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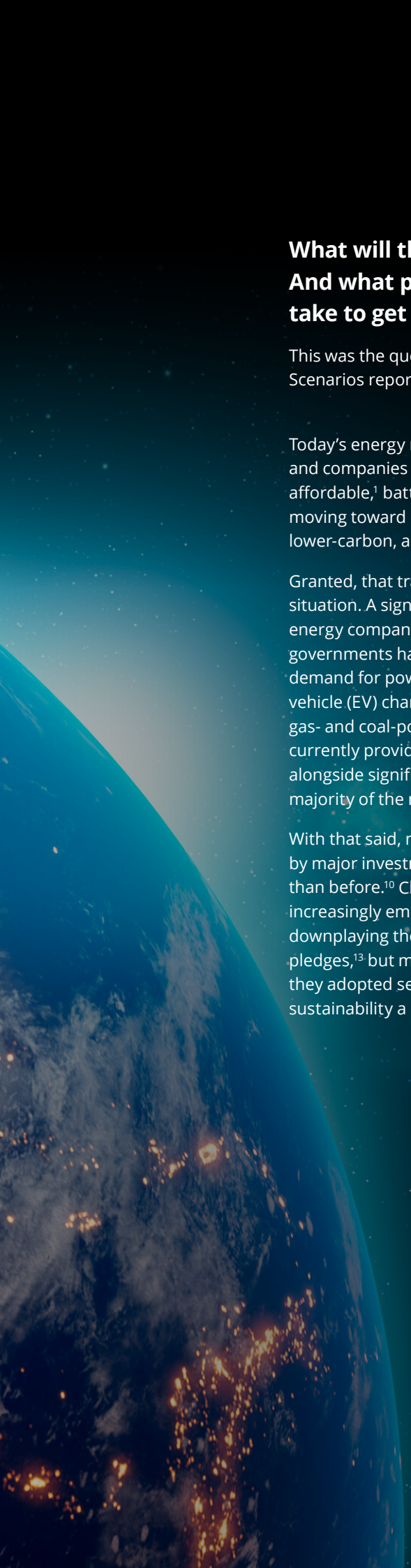
The rapidly evolving future of energy

Balancing energy security, affordability, and sustainability



What will the world's energy mix look like in 2035? And what path might business and government leaders take to get there?

This was the question we asked five years ago in our Future of Energy Scenarios report and we revisit it now with plenty of uncertainty still ahead.

Today's energy mix includes more sources than ever, offering governments and companies many options and choices. With solar becoming more affordable,[1] battery technology continuing to improve,[2] and new sources moving toward maturity,[3] the global energy mix is transitioning to a lower-carbon, all-of-the-above future.

Granted, that transition is changing shape, with a range of factors affecting the situation. A significant US policy turn[4] is only part of the shift. Some legacy energy companies are reducing renewable investment,[5] and some governments have begun to push back net-zero target dates.[6] The soaring demand for power, from energy-hungry data centers to breakthrough electric vehicle (EV) charging technology,[7] has led to companies hurriedly building gas- and coal-powered plants, needing more power than renewable power can currently provide.[8] India is building 30,000 MW of new coal-fired capacity alongside significant renewables construction, leaving coal generating the majority of the nation's power.[9]

With that said, most of the world is moving forward with electrification fueled by major investments in renewable power, even if at a slightly slower pace than before.[10] China, while building both coal and renewables capacity, is increasingly embracing EVs and green infrastructure.[11] Some companies are downplaying their public sustainability focus[12] and reassessing their net-zero pledges,[13] but many appear to be maintaining the low-carbon business models they adopted several years ago,[14] with institutional investors keeping sustainability a priority.[15] For CEOs, economics takes precedence over politics.

An all-of-the-above future

With signals so mixed, how should business and government leaders move forward? Waiting to see where the energy mix lands risks losing out on competitive advantage, with companies and countries encouraged to play by others' rules. Thoughtful crafting of multiple stories of how the state of energy might unfold in the upcoming years can lead to better decisions regarding asset investments, innovation portfolios, strategic positioning, digital transformation, and more.

