

Power is the highest-scoring sector for all countries in the fourth quartile, apart from Russia (which performs best on circular economy). Four of the nations have at some stage procured renewables capacity through auctions but held no rounds in 2022. Other barriers have been political and economic crises, unexpected policy changes, grid bottlenecks and onerous local content requirements. As a result, renewables build has been patchy in recent years. These technologies account for between 0.4% (Saudi Arabia) and 36% (Turkey) of electricity generation. None of the nations has a coal phase-out target, while Indonesia and Turkey have sizeable pipelines for new coal-fired power-generating capacity.

Figure 12: Quartile 4 – 2023 scores



Source: BloombergNEF. Note: Each country’s total score is weighted by each sector’s share of national greenhouse-gas emissions

In general the countries in this quartile have implemented even less low-carbon policy outside the electricity sector. Argentina and Indonesia have had mixed progress on their biofuel blending mandates, for instance, while Russia and Turkey have little concrete support to realize their clean hydrogen strategies. Argentina lost points for industry policy after suspending a subsidy program, slowing renewables deployment and increasing emissions per unit of output, as did Indonesia. Unlike the others in this quartile, Argentina has released an Action Plan for Agriculture and Climate Change, which has bold targets. But it focuses on climate adaptation over mitigation, and relies on funding from developed countries. Russia’s highest score and Turkey’s second-highest were for circular economy; Russia has some level of policy support but compliance and enforcement are weak. All five of these countries treat and recycle a relatively small share of municipal solid waste, with low or no landfill taxes in place.

Section 3. Cross-sector policy issues

Most low-carbon policies are implemented at the sector or technology level. But there are substantial policies that impact multiple, and sometimes all, economic sectors. These are the focus of this section.

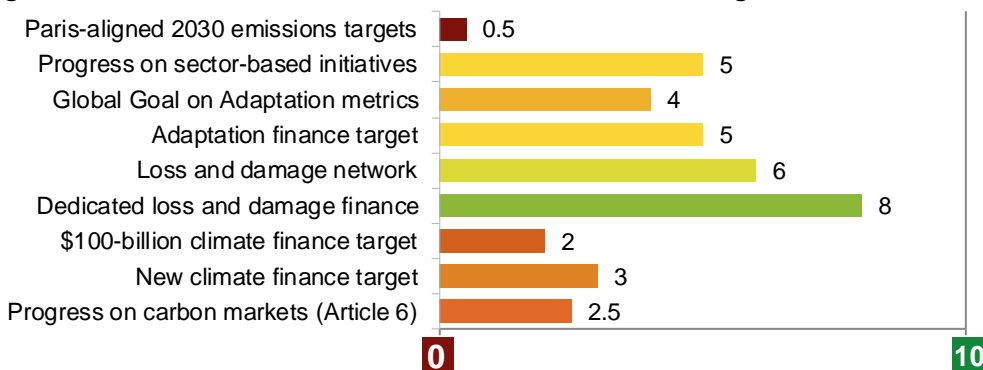
The highest-profile cross-sectoral policy issues tend to center on international climate negotiations. In 2022, the COP27 climate talks arguably failed to deliver on accelerating international and national climate action. On a similar low note, the G-20 countries provided nearly \$700 billion in public support for fossil fuels in 2021. But the last year has seen some of these nations introduce or improve carbon-pricing programs and make progress on mandating climate-risk disclosure by companies.

3.1. Climate negotiations

The UN climate summit in Sharm el-Sheikh largely failed to deliver on its promise to be an “implementation COP”

The UN climate summit in Sharm el-Sheikh largely failed to deliver on its promise to be an “implementation COP”. BNEF rated COP27 a 3.7 out of a possible 10 based on what was (and notably, was not) achieved in nine key areas (Figure 13). By comparison, COP26 scored a 6.

Figure 13: Evaluation of achievement for nine metrics of a meaningful COP27



Source: BloombergNEF, *Implementation COP Fails to Implement Much Climate Action* ([web | terminal](#))

The Sharm el-Sheikh Implementation Plan mostly maintained the level of ambition achieved at COP26. Like the Glasgow Climate Pact, the COP27 deal resolves to limit global warming to 1.5C and recognizes that this would require a 43% decrease in global emissions over 2019-2030, in accordance with the latest report by the Intergovernmental Panel on Climate Change. (For 2C, the reduction must be 25% or more.)

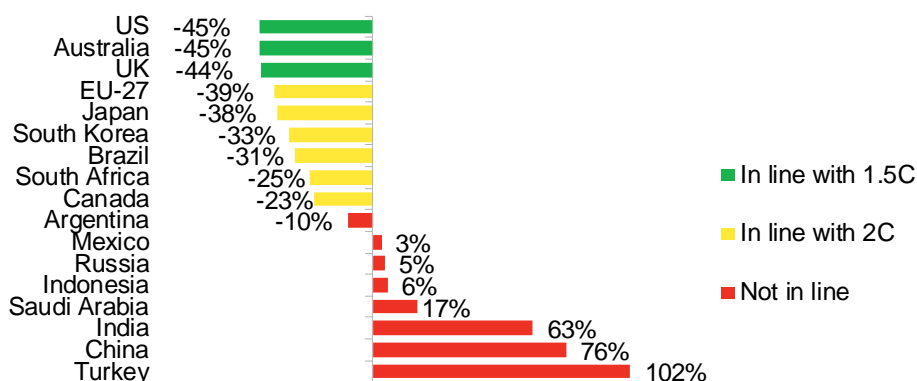
As for countries’ short-term strategies, the COP27 cover decision “requests parties that have not yet done so to revisit and strengthen the 2030 targets in their nationally determined contributions as necessary to align with the Paris Agreement temperature goal” but pushes the deadline to “end of 2023”. Again, it was caveated by the principle of “taking into account different national

The 2030 emissions targets of half the G-20 countries would not be in line with a 2-degree scenario

circumstances”. The bottom-up approach of the Paris climate deal means that parties cannot be forced to take on more ambitious pledges.

This wording is especially lax: it is not clear if parties should have strengthened their 2030 target within a particular period (for example, since COP26, the last two years, or even longer). Four G-20 countries – Australia, India, Indonesia and Mexico – have announced bolder 2030 emission-reduction targets since the 2021 summit, as requested in the Glasgow Pact. Yet half the G-20 countries would not be in line with even a 2-degree scenario (Figure 14). Given that these nations account for 80% of global emissions, it is no surprise that at a global level, climate plans are not sufficiently ambitious to avoid the worst climate outcomes. In October 2022, a UN report confirmed that, if implemented, governments’ climate targets announced by September 2022 would result in a 0.3% reduction in greenhouse-gas emissions over 2019-2030.

Figure 14: Change in greenhouse-gas emissions if G-20 countries’ 2030 targets are met



Source: World Resources Institute CAIT Climate Data Explorer, UNFCCC, BloombergNEF. Note: Change over 2019-2030 implied by unconditional or least ambitious targets, including land use and forestry emissions. The value may differ from estimates in BNEF’s New Energy Outlook 2022 ([web](#) | [terminal](#)) due to differences in scope on greenhouse gases and sectors covered.

The highlight of COP27 was a commitment to create a new dedicated fund to support “vulnerable” developing countries facing loss and damage from climate change

The highlight of COP27 was a commitment to create a new dedicated fund to support “vulnerable” developing countries facing loss and damage from climate change. Governments have yet to answer challenging questions on scope, recipients and contributors, with developed countries adamant that funding should also come from major emerging economies (notably China).

However, securing this concession arguably came at the expense of efforts to approve more ambitious action to cut emissions. Rich nations showed little motivation to deliver on the \$100 billion of climate finance that had been due to be reached by 2020, and most funding pledges in Egypt were for minor amounts. The COP27 deal is arguably weaker than the Glasgow pact as it makes no mention of a deadline. Countries also failed to reach consensus on changing “phasedown” of unabated coal to a phase-out, or on extending the scope of that promise to all fossil fuels.

Countries were meant to determine some of the final details behind the new global carbon offset schemes known as Article 6. But the texts adopted encouraged secrecy, could result in double counting of carbon credits and failed to address concerns around Indigenous Peoples’ rights. Other issues have been deferred to the 2023 summit.

3.2. Fossil-fuel support

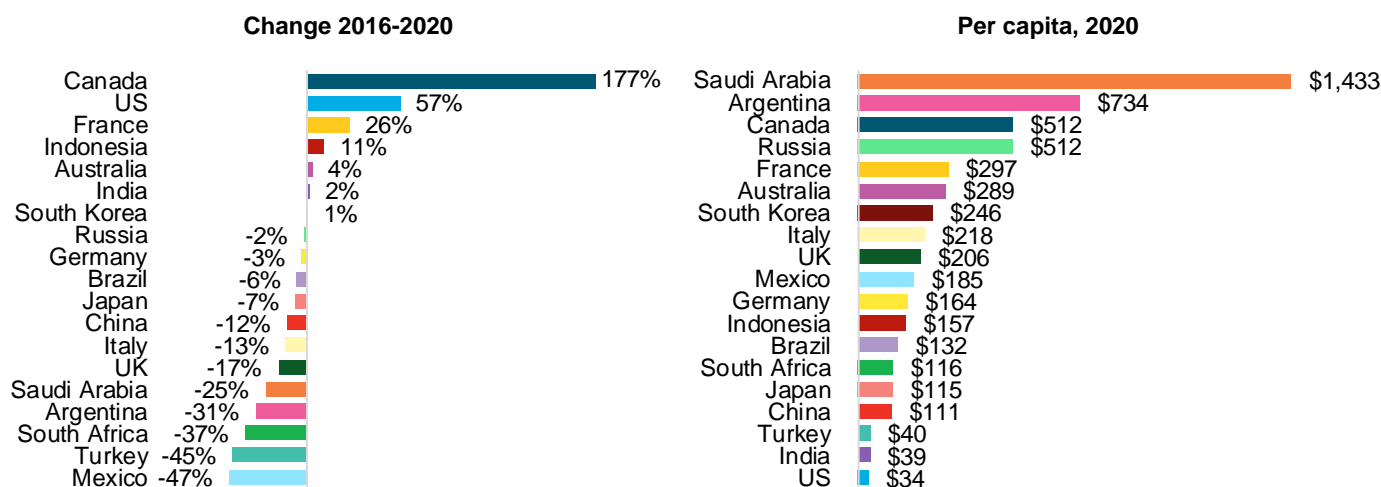
This Scoreboard takes account of the G-20 countries' cross-sector policy support in three main ways: phasing out fossil-fuel subsidies, implementing carbon pricing (Section 3.3) and introducing mandatory climate-risk disclosure for investors (Section 3.4). These are three concrete areas in which G-20 governments can act today to make significant contributions toward achieving the Paris Agreement goals, and their progress is tracked in BNEF's *Climate Policy Factbook*, with the last edition ([web](#) | [terminal](#)) released just before COP27.

G-20 governments and state-owned institutions provided some \$693 billion in support for coal, natural gas, oil and fossil-fuel power in 2021, based on BNEF's provisional estimates

On the first of these areas, G-20 governments and state-owned institutions provided some \$693 billion in support for coal, natural gas, oil and fossil-fuel power in 2021, based on BNEF's provisional estimates. This was the highest total since 2014, driven by increased aid in the form of retail energy price subsidies, tax breaks and budgetary transfers. Fossil-fuel support in 2020 was slightly lower, at \$598 billion, as reduced energy use due to Covid-19 allowed governments to spend less.

