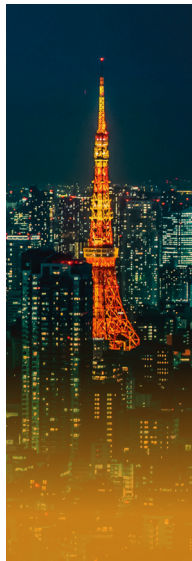


THE 2024  
GLOBAL  
ENERGY  
AGENDA





# Atlantic Council

## GLOBAL ENERGY CENTER

The Atlantic Council Global Energy Center develops and promotes pragmatic and nonpartisan policy solutions designed to advance global energy security, enhance economic opportunity, and accelerate pathways to net-zero emissions.



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# THE 2024 GLOBAL ENERGY AGENDA

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\* Essays were originally published during COP28, December 2023, with the exception of Pyatt's, whose essay is appearing for the first time in this report.



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# FOREWORD

## WROTE IN THIS SPACE LAST YEAR THAT

the 2023 United Nations Climate Conference, COP28, “will be colored by attainable, pragmatic solutions to achieve the inclusive and sustainable energy outcomes the world so urgently needs.” This turned out to be prescient. Despite wars threatening to derail ambitions to decarbonize, the world heeded the imperative of the climate crisis. Capping a year of behind-the-scenes negotiations, world governments at COP28 pledged to triple renewable capacity by 2030, twenty-two countries agreed to triple nuclear energy capacity by 2050, and parties called for a transition away from fossil fuels.

Critically, the historic shift to welcome oil and gas to the global dialogue on climate action in a credible manner will perhaps be the legacy of this COP, and an inflection point in our stewardship of a pragmatic, inclusive, and durable energy transition. Balancing the role of oil and gas production while expanding the use of clean energy is a tremendous challenge. As consecutive years of geopolitical turmoil and market volatility underscore, we can only accomplish the energy transition if we also pay renewed attention to energy security. Indeed, the emerging consensus in the energy and climate community is that climate action and continued energy security can and must proceed in tandem to create the pragmatic energy transition I called for last year.

With a “UAE Consensus” in hand, the task ahead now becomes “how do we do this.” In its fourth edition, the *Global Energy Agenda* has again provided insights from the global energy policy community on the path forward. This analysis is based on our annual survey and is accompanied by essays written by government, private-sector, and nonprofit leaders.

Throughout our survey, responses make clear that navigating the geopolitics of a world in transition remains our most urgent task. Participants identified current and potential future conflicts as dominant risks to both energy security and the energy transition. Continuation or escalation of Russia’s war in Ukraine will be the biggest geopolitical risk in 2024, according to 26 percent of respondents. An additional 21 percent of respondents said that fallout from the Israel-Hamas conflict was the biggest risk, while 15 percent said a new interstate conflict involving at least one energy-producing country was the greatest risk.

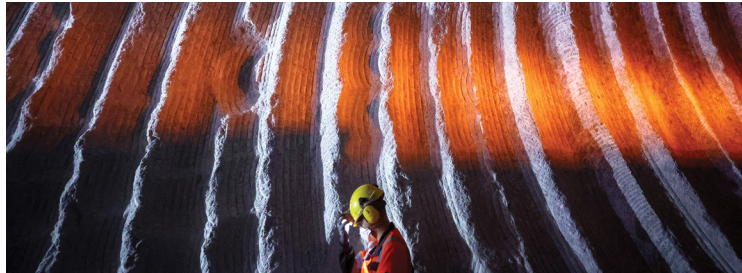
As we address the climate crisis, geopolitical pain points and fractures abound, disrupting and shaping the ways policymakers and industry leaders can marshal the energy transition while protecting energy security and access. Heading into 2024, the world could face even more uncertainty around harmonizing these goals. More than 50 percent of the world’s population heads to the polls this year, potentially setting the stage for macro trends to shape the energy agenda in unexpected ways, with clean energy leadership, concerns about Global North-South divisions, and US–China rivalry all framing how countries will think about their own security and prosperity, not just the unifying features of global climate action.

There does, however, remain plenty of room for optimism. We saw notable shifts in expected support for different energy technologies, reflecting a sorely-needed return to the types of projects that can immediately accelerate our climate goals. Asked which segments of the energy sector would see the greatest growth in investment, those predicting investment growth in carbon capture utilization and storage doubled to 8 percent from 4 percent, and electricity transmission saw a jump to 8 percent from 3 percent in last year’s survey. Solar and grid modernization’s growth expectations also ticked up. Meanwhile, the tool kit of energy technologies available to address the energy trilemma continues to expand, including advanced nuclear power and direct air capture.

Our findings underscore the reality that energy market fundamentals can shift rapidly due to geopolitics, technological changes, and more. Change will remain a constant, but the overarching message from our leadership essays and collective wisdom of more than 600 energy experts is that now is the time to leverage today’s energy crisis for faster progress.

I’m confident we can manage these changes constructively. By decarbonizing industry, transportation, and power systems as rapidly and economically as possible, the world can build on the pragmatism of COP28 to meet the needs of both climate security and energy security. As our energy leaders emphasize in their essays, we can only accomplish this together.

.....  
*Frederick Kempe*  
*President and Chief Executive Officer*  
*Atlantic Council*



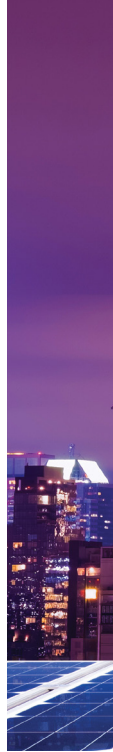
## INTRODUCTION

**A** SPIRATIONS THAT THE WORLD would overcome successive years of economic and geopolitical stress, prompted by the COVID-19 pandemic and exacerbated by Russia’s unrelenting war in Ukraine, seemed nearly attainable in early 2023. The United States, for example, was on the cusp of unleashing an infusion of stimulus for the energy sector brought on by passage of the Inflation Reduction Act (IRA), while consumers were benefiting from falling fuel prices, with the average retail gasoline price retreating to just over \$3 a gallon after reaching \$5 highs in 2022. Globally, a “staggering” 40 percent increase in renewable energy investment over the past two years underscored fresh momentum for the energy transition as highlighted by Fatih Birol, executive director of the International Energy Agency (and a member of the Atlantic Council’s International Advisory Board). That reality was reinforced further by the announcement of “the UAE Consensus” at

the United National Climate Conference (COP28)—a declaration that embodied the maturation of international diplomacy on climate change as countries agreed to “transition away from fossil fuels” in the energy system.

Nonetheless, all the success of 2023 cannot outpace a prevailing undercurrent in policy circles that not enough has been accomplished in the face of a fragile global economic and political outlook, especially as over 50 percent of the planet gears up for elections in 2024. In practice, energy companies and policymakers are being asked to embrace a net-zero future, which, as we saw in the United Arab Emirates, has widespread support. These same leaders, however, are also expected to fuel the world’s energy needs now—nearly 80 percent of which is still fed by oil, natural gas, and coal. This task is complicated by sustained trade tension between the United States and China, the post-pandemic reconfiguration of global supply chains, and—not the least—two





prominent wars affecting energy geopolitics: Russia's war in Ukraine and the fighting between Israel and Hamas. The world is watching closely to see if the latter expands into yet another regional conflict in the Middle East—a distinct possibility given Iran's backing of militant proxy groups in the region such as the Houthis in Yemen, which are currently responsible for disrupting global trade by targeting ships transiting the Red Sea.

## THE 2024 GLOBAL ENERGY AGENDA SURVEY AND EXPERT PERSPECTIVES

Amid these fraught circumstances, the start of the new year presents an opportune moment to take stock of the energy landscape that is so integral to economic development, climate mitigation, and, importantly, national security. In doing so, a global agenda for energy emerges, as described in this report

through diverse perspectives from a dozen key government, nonprofit, and private-sector leaders driving the energy transition, including Ukrainian Minister of Energy German Galushchenko, Moroccan Minister of Energy Transition and Sustainable Development Leila Benali, CEO and Special Representative of the UN Secretary-General for Sustainable Energy for All Damilola Ogunbiyi, and Green Climate Fund Executive Director Mafalda Duarte.

In addition to this collection of essays, we present the results of our annual global energy survey, the fourth in the series. It benefits from the insights of more than six hundred experts from around the world working in a variety of energy fields engaged directly in the sector or associated with it. This cross sampling provides rich perspective into the overall sector, the factors affecting energy geopolitics, markets, and the transition to net-zero emission targets. It also allows a more nuanced look at how views do—or do not—vary

by geography, industry, age, and other demographic attributes.

Insights from a detailed analysis of the survey appear throughout this report. Worth noting are four key findings:

**Immediate crises weigh heavily on the pulse of energy leaders, forging an expectation of and preparation for long-term energy market volatility.** Active wars and the potential for new conflicts are central contributors to perceptions of geopolitical risk. Only two years ago, cyberattacks, trade disputes, and the COVID-19 pandemic topped our respondents' list of leading risks in energy geopolitics. This year's respondents say the two existing conflicts are the most significant contributors to geopolitical risk—26 percent citing Russia and Ukraine, and 21 percent citing the conflict between Israel and Hamas. The possibility of a new war involving at least one energy producing country (15 percent) was similarly seen as a major risk to energy geopolitics.

Expectedly, the survey data reveals differences by geography. In Europe, for example, fighting between Russia and Ukraine is seen as by far the biggest danger to the sector (32 percent); whereas in the Middle East and North Africa (MENA), the Israel-Hamas conflict (30 percent) is the gravest concern. As we draw near the two-year anniversary of Russia's most recent invasion of Ukraine in a moment when other hot conflicts around the world are expanding, it's therefore unsurprising to see a corresponding impact on respondents' long-term perspectives.

Mirroring this viewpoint, Galushchenko writes in his essay, "Russia's war against Ukraine has triggered historic shifts in the energy sector, leading to volatile energy prices, supply shocks, security concerns, and economic uncertainty." Developing "a model of global energy resilience" has thus become an integral part of Ukraine's formula for peace and a critical tool for preventing "the use of energy as a geopolitical instrument of influence or a military tool of war."

Arguably hardened by successive years of conflict, over a quarter of respondents (27 percent) cite energy being deployed for geopolitical leverage as the most likely cause of market volatility in the coming decade. Another 12 percent see economic and resource nationalism—an issue that is gaining momentum as countries seek to bolster their own energy security

and avoid reliance on adversarial supply chains—as a principal risk to market stability. Interestingly, however, the primary concern of those most closely associated with oil and gas is different than the broader survey pool. Those involved in the production and sale of these fuels (38 percent), as well as respondents from the oil-rich MENA region (39 percent), see the biggest factor impacting market volatility to be underinvestment due to environmental, social, and governance (ESG) concerns. With the world's population breaching eight billion in 2023, the ability of governments and industry to ensure access to affordable and reliable energy is only likely to garner more scrutiny—especially given broad acceptance of mid-century climate targets. Whether from the Global North or the Global South,<sup>1</sup> this issue weighed on a meaningful community of respondents (17 percent), who likely recognize that an inability to meet burgeoning emerging market demand will inevitably exacerbate fraught geopolitical tensions around the world.

**Confidence in achieving a timely net-zero future is ebbing, but optimism about the economic benefits of an emissions-free energy system is fortifying global resolve to achieve climate goals.** In the IEA's 2023 publication titled *The Oil and Gas Industry in Net Zero Transitions*, the agency notes that achieving net-zero ambitions requires demand for oil and gas to fall by 45 percent below current consumption levels by 2050.<sup>2</sup> For context, global oil demand alone currently tops 100 million barrels a day. However, if survey responses on peak oil demand are a barometer for progress toward net zero, there's reason for pessimism. Most respondents see demand topping off in 2030 or later, with only 36 percent confident that demand will adjust in concert with the IEA benchmark. Year-on-year this is a dramatic shift, with over half of respondents (57 percent) in our prior year's survey confident that the world would reach peak demand before 2030. This lends credence to the skepticism detected in the survey regarding the world's ability to achieve its net-zero ambitions. Fully a third of respondents expect that achieving global net-zero by 2050 is highly unlikely and a further 30 percent see it as somewhat unlikely. Although our question last year on this topic differed slightly, that data suggest that confidence in reaching net zero has declined over the past twelve months.

1 Among other geographical groupings by country and region, this report occasionally refers to respondents in the Global South and Global North where this categorization provides meaningful insights based on the data analysis. There is some debate around the definitions of these terms, but for the purposes of this report, all respondents from the Group of Seventy-Seven (G77) countries and China are included in the Global South category. The rest of the survey pool is included in the Global North.

2 IEA, *The Oil and Gas Industry in Net Zero Transitions*, November 2023, 13, <https://www.iea.org/reports/the-oil-and-gas-industry-in-net-zero-transitions>.

Pessimism in the probability of achieving net zero by 2050 should not be misread for a lack of commitment to the overall goal, however. Most respondents see the path to net zero as an economic boon. Overall, 56 percent of respondents say that achieving net zero would help spur economic growth. Only 27 percent say that the economic impact will be negative. As Ogunbiyi writes, “up to \$5 trillion can be added to the economies of low-income countries by providing clean and affordable energy to those without it.” Additionally, the return on investment can go beyond direct economic payoffs—projects not only lower greenhouse gas emissions globally, but also, at the local level, they can lead to better quality of life and air quality with corresponding improvements to health outcomes. Ogunbiyi asserts, “We can turn energy poverty into an opportunity to transform entire nations and subregions, bringing hope and prosperity.”

Compared to a similar question asked last year, this year’s results suggest a shift toward support for the energy transition’s economic case. Indeed, now 40 percent of respondents believe both that global net zero will not take place by 2050—but, if accomplished, will have either no effect on the economy or a positive one. This helps explain at least some of the frustration expressed in comments given by those surveyed on the pace of change.

**Views of Global North and South are more aligned than expected, with one exception: the Middle East.**

A year ago we noted that “the Global South found success in drawing a renewed focus on how climate change is impacting developing nations”—the consequence of success realized during COP27 in Sharm el Sheikh, Egypt. In the year ahead, we anticipated that distance would grow between the transatlantic partners (i.e., the United States and Europe) and the majority of the developing world on how to approach energy and climate policy. Defining the Global South as G77 countries and China, this survey set out to robustly capture voices outside of typical policy circles in Washington, DC or Brussels. The results were unanticipated. By and large, respondents from the Global South demonstrated remarkable consistency with counterparts in the United States and Europe. With few exceptions, the one voting block that consistently diverged from Western counterparts and the rest of the Global South was the MENA region. Compared to all other regional demographics, respondents from the Middle East disproportionately see underinvestment because of ESG as the greatest cause of mar-

ket volatility, exhibit doubt about the ability to achieve net zero by midcentury, and lack confidence in the economic benefits of striving for a net-zero energy economy. There are, of course, one-off moments where other communities deviate from the norm—the United States places more weight on political will as an inhibitor to net zero, the war in Ukraine is a greater energy transition catalyst for Europeans, and the rest of the Global South places a stronger emphasis on the impact of extreme weather influencing the energy transition—but overall there is broad consistency across the majority of the world despite strikingly disparate starting positions and access to capital.