In our 2020 report,[16] we suggested scenario planning as a useful exercise to map out possible futures: specifically, the global state of the energy mix in 2035. In four scenarios, we looked at potential societal response to extreme weather—would it be proactive or reactive?—and whether national governments would mostly collaborate or go it alone. (See sidebar, "The 2020 scenarios—and where things stand today.") As seen in the five years since the report was published, the trend has been toward the "Me and my resource" scenario rather than, for example, "One team, one dream," which many assumed was the dominant direction of travel, based on reader feedback we received initially.

If anything, it's even more important today that business leaders place informed bets on the future of energy and for most companies, those bets should be spread across the table. With both energy demand and geopolitical matters likely to continue, an all-of-the-above energy strategy—tapping sources from fossil fuels to solar to geothermal—may prove the best way to help ensure stability and growth.

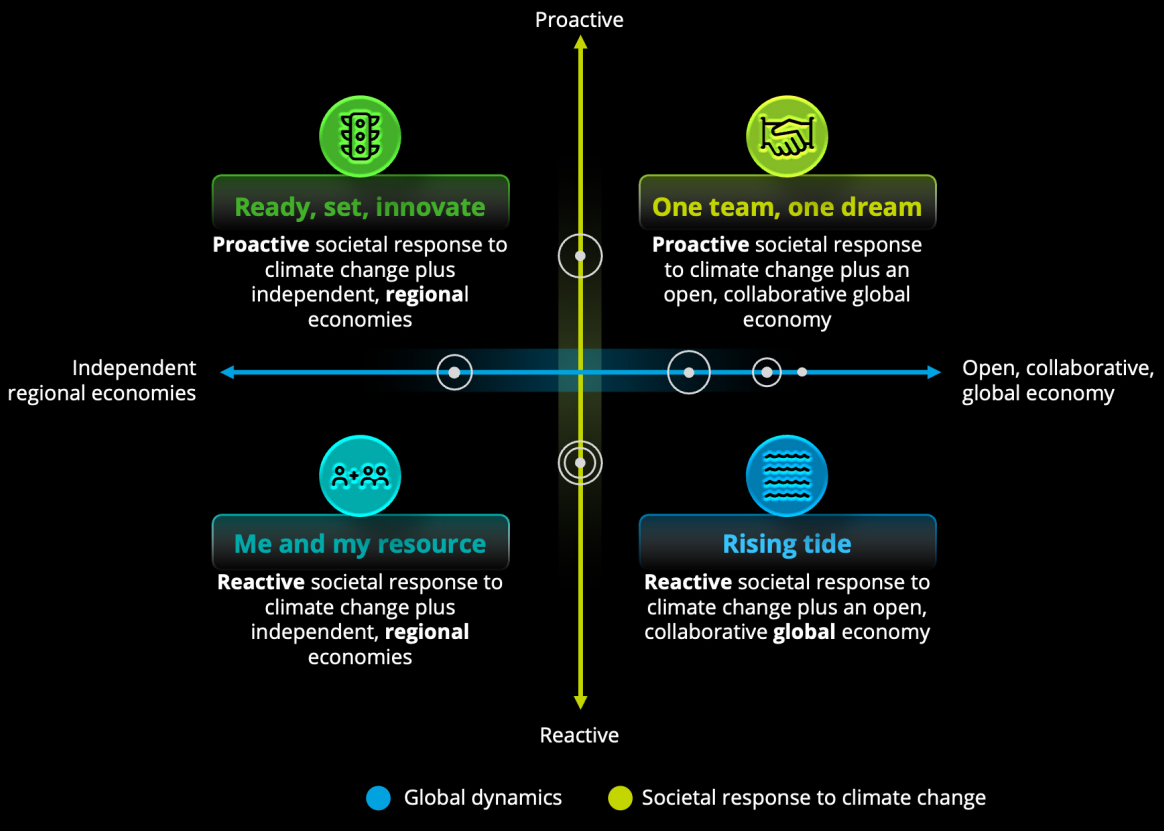
The 2020 scenarios—and where things stand today

The 2020 report laid out four divergent scenarios for the future of energy, including how governments and businesses might address extreme weather. The report looked at different directions the global economy might take over the next 15 years, plotted on a graph of proactive versus reactive and an open, collaborative, global economy versus independent, regional economies. No predictions were made on which of the four was most likely, other than to note that none would necessarily come to full fruition as the intractable future for a business or industry. Energy system modeling illustrated that each possible future was indeed plausible.