At a country level, China may have accounted for the largest share (26%) of G-20 fossil-fuel support in 2020. But it is well below other G-20 members on a per-capita basis – at \$111 in 2020 compared with, for example, Saudi Arabia (\$1,433), Argentina (\$734) and Canada (\$512) (Figure 15). China also scaled back this support by 12% over 2016-2020, while Canada more than doubled fossil-fuel support over 2016-2020, giving it a high per-capita total.

Figure 15: Change in fossil-fuel support, 2016-2020



Source: OECD, International Energy Agency, Oil Change International, Overseas Development Institute, BloombergNEF. Note: Includes budget transfers, tax expenditure, public finance, investment by state-owned enterprises (SOE) and consumer-price support. Data for all years have been updated and therefore may differ from previous editions of the Factbook

Fossil-fuel support from governments impedes the climate transition by distorting energy prices, encouraging wasteful use and production of fossil fuels, and resulting in investment into long-lived, emission-intensive equipment and infrastructure. Even consumer-targeted subsidies disproportionately benefit wealthier consumers. Phasing out this support entirely has the potential to accelerate the climate transition and achieve the goals of the Paris treaty.

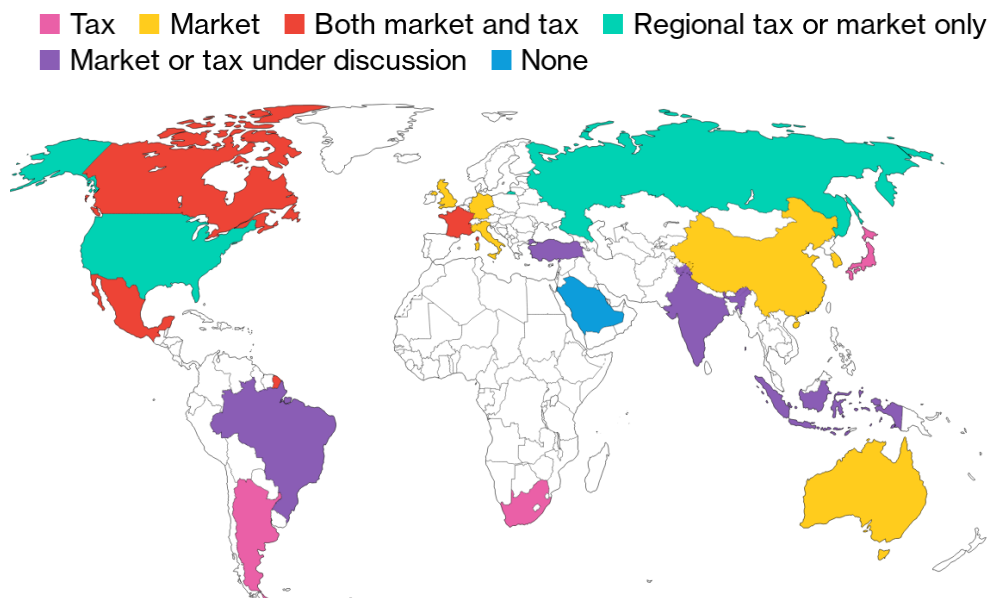
3.3. Carbon pricing

In total, 11 G-20 countries have operational nationwide carbon prices in place, though most are ineffective at driving decarbonization

In total, 11 G-20 countries have operational nationwide carbon prices in place. Indonesia has also passed legislation to introduce a CO2 tax though it is only due to start in 2025. Such policies are meant to force polluters to cover the societal costs associated with their greenhouse-gas emissions. But most are ineffective at driving decarbonization. This is because they feature carbon prices that are too low to influence behavior, grant certain emitters special allowances, or exempt emitters entirely from such schemes.

For example, China’s and South Korea’s carbon markets offer a sizeable share of permits for free. Argentina’s and Japan’s taxes may cover a sizeable share of national emissions, but the rates are too low to spur change.

Figure 16: Carbon markets and taxes across the G-20



Source: Governments, BloombergNEF

A national carbon price does not appear in the cards for the near future in the US or Russia, although a rising number of subnational policies have come into force in the last year, with the states of Washington and Oregon beginning their emission-trading schemes.

Overall Europe and Canada remain G-20 leaders for robust carbon policies, with prices close to or far above the level needed to limit global warming to 2C

Overall Europe and Canada remain G-20 leaders for robust carbon policies. In particular, prices in those jurisdictions are close to or far above the level needed to limit global warming to 2C above pre-industrial levels by the end of the century. The World Bank estimates this range to be \$40-\$80 per metric ton by 2020 and \$50-\$100 by 2030. The European Emissions Trading System has seen prices average €83 (\$87) per metric ton over the last year, while Canada’s national carbon price is currently pegged at C\$65 (\$48) per metric ton.

South Africa is also now moving in the right direction, after the government announced in February 2022 that the national CO2 tax would rise to \$30 per metric ton by 2030 and to \$120 beyond 2050. However, it also extended the current rules on tax-free allowances for another three years, enabling some companies to reduce their exposure.

Russia has now implemented its first pilot carbon-trading scheme, in the eastern region of Sakhalin. The program covers less than 1% of national emissions, so the country is classified as “mixed progress” in BNEF’s *Climate Policy Factbook* ([web](#) | [terminal](#)). Four G-20 nations lack carbon-pricing schemes and are deemed to be “wrong direction or insufficient progress”.¹

Carbon import tariffs

The EU adopted in 2Q 2023 the regulation to implement the Carbon Border Adjustment Mechanism (CBAM). The CBAM will be the first policy in the world to tax imports based on greenhouse-gas emissions and should enable the EU to reduce the generous free allocation to industrial companies without the risk of carbon leakage. A three-year transitional period begins October 1, 2023, but industrial players have time to get used to the new set-up as full auctioning of permits will only begin in 2034. In the meantime, various governments have voiced concerns about the carbon border tax. Some, including the US, Canada and the UK, are mulling implementing their own policies, or have argued they should be exempted from the CBAM.

3.4. International carbon markets (Article 6)

Countries have made little progress toward implementing the new international carbon market mechanisms known as Article 6

International trading of offsets looked set to take off after governments agreed the principal rules for new carbon market programs, known as Article 6, at COP26. Countries were meant to make more progress on the finer details of the new mechanisms at COP27. For much of the summit in Sharm el-Sheikh, it was touch-and-go on whether parties would reach consensus.² Eventually, they adopted a text but in large part punted on agreeing key issues to COP28, at the end of 2023. Otherwise, the text encouraged secrecy in the market, could result in double counting of carbon credits and failed to address concerns around Indigenous Peoples’ rights.

In the meantime, only a handful of Article 6.2 deals – those that use the accounting framework for international cooperation on climate action – have since taken place. The UN is still aiming for the global offsets market known as Article 6.4 to become operational by the end of this year, despite the slow progress.

Role of voluntary carbon registries

Voluntary registries play a central role in the trade of carbon offsets. Their supporters are looking to have them adapt to offer Article 6 credits.

Carbon offsets are typically verified via one of three mechanisms:

- Voluntary carbon registries, such as the Verified Carbon Standard or Gold Standard.
- National or regional carbon offset schemes, such as California’s offset program or Australia’s Emissions Reduction Fund.
- International crediting mechanisms, such as the Clean Development Mechanism (CDM) or Article 6.

Voluntary carbon registries have recently become the preferred route, accounting for over three-quarters of offsets issued in 2021. Only 11% of issuance last year came via international crediting mechanisms – in this case, the CDM.

1 *Carbon Markets in Asia Use Voluntary Programs as Launchpad* ([web](#) | [terminal](#)).

2 *Implementation COP Fails to Implement Much Climate Action* ([web](#) | [terminal](#)).

Voluntary registries are also now also trying to take advantage of the potential market offered by Article 6 trading. One of the big four voluntary registries, Verra is consulting on a proposed set of labels to specify if a project is aligned with Article 6. These labels aim to give assurance to buyers that the credits they acquire will be appropriately accounted for by the host country. It is unclear whether this type of initiative will accelerate or simply add to the plethora of initiatives currently in the voluntary carbon market space. Results of the consultation are expected later this year. Another registry, Gold Standard, piloted an initiative to work with select project developers in 2022 to understand what the steps, processes and assumed rules would need to look like to comply with Article 6 requirements once they are finalized.

Article 6.2 deals

However, not all countries have been completely put off by the slow start to Article 6

Not all countries have been completely put off by the slow start to Article 6. Switzerland wasted no time lining up 12 agreements with other nations to source offsets. Two are purchase agreements under which Switzerland will purchase certain volumes of credits from certain nations. The remainder are simply cooperative arrangements under which purchases could take place in the coming years. South Korea has also started negotiating with 17 nations in a bid to secure future contracts.

India recently published a list of the 13 activity types it has deemed eligible for Article 6.2 credits – such as sustainable aviation fuel, green hydrogen and CCUS projects – before it plans to establish a voluntary carbon market later this year. Japan, meanwhile, is taking a slightly different approach by allowing other countries to take part in its existing domestic offset program, the J-Credit Scheme. It now has bilateral deals with 21 nations that will allow offset trading aligned with Article 6 requirements and has just released its first call for business proposals with a total budget of around 15 billion yen (\$112 million).

Why might others be waiting?

Article 6 has also been slow out of the blocks because countries still have time to spare before the 2030 deadlines associated with their NDC targets arrive. Demand is therefore likely to ramp up toward the end of the decade as governments seek to source offsets to plug gaps left by insufficient domestic emissions reductions.

In addition, some countries have expressed hesitancy around using offsets to achieve their climate goals instead of domestic carbon abatement. The US and EU, for instance, have both signaled they will not use Article 6 to achieve their targets. This could be due to historical debates over the environmental credibility of some carbon offset projects.

Some countries, like Indonesia and Papua New Guinea, have announced restrictions on the export of carbon offsets from domestic projects. India has banned the export of offsets to international companies over fears it will not have enough remaining credits to meet its own goals. These emerging economies have historically played a key role in the global carbon market as a source of offsets.

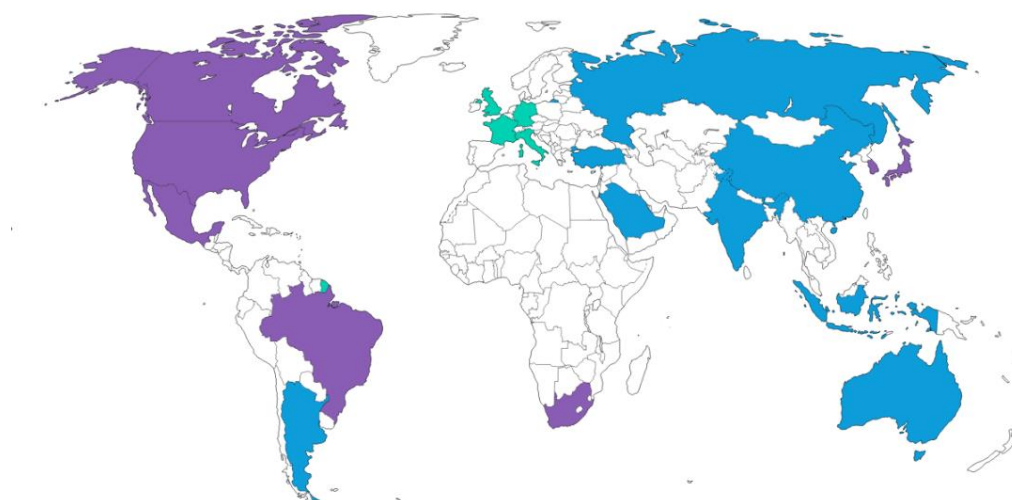
3.5. Climate-risk disclosure

More and more policymakers are voicing concerns over the risks to financial stability from climate change, with all G-20 countries having at least one policy to raise awareness on corporate social responsibility or sustainability

More and more policymakers are voicing concerns over the risks to financial stability from climate change, with all G-20 countries having at least one policy to raise awareness on corporate social responsibility or sustainability. More working groups, pilot projects and guidance documents on what is needed to build financial institutions’ capacity to assess and mitigate climate risks were launched last year. For example, Canada, Turkey and South Korea all released policy roadmaps to advance their sustainable finance regulatory frameworks, and in some cases, they have specifically focused on climate-related risk regulations.