**Natural gas is demonstrating its value for the future energy mix.** The final COP28 communiqué recognized “that transitional fuels can play a role in facilitating the energy transition while ensuring energy security.” It’s a subtle nod to the enduring and growing role natural gas, including liquefied natural gas (LNG), has in buttressing global energy security. The results of this year’s survey further reinforce this view. Nearly three-quarters of respondents see a long-term future for natural gas in the energy system either as a primary fuel (24 percent) or more commonly to support wide-scale deployment of clean energy technologies (51 percent). On the latter point of gas supporting low-carbon energy, there is a marked jump in this view, up from 37 percent last year. Consistent with the past two years, only 3 percent see a minimal role for natural gas in the future. On a regional basis, reversing two years of waning support for natural gas, Europeans are demonstrating that non-Russian sources of natural gas (mainly from the United States and Qatar) may meaningfully backstop European energy security. This trend coincides with expansive growth in LNG import infrastructure on the continent, in Germany in particular. Approximately two-thirds of Europeans see an enduring role for natural gas in the energy mix—a strong shift from the prior year, when less than half anticipated a permanent role for gas supplies.

With these key findings, we jump into this year’s *Global Energy Agenda* narrative that takes the pulse on where energy leaders see geopolitical risk, market influences, and factors affecting the world’s pace toward net-zero emissions. Read on for the complete analysis of our survey results and the insightful perspectives of energy leaders who will inform and shape energy policy in the year ahead.



## ■ CHAPTER 1

# Geopolitics and Energy Security

**IN NOVEMBER**, the International Energy Agency will celebrate its fiftieth anniversary. It's an organization that was founded in response to concerns over security of supply in the wake of the 1973 Oil Embargo, and rooted in promoting access to "secure oil supplies."<sup>3</sup> For fifty years, geopolitical lines have been drawn around shifting supplies of hydrocarbons. And, for a moment, some in the international community envisioned that renewable energy would serve as a panacea to the world's energy security needs. The reality is more complex. The contours of energy security are evolving as the

world undertakes a vast transformation of the energy system, but not in a manner that will surmount the immediate effect of national security and the economic competitiveness of each country.

Take the case of Germany. The war in Ukraine has directly impacted where the country sources its energy. To limit contraction of the country's economy, which saw a 0.3 percent decline in 2023, German leadership set in motion an expansive reform of the energy system, supplanting Russian natural gas with imported LNG, reviving mothballed coal-fired power plants, and putting in place generous energy subsi-

3 Agreement on an International Energy Program, as amended February 20, 2022, accessed via IEA website, [https://iea.blob.core.windows.net/assets/a65d875d-598f-446f-8073-3c17ce7ff76a/IEP\\_Agreement\\_Updated2023.pdf](https://iea.blob.core.windows.net/assets/a65d875d-598f-446f-8073-3c17ce7ff76a/IEP_Agreement_Updated2023.pdf).



Russian military vehicles escort an International Atomic Energy Agency (IAEA) mission, leaving the Zaporizhzhia nuclear power plant in Russian-controlled Ukraine, June 15, 2023.

REUTERS/Alexander Ermochenko

dies. These German actions are intended to maintain its competitiveness, industrial leadership, and, ultimately national security—a direct response from lessons learned through overreliance on Russia. Germany’s decisions should not be read as a permanent deviation from the country’s commitment to a clean energy future but an evolution in how energy security is recalibrating to reflect the energy transition.

At the same time that Berlin is reinforcing its immediate economic needs, the country is enhancing its energy efficiency, preparing the clean energy workforce of the future, and sustaining investment in deployment of renewable energy. As Amos Hochstein, President Joe Biden’s senior advisor for energy and investment, noted during the Atlantic Council Global Energy Forum in Dubai this past December, the lesson for breaking away from dependency on Russia is the importance of avoiding any “single point of failure” in

any supply chain—stating, “That was true on oil. And it was true on gas. And it is now true on renewables.”

Around the world, governments and organizations like the IEA are adapting to a new slate of energy technologies. In doing so, they must each weigh how to balance these resources with conventional energy, which remains the backbone of modern society—responding to current events, while ensuring that, as the energy system shifts toward net-zero emissions, they do not cede influence to adversaries, whether Russia for natural gas or China for clean energy technologies.

The new energy landscape is vibrant and growing, yet the policy responses are familiar, underscoring why the *Global Energy Agenda* continues to prioritize energy security. As you will see through the following essays and survey analysis, current events weigh heavily on how policymakers, industry executives, and civil society leaders approach the energy transition.

...continued on page 11



## Energy security as the foundation for Ukraine's formula for peace

*A vision for the long-term reconstruction of the Ukrainian energy system and securing global energy security*

by German Galushchenko

The enduring struggle of the Ukrainian people for their independence, sovereignty, and their very existence is approaching the seven-hundred-day mark. Despite the heavy losses, destruction, and constant shelling, Ukraine continues to be a symbol of defiance, an example of true freedom and courage, an important actor in the international arena, a reliable partner for its allies, and a major focus of attention among geopolitical experts and media circles.

Not only is Ukraine defending its right to exist, it is also making a significant contribution to the international agenda by setting a number of precedents for the world: in military capabilities, through its long-term defense and the heroic deeds of its armed forces that have shattered the myth that Russia has the world's "second best military"; in the economic sphere, through its resilience and high level of adaptability and growth capacity; in the energy sector, by counteracting the physical threats to nuclear reactors, surviving blackouts, and destroying the Russian monopoly in the production of special types of nuclear fuel; and in the geopolitical sector, in the form of unity of the democratic world in the fight against a common aggressor that is trying to influence the world order and domestic policies of other countries through terror, blackmail, bribery, and disinformation.

Unfortunately, this war has also created negative precedents, such as the first attack in history on peaceful nuclear facilities, including the occupation of a nuclear power plant of an International Atomic Energy Agency member state by another member state; provoking a massive human-caused disaster in Europe with the destruction of the Kakhovka hydroelectric power plant; and Russia's use of Ukrainian energy facilities and

infrastructure as instruments for causing humanitarian damage, as targets for missiles and drones, as storage for weapons and explosives, and as a station for military personnel and equipment. Of the many international precedents set by the war, Russia's malicious leveraging of energy and nuclear security has raised the alarm on just how powerful a weapon energy can be.

Russia's war against Ukraine has triggered historic shifts in the energy sector, leading to volatile energy prices, supply shocks, security concerns, and economic uncertainty. The import of Russian fossil fuels has become politically toxic for most of its consumers, leading to the democratic world's sudden need to search for new supply chains and other ways to meet its energy needs. One of the first measures countries took to pivot away from Russian energy supplies was to accelerate the pace of the energy transition to low-carbon or carbon-free sources and technologies, making decarbonization a focal point of the geopolitical debate. The fight of Ukraine and its allies has thus expanded from a battle for territory and independence to a stand against the dictatorship of fossil fuels the world over. That is why the main task that Ukraine is working on today with its international partners is to jointly develop a model of global energy resilience that will prevent any future cases of violation of energy and nuclear security and the use of energy as a geopolitical instrument of influence or a military tool of war. This task is a crucial element of the peace formula—a plan for the war's end—that was presented by Ukrainian President Volodymyr Zelenskyy first at the Group of Twenty summit in November 2022, and then later at the United Nations General Assembly in September.

Among the ten points of the formula for restoring peace, two are dedicated to energy, highlighting its critical importance to the process. They address the need to guarantee energy security and radiation and nuclear safety, as their absence has multiple destabilizing effects. Without these safeguards, the risk of global food and climate insecurity will become even greater, Russia's ability to exert pressure on political and geopolitical decision-making and to manipulate public opinion through nuclear blackmail will grow, as will its propensity to commit crimes against humanity and the environment with impunity.

However, amid the terrible events taking place in Ukraine, we must seize upon the promise of the future. Ukraine now has the opportunity to completely rebuild its energy system and the country as a whole, to elevate energy and nuclear safety to a new level, and to initiate the process of strength-

ening international security guarantees. I am confident that Ukraine's experience with rebuilding based on the principles of the peace formula will become a valuable asset for European and global energy policy. The peace formula proposed by Ukraine is essential not only for ending the war and guaranteeing peace in Ukraine, but also for a universal set of measures to end other wars and armed conflicts on the planet and overcome global problems. That is why the formula is based on international cooperation and coordination of efforts, in particular, to develop mechanisms for responding to cases of energy coercion and blackmail. Countries that uphold the principles of democracy must agree on these mechanisms and requirements for excluding from international processes an aggressor state that violates international law and the values of sustainable development and climate security. Accountability for



UNDP

The United Nations Development Programme in Ukraine installs solar panels.

“

**The fight of Ukraine and its allies has thus expanded from a battle for territory and independence to a stand against the dictatorship of fossil fuels the world over.**

—*German Galushchenko*

”

aggression against energy and climate security should also become a functioning part of international law in the form of appropriate reparations, for example, for greenhouse gas emissions generated by armed hostilities.

Rebuilding Ukraine’s energy sector in line with the world’s best practices in sustainable development and decarbonization will help to finally break the grip of the fossil fuel dictatorship and strengthen the new energy model of the world. An important step toward this will be, in particular, Ukraine’s accession to the European Union’s (EU’s) energy regions as a kind of rapid response to energy crises and shortages across Europe, the development of a network of interconnectors for efficient cross-border electricity exchange, and Ukraine’s access to regional gas security clusters in Central and Southeast Europe. Attacks on and occupation of energy infrastructure, which are increasingly becoming the norm in modern warfare, should serve as an incentive to develop new international approaches and standards to ensure the physical security of such facilities, develop international logistics infrastructure and routes for the rapid supply of necessary equipment and spare parts, develop storage networks in safe regions, and strengthen the international legal framework for preventing nuclear threats.

Today, Ukraine is still Europe’s largest country with a great potential for innovative and technological recovery, also becoming a major supplier of renewable energy and critical and rare earth mate-

rials. Our goal is for Ukraine to become an energy hub in Europe, which is already being borne out: our foreign partners are utilizing Ukrainian underground natural gas storage facilities; Ukraine continues to export electricity to the EU even amid the war; and in recognition of Ukraine as one of the key partners in the development of the hydrogen industry, the EU included our country among the signatories to the Roadmaps to New Nuclear conference communiqué.

In the long run, Ukraine is eager to become a net exporter of affordable and clean energy, as well as a substantial contributor to energy security in the world. We can be confident in this outcome, as Ukraine has one of the largest available platforms for the development of innovative infrastructure and projects, including industrial parks, green technologies, renewable energy, hydrogen, and small modular reactor technology.

Ukraine’s experience in ensuring the functioning of the energy system during the war, as well as the precedents it has set, including the first-ever comprehensive peace formula, have already paved the way for a new model of global energy sustainability based on energy and nuclear security principles, which will facilitate a joint transition to a clean, decarbonized, and, most importantly, peaceful future.

*German Galushchenko is the minister of energy of Ukraine.*



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## WAR WILL SHAPE THE NEAR-TERM ENERGY ENVIRONMENT

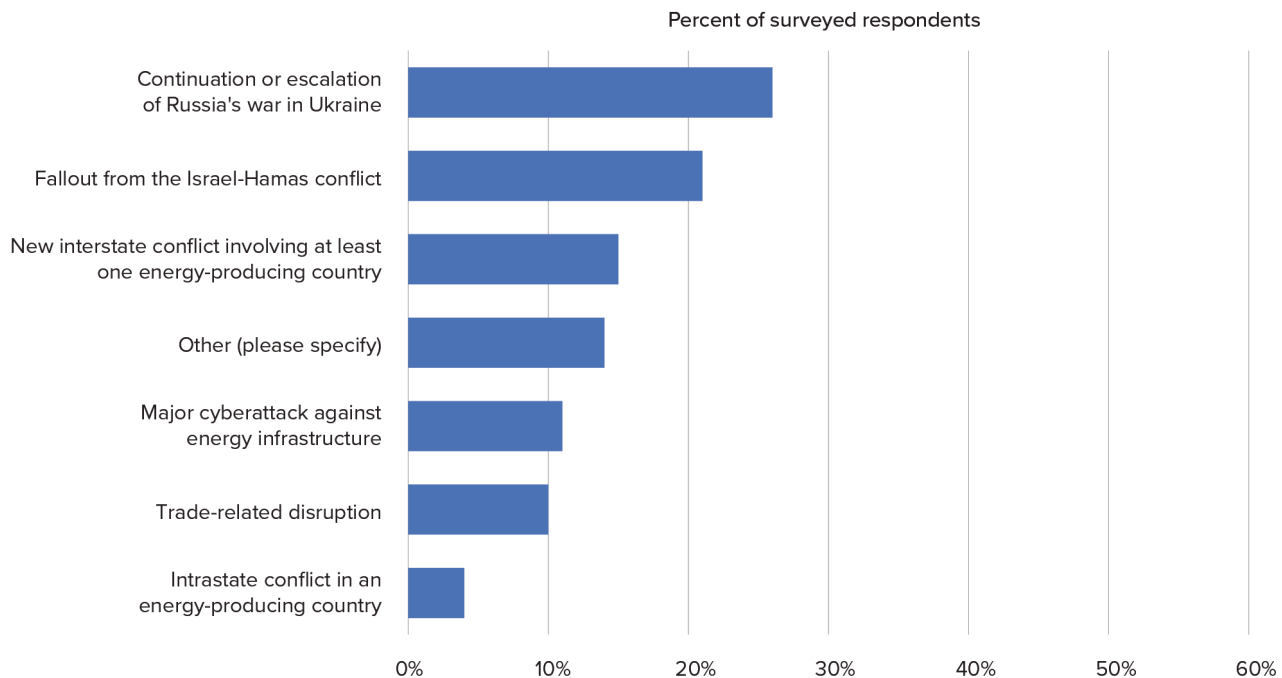
Just two years ago, survey respondents considered cyberattacks, trade disputes, and the effects of the COVID-19 pandemic to be the most pressing geopolitical risks facing the energy market. In our last survey, Russia's invasion of Ukraine shook up perceptions: it was by far the most commonly cited leading risk (by 47 percent of those respondents), well ahead of the second-place response of cyberattack (13 percent).

Now, international armed conflict has come to dominate the geopolitical risk agenda. While the proportion of those naming the Russia-Ukraine war as the biggest concern (26 percent) has gone down from last year, the drop is made up for by those selecting fallout from the Israel-Hamas conflict (21 percent). Third is any new interstate conflict involving at least one energy-producing country (15 percent). Cyberattacks and trade disputes have now fallen down the list to below "other."

Three things are particularly striking about these answers. First, the top two choices are based on conflicts that, despite having long roots, have only recently become full-blown wars—one in February 2022 and the other in October 2023. The second noteworthy attribute of the current range of geopolitical risks is that these wars, while not predominantly about resources, have had a dramatic impact on the perceived stability of energy markets—Russia's war in Ukraine, of course, dramatically transforming how Europe accesses the energy resources propelling its economy. Additionally, beyond the impact on energy geopolitics, these conflicts have changed the thinking around markets and the pace of the energy transition. As discussed elsewhere, governments' consideration of how to gain advantage in a world of conflict are expected to increasingly contribute to market volatility over the coming decade.

Looking at variations within these answers, local considerations inevitably affect risk perceptions.

### What will be the biggest risk in energy geopolitics in 2024?



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.