The "One team, one dream" scenario had the potential for an optimal outcome for combating extreme weather, with global collaboration and adoption of low-carbon systems accelerating electrification and drastically reducing energy demand and emissions even as overall economies grew. But with challenges of energy security and affordability increasingly taking precedence, governments and utilities worldwide are shifting in other directions.

Still, cooperation remains important to the future of energy, both between countries and among business, government, and civil society. The 2025 UN Climate Conference—COP30, in Brazil—will highlight collaboration in Latin America and South America.[17]

Figure 1. Four scenarios of the 2035 energy mix, driven by the global response to extreme weather



Source: Deloitte Analysis

From sustainability to security

In looking ahead to their nations' energy needs, resources, capabilities, and alliances, many policymakers around the world have been aiming to balance three factors—energy affordability, sustainability, and security and independence. For much of the last decade, leaders emphasized sustainability: Governments worldwide endorsed extreme weather predictions, made ambitious aid pledges, and offered incentives to steer companies toward renewable energy use. The effort undeniably set systems in motion and built both institutions and momentum toward a lower-carbon future.

But the focus has broadly shifted: from sustainability to affordability and security. In certain regions and circumstances, renewable energy may cost less than coal and natural gas,[18] but in most regions of the world, there's not yet enough available clean power to keep up with demand; transmission and storage infrastructure is unready to effectively incorporate solar and wind at scale.[19]

In the United States—a net energy exporter since 2019 and already the world's largest oil producer[20]—the federal government is looking to lower prices by boosting production even further and helping to make gas-powered plants increasingly central to electric grids.[21] Granted, making more drilling leases available doesn't necessarily mean that oil and gas companies will rush to bid on those leases,[22] and increasing supply may lower oil prices past the breakeven point for some producing areas.[23] But at least for the next few years, the US government will likely place less emphasis on sustainability efforts, with corporate choices on data centers and other major energy users playing a role as well.[24] For the moment, the full impact on companies of recent legislation is still unclear.

In Europe and many other regions, energy security has become important, with the primary factor being ongoing disruption from the Russia–Ukraine war[25] and US tariffs that are changing established trade alliances and energy supply chains.[26] Geopolitical uncertainty has pushed resilience to the fore as energy demand rapidly climbs. Eschewing Russian energy imports, some countries have needed to burn more fossil fuels as they consider their energy security.[27] A number of European countries have accelerated renewables programs while importing more natural gas.[28] Leaders are once again discussing nuclear power.[29]

Some observers see the disruption as an opportunity for Europe to refashion energy supply chains and bolster security[30]; others wonder whether the region can continue to quickly build out renewable grid infrastructure to keep pace with demand.[31] Utilities worldwide are looking to further ramp up investment in renewable electrification projects, in a volatile global economic environment.[32] And some cities are pursuing sustainability initiatives despite their national governments slowing efforts.[33]

Tomorrow's infrastructure for tomorrow's demand

For each country, manufacturer, and utility, infrastructure may be some of the biggest question marks. In ways, the future of energy could depend on the strength, resilience, and improvement of electric grids and storage.

Grids in some countries are struggling to keep up with new demand, and analysts expect proliferating data centers to add new strain.[34] Relieving the bottleneck of grid congestion will be increasingly important for continuing electrification.[35] So will distributed energy and storage—and indeed, storage is already climbing, with US utilities installing 12.3GW in 2024 alone.[36]

A key concern is the extent to which utilities, constrained by their rate base after several years of rising customer electricity bills,[37] will be able to afford to build out infrastructure. The power sector's costs are rising, and complexity is deepening, with increasingly extreme weather and macroeconomic pressures contributing to cost increases.