Figure 17: Implementation of climate-risk disclosure policy

- Right direction
- Mixed progress
- Wrong direction or insufficient progress



Source: BloombergNEF, *Climate Policy Factbook: COP27 Edition* ([web](#) | [terminal](#)). Note: As of November 2022. Rated based on implementation of mandatory, specific nationwide climate-risk disclosure for investors (asset managers and pension funds).

At its 2021 summit, the G-7 backed “moving towards” mandatory climate-risk disclosure, but so far the three EU member states and the UK are the only G-20 countries to have put in place such nationwide regulations on investors (asset managers and pension funds). Japan has started with a subset of companies only. More G-20 members have pledged to assess and mitigate the climate-risk exposure of their financial systems, but only the US has proposed a regulation that is undergoing approval. While voluntary guidance may help improve financial market participants’ capabilities without being too disruptive for current market practices, the approach allows institutions to delay action. Some regulators have focused their efforts only on having companies disclose the effects climate change will have on the firm’s performance. But others like the EU have implemented “double materiality”, requiring companies to disclose as well how their actions are impacting the climate.

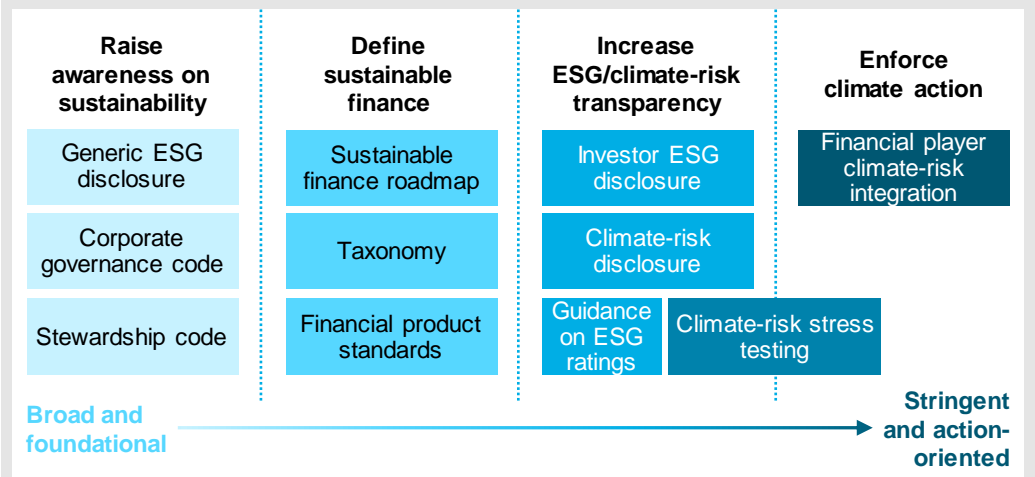
Central banks have also begun to play larger roles. In the last year, China, Australia, Canada and Japan have initiated pilot climate-risk stress-tests, designed to help financial players gain experience assessing climate-related risks and raise awareness about potential losses from inaction. More countries are also working on or have passed some generic environmental disclosure rules and green taxonomies. This list includes Australia, South Korea and Indonesia.

Environmental taxonomies help identify which activities should be financed first to support the low-carbon transition of economies. Despite being voluntary in most countries, taxonomies bring more transparency and can help standardize company reporting, which informs the analysis by financial institutions.

Navigating sustainable finance policies

To help readers navigate the policy complex and understand the role of new policies in the market, BNEF created a sustainable finance ‘policy framework.’ This framework classifies 11 types of environmental, social and governance (ESG) sustainable finance and climate-related policies into four phases of development. These are defined according to BNEF’s view of the distinct steps that categorize the maturing of sustainable finance markets – from broad and foundational policies, to more stringent and action-oriented ones – even though regulators may not follow this exact order when introducing policies. See: *Navigating Sustainable Finance Policies: Global Overview and Outlook* ([web](#) | [terminal](#)).

Figure 18: Sustainable finance policy framework



Source: BloombergNEF

3.6. Shifting clean-tech supply chains

G-20 countries are increasingly keen to localize the production of clean technologies within their borders

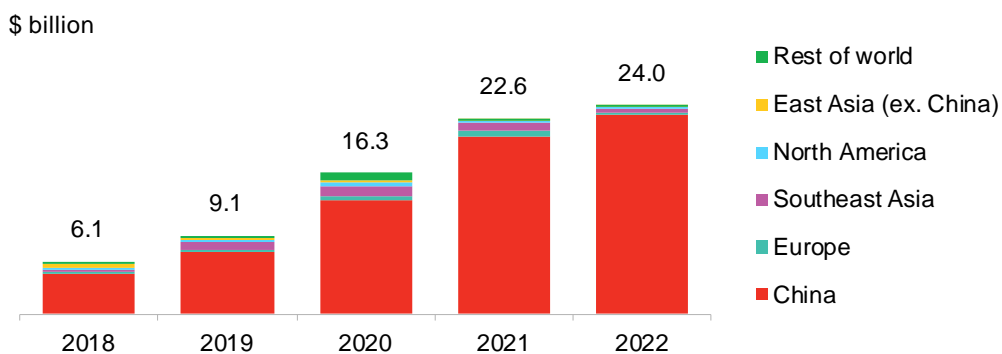
G-20 countries are increasingly keen to localize the production of clean technologies within their borders. In devising industrial strategies that prioritize the local manufacture of solar, batteries and electrolyzers or the extraction and refining of battery metals, governments have set their sights on several goals. These include local job and value creation, and easing reliance on Chinese imports. Some policies are focused on incentivizing production within domestic borders, while others seek to help trade partners grow their own supply chains.

If it takes off, this trend may buck the primacy of economic efficiency that characterizes today’s clean tech ecosystem. This section looks at where clean tech supply chains are expanding, and unpacks the policies that aim to drive the creation of a local manufacturing base for key low-carbon technologies.

It is generally appreciated that factories producing solar and lithium-ion batteries and their related inputs are largely concentrated in China. The country harbors over two-thirds of the world’s production capacity across 11 key clean-energy segments, including polysilicon and wafers for

solar, and cathodes and anodes for batteries. What is perhaps less understood is how that manufacturing base is still expanding at a rapid pace: China continued to account for over 90% of new solar and battery factories by capex value in 2022. For PV, that share amounted to a whopping 96% (Figure 19).³

Figure 19: Estimated capex represented by yearly solar factory additions by geography



Source: BloombergNEF. Note: Includes factories manufacturing polysilicon, wafers, ingots, cells and modules. 2022 data covers January to November.

Sustained domestic investment in factory additions continues to strengthen China’s dominance of clean tech. But the beginnings of a potential shift are discernible as policymakers worldwide set their sights on onshoring clean energy supply chains

Industrial strategy meets clean tech

Sustained domestic investment in factory additions continues to strengthen China’s dominance of clean tech. But the beginnings of a potential shift are discernible as policymakers worldwide set their sights on onshoring clean energy supply chains. In August, the Inflation Reduction Act (IRA) fired the starting shot for a renewed bid to foster a made-in-America energy transition for everything from PV and wind turbines to battery components and their associated metals. Its provisions harbor the promise of domestic job creation and aim to diversify concentrated clean-tech supply chains.

The IRA has elevated industrial policy – targeted government interventions to expand favored sectors – to a renewed prominence in the energy transition. New production tax credits will subsidize the production of specific components in the US. These credits typically amount to a substantial portion of equipment costs and, like many IRA incentives, are budgetarily unlimited. That is, there is theoretically no cap on how much they might draw from the federal budget for as long as they are available (2023-32 for the most part). The \$57.6 billion of EV and battery-making projects announced post-IRA suggests that investors are taking the bait.

The IRA’s latent protectionism is especially evident when it comes to EVs. The local-content strings attached to a \$7,500 EV subsidy are particularly controversial. Making an EV model eligible for the full credit requires the fulfillment of two criteria: one mandates assembly in North America, the other that EV critical minerals be sourced from places with which the US has a free trade agreement (FTA). These rules would appear to run afoul of international trade law, and South Korea and the EU have complained loudly.

Policymakers struggle to strike the balance

After initially bristling at the IRA’s provisions, however, some US trade partners decided to play ball. Certain countries lacking FTAs with the US have drawn up agreements that would see them

³ Energy Transition Investment Trends 2023 (web | terminal).

qualify for the EV tax credit's critical minerals requirement. The European Commission is keen to arrive at a similar understanding, although the negotiations could be fraught. The IRA's provisions are currently being clarified, as the Treasury develops additional guidance on exactly who is eligible for what.⁴

Table 1: EU manufacturing targets in context

	Installed EU capacity, 2022	EU target, 2030	Targeted growth 2022-2030	Share of forecast demand, 2030	Required factory capex, 2023-2030
Li-ion batteries	20GWh/year	550GWh/year	x27.5	74%	\$75.8bn
Solar	1.5GW/year	30GW/year	x20.0	39%	\$16.0bn
Wind	21.5GW/year	36GW/year	x1.7	106%	n/a
Electrolyzers	2.2GW/year	38GW/year	x17.3	40%	\$3.7bn

Source: BloombergNEF. Note: Targets referred to by the Act for different technologies highlighted in green. Share of BNEF forecast demand shown rather than demand forecast by the European Commission. For installed EU capacity, solar refers to PV cells, wind to nacelle, batteries to battery cells (installed battery capacity includes non-EU Europe). Investment includes upstream components for batteries and solar excluding polysilicon.

The EU is concerned that the IRA's allure will divert investment to the US. In response, its proposed Net-Zero Industry Act, revealed in April 2023, aims to show that the EU is also serious about clean-tech supply chains. The act's targets foresee onshoring production across clean tech sectors (Table 1). A European Critical Minerals Act, also in the proposal stage, aims to build out the extraction and refining of metals key to making batteries

Shortcomings include a dearth of actual funding associated with the initiative. The policy also makes it no easier to access existing sources of funds, and it lacks clarity on key details such as, say, which parts of clean-tech value chains are covered by the onshoring targets. What's more, the act would appear to undermine the EU's stated objective of playing by WTO rules by proposing bold localization targets.⁵

Replicating China's supply chains elsewhere is a monumental task and comes at a cost

India, on the other hand, has been entirely unambiguous about its goal of onshoring more manufacturing. The government, often keen to apply protectionist policies for choice sectors, has made a bid to localize solar manufacturing. Its industrial policy arsenal is impressive, composed of a hefty import tax on solar modules, a strict list of approved producers, a manufacturing subsidy and domestic content rules.