Among European respondents, for example, 32 percent list Russia-Ukraine fighting as the top concern, while 21 percent cite the conflict between Israel and Hamas. Among MENA respondents, the numbers are roughly reversed, as 30 percent call the fallout from the Israel-Hamas conflict the biggest risk and 20 percent instead cite the Russia-Ukraine war. In both cases, however, the conflicts are among the top three risks.

Following interstate conflicts, a relatively large number of respondents say that “other” risks will shape energy geopolitics in 2024. Digging into the written answers that expand on the choice of “other” reveals a range of concerns. The most prominent of them was that energy policies designed to address climate change would have the unintended consequence of undermining economic growth and destabilizing states. This is a nontrivial matter. As former Minister of Climate and Environment and COP24 President Michał Kurtyka wrote in his essay, the European Green Deal “must be reframed not simply as a climate plan, but as an initiative with economic security and competitiveness at its core.”

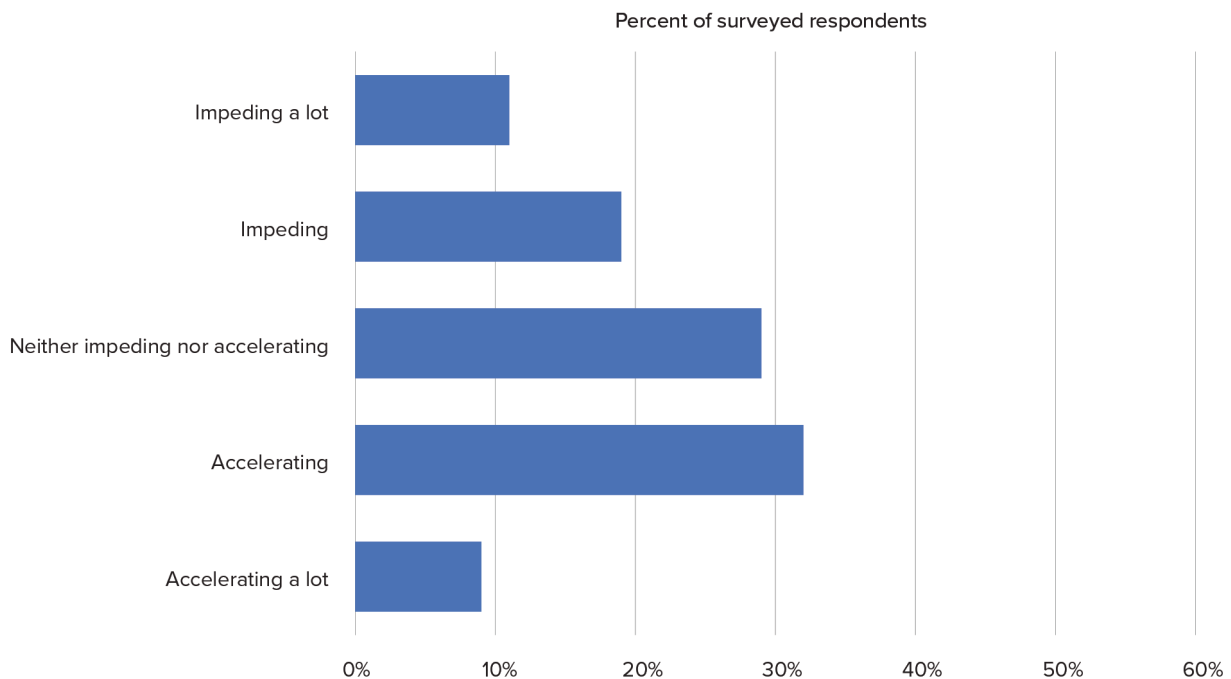
## THE INFLUENCE OF GEOGRAPHY AND IMMEDIACY

In looking at respondents’ perspectives regarding the impact of Russia’s war with Ukraine on the energy transition, one can argue that geopolitical headwinds from global conflict may have limited bearing on long-term sectoral goals. Respondents, as a group, are more likely to say that Russia’s war with Ukraine is accelerating the energy transition (41 percent) than impeding it (30 percent). A closer examination of the data, however, reveals geographic and time-dependent trends worth noting.

To begin with, the imbalance toward those who view the war as accelerating the transition is largely an artifact of European attitudes. Among this group, 55 percent of respondents see the conflict bringing about a faster energy transition, more than double the number who say it is impeding change (27 percent). In the United States and the Global South, however, only around a third say that the war in Ukraine is speeding up the energy transition, roughly comparable to the number who say the war is slowing down any energy shift.

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### Is Russia’s war in Ukraine impeding or accelerating the energy transition to net-zero emissions?



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.



# Europe needs a Green Deal that can meet the moment

by Michał Kurtyka

Europe is at a crossroads. War has returned to the continent and the global economic order is unraveling, evidenced by the decoupling of cross-border supply chains and a resurgence of national industrial policies. As the European Union (EU) grapples with this upheaval, it must confront a new geopolitical paradigm.

Energy is central to this equation—and has been since the beginning of the European project and the creation of its Coal and Steel Community in 1951 as well as the Euratom Treaty signed in 1957. Then, as now, energy was vital for Europe's security and prosperity. However, with both being challenged today and with European Parliament elections approaching in June 2024, a new commission must again find a way to realize Europe's dream. Europe's ability to prosper in an increasingly competitive and destabilized world is at stake—as is Europeans' commitment to continental integration.

The European Green Deal is emblematic of this commitment and vital for achieving Europe's ambitions. But it must be reframed not simply as a climate plan, but as an initiative with economic security and competitiveness at its core. To do so, Europe must ask itself two simple questions: how it will grow its economy, and what energy sources should fuel that growth?

The war in Ukraine shows that Europe's energy system is torn between two paradigms: a conventional one, based on fossil energy, and an alternative model, based on renewables. The failure of conventional energy—dominated in Europe by Russia—to provide economic security and competitiveness is evident. However, the renewables paradigm cannot provide security of supply and economic competitiveness either—first and foremost because Europe is reliant on others for these

technologies, but secondarily, because of inherent intermittency of weather-dependent energy sources. In Europe's efforts to secure and decarbonize its economy, it holds none of the cards to do so.

Europe's pursuit of energy security and decarbonization objectives requires three major levers. Not one is "Made in Europe."

The first—perhaps counterintuitive—lever is gas. The twin ascendancies of shale and liquified natural gas (LNG) led to the biggest geopolitical revolution of the twenty-first century. They reduced the leverage of pipeline gas suppliers while pricing out coal in the United States and many developing countries. While LNG reduces Europe's dependence on both Russia and coal, this lever is decidedly "Made in America."

The second, more obvious lever is renewable power. While renewables reduce both emissions and the power of fossil fuel exporters, that clout has gone elsewhere. Seventy-six percent of all lithium-ion battery cell production,<sup>1</sup> seven out of ten best-selling electric vehicles,<sup>2</sup> and soon 95 percent of solar photovoltaic manufacturing<sup>3</sup> all come from one country—this lever is "Made in China." That may change under the United States' Inflation Reduction Act (IRA). In either case, European renewable energy autonomy remains elusive.

The third lever—and most controversial one, at least in Europe—is nuclear energy. This powerful decarbonization tool remains underutilized in the West, but not in the East. Russia is the world's leading nuclear technology and fuel exporter, and China is rapidly catching up. While Europeans debate nuclear energy's role in their energy transition among themselves, the prospects for this source of power to be "Made in Europe" languish.

1 Senate Committee on Energy and Natural Resources. "Manchin Questions Witnesses on Ending Reliance on China for Critical Minerals." Senate Committee on Energy and Natural Resources, September 28, 2023. <https://www.energy.senate.gov/2023/9/manchin-questions-witnesses-on-ending-reliance-on-china-for-critical-minerals>.

2 José Pontes. "Best Selling Electric Cars In The World — January 2023." Clean Technica, March 3, 2023. <https://cleantechnica.com/2023/03/03/best-selling-electric-cars-in-the-world-january-2023/>.

3 International Energy Agency. Special Report on Solar PV Global Supply Chains. IEA, July 2022.



EU flags at the European Commission Berlaymont building

Europe is stuck in the middle of three conventional and alternative energy powers. It lacks the oil and gas resources of the United States or Russia. And it does not possess the industrial materials or manufacturing capabilities of China, while its energy crunch renders European industry increasingly uncompetitive. Europe also lacks significant capabilities in nuclear power, thanks largely to the political choices of a few member states that impede a unified approach.

Europe so far has been unable to put forward a credible alternative to the IRA or Chinese industrial policy due to insufficient coordination and lack of fiscal firepower behind its push for net zero. Europe is not lacking resources: nearly €800 billion was committed last winter to shield industries and consumers against rising fossil fuel prices;<sup>4</sup> its members states' combined spending on renewables is greater than that of the United States' as a percent of total gross domestic product.<sup>5</sup> But its climate and industrial objectives are structurally disconnected. And both the US and Chinese examples show that when climate objectives are aligned with well-funded industrial policy, they can deliver astonishing results.

Chinese industrial policy has cemented the country as the dominant force in the global clean energy supply chain. In the United States, the IRA is diversifying that supply chain and creating a boom for cleantech manufacturing and related sectors. As of August 2023, the law has been responsible for more than 170,000 jobs attached to 272 clean power projects and is projected to create 9 million total jobs over the next decade.<sup>6</sup>

Europe risks being left behind if it does not take swift action to ensure its energy future is “Made in Europe” where necessary, and “Made with Europe” where possible, stabilizing and encompassing its neighborhoods and trade partners. To do so, it must create a compelling complement to the IRA and create the fiscal space to finance it. This requires renewed European leadership and a clear vision on energy security and its vital role in the future of Europe.

*Michał Kurtyka is a distinguished fellow with the Atlantic Council Global Energy Center. He served as Poland's first minister of climate and environment, and as COP24 president.*

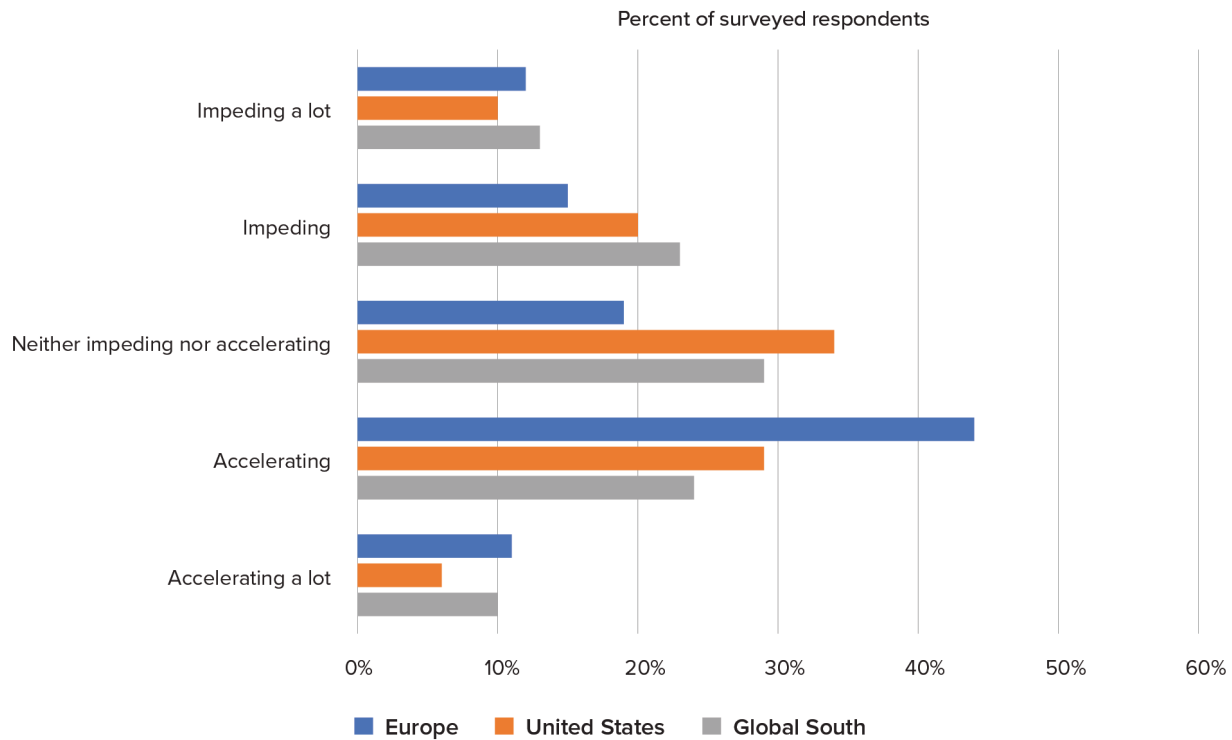
4 Kate Abnett. “Europe's spend on energy crisis nears 800 billion euros.” Reuters, February 13, 2023. <https://www.reuters.com/business/energy/europes-spend-energy-crisis-nears-800-billion-euros-2023-02-13/#:~:text=The%20792%2Dbillion%2Deuro%20total,deliveries%20to%20Europe%20in%202022>.

5 Sophia Busch and Carrie Hsu, “US climate spending may soon match that of developed peers.” The Atlantic Council, August 22, 2022. <https://www.atlanticcouncil.org/blogs/econographics/us-climate-spending-may-soon-match-developed-peers>.

6 Climate Power. One Year of Our Clean Energy Boom. Climate Power, July 25, 2023.

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## Is Russia's war in Ukraine impeding or accelerating the energy transition to net-zero emissions?



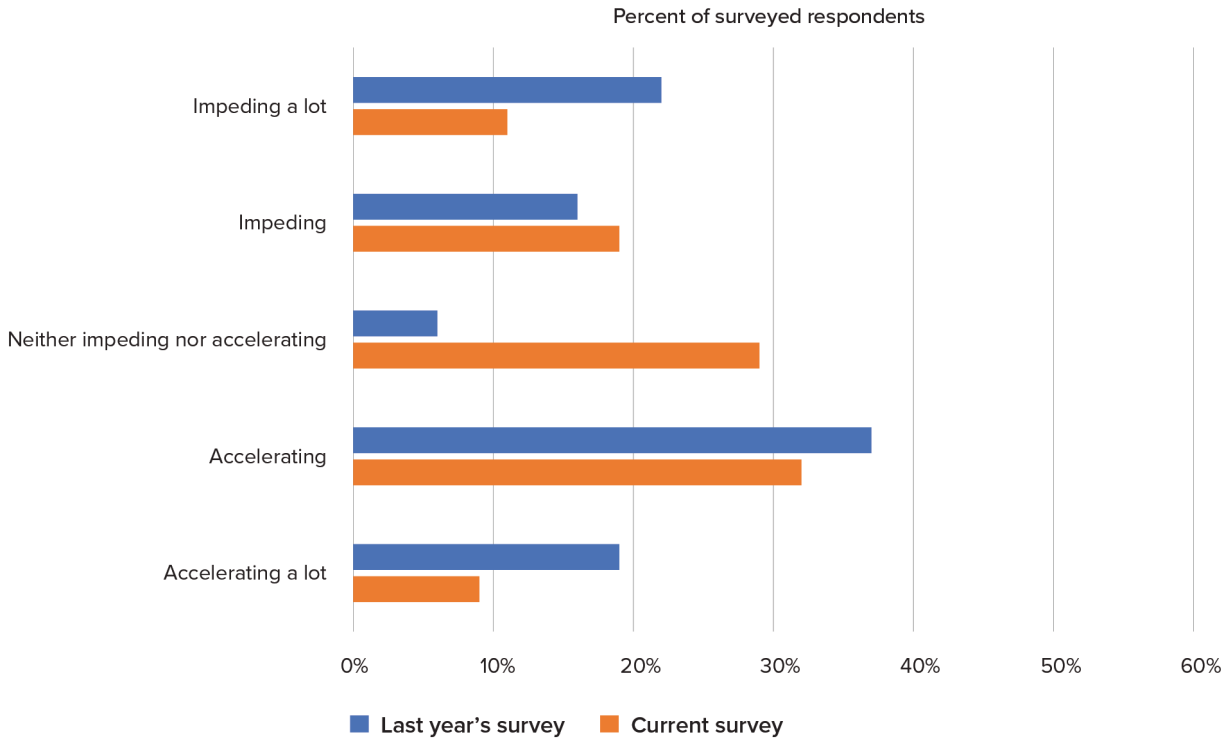
SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.