In the United States, analysts see the power sector needing substantial and sustained capital investments over the next two to three decades to fund rising electricity needs. Investments could total US$1.4 trillion from 2025 to 2030, with electric companies exploring funding options beyond issuing debt and equity, including private capital, partnerships with tech companies, and selling unregulated assets, noncore businesses, and project platforms.[38]

The various global futures of energy

When it comes to energy, China is notable in a number of ways: The nation routinely unveils new cleantech[39] and is installing wind and solar power projects faster than any other country[40] yet burns more coal than the rest of the world combined[41] as coal remains an important part of its energy mix. Its shifts on energy sourcing can have a global impact on both economic trends and extreme weather, which is why recent developments continue to draw close attention. In 2024, China added 356GW of wind and solar capacity—more than four times the European Union's rate—but also approved 66.7GW of new coal projects and began construction on 94.5GW of new coal plants, many scheduled to come online in the next two to three years.[42]

India, too, has leaned into coal use.[43] Notwithstanding a long-term strategy of boosting renewable capacity to 500GW by 2030—and emissions' well-documented negative impacts on local health and farming[44]—coal still dominates the energy mix in the world's most populous country.[45] Leaders' decisions will have an outsize impact on the future of energy.

At least in the near term, Canada faces a different set of challenges and uncertainties, many dealing with changes in US trade and tariff policy. Over the last century the countries have integrated their energy supply, particularly electricity through electric grids, and power has long flowed both ways across the border via 86 high-voltage lines.[46] In 2024, the United States imported 11,381GW of Canadian electricity.[47] With tariffs potentially disrupting the relationship, Canada is looking at easing permitting and allowing more global energy development, strengthening trade relationships with allies overseas; energy executives have called for new natural gas pipelines and terminals to protect the nation's energy security.[48] Daily news developments make it difficult to forecast the Canadian energy situation even months ahead, much less a decade, but it's likely that leaders will continue to emphasize security.

Per capita, the Global South currently uses only a fifth of the power that the rest of the world does, but industrialization will drive up energy demand for the foreseeable future.[49] The question is what energy mix will power those regions as they grow—whether they're able to jump beyond most fossil fuels—and that will largely depend on how collaboration develops.[50] Some analysts see Global South governments accelerating adoption of cleantech energy sources, with solar and wind providing an ever-larger share of electricity.[51] With power needs so great, leaders will likely look to electrify communities however they can.

What happens next?

With the long-term cost of installing renewable energy declining and technology more available and compatible, renewable capacity will likely continue to grow.[52] Indeed, in 2024, renewables accounted for 93% of worldwide growth in electricity generating capacity, with 585GW of capacity installed; overall, renewable technologies—including wind, solar, geothermal, hydroelectric, and more—now provide nearly half of global power generating capacity.[53]

That said, leaders should assume that the economics of energy, and the business case for various energy sources, will likely continue to shift. External factors—shifting tariff and trade policy, continued dislocation of energy trade routes from geopolitical uncertainty, an unexpected carbon-removal technological breakthrough—could force hurried rethinking of energy sources and supply chains. Energy security could remain a top priority, with leaders looking to build resilience against extreme weather events as well as international-relations matters.

And no matter what happens, economics will be central to decisions. Most energy leaders will make decisions on oil use—for instance, whether to proceed with or cancel long-planned pipelines—based on the business case for oil.[54] Nuclear power, eyed as a potential solution to skyrocketing data-center demand,[55] will likely play a growing role in the future of energy only if insurance doesn't make it prohibitively expensive; the long-forecast clean hydrogen economy will emerge if and when the numbers make sense.[56] In every energy system, from source to transmission to delivery, someone has to account for and pay for short-term risk in the context of long-term opportunity.[57]

Business and government leaders, aiming to control their destiny and their place in the long value chain of energy production, should consider pursuing an all-of-the-above strategy in the coming months and years. In assessing the various possible paths to an energy future that's sustainable despite rising demand, it's important for companies to prioritize affordability and security. The stakes for companies, industries, national economies, and the planet are high.

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