Introduced over the last two years, the policies are already showing signs of being excessive. A 40% import tax on modules introduced in April 2022 resulted in equipment scarcity and hiked project costs. Policymakers have since relented, relaxing rules on local content and approved manufacturers. While the EU may have been too timid in attempting to meet its onshoring goals, India may have gone too far too quickly.⁶

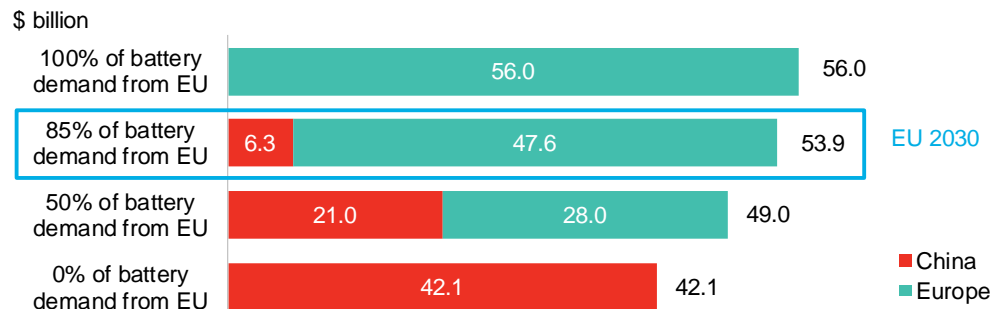
Onshoring supply chains is not all fun and games

While vertiginous declines in the solar and battery costs owe much to Western technology, it was sustained Chinese investment over more than a decade that brought them to scale. Replicating those supply chains elsewhere is a monumental task. Doing so also comes at a cost: building the

4 Everything EV All at Once: New US Tax Credits Explained ([web](#) | [terminal](#)).
 5 Europe's Bid to Reshore Clean Tech Pulls Its Punches ([web](#) | [terminal](#)) and EU's Critical Minerals Act Lacks Incentive and Funding ([web](#) | [terminal](#)).
 6 India's Muddled Solar Policy Is a Failure on Two Fronts ([web](#) | [terminal](#)).

clean-tech factories implied by the EU's 2030 onshoring targets would require about \$74 billion. Even greater than upfront factory spending is the inflationary impact on the wider energy transition. The EU would require that 85% of EV and energy storage batteries used in the bloc be locally sourced, but when compared to a scenario reliant on Chinese batteries, doing so would boost deployment costs by an annual \$12 billion (Figure 20).

Figure 20: Yearly cost of meeting the EU's battery manufacturing target under different scenarios in 2030



Source: BloombergNEF. Note: Total cost of all batteries bought for EVs and storage. Uses European Commission demand forecast of 647GWh. Includes cost of transporting batteries.

Geopolitics are increasingly hard to ignore as the China-US rivalry spills into the technological realm

Geopolitics are increasingly hard to ignore as the China-US rivalry spills into the technological realm. The White House has long restricted imports of PV products, but moves to actively cut China off from other 'strategic' technologies are in full swing. From October 7, 2022, firms using US components, people or code to make semiconductors destined for China were told to stop. The US has pressured the likes of the Netherlands to impose restrictions of their own.

Tit-for-tat responses from China could target clean tech where it has a near-monopoly. China could throttle exports of factory equipment just as Western manufacturers seek to build out their production capabilities. In early 2022, Chinese ministries proposed curbing exports of equipment used to make the ingots and wafers from which PV cells are fashioned. Restricted access to factory equipment could hamstring plans to grow a clean manufacturing base.⁷

Opportunities for escalation abound. Whether the US deems China a "federal entity of concern" under the IRA could rule out tax-credit eligibility for, say, EVs using equipment sourced from such entities. Those rules won't come in force until 2024, but uncertainty on whether they will apply to China may well deter investments. So too could suspicion around Chinese investments, as shown by the political scrutiny applied to a US battery plant to be built by Ford while licensing technology from China's CATL, the world's largest battery-maker. Preventing firms at the technological bleeding-edge to invest in the US shuts out a vital source of manufacturing know-how.

⁷ [Who Wins and Who Loses If China Bans Solar Tech Exports? \(web | terminal\)](#).

Section 4. Focus section: energy crisis

The global crisis of the last 18 months has driven energy reliability and affordability up the political agenda

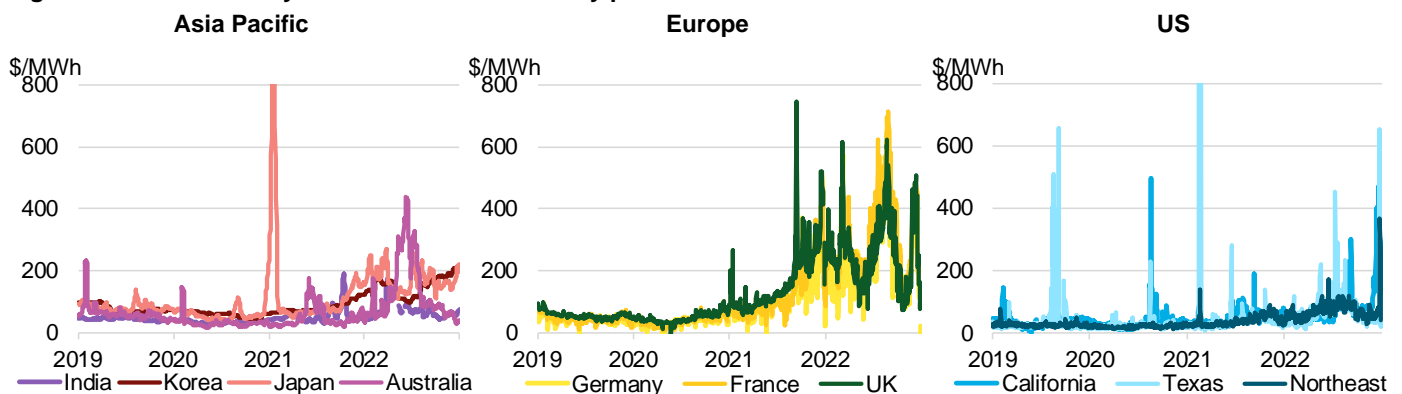
Energy policymakers must juggle a trilemma of sometimes conflicting priorities: affordability and access; security of supply; and environmental sustainability. Over 2015-2021, many governments focused on how to achieve a ‘cleaner’ energy mix. However, the global crisis of the last 18 months has driven energy reliability and affordability up the political agenda. This section explores how the G-20 governments have responded to these pressures and to what extent these efforts could impede their efforts to decarbonize the energy sector.

Each Policy Scoreboard includes a special section highlighting a pertinent issue with potential repercussions for the G-20 nations’ decarbonization. The measures discussed in this section only feed into a country’s score if they relate to a type of low-carbon policy included within the Scoreboard methodology (Appendix A.1).

4.1. Causes and effects

Various factors combined in 2022 to tip the world into a fully fledged global energy crisis. These drivers included the post-Covid economic recovery, overdue maintenance work and lack of investment in energy infrastructure, already tight energy markets, and in February 2022, Russia’s invasion of Ukraine. The scale and effects of this crisis have varied across countries. Europe and parts of Asia have been especially exposed to the effects: pre-2022, Russia accounted for 40% of gas consumption, 27% of oil imports and 52% of coal imports in the EU. Japan and South Korea, for example, have been hit because they rely on energy imports: they have the second- and third-lowest primary energy self-sufficiency ratio out of the OECD members, at 12.1% and 17.7% in 2019. This compares with the US at 104.2% and Australia 338.5%.

Figure 21: Wholesale day-ahead baseload electricity prices in selected markets



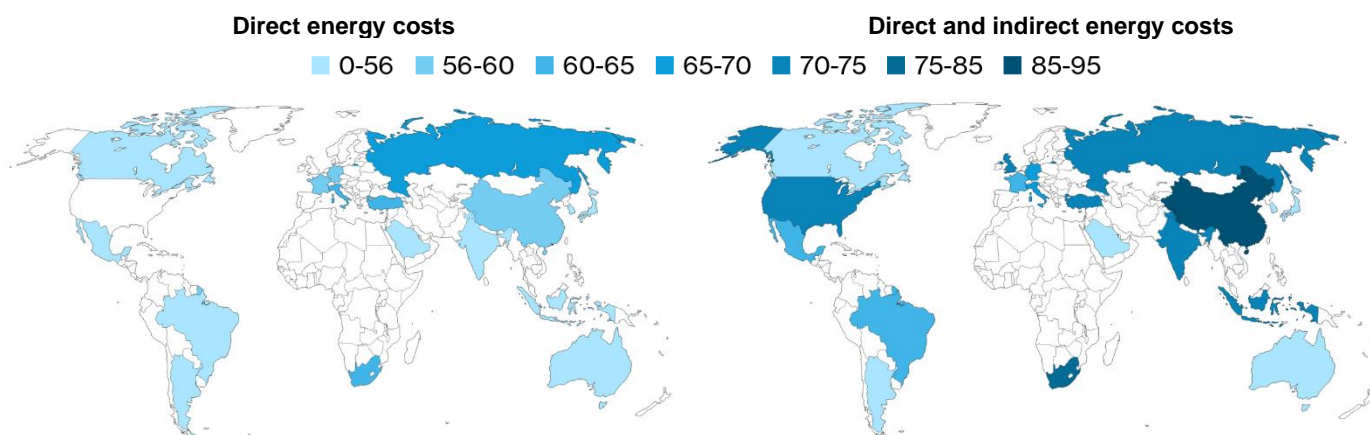
Source: Bloomberg terminal, Australian Energy Market Operator, JPEX, Energy Market Company, Ministry of Power. Note: Australia is average of Queensland and Victoria. Japan is average of Japan East and West. California is CAISO SP15. Texas is ERCOT North Hub. Northeast is PJM East Hub.

Europe had to increasingly rely on shipped liquefied natural gas (LNG) as Russian gas flows into the continent dwindled. This process had started in the summer of 2021, and was exacerbated after the Russian invasion of Ukraine. LNG imports to Western Europe surged to 99 billion cubic meters (Bcm) in 2022 – a year-on-year gain of 47Bcm as LNG accounted for 70% of the lost Russian supply. However, for Europe to attract such high volumes, the European gas benchmark (TTF) had to price out Asian markets like India, Pakistan and Bangladesh out of the spot market and trade at a premium to the Japan-Korea Marker (the spot price index for LNG delivered to Japan and South Korea). With many major economies dependent on gas for power generation, electricity prices also rose (Figure 21). Average wholesale power prices in 2022 in France, Australia and Germany were four times 2020 levels; almost triple 2020 levels in Japan, South Korea and the UK; and double 2020 levels in India.

Other countries in the APAC region have faced a double whammy of the global crisis and their own energy-related challenges: India experienced power shortages in 2Q-3Q 2022 mainly due to hotter-than-average weather and faster rise in economic activity increasing demand for electricity.⁸ At the same time, electricity production was constrained by fuel shortages and high international prices. The hot summer also pushed up electricity demand in Japan and South Korea, raising power prices. As well as abnormally hot weather, China experienced an unexpected drought last summer, resulting in serious power shortages in Sichuan – the country’s biggest hydropower producer. Australia faced a power crunch due to high gas prices and the fact that around a quarter of its coal-fired generating capacity was offline for maintenance or unplanned outages.