Moreover, opinions about the likely impact of the conflict on the energy market are moderating greatly. In last year's survey, more than 40 percent of respondents said that the war was affecting the speed of the transition a lot in one direction or another. In the intervening year that number has been roughly cut in half (to 20 percent). Meanwhile, the figure for those who see no change has skyrocketed from 6 percent to 29 percent. This pattern repeats in subgroups throughout the survey population.

The decline in the extent of change that respondents see arising from the war is similar to the drop that occurred in earlier surveys when respondents were asked about the impact of the COVID-19 pandemic on the energy transition. It appears that, as with the pandemic, initial strong impressions formed in response to a major event moderate over time.

Finally, respondents appear to be shaping their views about the impact of what is happening in Ukraine to align with their thinking about net zero.

## Is Russia’s war in Ukraine impeding or accelerating the energy transition to net-zero emissions?



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.

Among those who believe that global attainment of net zero by 2050 is highly likely, 58 percent say that the conflict is accelerating that transition, including 33 percent who say it is doing so a lot. Only 25 percent see it slowing the process. Among those who consider reaching net zero to be highly unlikely, views run the opposite way: 37 percent say that Russia’s war is impeding the transition and 27 percent that it is speeding it up.

Regardless of where respondents fall on this question, one takeaway seems clear: armed conflict injects uncertainty into the energy transition, further reinforcing the notion that a more reliable, diverse, and resilient energy system can buffer countries against coercive actors and short-term geopolitical risks as well as longer-term energy market volatility.

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# To achieve carbon neutrality, countries must navigate geopolitics and energy together

by Shin Hosaka

Energy security has been an age-old challenge since long before the Industrial Revolution. Now, amid this context, a new challenge of dealing with environmental issues has arisen. A few years ago, the narrative around the energy transition toward net-zero emissions followed a simplistic trajectory; it gave the impression that the world would seamlessly transition from the constraints of commodities such as oil and natural gas, embracing the geopolitical benefits that such a move would entail. However, as I have seen in my tenure as the commissioner of the Agency for Natural Resources and Energy and as the vice minister of Japan's Ministry of Economy, Trade and Industry (METI), this energy transition is far more intricate. Energy dynamics, replete with their occasional turbulence, still hold sway over global geopolitics. In this context, I believe that multilateralism is a key driving force to encourage energy transitions toward net zero.

Policymakers must face this reality head-on, realizing a green society necessitates the formulation of new policies and global collaboration.

I wish to shed light on Japan's perspective leading up to the Group of Seven (G7) Ministers' Meeting on Climate, Energy, and Environment—which Japan hosted in April 2023—and the first-ever LNG Producers-Consumers Conference, which we co-hosted with the International Energy Agency (IEA) in July.

The significance of these meetings lies in their timing, held amid what the IEA called the world's "first truly global energy crisis." Concurrently, these events took place at a time when forces are pulling apart the worlds of the haves and have-nots. Furthermore, I believe these deliberations will spark conversations about the world's approach to both COP28 and the energy crisis at hand.

The issues surrounding energy are a common challenge for the planet's 8 billion people. Japan's journey to the G7 Ministers' Meeting on Climate, Energy, and Environment began with the conviction that the outcomes of the G7 should not merely benefit its member states or other developed nations. Instead, these outcomes should also foster collaboration with its Asian neighbors and countries from the Global South. The essence of energy, especially in these critical times, demands that developed nations must confront their global responsibilities rather than scramble for resources.

To clarify any misconceptions, the Japanese government remains a staunch supporter of a carbon-neutral world. However, the path to carbon neutrality should be tailored to individual countries' unique circumstances, embracing various pathways and being inclusive of all technologies, which is one of the important messages of the G7 in 2023.

Japan, having faced an energy crisis nearly fifty years ago, advanced its technological development vigorously. Solar power, now ubiquitous in our country, owes its commercial success to Japan's relentless research and development. We not only learned from the crisis, but also significantly contributed to the world's green transition. Our sights are now set on being frontrunners for hydrogen technology, carbon capture utilization and storage, and other clean energy solutions, and we're actively offering extensive technological support to those seeking it.

It is also important to address the crucial topic of enhancing liquefied natural gas (LNG) and natural gas security, often regarded as ground zero of the energy crisis. The G7 Ministers' Meeting on Climate, Energy, and Environment highlighted the need for investment to prepare for potential gas



Night view of Tokyo, Japan

shortages. Recognizing the importance of dialogue between producing and consuming countries, the LNG Producer-Consumer Conference was convened in Tokyo in July. Japan proposed enhancing the IEA's capabilities in the natural gas and LNG sectors, and announced a new partnership to address methane, a pressing concern for cleaner LNG and natural gas utilization. To reiterate, Japan is not advocating actions contrary to achieving carbon neutrality. Our vision is to integrate LNG and natural gas as strategic buffers to accelerate the green economy.

Reflecting on the current situation, had Europe maintained substantial underground reserves and Japan had a system to prevent supply interruptions, could the response to the crisis have been mitigated? Could price fluctuations have been better managed? Both Singapore and the Japanese government are beginning strategic LNG reserve mechanisms. While it might be challenging to maintain buffers like crude oil, various options exist for LNG and natural gas reserves. We aim to collaboratively analyze these with international organizations, including the IEA, to discover

a new form of international collaboration, balancing three important elements of energy policy: energy security, the climate crisis, and geopolitical risks.

To address the problem of methane emissions, Japan successfully engaged the governments of likeminded countries as well as the private sector. Exemplifying public-private cooperation, Japan and South Korea's leading LNG buyers formed the Coalition for LNG Emission Abatement toward Net-Zero (CLEAN) initiative as a methane countermeasure. Additionally, an agreement was reached between Japan, South Korea, the United States, Australia, and the European Commission to work on methane countermeasures.<sup>1</sup> More specifically, according to the new framework, Japanese and Korean LNG buyers will ask suppliers for data on methane reduction measures and data on LNG projects, and Japan Organization for Metals and Energy Security (JOGMEC)—a neutral third-party organization affiliated with the Japanese government—will collect and publish this information. JOGMEC will discuss best practices with the suppliers and encourage improvements as neces-

<sup>1</sup> Japanese Ministry of Economy, Trade, Industry. *Joint Statement on Accelerating Methane Mitigation from the LNG Value Chain*. METI, July 18, 2023.



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**I believe that multilateralism is a key driving force to encourage energy transitions toward net zero.**

—Shin Hosaka

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sary. The governments involved intend to support this initiative to the maximum extent possible. This new public-private partnership will signal to the market the need for methane control measures, and as data is collected more accurately and on a larger scale, it will indicate which projects are striving to combine environmental measures with a stable supply.

Another essential aspect of the energy transition is fostering dialogue on markets, particularly the finance sector. Japan took the initiative to establish transition finance methodologies to support practical decarbonization for hard-to-abate sectors. Looking forward, we will issue GX (Green Transformation) Economy Transition Bonds dedicated to financing government investments toward carbon neutrality. These measures are gaining traction among Asian peers, with a growing recognition of their role in achieving a practical energy transition, ensuring stable supply, and facilitating economic growth. In 2021, financial institutions in Japan, in collaboration with their counterparts in Asia and the West, launched a study group for transition finance, culminating in unique guidelines. Currently, based on the requests of various Asian nations, Japan is holistically promoting the Asia Energy Transition Initiative, packaging strategies such as the carbon-neutrality roadmap formulation, establishment of transition finance and funding provision, technology deployment in Asia, and institutional design support to achieve the Asia Zero Emission Community (AZEC) vision.

The conclusions drawn from these discussions resonate with the sentiment of unified commit-

ment—addressing energy security, the climate crisis, and geopolitical risks as a consolidated challenge. We hope to share these initiatives and results with the United Arab Emirates (UAE) at COP28 and engage in meaningful dialogues with many stakeholders to build systems that prevent repeating past crises and ensure global carbon neutrality.

To summarize, I would like to conclude with the three key messages.

- First, prioritizing energy security is paramount to propelling the green movement. Overlooking this major concern could inadvertently amplify the perils associated with climate change.
- Second, the pursuit of a net-zero future, though universally acknowledged as a goal, has multiple pathways based on each national circumstance. It is my hope that COP28 recognizes that each country has its own situation and respects these various pathways.
- Third, my aspiration for COP28 is to see it not as an arena of division, but as a testament to renewed cooperation and solidarity.

In these challenging times, our responsibility is not just to our respective nations but to our shared planet. For COP28, let's remember our common purpose and the intricate web of geopolitics and energy that we must navigate together.

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*Shin Hosaka is Japan's vice minister of international affairs at the Ministry of Economy, Trade, and Industry.*



## Energy security is global security

by Geoffrey R. Pyatt

As assistant secretary of state for energy resources, my team and I focus on two key, complementary goals: energy security and energy transition.

In nine years as a US ambassador in Europe, I witnessed time and again Vladimir Putin's use of energy as a tool of coercion. I saw it as ambassador to Greece when Russia cut off gas supplies to neighboring Bulgaria, and as ambassador to Ukraine when Russia tried to pressure Ukraine and the EU by altering gas transit, upending the reliable flow of energy.

Since Russia's full-scale invasion of Ukraine failed on the battlefield, Putin has unleashed a wave of brutal attacks against Ukrainian civilians and the energy infrastructure that keeps their lights on and their homes warm.

Ukraine's power generation capacity has been degraded by almost 50 percent since February 2022. Despite this, Ukrainian energy workers, supported by a Group of Seven-plus (G7+) coalition, have done all they can to repair, restore, and harden the grid and generation facilities.

This work has, so far, prevented large-scale blackouts this winter. Ukraine has even been able to store Europe's excess gas and help address European concerns about shortages.

Nevertheless, this war has highlighted how malevolent actors can weaponize energy resources, and the importance of diversification.

It also has demonstrated how US national security, and the security of our friends and allies, depends on energy security, and how America's energy abundance can contribute to our alliance relationships.

The European Commission's rapid response through its RePowerEU package and US-EU cooperation, including through the US-EU Energy Council, has helped drive new energy efficiencies to bring down demand, while the amount of US liquefied natural gas (LNG) sent to Europe has surged. Russian piped natural gas exports to

Europe, which had been receding since 2020, plummeted drastically after 2022 to a new low of around 27 billion cubic meters in 2023. Making up for this significant drop in supply, US LNG producers stepped up to deliver supplies to Europe, with some 70 percent of US LNG exports last year going to the continent. Our partners have turned away from Russia as an energy source, I believe, permanently. Since 2022, US exporters have supplied the EU with approximately 90 million tons of LNG, three times as much as the next largest supplier.

While the United States has met Europe's immediate supply challenges going into this winter, the urgency of the energy transition is increasingly clear. The safest source of energy is what we generate ourselves, and what we can build or share with our allies and partners globally.

This effort starts at home. The multiplier effect of the US Inflation Reduction Act, the Bipartisan Infrastructure Law, and the CHIPS and Science Act is tremendous. The United States has entered a clean energy manufacturing renaissance, driven by public-private partnership, which has unleashed the private sector to help meet domestic and global energy needs.

These pieces of legislation have built the platforms upon which US and international companies can build value and launch the infrastructure and technologies of tomorrow.

Since the beginning of the Biden-Harris administration, private companies have announced \$628 billion of investment in the industries associated with the energy transition: clean power, heavy industry, biomanufacturing, clean energy manufacturing, electric vehicles, batteries, carbon capture utilization and storage, and semiconductors.

During my meetings with energy ministers, private-sector executives, civil society, and stakeholders around the world, everyone has demonstrated their understanding that energy access

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**The United States has entered a clean energy manufacturing renaissance, driven by public-private partnership.**

—Geoffrey R. Pyatt

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affects agriculture, business, communications, education, food systems, healthcare, and transportation.

Energy security means energy access and supply without threat of coercion, and without concern over dependencies. It means a country has choice and the opportunity for growth.

The energy transition has been and will continue to be an important element in ensuring our long-term energy security. But for the energy transition to succeed, it must be just.

We have created the tools to achieve this. The Minerals Security Partnership (MSP), for example, has served as a catalyst for public- and private-sector investments to build the diversified, secure, and responsible global critical minerals supply chains that underpin the minerals and metals essential to the energy transition. Everyone agrees that market dominance by a single supplier is unhealthy.

The MSP was created to offer producer countries a better deal than our adversaries. This means opportunities for local communities and value for our partners—from extraction all the way through recycling—pursued with high environmental, social, and governance standards.

The United States has also anchored the Just Energy Transition Partnerships with South Africa, Indonesia, and Vietnam, a G7+ effort to help each of these countries accelerate their energy transition with the support of multibillion-dollar assistance programs.

Additional programs like the Partnership for Global Infrastructure and Investment, an initiative to leverage over \$600 billion in sustainable infrastructure financing, including for energy security and transition, are also means by which the United States and our partners have been working to help countries around the world grow at a faster pace.

The United States recognizes that nations don't just want to decarbonize. They want to prosper.

This is a global effort. In Dubai at the 2023 United Nations Climate Conference, COP28, nearly 200 governments called on the world to transition away from fossil fuels in a just, orderly, and equitable manner. Corporations and nations pledged to significantly reduce methane emissions. The United States helped win pledges by more than one hundred countries to triple renewable energy capacity by 2030 and by twenty countries to triple deployment of safe, secure, and reliable nuclear energy from 2020 levels by 2050. The United States joined Canada, Japan, France, and the United Kingdom to mobilize billions of dollars of investment in fuel for our nuclear power plants and move away from dependence on Russian nuclear fuel supplies.

These agreements, commitments, and ambitions will shape our geopolitics for decades to come. No one country can fulfill these goals alone.

Secretary of State Antony J. Blinken, in remarks to university students at the Johns Hopkins School of Advanced International Studies last September, said that US domestic and foreign policy are more aligned than ever, and that they must be able to face the “defining tests of this emerging era.”

We face these tests in the United States, in Ukraine, in Dubai. Everywhere. It is a historic moment. To be a diplomat, working with allies and partners, you must be optimistic. When I consider our shared energy future, both its challenges and its promises, I certainly am.

We have an opportunity to transition energy systems globally and an imperative to change them now.