As a result of wholesale price increases, retail consumers have seen energy costs surge. Households in most G-20 countries, especially in Europe and Asia, faced higher energy costs in September 2022 compared with the previous February levels. These increases were even greater – and covered more countries – when both direct and indirect costs were taken into account.

Figure 22: Energy cost changes (%) for households in G-20 countries between Feb. 23 and Sept. 13, 2022



Source: Guan, Y. et al, “Burden of the Global Energy Price Crisis on Households,” *Nature Energy*, Feb. 16, 2023; BloombergNEF.
 Note: Indirect energy costs include costs incurred due to the impact of rising energy costs on goods and services.

The US also saw a significant spike in energy prices in 2022, although the country’s average gas and power prices remained lower than Europe. For example, wholesale electricity prices in California were on average 150% more than 2020 levels, and 238% more than 2020 levels for

8 [India’s Acute Power Crisis Could Worsen in Coming Months \(web | terminal\)](#)

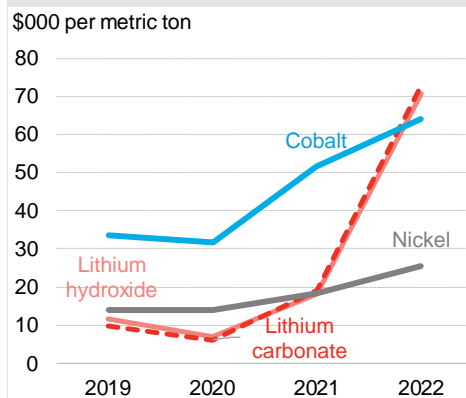
PJM in the Northeast US. The country was especially affected by surging oil prices in large part , recovery in domestic gasoline demand and a lack of global refining capacity. This sent retail prices at the pump to over \$5 per gallon in July, their highest level on record. Gasoline consumption fell in response.

Impact of Russia’s invasion of Ukraine beyond energy

Russia’s invasion of Ukraine did not only affect energy: metals markets were also thrown into disarray, as Russian exports are used in a wide range of products ranging from steel for bridges to platinum for catalytic converters used in cars. Lithium carbonate, for example, averaged \$72,831 per metric ton in 2022 – 3.8 times the 2021 price (Figure 23).

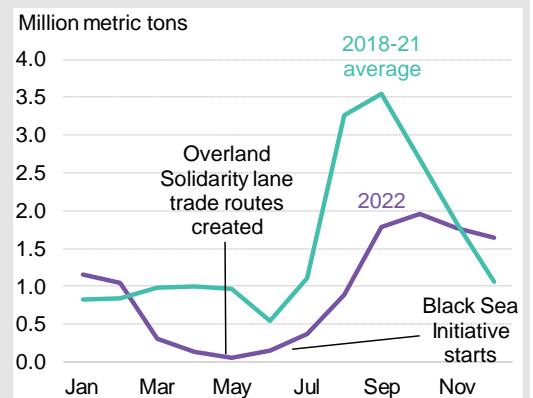
In agriculture, the war has resulted in the annexation of some of the world’s most fertile land, sending the upcoming grain harvest and exports to record lows. Fertilizer production and prices are controlled by gas prices, causing many plants to reduce or shut down production, driving up costs throughout Europe and abroad. The energy crisis has also rippled through other parts of the food and agriculture supply chains. Liquid CO2 used in food and beverage production has been in short supply, and crop protection chemical production has shifted from Europe to China, which has been unable to keep up with demand. The conflict has added fuel to already rampant food inflation across the world. The poorest and most vulnerable populations are being hit hardest, especially those directly reliant on Ukrainian and Russian grain imports.

Figure 23: Battery metals prices



Source: *Battery Metals Monthly: Turbulence Ahead* ([web](#) | [terminal](#)), *Fastmarkets*, *Asian Metal Inc*, *London Metal Exchange*

Figure 24: Ukraine wheat exports



Source: *Ukraine War Has Tainted Europe’s Breadbasket for Years* ([web](#) | [terminal](#))

4.2. Government responses

Government responses to the energy crisis have differed in form and scale. But broadly speaking, measures have varied along two parameters:

- They targeted either the demand or supply side of the market.
- They sought to protect market participants from the effects of the energy crisis, or they aimed to tackle the energy shortage directly.

With most possible responses, the government had to compromise on one or more elements of the energy trilemma.

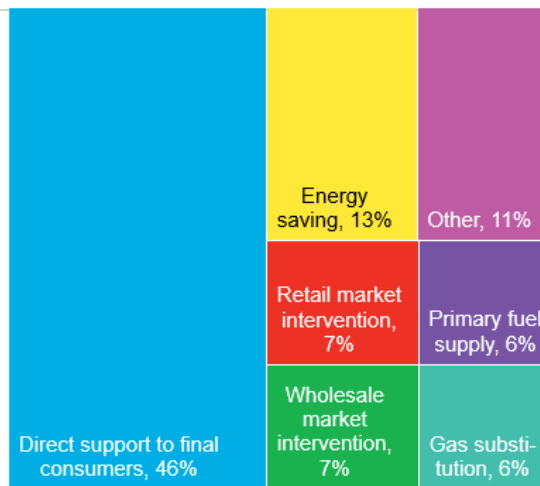
Table 2: Examples of government responses to the energy crisis and the potential impact on elements of the energy trilemma

		Intervention objective	
Target	To protect consumers and producers		To ensure adequate supply
Demand side	Retail price caps		Demand response and energy efficiency incentives (eg, grants, loans, vouchers, points)
	Grants, loans, tax cuts		Mandated energy rationing
	Windfall taxes/clawbacks		
		Clean: ● Secure: ●● Cheap: ●●●	Clean: ●●● Secure: ●●● Cheap: ●●
Supply side	Wholesale price caps		Incentives for low-carbon energy supply
	Loans, guarantees and other subsidies		Incentives for new fossil-fuel energy supply
	Corporate bailouts		
		Clean: ● Secure: ●●● Cheap: ●●	Clean: ●● Secure: ●●● Cheap: ●●

Source: BloombergNEF

Legend: Focus – ● Low ●● Mixed ●●● High Type – Incentive Regulation

Figure 25: Types of emergency measures implemented by EU nations and Norway in 2022



Source: ACER, BloombergNEF

The most common government response to the energy crisis has been measures to protect energy consumers, mostly in the form of policy “carrots” like funding

To protect consumers and producers

Some 64% of emergency measures implemented by EU countries and Norway in response to the energy crisis focused on affordability, and 36% on security of supply, according to data from the European Union Agency for the Cooperation of Energy Regulators (ACER). This also explains why the most common type of measure in Europe has comprised direct support to final consumers (Figure 25), mostly in form of policy “carrots” like grants and other financial or fiscal incentives. A further 14% has comprised interventions into the wholesale and retail energy markets, with many such measures taking the form of policy “sticks” like price caps.

Financial and fiscal incentives

Countries had already ramped up funding for energy affordability during the Covid-19 pandemic. But this support increased even further in 2022, to some \$482 billion globally based on IEA data – 3.4 times more than the aggregate 2020-2021 sum. Broadly speaking, such financial support needs to be temporary and designed carefully to ensure that it does not over-compensate recipients. This can encourage wasteful consumption of energy and fuels, which can mean unnecessary greenhouse-gas emissions. This is less of a risk if – as has been the case in many markets – energy prices have risen. But the risk rises if government also implements generous price caps to weaken the price signal to consumers.

The G-20 countries accounted for 69% of the global energy affordability funding in 2022, of which 62% was financed by European governments. In July, Germany announced a new Climate and Transformation Fund, which included some €47.6 billion (\$52 billion) in relief from electricity prices. In the residential sector, much of this support has been targeted at vulnerable customers. In September, the French government said it would allocate €1.8 billion in support for low-income households, and the UK has provided top-up Cold Weather Payments to pensioners and people with disabilities.

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Figure 26: Global government funding for energy affordability since 2020

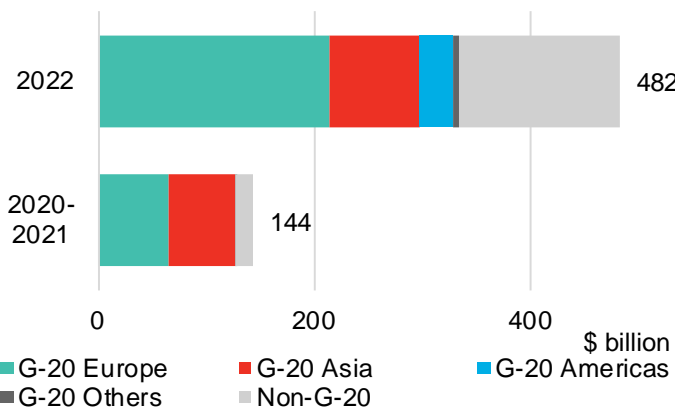
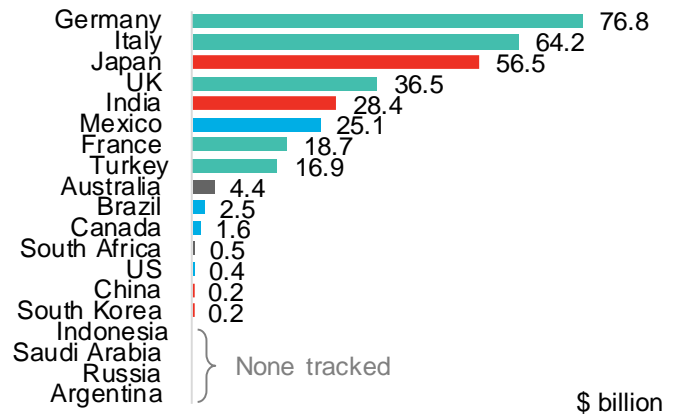


Figure 27: G-20 countries' government funding for energy affordability, 2022



Source: IEA, BloombergNEF. Note: Excludes government subsidies on retail power tariffs.

Companies have also received funding, often on the grounds of providing liquidity and trading (such as in the Czech Republic and Sweden). Italy has rolled out multiple schemes providing grants, tax breaks, loans and guarantees to help companies, including a €1.2 billion program for agriculture, forestry and fisheries, and €3.6 billion in grants, loans and guarantees for other sectors. Germany provided lines of credit to gas-storing companies in June 2022 and €68 billion in loan guarantees to failing energy players disrupted by Russian supply cuts.

In some cases this support has been extended to corporate bailouts. German utility Uniper's shareholders agreed in December to a €33 billion state-aid plan, having reported a €40 billion net loss in the first nine months of 2022. In total the UK saw more than two dozen British energy suppliers go out of business in 2022. The biggest was Bulb, prompting the government to pay some £4.5 billion to help fund the company's eventual takeover by rival Octopus Energy.

Most of this support was aimed at power and heating energy consumption, though some was targeted at transport

Some support was targeted at energy use for transport: India, for instance, reduced taxes on petrol and diesel, while South Africa froze the general fuel levy and Canada implemented a C\$750-million (\$554-million) "Payments for Transit" program. With gasoline prices reaching record highs in July 2022, 29 US states had proposed legislation by August to change the gas or diesel tax, or provide a gas tax rebate. Yet most governmental support was aimed at power and heating energy consumption. The UK increased funding for the Warm Home Discount scheme, for example, while the provinces of Hainan and Shenzhen implemented corporate electricity consumer subsidy programs.

The Japanese government has also rolled out various measures to shield consumers from the effects of the energy crisis: in October 2022, it announced measures that should cut electricity bills for households by 20% on average as part of a 25-trillion-yen (\$170-billion) package. The costs of city gas would also be reduced by 10% for households and small companies, while existing subsidies for gasoline and heating oil, first introduced in January 2022, would be further extended. South Korea has extended and increased tax cuts on fuel consumption to record levels and implemented emergency measures to curb inflation and fuel prices.

In addition to offering incentives, various governments have intervened directly in energy markets by imposing caps on prices

Price caps

In addition to offering incentives, various governments have intervened directly in energy markets by imposing caps on prices. A number of European countries imposed a ceiling on retail power and gas prices focused on residential consumers – especially low-income households or those on regulated tariffs – and, in some cases, small businesses. France was one of the first to take such steps: in October 2021, it froze gas bills and in February 2022 it capped the increase in electricity bills at 4%. In September, the government said that it would limit gas and power price hikes to 15% for 2023. In December 2022, the Australian government introduced a temporary ceiling on wholesale natural gas contracts as well as an A\$1.5 billion (\$1 billion) package to support households and small businesses. This came six months after the operator suspended the wholesale power market to ensure stable supply amid surging fuel prices and reduced coal-fired generating capacity.⁹

In December 2022, the EU adopted a temporary “market correction mechanism” to protect consumers from “excessively high gas prices”. The mechanism would be triggered if benchmark Dutch TTF gas prices exceed €180 (\$197) per megawatt-hour for a given period and at least €35 more than global LNG prices. If the cap had been introduced in January 2022, it would be used for around 40 days in August and September.

The European Securities and Markets Authority (ESMA) and Agency for the Cooperation of Energy Regulators (ACER) were tasked with a preliminary assessment of the mechanism’s impact. Both of their reports published in January 2023 found that it could have implications for financial and energy markets in the longer term: for example, it raises political risk and may drive up over-the-counter (OTC) trading, which tends to be less transparent. It may also reduce security of energy supply if it lowers the attractiveness of EU markets especially relative to stronger competition from Asia. With an initial lifetime of a year, the mechanism would be deactivated automatically under certain circumstances and if the European Commission considers that it poses a risk to security of supply, intra-EU gas flows or financial stability.

Such market interventions need careful design to ensure they have the intended impact without unintended consequences

Caps on retail energy prices could lead to wasteful consumption, potentially increasing emissions. Such market interventions need careful design to ensure they have the intended impact without unintended consequences. For example, in June 2022, Spain and Portugal put a temporary cap on natural gas used for power generation.¹⁰ Iberian electricity markets are particularly exposed to the European gas price crisis, due to their limited interconnectivity with the rest of the continent and the central role of gas as a price-setting technology.

BNEF analysis suggests that the Iberian cap is unlikely to affect power prices in 2023, as reduced European gas prices may keep the mechanism from being triggered. But the Iberian cap has had a distortive effect on the market, with consequences for decarbonization: while it drove down costs for consumers, it also raised gas demand.¹¹ As a result, Spain increased gas-fired electricity generation in 2022, in contrast to its neighboring countries. Italy, for example, maintained gas output levels despite a drop in hydropower (Figure 28). In addition to this effect, the cap dampened investment signals for low-carbon flexible technologies like batteries by reducing intraday volatility.

⁹ [Australia’s Power Market Grinds to a Halt \(web | terminal\)](#)

¹⁰ [Iberia’s Proposal to Cap Gas Prices Is Short-Sighted \(web | terminal\)](#)

¹¹ [Iberia’s Gas Price Cap to Lose its Potency in Power Market \(web | terminal\)](#)

Profit clawbacks

Another trend was the introduction of windfall profit clawbacks and regulations. In October, EU member states approved a package of emergency measures aiming to deliver a coordinated bloc-wide response to the energy crisis. This requires national governments to recover revenue exceeding €180 per MWh from “inframarginal generators” and impose “solidarity levies” on the profits of fossil-fuel producers and refiners. The resulting revenue was to be redistributed to consumers.

In theory a revenue cap on inframarginal electricity producers could impede clean energy deployment because it applies to technologies with lower costs than coal and gas, including renewables and nuclear power. Because of historical reductions in wind and solar costs, investors in such EU projects should still see significant upside despite the revenue cap. BNEF analysis shows that power prices, even after hypothetically being capped, remain high enough to drive investment.¹² For an onshore wind farm in Germany, the uncapped internal rate of return (IRR) stands at 10%, and the capped at 7%, when the hurdle IRR is just 4% (Figure 29). For solar, the numbers are 13%, 8%, and 5%, respectively.

Figure 28: Annual average power demand and supply stack of Spain and Italy

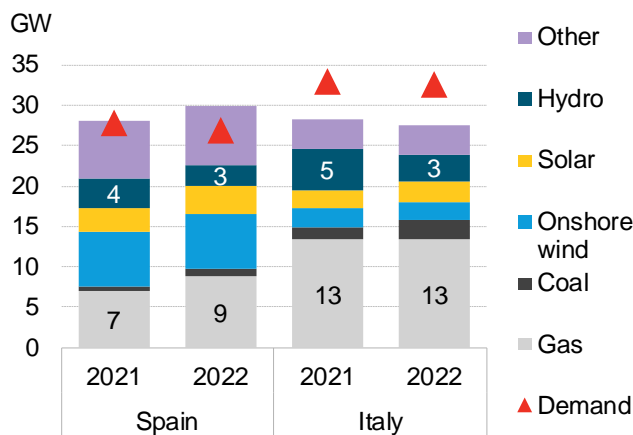
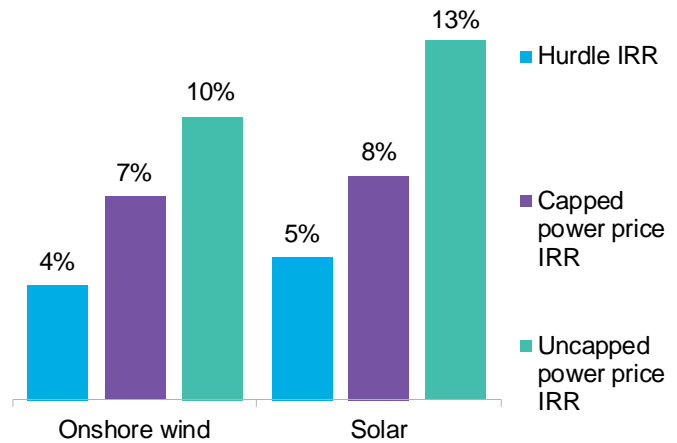


Figure 29: Internal rate of return for projects in Germany under different price scenarios



Source: BloombergNEF. Note for Figure 29: IRR refers to internal rate of return. Projects are assumed to commence operation in 2023. Uncapped and capped power price used for first year of operation. For all future years we use the levelized cost of electricity for the technology as calculated by BNEF using the hurdle IRR. See: 1H 2022 LCOE Update ([web](#) | [terminal](#)).

By year-end, electricity generators across Europe faced a slew of windfall taxes on revenue

By year-end, electricity generators across Europe faced a slew of windfall taxes on revenue, with many governments introducing harsher levies than the cap required by the EU. Policymakers face a tough balancing act, as efforts to reduce energy bills will eat into generators’ revenues, lowering the amount of capital they can reinvest in new renewables build.¹³ However, such interventions may raise economic and regulatory risks in the longer term, damaging investor confidence. The EU revenue cap may not infringe on renewables investment, but the UK’s windfall tax could wipe out more than a quarter of the revenue of some renewable energy generators, based on BNEF analysis.¹⁴ The 45% levy, which came into force in January 2023, applies to “extraordinary profits” from low-carbon electricity generators. The Electricity Generator Levy will primarily affect 14GW

¹² EU Power Price Cap Would Not Harm Renewables Investment ([web](#) | [terminal](#))

¹³ European Power Weekly: Jumble of EU Windfall Taxes Could Shift Energy Investment ([web](#) | [terminal](#))

¹⁴ Renewables Face 27% Hit to Revenue from UK’s Windfall Tax ([web](#) | [terminal](#))

of wind and solar and 7GW of the nuclear power fleet – equivalent to some 38% of the UK’s low-carbon generating capacity. A further 19GW of wind, solar and hydropower could be exposed.

Such interventions may raise economic and regulatory risks in the longer term, and may not lead to lower energy bills

Another downside is that such policies may not lower retail energy bills: the effectiveness of the EU revenue cap will depend on the share of inframarginal generation in each nation, as well as the exposure of such generation to market prices. Countries with a higher share of generation from inframarginal technologies would be able to claw back relatively more revenue. For instance, in 2021 inframarginal technologies comprised 53% of generation in Germany and 45% in Poland. Still, a high share is not synonymous with higher returns for governments. The impact of the cap also depends on the volume of inframarginal technologies that benefit from high power prices. For example, renewables with fixed-price subsidy contracts would not be impacted. The same goes for generators that have hedged their output at prices below the cap. And in France, a large portion of nuclear output is sold at a regulated price, which is at a discount to spot prices.

To ensure adequate energy supply

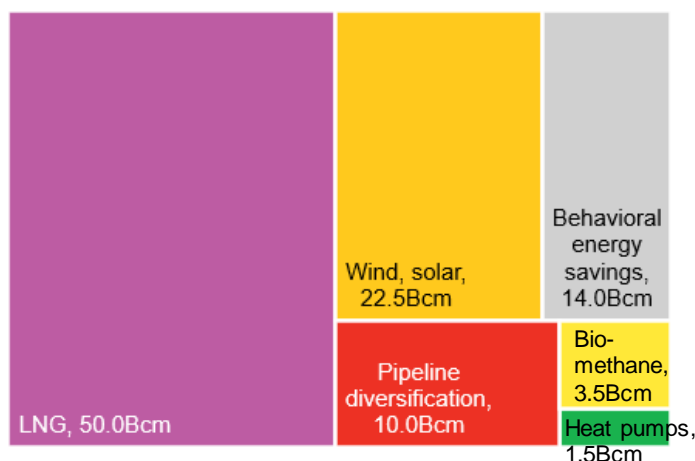
Governments have also introduced a range of policies to mitigate pressure on the energy system by reducing demand or increasing supply

In addition to measures to protect consumers and producers, governments have introduced a range of policies to mitigate pressure on the energy system – by incentivizing either demand reduction or additional supply. In Europe, the most common measure has focused on promoting energy savings (Figure 25) followed by policies to switch to alternative sources of supply (whether fossil fuel or clean technologies).

Measures to cut demand

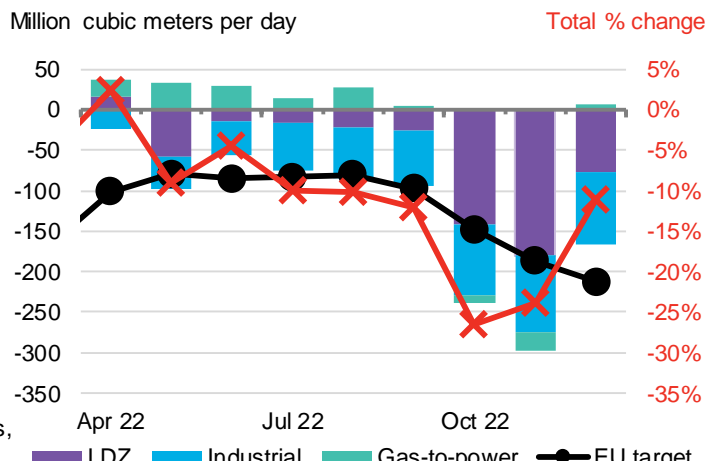
If designed effectively, energy efficiency and demand response policies have the benefit of promoting all three elements of the energy trilemma, including decarbonization. Due to its reliance on Russian gas, the EU had one of the boldest targets for reducing gas demand in the short and medium term: the REPowerEU plan, released in March, aimed to cut Russian gas imports by over two-thirds in 2022.¹⁵

Figure 30: EU targets to displace Russian gas imports in 2022



Source: Europe Plans Break from Russian Gas (web | terminal)

Figure 31: Europe Perimeter gas demand in 2022 compared with EU 15% reduction target



Source: European Gas Outlook 2023-24: Winter Worries Melting (web | terminal). Note: ‘Europe Perimeter’ is Northwest Europe, Italy and Austria.