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*Ambassador Geoffrey R. Pyatt is the US assistant secretary for energy resources at the US Department of State.*



## ■ CHAPTER II

# Energy Markets

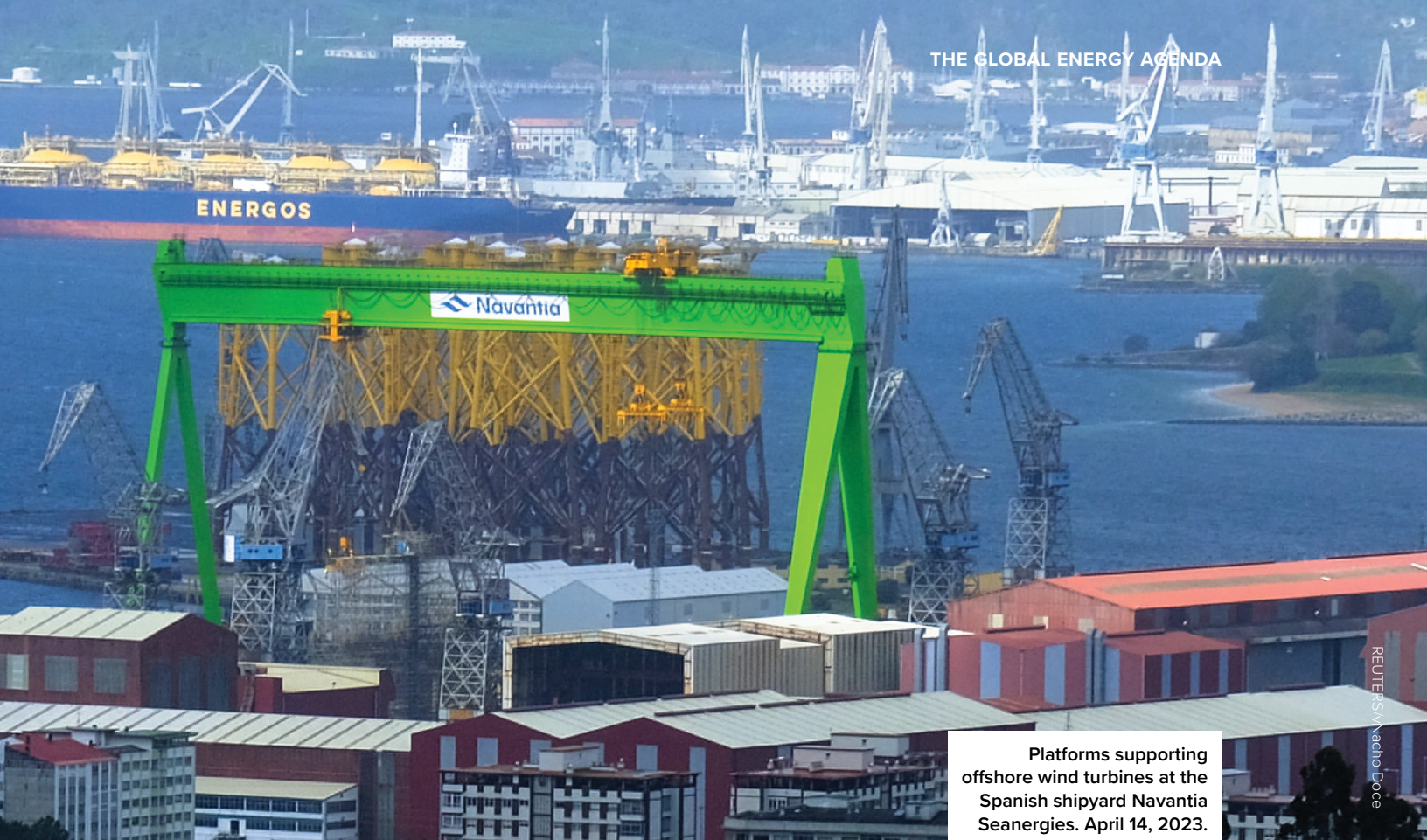
**W**HEN IT COMES TO GAUGING American voter sentiment on the economy, there are few bellwethers more predictive than prices at the pump. Heightened chatter about gasoline prices is an inevitable feature of every election cycle, and 2024 will not be an exception. Since taking office, President Biden has zeroed in on the importance of retail gasoline, promising as recently as September that he would “get those gas prices down” (the retail price was \$3.96 per gallon and in December 2023, it was \$3.26 per gallon).<sup>4</sup> In December, former President Trump, in turn, made headlines for hyperbolically stating that “Gasoline prices are now \$5,

\$6, \$7 and even \$8 a gallon.”<sup>5</sup> National elections in the United States can be won or lost in its automobile-centric suburbs—and politicians know it.

In fairness, however, price sensitivity resonates across the world. Europe was quick to implement energy subsidies in the wake of Russia’s invasion of Ukraine, Japan invested billions to reserve access to US LNG exports necessary for stabilizing a market grappling with a fragile post-Fukushima nuclear outlook, and the developing world often laments how high borrowing costs are impeding energy access in Africa and South Asia. So, it is telling that in a postpandemic world, countries are retrenching from decades of globalization fixated not only on access to low-cost

4 “Remarks by President Biden on Bidenomics I Largo, MD,” White House Briefing Room, September 14, 2023, <https://www.whitehouse.gov/briefing-room/speeches-remarks/2023/09/14/remarks-by-president-biden-on-bidenomics-largo-md/>; and “Retail Prices for Gasoline, All Grades,” US Energy Information Agency, released January 16, 2024, [https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pets&s=emm\\_epm0\\_pte\\_nus\\_dpg&f=m](https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pets&s=emm_epm0_pte_nus_dpg&f=m).

5 Louis Jacobson “Fact Check: Are Gas Prices Really \$5 to \$8 a Gallon, as Donald Trump Said?,” *Houston Chronicle*, December 18, 2023, <https://www.houstonchronicle.com/politics/texas/politifact/article/fact-check-trump-gas-18557136.php>.



Platforms supporting offshore wind turbines at the Spanish shipyard Navantia Seenergies. April 14, 2023.

REUTERS/Nacho Doce

commodities, but also, and perhaps predominantly, on managing the fragility and insecurity of supply chains in a manner that drives domestic manufacturing and other internal drivers of economic growth. As US Assistant Secretary for Energy Resources Geoffrey R. Pyatt notes in his essay, “The safest source of energy is what we generate ourselves, and what we can build or share with our allies and partners globally.”

Such focus on “energy independence” and similar policies predate 2020. Energy-related tariffs, for example, were a central feature of President Trump’s “America First” economic strategy. What is a novel force of energy-transition economics today, however, is the emergence of industrial policy focused on clean energy leadership. Throughout 2023, as the combined economic impact of the United States’ Inflation Reduction Act, the Bipartisan Infrastructure Law, and the CHIPS and Science Act began to transform the US energy system, it became clearer that support of indigenous energy supply chains remains a central facet of US energy policy. The survey results of the *Global Energy Agenda* reinforce that, consistent with a world in which the risk of global conflict is heightened, this trend is not confined to America alone.

Energy serves as an important instrument for, and consideration of, industrial policy around the world.

This need not inevitably mean a world of purely competing nation states or alliances without any common global vision. The majority of survey participants express the view (through their responses to multiple questions) that although certain drivers such as security are nationally focused, the resulting acceleration of the energy transition is a shared goal among world governments aiming to blunt the impacts of climate change in the long term.

Over the coming decade, however, a majority of respondents ostensibly sense that internally focused policy considerations will play an important role in driving energy market volatility. Overall, 27 percent expect that use of energy for geopolitical leverage will be the main driver of such price and supply uncertainty, the most common choice. An additional 12 percent selected the more general but related option, that economic or resource nationalism will stimulate market volatility. And 17 percent doubted our ability to meet increasing demand from emerging markets, indicating that global supply shortfalls may be on the horizon.

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# A people-centric energy transformation

by Leila Benali

Describing the recent crush of global crises, a wise man said, “We faced a century’s worth of tragedies in less than two years.” Our health systems might have emerged more resilient following the COVID-19 pandemic, but our economies and financial systems are still struggling at a time when emerging markets, like Morocco, want to escape the middle-income trap of 3 percent GDP growth.

The Russia-Ukraine war added to the unprecedented disturbance in already dislocated commodities supply chains, threatening nations’ energy security and triggering global inflationary pressure. It is not the first time humanity faces such continuous accumulation of upheavals, but it is the first time it does so at such record levels of global debt—238 percent of global GDP in 2022. This does not leave much room to tackle the triple planetary crisis of our time: climate change, environmental degradation, and biodiversity loss.

We are more often reminded of the fragility of our environment, with extreme weather events or natural disasters. A quarter of the United Nations’ membership, mostly Small Island Developing States, is at risk of disappearing by the end of the century because of rising sea levels. Humanity will face climate-triggered questions over sovereignty and national identity for the first time. Is our post-World War II world order, including our Bretton Woods institutions, equipped to answer?

Part of the answer is already known: decarbonization of emitting sectors and acceleration of the energy transition would soften the worst impacts of climate change. And maybe, in the twenty-first century, some countries should show the way despite low historic responsibility for causing planetary warming. Morocco has a longstanding commitment toward sustainability despite its negligible emissions. It was one of the first countries to target a reduction of its greenhouse gas emissions by 45.5 percent by 2030 in its Nationally Determined Contribution.

To achieve necessary emissions cuts, pragmatism and inclusiveness are key. When affordability, as well as economic and social development are nonnegotiable, there is no room for ideology in technology and fuel taxonomies. We must leave the traditional energy transition narrative, driven by divisions, in the twentieth century, and embrace twenty-first century narratives.

Morocco generates more than 40 percent of its electricity capacity from renewable energy, and is also a fossil fuel importer, still largely exposed to global commodities’ price volatility and supply issues. Its approach to energy and climate, built over three decades, thus takes into account the complexity of building a credible, sustainable development path, while understanding the long-term nature of energy investments, and the role of lower-carbon fuels like natural gas as key to a well-ordered energy transition.

Coal-based generation will be phased out. More importantly, we want to harness our exceptional renewable resources, and the momentum created by rising technologies like green hydrogen, e-fuels, and storage. We want to leverage our favorable legal framework and three decades of experience in structuring and developing renewable and private energy projects.

Our strategic objectives are threefold:

1. Accelerate (i.e., triple) the pace of investments in renewable energies and key sectors like transmission infrastructure and storage solutions, starting today
2. Build resilient and agile energy systems and grids that are secure, affordable, and sustainable
3. Put people at the center of our energy transition and net-zero pathways, permeating the new socioeconomic models we are building

How will we achieve these objectives? The National Strategy for Sustainable Development (NSSD) is our reference framework to support policies and programs in implementing

Jamaa el Fna is a famous square and marketplace in Marakesh's medina quarter.



SHUTTERSTOCK/Matej Kastelic

Morocco's sustainable development priorities. It is aligned with the 2030 Agenda and its seventeen Sustainable Development Goals as well as the main orientations of the Kingdom's New Development Model.

The NSSD aims, by 2050, to promote resilience, human development, and reduction of social and territorial inequalities; mitigate and adapt to the consequences of climate change; and protect the environment.

What is different about this strategy is the approach. Through constant consultation, we harness the collective intelligence of all stakeholders—including local authorities, the private sector, civil society, youth, Moroccans living abroad and minorities—to shape the future they want for the country, and to craft with the government the relevant tools to operationalize our social and economic sustainable development path. This inclusive and democratic approach is already having tangible impacts on our new generation of public policies.

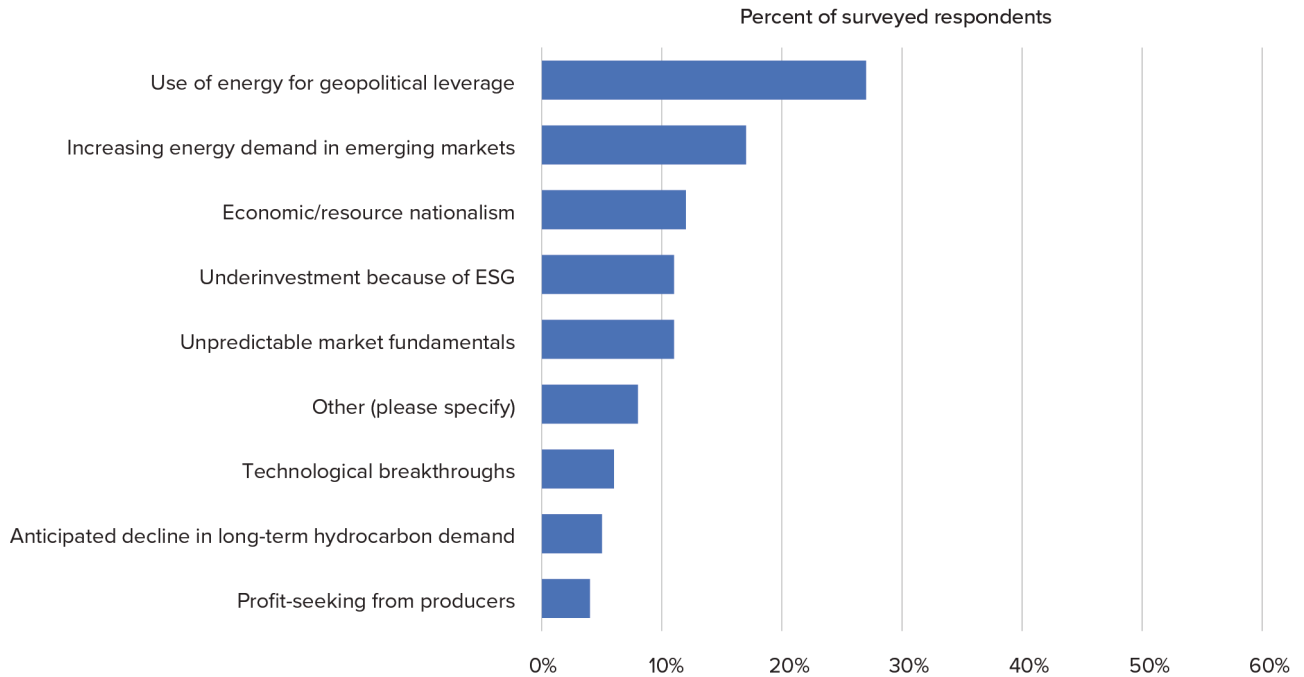
Morocco's development path needs to be holistic, just, and sustainable. Therefore, this is a space and time for society to define the positive and negative externalities of development and price them. These policy levers for sustainable development are defined at the local level, acknowledging the diverse needs and aspirations of our twelve regions.

Even if I am personally excited by the leaps in space technologies, there is still no Planet B, and human societies are still dependent on their environment on Planet Earth. Morocco's sustainable development strategy is not only a response to the climate crisis, or another mere net-zero pathway, but a means to reintroduce humanity into our policies, placing people at the center of the system.

*Leila Benali is the minister of energy transition and sustainable development of Morocco and president of the UN Assembly for Environment.*

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### Over the next ten years, what will be the most important cause of energy market volatility?



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.

There are only modest variations across most sub-populations of the survey pool. Whether looking by age, gender, time working in the industry, or geography, the replies are similar. This is most striking when comparing replies from the Global South and Global North. For example, although one might expect a substantial difference in the proportion focusing on increasing energy demand in emerging markets for this question, it is muted: 20 percent in the Global South and 16 percent in the Global North.

Two sets of differences, however, stand out among otherwise consistent replies. The groups that are the most closely associated with oil and gas production—those working in the sector, and those living in the MENA region, where fossil fuel resources play an outsized role in the economy—are the most likely to see underinvestment due to ESG considerations as an important cause of energy market volatility. Among those working in oil and gas, 38 percent selected this option; for those in the MENA region, it was 39 percent. In both cases, this is the most common answer.