15 Europe Plans Break from Russian Gas (web | terminal)

Half of the displaced volume was to be substituted by imports from elsewhere (mainly LNG) and the rest was to come from behavioral energy savings and renewables deployment (see below).

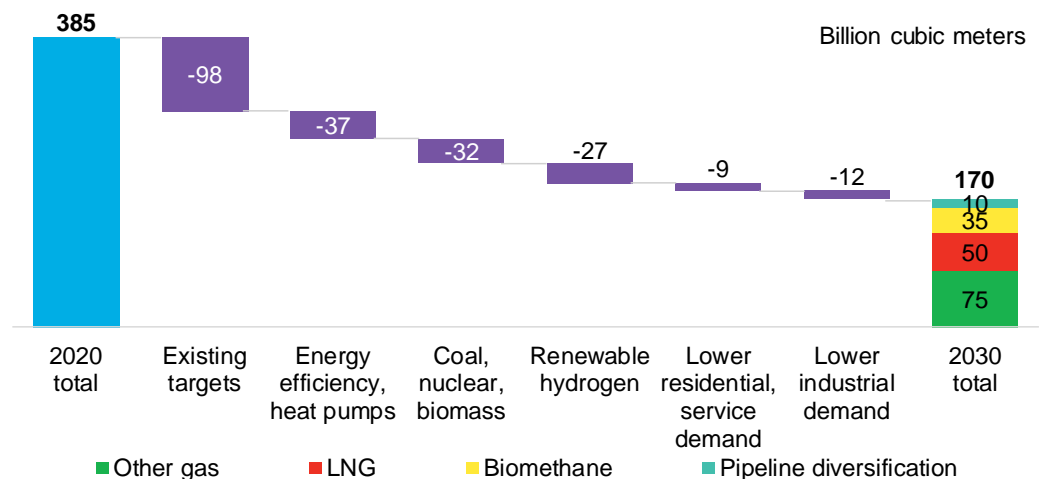
Gas supply-side changes (see [below](#)) were not sufficient to alleviate the loss of Russian supply in 2022 from the balance for the 'Europe Perimeter' (Northwest Europe, Italy and Austria).¹⁶ This drove up prices, helping to curb demand, as did the relatively mild winter. As a result, the EU overachieved on its target to cut gas consumption by 15% over August 2022-March 2023 relative to average use in the preceding five years. The Commission expects demand destruction to gradually ease, which is in line with BNEF projections.

Officially proposed in May 2022, the REPowerEU package aims to cut natural gas use by 56% (215 billion cubic meters) from 2020 levels 2030 below (Figure 32). The demand-side goals are ambitious, requiring immediate and sustained responses by governments and consumers to move away from gas, especially for heat.¹⁷

Beyond EU-level targets, member states have rolled out national funding programs to bolster energy savings.

Beyond EU-level targets, member states have rolled out national funding programs to bolster energy savings. Germany announced in March 2022 a new scheme to promote replacing gas boilers with heat pumps, higher energy efficiency standards for new buildings, an obligation for new heating systems to be 65% renewables by 2024, and an increase in biogas production. In addition, it announced in July a €178-billion Special Climate and Transformation Fund to "make energy supplies environmentally friendly, reliable and affordable", with support for buildings' energy efficiency and renewable hydrogen. In October, France announced the Energy Sobriety plan, which aims to reduce energy use by 10% over the next two years relative to 2019 levels. The package includes financial support to incentivize households to switch heating systems through the MaPrimeRenov scheme. Public information campaigns have also been implemented in countries including Japan, South Korea and the UK.

Figure 32: European Commission targets for EU natural gas consumption by 2030, based on REPowerEU package



Source: European Commission, Eurostat. Note: For full assumptions, see: [EU's Russian Gas Phase-Out Hinges on Clean Energy \(web | terminal\)](#).

16 [European Gas Outlook 2023-24: Winter Worries Melting \(web | terminal\)](#)

17 [EU's Russian Gas Phase-Out Hinges on Clean Energy \(web | terminal\)](#)

Other countries have introduced demand response incentives, for which commercial and industrial consumers are the best targets

Other countries have introduced demand response incentives. The Japanese government introduced a new program in June that awards points worth 2,000 yen (\$14) for households and 200,000 yen (\$1,400) for companies participating in utilities' demand-response schemes; these points can be used to pay for electricity bills or shopping. The first two live events of the UK Demand Flexibility Service were held in January 2023, during which the electricity system operator procured on average 1% of the grid's peak demand.¹⁸ The mean bid was around £4,230 (\$5,272) per MWh – some 28 times the UK's average power price in January 2023 – and the simple policy could be an effective way to balance the grid at crunch times, albeit at a relatively high cost.

As part of the EU's temporary measures passed in October 2022, most member states were mandated to cut electricity consumption by 5% during the top 10% of peak price hours. The aim is to hit two birds (electricity and gas demand) with one stone. But the effectiveness will depend on each country's share of gas-fired generation during peak hours and the efficiency of the gas fleet. A 5% drop in total power demand in Germany over December 2021 to March 2022 would have reduced overall electricity demand by 2TWh, based on BNEF analysis. Assuming gas generators are affected, this would have cut winter power demand in 2021 by 4%.

Commercial and industrial electricity customers are likely to remain the best source of demand response. Engaging residential consumers in demand-side flexibility schemes has historically been challenging, as retailers have tended to shield them from variations in hourly and daily power prices. Many households do not have the required smart meters: even in the EU, only 11 member states have achieved penetration of over 80%. In addition, they need to be enrolled in a time-varying tariff, and the high fluctuations in energy prices may deter some consumers from switching from the certainty of a fixed rate.¹⁹

Some governments have also implemented more of a policy 'stick' approach to promoting energy conservation, with varying degrees of obligation

Some countries have also implemented more of a policy 'stick' approach to promoting energy conservation, with varying degrees of obligation. The Japanese government asked companies and households to conserve energy in certain regions at various times in 2022, especially ahead of the winter season, when heating use is high, and hot weather, which pushes up demand for air conditioning. The announcement in June was the first such nationwide request since 2015, when nuclear power plants were offline after the Fukushima disaster. Germany also issued various official energy-saving requests.

Some policymakers went further, introducing mandates to cut energy demand: in 2022, Italy's 'Operation Thermostat' initiative introduced maximum limits on the use of heating and air conditioning in public buildings, although it was not clear how compliance with these restrictions would be monitored and enforced. Other European countries have also implemented similar regulations on public buildings and spaces, with France extending such restrictions to certain shops. Rising international energy costs also prompted various European governments to discuss the possibility of load shedding, while some countries in Asia had to implement energy rationing.

Measures to replace or increase supply

As outlined above, a substantial ramp-up in LNG imports as well as a mild winter price-driven gas demand destruction helped Europe avoid a bleak winter. As a result, the region has raced to build up regasification capacity. By the end of 1Q 2023, Germany (the largest recipient of Russian-piped gas) had deployed three floating storage regasification units, bringing in 13.5Bcm in annual

¹⁸ *UK's Energy-Saving Scheme Unlocks Power of Demand Response* ([web](#) | [terminal](#))

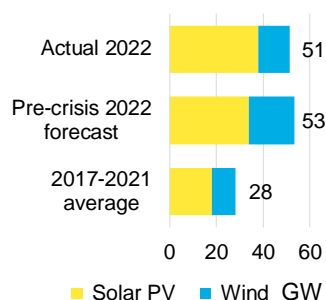
¹⁹ For more on these challenges, see: *Sector Coupling in Europe: Powering Decarbonization* ([web](#) | [terminal](#)).

Policymakers in Europe and beyond have also taken steps to promote switching to other (that is, non-gas-dependent) energy sources

import capacity. By 2024, this will rise to 37Bcm (six terminals) but will still leave a Russian supply deficit of almost 27Bcm/year. The Netherlands and Italy have also added regasification capacity in response to the energy crisis.²⁰

Policymakers in Europe and beyond have also taken steps to promote switching to other (that is, non-gas-dependent) energy sources. However, such measures have been less common than policies to promote energy savings. One reason is that the latter have a more immediate impact on tackling energy shortages than the former. Nonetheless, some governments have sought to promote low-carbon technologies, especially as a longer-term strategy. As well as encouraging switching to alternative sources of gas supply, the REPowerEU plan aimed to replace 20 billion cubic meters of Russian gas in 2022 with additional wind and solar build, equating to an approximate 20% increase in annual average deployment. In practice, the EU installed 53.5GW of wind and solar PV in 2022 (Figure 33), marking a 90% increase in average annual build over 2017-2021. But it was only 4% more than the 2022 new build forecast by BNEF at end-2021, suggesting the war had little impact on short-term deployment.

Figure 33: Wind and solar PV new build in the EU



Source: BloombergNEF.
Note: 2017-2021 annual average excludes the UK.

Achieving the 2030 targets in the REPowerEU package will also require substantial clean energy deployment, reaching 1,236GW of total installed renewables capacity by the end of the decade. The renewable hydrogen demand goal for 2030 looks especially infeasible, as it far exceeds existing total H2 demand in the EU. Using clean hydrogen in new sectors such as steel would require scale-up of end-use technologies, which are unlikely to be commercially available before the second half of the decade.²¹

The EU and member states are working to tackle permitting and other bottlenecks. For example Spain has shortened the consultation period required for renewables projects, Italy simplified procedures for new solar PV and wind plants and in Cyprus, a building permit for a renewables project is now considered to be granted if it already has a planning permit. In addition, national governments have announced new renewables funding: for example, in October, Austria announced €250 million in investment support, and Italy adopted two packages totaling €22 billion in April-May 2022, both of which include measures to promote wind and solar PV build. In July, Germany approved a medium-term plan to boost renewables capacity, with targets to increase onshore wind and solar capacity by 86% and 226% over 2023-2030.²² This will entail higher auction volumes, more land allocated to renewables deployment and higher remuneration rates for rooftop solar below 40kW not captured in tenders. By the end of the decade, the country aims to source 80% of gross electricity consumption from renewables compared with the previous 65% target.

The Japanese government has pledged to use nuclear and renewable power to cut dependence on Russia. Restarts of idle units will see nuclear generation almost double in 2023, based on BNEF analysis, reducing LNG demand for some utilities.²³ However, at least one operator has indicated that the restarts may be delayed. Renewable energy will also help bolster supply with solar (to add 4.9-5.9GW) and wind (718MW), although the new build for PV and offshore wind will be lower than the 2022 volumes. At end-2022 the government released the 'GX Green Transformation' strategy, which was approved in February 2023. In a shift away from the policy of recent years, Japan intends to consider replacing nuclear reactors due to be decommissioned with next-generation models at the same power plant and may extend a reactor's lifetime beyond

20 *European Gas Outlook 2023-24: Winter Worries Melting* ([web](#) | [terminal](#)).