Another variation in responses to this question comes from survey participants who think that oil

will not peak before 2040—if ever—and believe that achieving net zero would cause an economic drag. This subset of respondents sees ESG-related underinvestment as the biggest cause (31 percent) of volatility. They have little confidence in the ability of sources other than fossil fuels to deliver the energy that the world economy needs, and expect that reduced investment in these sources will lead to higher prices and lower supply.

### THE FUTURE OF OIL AND GAS IN THE ENERGY MIX

On average, those surveyed expect that oil demand will peak in fifteen years, or around 2039. Last year, the estimate was early 2036, and three years ago, in our first *Global Energy Agenda* survey, respondents put it near the start of the 2030s. These figures are based on the mean value of the responses; the median projected date is earlier. By the latter metric, the survey pool as a group expects peak oil to occur in 2034, pushed back from last year’s response of 2029.

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# Energy companies are essential to global climate solutions

by Mansoor Mohamed Al Hamed

Societies and economies have come to depend upon access to reliable, affordable, secure, and sustainable energy. To provide this access, a complex and intricate system has emerged.

But energy systems are changing fast, shaped by many factors and diverse actors. Chief among these drivers is the need to transition to a lower-carbon future. This assessment is almost universally accepted. The question requiring consensus, however, is how do the world's leaders accelerate the transition while ensuring communities do not suffer, and that people maintain access to the energy they need in order to develop and grow.

As Fatih Birol, head of the International Energy Agency, has said, "No energy company will be unaffected by clean energy transitions. Every part of the industry needs to consider how to respond. Doing nothing is simply not an option."

How then can the energy sector ensure it contributes to the transition while also ensuring its long-term viability and that it meets the needs of consumers?

## Part of the solution

At its core, this question asks: should today's oil and gas companies be viewed as part of the problem, or could they be crucial to solving it?

In addressing this question, three considerations provide the boundaries for the debate.

First, demand for the services that energy provides is increasing due to a growing global population—some of whom remain without access to modern energy—and an expanding global economy. Take Southeast Asia as an example. According to analysts, gas demand is set to increase by 88 percent by 2050, driven by growth in countries such as Indonesia, where the population is expected to rise from 274 million to 325 million by 2045.

Second, the vision of the future must recognize that oil and natural gas play critical roles in today's energy and economic systems, and that afford-

able, reliable supplies of liquids and gases (of different types) are necessary to sustain energy access and expand it.

Indeed, gas will be key to the transition and will likely remain an important part of the energy mix for many decades, not least because it produces 50 percent less CO<sub>2</sub> for power generation than coal. Natural gas is also abundant and provides a vital back-up power supply for renewables.

And last but far from least, setting the terms of oil and gas's role in the transition is imperative to reduce energy-related emissions in line with international climate targets as set out in the Paris Agreement.

Energy companies are acutely aware of the need to navigate the energy trilemma of affordability, security, and sustainability, while being part of the transition. To achieve these goals, the energy sector has to be part of the solution.

## Accelerating the transition in partnership with energy producers

The question the world faces is therefore not whether to transition, but at what pace it can achieve the change while balancing the complex factors and challenges at play.

What is patently true, however, is that without the engagement and focus of the energy sector, together with the scale, capabilities, and capital the industry can deploy, progress will be slower, more expensive, and more difficult.

How then can global leaders ensure energy companies are empowered to accelerate progress?

Decision makers must remember that energy is a system not a sector. All parties must align on common goals, regulations, and systems to enable an accelerated transition. This is a hugely complex task, but without regulatory frameworks in areas such as carbon credits and the nascent hydrogen market, investments won't be incentivized. The energy system needs collective action and global frameworks.

Aerial view of oil and gas refinery and petrochemical plant in Bangkok, Thailand.



SHUTTERSTOCK/Travel mania

Additionally, national governments must set out clear visions that frame how the energy ecosystem must evolve. They must commit to net-zero emissions by 2050, and set interim targets for reducing carbon emissions. Achieving these targets requires significant investments in renewable and nuclear energy projects.

Industry must also play a key role by expanding the technology, innovation, and problem-solving capacity that is essential to finding solutions and accelerating progress. What's more, the solutions can be a win-win.

As an industry, we cannot shy away from the facts. As of today, 15 percent of global energy-related GHG emissions come from the process of getting oil and gas out of the ground and to consumers.<sup>1</sup> But reducing emissions intensity of oil and gas scope one greenhouse gases is possible through portfolio rebalancing and exploring technologies that support the optimization of the business.

More can be done, however. For instance, reducing methane leaks to the atmosphere is

the single most important way for the industry to bring down emissions. And measures adopted to tackle methane emissions will generate revenues of about \$45 billion from the sale of captured methane.<sup>2</sup>

Oil and gas companies must also invest in low-carbon and renewables business outside their core operations—such investments are currently less than 5 percent of total capital expenditures. Ramping up investment is a critical factor in accelerating change.<sup>3</sup>

The transformation of the energy system will happen with or without the oil and gas sector, but if energy companies are not fully engaged and committed, it will be slower and more expensive. The world cannot afford for the legacy energy companies to sit on the sidelines, and in the long-term these companies cannot afford it either.

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*Mansoor Mohamed Al Hamed is CEO of Mubadala Energy. Mubadala Energy is a sponsor of the 2023 Atlantic Council Global Energy Forum.*

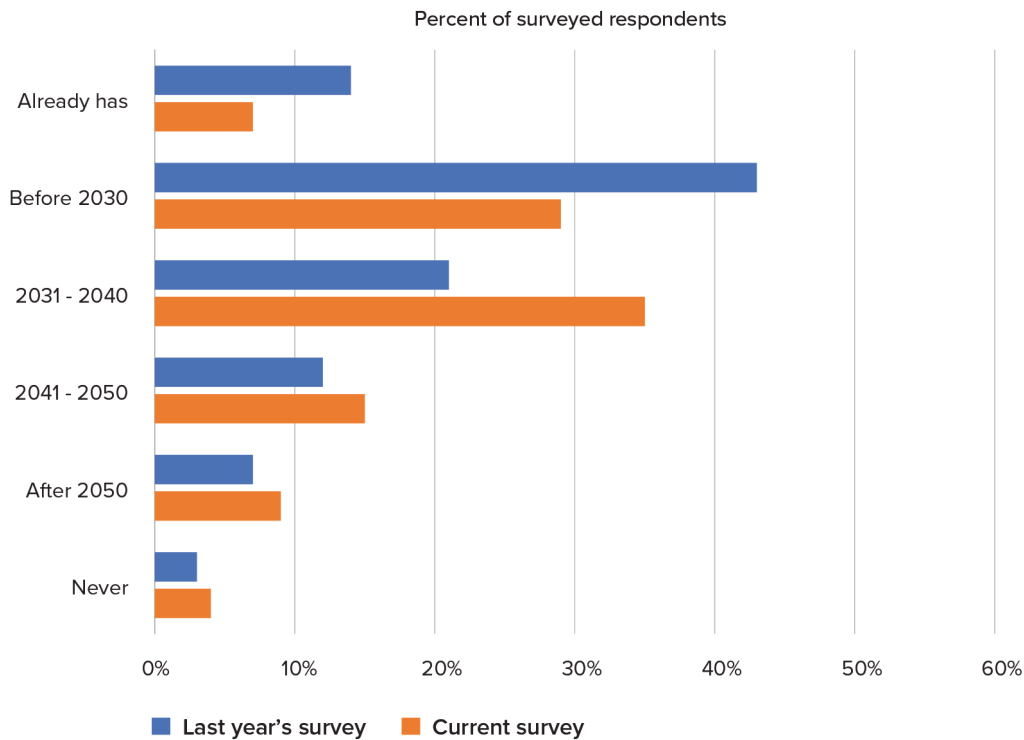
1 International Energy Agency. "Emissions from Oil and Gas Operations in Net Zero Transitions. A World Energy Outlook Special Report on the Oil and Gas Industry and COP28." IEA, May 2023. <https://www.iea.org/reports/emissions-from-oil-and-gas-operations-in-net-zero-transitions>.

2 International Energy Agency. Financing Reductions in Oil and Gas Methane Emissions A World Energy Outlook Special Report on the Oil and Gas Industry and COP28. IEA, 2023.

3 International Energy Agency. "Overview and key findings." IEA, 2023. <https://www.iea.org/reports/world-energy-investment-2023/overview-and-key-findings>.

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## When will oil demand (global annual average) peak?



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.

This change in the expectation about the longevity of growing oil demand is energy sector-wide rather than concentrated in specific areas—with one exception. Every segment of the survey population for which comparable data are available shows a later mean projected time for the arrival of peak oil—except for oil and gas producers.

On the surface, our respondents seem to be bucking conventional wisdom with these projections. In particular, the IEA is currently predicting that peak oil, along with peak gas and peak coal, will occur before 2030. A closer look at the IEA's figures, however, indicates that our respondents are not necessarily very far from the mainstream.

The word “peak” suggests a visible point after which oil use will decline noticeably. While this may already be occurring in advanced economies, according to the IEA figures, the projected worldwide decrease in consumption after 2030 is minor until 2050. Certainly, under this scenario, other fuels will address a growing global demand for energy in the years ahead. Thus, the market for oil will not so much experience a postpeak drop-off but rather a projected peak and plateau. The timing of greatest demand

**Table 1: Projected Date of Peak Oil by Geography and Sector**

	Last year's survey	Current survey
<b>Geography</b>		
United States	Mid-2037	Late 2039
Europe	Mid-2033	Mid-2035
MENA	Late 2033	Late 2042
<b>Sector</b>		
Academics, analysts, and media	Mid-2032	Mid-2037
Government	Late 2034	Late 2038
Low-carbon industries	Mid-2037	Mid-2038
Oil and gas industry	Early 2042	Mid-2039

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## A catalyst for cleaner energy

*How better public-private partnerships will turbo charge decarbonization*

by Scott Strazik

As the world gathers in Dubai for an impactful UN Climate Change Conference, we find ourselves at the cusp of unprecedented opportunity for action. The private sector must deliver, service, and innovate the technologies that help provide electricity reliably, affordably, and globally. Wind, natural gas, nuclear energy, and grid construction, connections, and upgrades are clear drivers for the future of a successful energy transition. The world can fast track these efforts if we continue to see the growth of strong public and private partnerships.

Across industries, the past few years have shown encouraging signs of support for this growth, such as an expansion in clean tech financing, increased investment throughout the private sector, more policy certainty around the globe, and new collaborations among companies and governments.

While these factors have contributed to moving the energy landscape in a positive direction, hurdles remain. For example, in the race to reduce carbon emissions, the demand for power is still outpacing the current supply—and this gap will persist. Global electricity demand has risen consistently at a clip of more than two percent since 2015,<sup>1</sup> yet at the same time roughly 775 million people around the world still lack access to affordable, reliable, and sustainable energy.

Because of this, the role of the private sector—specifically around innovation and technology—has never been more crucial as we continue to

electrify the world while simultaneously working to decarbonize it.

The good news is that while we confront these challenges, there are now new coordinated and deliberate efforts to address climate change at the scale and size it demands. The public and private sectors are working in tandem more than ever before. Innovative new technologies are being developed and deployed faster, and, importantly, across continents and throughout governments, there's recognition that the energy transition must also help developing economies improve the quality of life for citizens.

Recent advancements toward decarbonization have been driven in part by policies that are elevating the role of business to lead the development and deployment of critical technologies at scale. For example, the Inflation Reduction Act (IRA) in the United States has steered significant financing toward cleaner manufacturing and lower-carbon technologies,<sup>2</sup> and implementation of the law has already helped spur job creation and investments by US-based manufacturers. By the August 2023 one-year mark after IRA's passage, more than 200 new clean energy projects had been publicly announced, representing more than \$86 billion in investments and tens of thousands of new jobs.<sup>3</sup>

The energy transition presents a clear opportunity for more partnerships like these among governments, industries, and communities. Innovative energy technologies, such as small modular reactors, are being deployed globally so that all

1 International Energy Agency. "Electricity," IEA, July 11, 2023. <https://www.iea.org/energy-system/electricity>.

2 Jennifer A Dlouhy and Michelle Jamrisko. "Biden Policies Drive Smart Bets on Green Technology, Brainard Says." Bloomberg, September 19, 2023. <https://www.bloomberg.com/news/articles/2023-09-19/biden-ira-and-policies-drive-smart-bets-on-green-technology-lael-brainard?sref=a9fBmPFG>.

3 Kristin Toussaint. "278 billion and 170,600 jobs: How Biden's Landmark climate bill changed the economy." Fast Company, August 15, 2023. <https://www.fastcompany.com/90938486/inflation-reduction-act-bidens-land-mark-climate-bill>.



Blue solar cell panels, New York skyline illuminated at night in the background

SHUTTERSTOCK/CK Photo

regions can benefit from the jobs, supply chain, and training that come alongside a lower-carbon energy source. And countries including the COP28 host, the United Arab Emirates (UAE), are advancing ambitious goals like the Net Zero by 2050 Strategic Initiative that align with the goals of the Paris Agreement.<sup>4</sup>

We can do more. Ensuring greater access to electricity for populations currently in need while also addressing climate change is possible if we deploy diverse generating technologies today, and invest in the breakthrough innovations of tomorrow. This vision requires a diverse suite of the latest solutions in renewables, gas, nuclear, grid, and digital technologies. Through a combination of coal-to-gas switching, enhanced grid resiliency, and investments in infrastructure needed to

deploy more renewables, we can balance reducing carbon emissions with power reliability to ensure communities can thrive and economies keep growing.

As the private and public sectors look for more opportunities for partnerships throughout the energy transition, I'm confident we will see a force multiplier that accelerates the work to electrify the world while simultaneously decarbonizing it. This spirit and letter of partnership and cooperation is the thread that connects our efforts and determines their success. We must move forward and work to meet this moment together.

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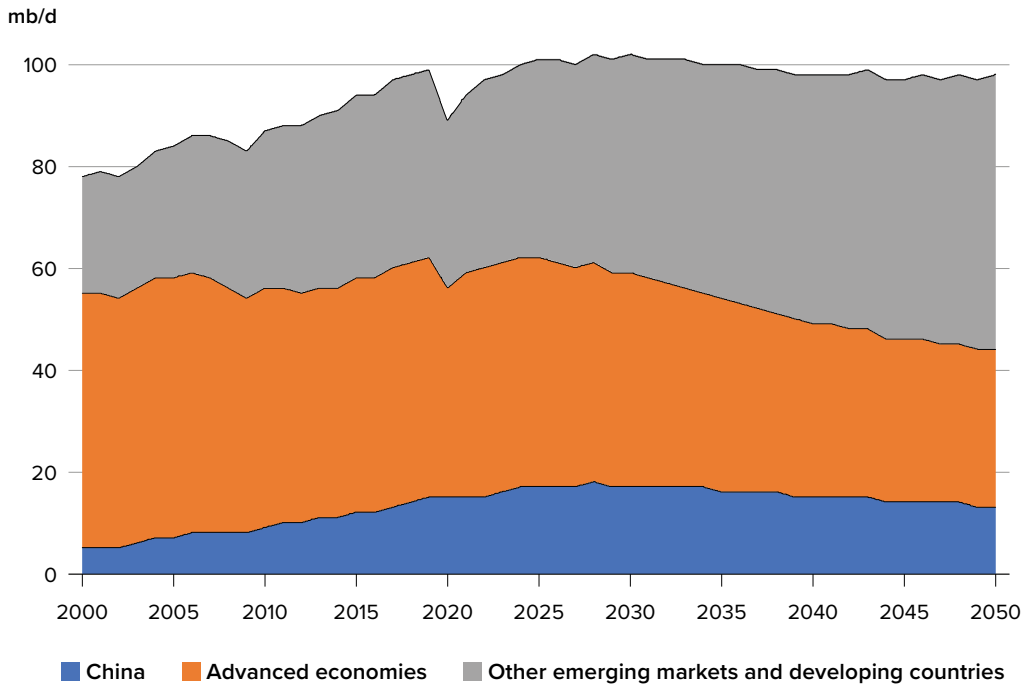
*Scott Strazik is the CEO of GE Vernova. GE Vernova is a sponsor of the 2023 Atlantic Council Global Energy Forum.*

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<sup>4</sup> Embassy of the United Arab Emirates, Washington DC. "UAE Energy Diversification." Embassy of the UAE, Washington DC. <https://www.uae-embassy.org/discover-uae/climate-and-energy/uae-energy-diversification#:~:text=In%202023%2C%20the%20UAE%20updated,mix%20to%2030%25%20by%202031.>

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## Oil demand by region in the Stated Policies Scenario, 2000-2050



THE STATED POLICIES SCENARIO PROJECTS OUTCOMES BASED ON "THE LATEST POLICY SETTINGS, INCLUDING ENERGY, CLIMATE AND RELATED INDUSTRIAL POLICIES."

SOURCE: IEA, WORLD ENERGY OUTLOOK 2023, EXECUTIVE SUMMARY, 2023, LICENSE: CC BY 4.0, [HTTPS://WWW.IEA.ORG/REPORTS/WORLD-ENERGY-OUTLOOK-2023/EXECUTIVE-SUMMARY](https://www.iea.org/reports/world-energy-outlook-2023/executive-summary).

within those years is very hard to pinpoint. With only a slight change to the slope of this plateau, the IEA and our respondents on average would have very similar answers. Both seem to be saying that oil is not a growing commodity class, but also that it is not going anywhere quickly.

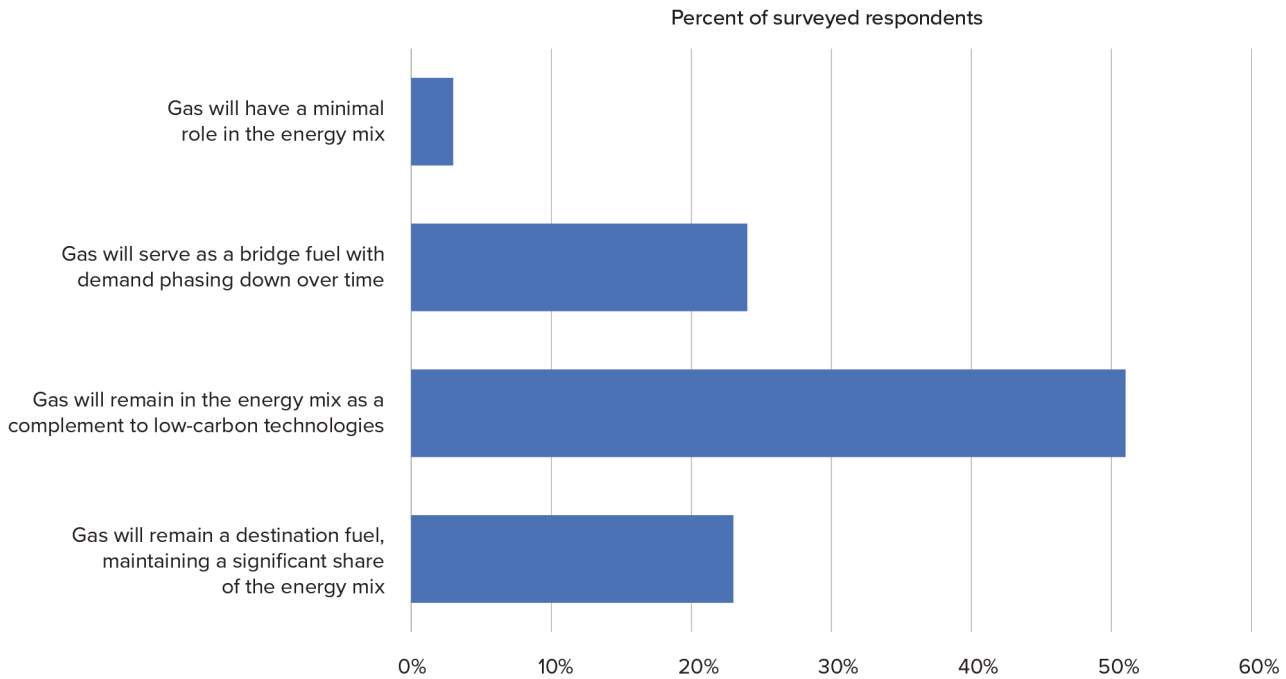
As for natural gas, most of our respondents see a permanent role for this fossil fuel in providing energy for the world: 23 percent say that it will be a "destination" fuel with a significant role in the energy mix, and just over half (51 percent) believe that it will remain as a complement to low-carbon technologies. Only 3 percent say it will have only a minimal role in the years ahead.

Compared with last year, respondents as a group see a longer future for gas. The numbers taking the most extreme positions in either direction—who either foresaw a minimal role (3 percent last year) or that gas

would be a destination fuel (19 percent last year)—have changed little this year. The shift has instead been among those predicting gas would be a bridge fuel, declining from 38 percent last year to 24 percent this year; and among respondents who foresaw a longer-term future, with a spike from 39 percent last year to 51 percent this year, predicting gas will remain in the energy mix as a complement to low-carbon technologies.

This suggests a growing comfort in the global community for embracing natural gas as an enabler of clean energy deployment, with a greater number of respondents presumably coming to think that gas will be needed to provide a backstop amid possible fluctuations in generation inherent in technologies such as wind and solar. Such an interpretation would be consistent with changes in responses from Europe, where the Russian invasion of Ukraine completely

## Which of these statements best describes the future of natural gas?



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.

upended supply routes for gas in 2022. In our last survey, 49 percent of Europeans thought that gas would be a temporary bridge fuel; this year that dropped to 28 percent.

Energy producers, alternatively, are certainly convinced of the longevity of the role for natural gas. Among those working in fossil fuels, 94 percent think that it will be either a destination fuel (36 percent) or a necessary complement to low-carbon energy (58 percent). Respondents from low-carbon energy sectors, while not matching these figures, are not far off the survey average (at 20 percent and 47 percent, respectively). Although the number of respondents from the renewable generation industry are too small to draw strong conclusions, even they are close to the average on this question, with 15 percent seeing gas as a destination fuel and 50 percent as support for low-carbon sources.

In every part of the sector, then, most respondents now acknowledge a long-term role for gas, even those who expect renewables to play the primary role in energy generation. This change in attitude reflects an acceptance that each country, and even each region, must transition according to its needs and resources. As Minister Benali wrote in her essay about Morocco, which generates more than 40 percent of its electricity capacity from renewable energy, “Its approach to energy and climate, built over three decades, thus takes into account the complexity of building a credible, sustainable development path, while understanding the long-term nature of energy investments, and the role of lower-carbon fuels like natural gas as key to a well-ordered energy transition.”

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## To make a lasting impact on carbon emissions, we must respect the developing world's needs

*Policymakers must remember that the ultimate goal is cutting emissions, not energy consumption in the developing world.*

by Majid Jafar

As COP28 kicks off in the United Arab Emirates, the divide between Western countries and the developing world over cutting global carbon emissions has never been deeper. As Western activists and policymakers focus on cutting oil and gas production and wrangle over whether to phase out or phase down the use of hydrocarbons, those in the developing world increasingly see their future coming down to reducing emissions at the cost of economic progress.

Bridging this divide will be critical for any real, lasting climate progress. The developing world is where the entire climate change battle will be won or lost; it is where all the net growth in emissions will come from, because it is where the most rapid economic and population growth is taking place. These nations must progress toward a lower-emissions pathway to development, but policymakers must disabuse themselves of the idea that progress can be accomplished by reducing access to energy supply or simply cutting consumption.

### Unintended consequences

Every nation has been grappling with the energy trilemma of affordability, availability, and sustainability as energy crises began in 2022. Every leg of this trilemma is critical to maintaining equilibrium and ensuring that energy security is met while emissions fall. But while European countries realized the importance of the trilemma when the energy crisis began, the developing world has faced the challenge for decades.

The West's choices and policies have had significant unintended consequences on the developing world, which often bears the brunt of climate change impacts despite contributing minimally to

the problem. Western policies that seek to dampen investment in oil and gas only darken the picture by raising energy costs and creating shortages for those who can least afford them.

European policymakers, for example, proudly heralded their ability to prevent energy shortages at home amid the energy crisis of 2022 by amassing liquefied natural gas (LNG) supplies from around the world. But the triumphalism ignored the impact of their deep pockets on energy costs and supply going to developing countries like Pakistan, Bangladesh, and others. The result in these emerging markets was skyrocketing LNG costs, energy shortages, inflation, and ultimately greater use of dirtier fuels.

Adoption of natural gas with renewables by the developing world promises to be the most effective means of cutting carbon emissions quickly and affordably. Enabling the developing world to begin the downward march of carbon emissions now is crucial to this goal. Yet when investment in gas is starved to discourage its development and use, or the cost of capital is too high to enable the shift, the Global South is forced to resort to cheaper but higher-emitting fuels, namely coal.

### License to operate

The oil and gas industry is also making tangible progress to be part of the climate solution. Most companies have pledged to reduce their carbon intensity and prevent methane leaks ahead of COP28, further reinforcing the reductions possible with natural gas and other cleaner sources of fuel. Substituting diesel and fuel oil with natural gas is one way the industry can decrease CO<sub>2</sub> emissions. Additionally, process improvements





Electric pylons  
in a desert near  
Aswan, Egypt

to lower carbon intensity along with offsets can enable the industry to achieve carbon neutrality across operations.

Efforts like these can create a virtuous circle of emissions reductions while ensuring affordable and reliable energy supply for developing economies. In time, the energy mix will include natural gas and other clean fuels such as hydrogen, in addition to intermittent renewables and other forms of new energy.

### Financing the change

Ultimately, change on the order required to reduce emissions is only possible with global cooperation.

Lasting change requires genuine efforts from the West to respect and address the needs of developing nations by fulfilling climate funding commitments and providing finance as well as technical support and assistance.

One promising solution would be a new global institution, such as a World Carbon Bank, to channel technical assistance and climate aid to developing countries. Another powerful solution would be to establish a global system of carbon pricing to create economic incentives for reducing greenhouse gas emissions by incorporating the true cost of carbon into market decisions.

Clearly, the inherent distrust developing countries feel toward the West remains a major stumbling block to achieving global net-zero ambitions. It is therefore crucial to have a neutral space to host these conversations where all countries'

views will be welcomed and provided an equal platform.

COP is such a platform, and the UAE as the COP28 convener offers a model for action. As an early and major investor in all forms of energy, the UAE has the resources, both in terms of finance and low-cost solar energy supply, to advance the technologies of the future such as hydrogen. It plans to invest \$54 billion in renewables over the next seven years as part of efforts to reach net-zero emissions by 2050.

The UAE's geographical location also makes it a strategic meeting point between the Global South and North, serving as a hub for trade, finance, and diplomacy, with strong ties to both developed and developing nations.

The fight against climate change requires global solidarity, collaboration, and systematic thinking. Climate policies must be revised to reflect the needs and views of developing nations as well as those of the West. Undermining poorer countries' growth in order to cut emissions is not a viable path to change; only by respecting those countries' needs can we make a lasting impact. That is why we can all look forward to real and lasting action at COP28 in Dubai this year.

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*Majid Jafar is the CEO of Crescent Petroleum and a member of the Atlantic Council's International Advisory Board. Crescent Petroleum is a sponsor of the 2023 Atlantic Council Global Energy Forum.*



## ■ CHAPTER III

# The Path to Net Zero and Its Economic Impact

**G** **OING INTO 2023**, there was high hope that COP28 would succeed in advancing an inclusive energy transition and align “all segments of the global energy system...to enhance energy security while stemming global greenhouse gas emissions.”<sup>6</sup> However, by mid-2023, optimism about the summit would likely have been hard to come by. An agreement to establish a “loss and damage” climate fund

was at the heart of a feud between rich and poor countries, and the future of fossil fuels was sowing division between a community of producing nations and a patchwork of European, African, and island nations. Progress on the energy transition felt out of reach. Yet at the conclusion of the conference, COP28 did deliver, charting a pathway for extending climate aid to the developing world and setting in place “a global reduction in energy-related

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<sup>6</sup> Landon Derentz et al., eds., *The 2023 Global Energy Agenda*, Atlantic Council, January 13, 2023, <https://www.atlanticcouncil.org/content-series/global-energy-agenda/the-2023-global-energy-agenda/>.



Evaporation pools for lithium extraction in the Salar de Uyuni in Bolivia. December 15, 2023.

REUTERS/Claudia Morales

greenhouse gas emissions by 2030 of around 4 gigatonnes of CO<sub>2</sub> equivalent.”<sup>7</sup>

Not yet privy to the outcomes of COP28, respondents’ views in this year’s survey, taken in November 2023, reflect a somber outlook for achieving net zero by 2050. In some ways, this should not be a surprise. Even the COP28 president, Sultan Al Jaber, said in the run-up to the conference that the world is “way off track” to achieving its climate goals,<sup>8</sup> and while the “UAE Consensus” is indicative of progress, it falls short of the Paris Agreement aim of limiting global temperature rise to 1.5°C. The respondents’ perspectives on fossil fuels, for example, are consistent with the realities of global efforts to confront climate change. If gas will continue to play an important role in support

of renewables, and if worldwide oil consumption will keep rising—even modestly—until 2039, the prospect for emission cuts consistent with global net zero is low.

Timeliness of the transition aside, respondents in this year’s survey are largely steadfast in their determination to press forward with a transformation of our energy systems. While many are alarmed by the consequences of climate change, a growing contingent are equally inspired for the economic reward of deploying the clean energy technologies critical for turning net zero into a reality. This juxtaposition crystallizes through the views of those surveyed and through stories of success shared in our collection of leaders’ essays.

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7 Landon Derentz, “COP28’s Legacy Will Be Measured by Emissions Reduction, not ‘Historic’ Text,” *EnergySource* (blog), Atlantic Council, December 15, 2023, <https://www.atlanticcouncil.org/blogs/energysource/cop28s-legacy-will-be-measured-by-emissions-reduction-not-historic-text/>.

8 Federica Di Sario, “World ‘Way Off Track’ on Climate Targets, Says UAE Oil Boss Named COP28 Chief,” *Politico Pro*, January 14, 2023, <https://www.politico.eu/article/cop28-climate-change-targets-world-way-off-track-sultan-ahmed-al-jaber/>.