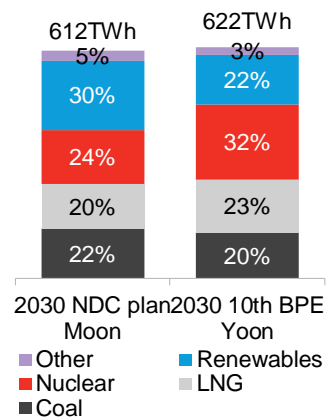
21 *EU Hydrogen Quotas Raise Global Demand for Green Molecules* ([web](#) | [terminal](#)).

22 *European Power Weekly: Germany's Plan Boosts Wind and Solar Power by 19%* ([web](#) | [terminal](#)).

23 *Nuclear Restarts Do Little to Ease Fuel Costs* ([web](#) | [terminal](#)).

the 60-year limit by excluding shutdown periods, subject to safety approval by the Nuclear Regulation Authority. This is surprising, given that no reactor in the world has operated for over 60 years. The strategy also promotes the use of carbon capture and storage for power generation and ammonia production.

Figure 34: South Korea comparison of 2030 power mix targets

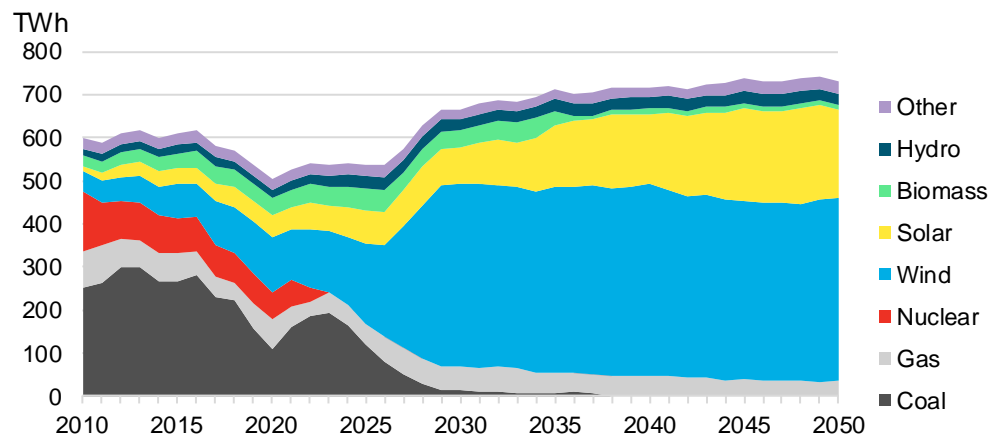


Source: Korean government, BloombergNEF. Note: NDC is Nationally Determined Contribution. BPE is Basic Plan for Electricity Supply and Demand

South Korea is also focusing on nuclear power: the 10th Basic Plan for Electricity Supply and Demand, released in January 2023, raised the 2030 nuclear generation target to 32.4% – up from 23.9% – and lowered the goal for renewables to 21.6% from 30.2% (Figure 34).²⁴ This move had been anticipated since President Yoon Suk-yeol came to power in May 2022. The government intends to extend the lifetime of existing reactors, resume construction of two reactors and expedite the commissioning of three reactors under construction.

In the longer term, European governments are also considering power market reform, with the aim of promoting energy security and decarbonization. Published in March 2023, the European Commission’s proposals aim to improve market liquidity for forward contracts and power purchase agreements, and encourage more active participation by retail consumers.²⁵ The reforms should accelerate the deployment of energy storage and demand response, as well. The UK has also kicked off its own power market reform, with a key aim being to improve investment signals for wind and solar generation.²⁶ It also seeks to increase investment in capacity that generates power on demand and provides flexibility.

Figure 35: Electricity generation in Germany



Source: BloombergNEF, 2022 Germany Power Market Outlook ([web](#) | [terminal](#))

However, not all of these schemes to create alternative energy supply have focused on low-carbon technologies

Not all of these schemes to create alternative energy supply have focused on low-carbon technologies. As stated above, the REPowerEU targets for 2022 and 2023 included switching from Russian gas to other gas supply by pipeline and as LNG. In the US, in response to climbing motor fuel prices, the Biden administration announced in October 2022 that it would release another 15 million barrels from the Strategic Petroleum Reserve, marking a record 180-million-barrel drawdown in 2022, and replenish the Reserve through fixed-price contracts. It also called for oil and gas companies to pass on savings from declining oil and wholesale gas prices to consumers.

24 1H 2023 South Korea Market Outlook: Pivot to Nuclear ([web](#) | [terminal](#))

25 EU Power Market Reform: Pushing Flexibility and Hedging ([web](#) | [terminal](#))

26 The UK Starts to Reform its Power Market for Net Zero ([web](#) | [terminal](#))

The energy crisis prompted some European governments to restart fossil-fuel generating capacity. Germany extended the lifetime of 10GW of coal and oil power plants that were set to close but are now due to operate until 2024.²⁷ The UK pushed back the closing date of three coal-power stations, and the 600MW St Avold coal plant in France was rebooted in November 2022. These moves will increase greenhouse-gas emissions in the short term but so far they are likely to be a short-lived trend, as governments have retained their phase-out targets. Eight EU member states are already coal-free and another 16 – including France, Germany and Italy – aim to join them by 2038. BNEF's *2022 Germany Power Market Outlook* ([web](#) | [terminal](#)) assumes that coal is phased out by 2038, as planned, and wind and solar generation reaches 76% by 2030.

Outside Europe, the global energy crisis and domestic power crunch has spurred Chinese policymakers to reiterate the importance of coal in ensuring energy security. At the annual National Energy Work Conference in December 2022, the National Energy Administration said that while China will invest heavily in wind and solar, coal will remain the cornerstone of energy supply.²⁸ The government has approved new coal mines to provide sufficient domestic supply and requires coal users, such as power plants, to ensure sufficient fuel stockpiles. However, high renewables penetration would also improve energy security: a government report released in October 2022 suggests that China plans to first build large volumes of renewables capacity to meet additional demand and then phase out existing fossil-fuel generation.²⁹

²⁷ *Germany's Coal Return to Cut 52% of Gas Use for Power* ([web](#) | [terminal](#))

²⁸ *China Policy Bulletin: Renewables Reshape Power System* ([web](#) | [terminal](#))

²⁹ *China Policy Bulletin: Party Congress Sets Energy Agenda* ([web](#) | [terminal](#))

Appendix

Appendix A. Scoreboard methodology

A.1. Policy presence

The table below shows the types of policy in a given sector used for the presence metrics in the Policy Scoreboard.

Table 3: Policy Scoreboard presence metrics

Points	Power	Fuels and CCUS	Road transport	Buildings	Industry	Circular economy	Agriculture
1	Renewables grants or loans	Strategy for green gas or CCUS	EV grants or loans	Energy efficiency plan	Energy efficiency or circular economy incentives	Municipal solid waste recycling target	Funding for climate solutions other than ruminants
2	Renewables or emissions target for power	Green gas or CCUS grants or loans	EV deployment target	Low-carbon heat plan	Renewable heat or emissions target for industry	EPR scheme or limit on single-use plastics	Sustainable agriculture strategy
3	Renewables feed-in tariff, premium or tax credit	Carbon capture incentives	EV purchase subsidies	Operating cost subsidies on low-carbon heat	Operating cost subsidies on electrification or renewables	Fees or recycling targets for packaging	Land-clearing regulations on farms or emissions target for agriculture
4	Renewables auctions or mandate	Blending mandate or other demand-side incentives	EV charging support	Heat pump tax credits, grants or loans, carbon price	Upfront cost subsidies on electrification or renewables	Pay-as-you-throw schemes	Funding for climate solutions linked with ruminants
5	Funding for low-carbon energy storage	Infrastructure support	Fuel economy standards	Energy performance standards or boiler ban on new homes	Fossil-fuel ban or carbon price on industry	Eco-modulated EPR scheme	Carbon offset program with approved agriculture projects
6	Coal-power ban or carbon price	Carbon utilization incentives	ICE ban or carbon price	Energy performance standards or boiler ban on existing homes	Mandates on products, materials or companies	Recycled content laws	Carbon price on agricultural producers or sustainability mandates

Source: BloombergNEF. Note: ICE means internal combustion engine. EPR is extended producer responsibility.

A.2. Policy robustness

The table below outlines the factors used to assess the robustness of a country's policies in a given sector and reasons for assigning the minimum or maximum number of points.

Table 4: Factors used to evaluate policy robustness

Factor	Minimum = 0 points	Maximum = 6 points
Transparency of information about policies and policy-making process	It is impossible to know what government policies and regulations are in place in a given sector, and there is no clear method of contacting the relevant government body. If you're lucky, there is a newspaper article on a proposed policy, but you have no clear way to find out how it will be passed, how it will be implemented, or what stage it has reached. No stakeholder consultation on changes, which are not communicated clearly to the public.	Government publishes on a public website details about policies including description, status, method of implementation, etc. For proposed policies, you can easily find out which legislative/regulatory process applies and the status of the proposal. Forthcoming changes are well publicized in advance; stakeholder consultations are held to get public comment, and they are communicated clearly to the public. Website has a clear way to contact the relevant government body.
Predictability of the policy-making process	Policies and regulations are changed frequently, with no clear, established method for amendments. Essentially, you can't be sure that a policy will remain in place, in its current form, for the foreseeable future. At worst, the government/regulator makes retroactive changes, notably changes that reduce potential revenue or other upside from a project or investment.	You can be relatively sure of a policy or regulation's stability over the foreseeable future. If changes are proposed, then they are infrequent, follow a clear established process and are not retroactive.
Completeness of policy mix	The question here is whether the country has enough policy support to reach net-zero emissions in this sector. A country that scores 0 might have no policies in a given sector, or might only have one policy targeted at one technology/area (eg, landfill fees in a circular economy, a target for hydrogen production, or a grant scheme for heat pumps and nothing else). This 'completeness' thus relates both to the decarbonization pathways and solutions, and types of policy support in place.	In a given sector, government has implemented support to incentivize a range of technologies or practices using a range of policy types (carrots and sticks). In power, for example, the country has incentives for renewable energy and battery storage, or in low-carbon fuels, it has policies for biofuels and low-carbon hydrogen, or it has grant schemes for heat pumps and a ban on oil-fired boilers in buildings.
Stringency and achievability	Sector or technology targets and regulations are set so low or at such weak levels that the country needs to make little effort to achieve them and/or they would not put the country on track to reach net-zero by mid-century. For example, a country has energy performance standards but only for certain types of building over a certain size in certain areas of the capital city. Alternatively the targets or regulations (eg, local content requirements) are set so high that they are unrealistic.	Sector or technology targets would require substantive but not unrealistic effort to be achieved. They put the country on track to reach net zero by mid-century.
Effectiveness of policies	The policies seem to have had no impact on the market in practice (eg, no increase in EVs or renewable power). Additionally, this lack of effectiveness cannot be attributed to outside factors (eg, the pandemic).	The policies have had, or at least begun to have, a noticeable effect on the market.

Source: BloombergNEF

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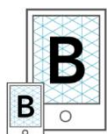
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