# The energy transition can proactively shape a more equal and inclusive world

by Damilola Ogunbiyi

Energy is a complex issue in the developing world. In Africa and Asia, for instance, we have growing energy demand, insufficient energy infrastructure, and major constraints on financing energy system development. So how can the Global South countries tackle these enormous challenges and still meet their net-zero imperative? We must turn this equation on its head and move beyond ambition to action by putting in place concrete measures to achieve both.

As you read this, billions of people do not have access to the minimum modern energy level required to live healthier, more productive, and dignified lives. Six hundred and seventy-five million people remain without access to electricity, while 2.3 billion still cook with rudimentary technologies and highly harmful fuels.<sup>1</sup>

The energy transition can be a moment where we intentionally and holistically shape a more equal and inclusive world. We can turn energy poverty into an opportunity to transform entire nations and subregions, bringing hope and prosperity.

Indeed, studies show that up to \$5 trillion can be added to the economies of low-income countries by providing clean and affordable energy to those without it.<sup>2</sup> At the same time, the energy transition provides investment opportunities in these emerging economies and developing nations, underpinned by growing energy demand. For example, Ghana recently launched the Ghana Energy Transition and Investment Plan, which shows that a \$550 billion opportunity exists for the international community to invest in the country's sustainable development.<sup>3</sup>

## The clean energy transition is already underway

Technological developments, falling costs, innovative approaches, and digitalization are opening new avenues for accelerating the energy transition and spurring greater adoption of renewables. Global renewable capacity additions continue to soar with cumulative capacity expected to reach over 4,500 gigawatts (GW) by the end of 2024, equal to the total power capacity of China and the United States combined.<sup>4</sup> By 2027, it is expected that solar photovoltaics' installed power capacity will surpass that of coal, becoming the largest renewable energy source in the world.

With this growing momentum, there is a massive opportunity in many developing regions to directly invest in renewable energy technologies. I can give the example of Freetown, the capital city of Sierra Leone, where the transport sector has a significant impact on the air quality, accounting for 31 percent of total municipal greenhouse gas emissions.<sup>5</sup> The city's leadership is currently undertaking a feasibility study to use a solar-powered cable car that will cut the commute of residents needing to cross the city from two hours to twenty minutes. This would reduce the chronic traffic congestion in the city and corresponding emissions, and improve the quality of life for the residents of Freetown.

The acceleration toward renewable energy sources is also essential for long-term energy security, price stability, and national resilience. The ongoing energy crisis has shown us just how vulnerable many of us are. It is estimated that up

1 IEA, IRENA, UNSD, World Bank, WHO. 2023. Tracking SDG 7: The Energy Progress Report. World Bank. 2023.

2 Hussain Samad and Fan Zhang. Benefits of Electrification and the Role of Reliability: Evidence from India. Green Policy Platform, 2016.

3 Sustainable Energy for All. "Ghana Energy Transition and Investment Plan." SE for All. <https://www.seforall.org/our-work/initiatives-projects/energy-transition-plans/ghana>.

4 International Energy Agency. "Renewable power on course to shatter more records as countries around the world speed up deployment." IEA, June 1, 2023. <https://www.iea.org/news/renewable-power-on-course-to-shatter-more-records-as-countries-around-the-world-speed-up-deployment>.

5 Yvonne Aki-Sawyer. "Developing a cable car mass transit network to connect the city." C40 Cities Finance Facility. <https://c40cff.org/projects/connecting-the-city-with-a-cable-car-mass-transit-network#:~:text=This%20project%20will%20not%20only,transformational%20change%20in%20the%20city.>

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**The energy transition can be a moment where we intentionally and holistically shape a more equal and inclusive world.**

—Damilola Ogunbiyi

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to 80 percent of the global population lives in countries that are net energy importers.<sup>6</sup> There is, therefore, a need for a profound shift that would lessen the dependence on energy imports for many countries.

### **Achieving the dual targets of energy transition and energy access**

One thing that is absolutely clear is that the energy demand in developing countries is rapidly increasing, and if we do not urgently redesign the ways in which energy is produced, consumed, and financed, especially in emerging economies, we will fail in our quest to achieve a truly global clean energy transition.

With the growing demand for clean energy across the world, there is no reason why countries in Africa and Southeast Asia that have abundant natural resources such as critical minerals cannot set up local manufacturing to produce cost-competitive products to serve their own needs while also supporting the needs of the global energy transition. For example, it is projected that renewable energy manufacturing in Southeast Asia can generate up to \$100 billion in sustainable revenue by 2030, with a potential 6 million renewable energy jobs to be created by 2050.<sup>7</sup> It is for this

reason that Sustainable Energy for All (SEforALL) and its partners are championing the Renewable Energy Manufacturing Initiative, which aims to drive investment and mobilize action in developing countries to scale up renewable energy manufacturing capabilities.<sup>8</sup>

Moreover, many of the countries that currently face energy access challenges have some of the ingredients to build a globally competitive renewable energy ecosystem. These ingredients include growing demand, natural resources, trade partnerships, and many supporting tools and incentives. However, inadequate financing continues to hamper progress; clean energy investment is not going to the countries and regions with the largest deficit. For example, Sub-Saharan Africa received less than 1.5 percent of the amount invested globally between 2000 and 2020.<sup>9</sup>

We must find ways to reform the current international financial architecture, which is fragmented and offers insufficient solutions, to ensure that funding is deployed to developing countries at scale and in ways that do not add more pressure to debt-burdened nations. I am particularly glad that this discussion has now taken center stage and there is growing consensus on the need for urgent reform.

6 International Renewable Energy Agency. World Energy Transitions Outlook 2022. IRENA, 2022.

7 Sustainable Energy for All. “Renewable Energy Manufacturing: Opportunities for Southeast Asia.” SE for All, August 24, 2023. <https://www.seforall.org/publications/renewable-energy-manufacturing-opportunities-for-southeast-asia>.

8 Sustainable Energy for All. “Renewable Energy Manufacturing Initiative.” SE for All, 2023. <https://www.seforall.org/our-work/initiatives-projects/renewable-energy-manufacturing-initiative>.

9 International Renewable Energy Agency. Global landscape of renewable energy finance 2023. IRENA, February 2023.



SHUTTERSTOCK/TUKIO

I do see an opportunity to develop innovative and holistic solutions that move private capital at scale, such as through creative finance arrangements, including concessional finance and blended finance. At SEforALL, we are showcasing how results-based finance can significantly accelerate and scale up energy access through private sector interventions.<sup>10</sup> I do hope that this can serve as a model to ensure the faster deployment of end-user electricity connections and clean cooking solutions across the globe.

### **Transformational changes are required**

The solutions I have highlighted speak to an opportunity to also change the mindset that tells

us we cannot solve the challenges we face, or that we have to wait to have a perfect solution that can work for our unique environments and contexts.

The urgency of the energy issues we face does not provide us with the luxury of time; we must quickly find ways to deliver affordable, reliable, and clean energy while accelerating the transition to cleaner renewable energy sources. This will help us foster a more equitable and inclusive world.

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*Damilola Ogunbiyi is the CEO and Special Representative of the UN Secretary-General for Sustainable Energy for All, and Co-Chair of UN-Energy.*

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10 Sustainable Energy for All. "Universal Energy Facility." SE for All. <https://www.seforall.org/our-work/initiatives-projects/UEF>.

...continued from page 37

Telling the account of a Kenyan coffee farmer, for example, Mafalda Duarte, executive director of Green Climate Fund, shares how the embrace of clean energy can have an expansive impact on the economy in local communities. “With a solar-powered irrigation pump, [Josephine] transformed her farmland, built a home, and now contributes significantly to her community. Funds like GCF bring the world community together to create millions of stories like Josephine’s, while safeguarding a future that belongs to all of us.”

When asked to elaborate on whether net zero will be achieved by 2050, the most common belief, held by 33 percent, is that it is highly unlikely, and a further 30 percent consider it somewhat unlikely. One-fifth (22 percent) did not take a position, while only 14 percent think reaching net zero by 2050 is either somewhat or highly likely.

A similar question last year did not give respondents the option of avoiding a prediction. Then, 55 percent thought net zero by 2050 to be unlikely and 45 percent likely. This suggests, when compared to the current answers, that either net-zero pessimism has risen at least to some extent in the past year or those compelled to make a prognostication for the 2023 survey allowed their optimism to outweigh

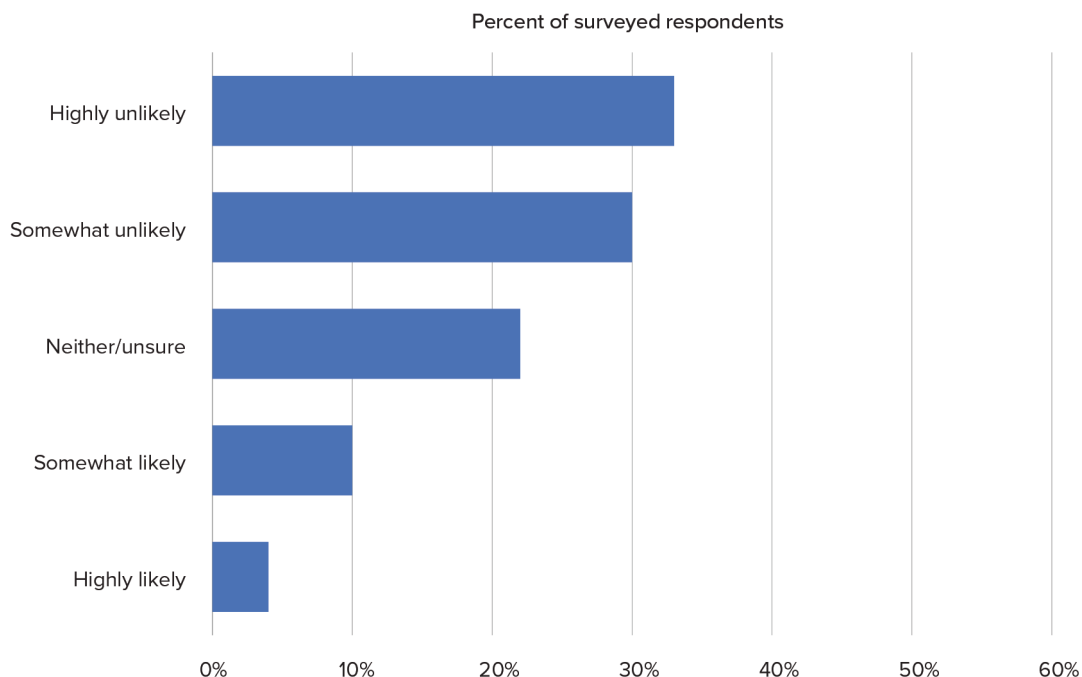
doubts about the transition in the absence of an alternative choice.

For this question, variations by region are minimal, but a noticeable differential emerges in sectors’ alignment on net zero. Among respondents in finance, 80 percent see net zero as unlikely, while more than 60 percent hold this view in government, oil and gas, think tanks, academia, and media. Of those surveyed in low-carbon energy production, 51 percent think that reaching net zero is unlikely.

A deeper dive into the data shows that even the subset of our respondents who believe that peak oil has already happened or will happen by the end of the decade are pessimistic about net-zero prospects: only 20 percent of this group expect the world to achieve net-zero emissions by 2050. While this aspiration appears to be increasingly elusive, these respondents still think it a worthwhile aim. One wrote, “Even if unlikely, we have to keep striving to achieve that goal! Not doing so would put the world in an even worse position.”

Underscoring views on efforts to reach global net zero, respondents commented on the closely related topic of limiting warming to below 2°C. Some talk of the urgency of the energy transition—or, in far fewer cases, the lack thereof. Others describe the kind of

## How likely is achieving global net-zero greenhouse gas emissions by 2050?



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.

technologies that would be needed in order to succeed in this task and some discussed the barriers to reaching this goal.

A clear message comes from the answers overall. Consistent with the skeptical views regarding the possibility of attaining net zero, only a handful of these responses could be characterized as positive or hopeful about progress toward limiting temperature increases. Of the more than 500 answers, for example, only seven use some variation on the word “hopeful.” Far more commonly used was the word “slow” (mentioned ninety times) and variations on this pace for limiting warming.

Even among those who consider attainment of net zero to be likely or very likely, the tone is roughly the same. Setting this group apart on this question from other respondents is the expression of hope that this effort is too important for the world not to turn things around. One wrote that rising temperatures are “an existential threat to mankind.”

## THE CHALLENGES FACING NET-ZERO ACCELERATION

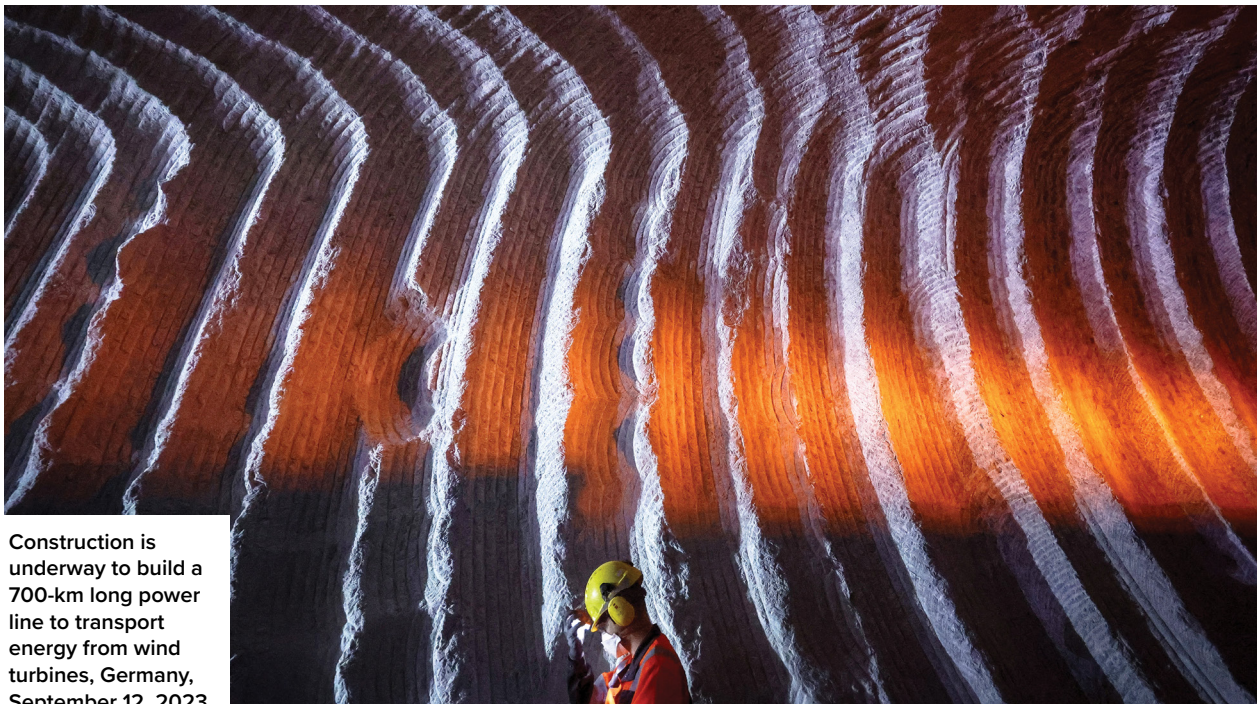
If most respondents think that net zero is a critical aim and yet an even larger majority believe that it is unlikely to occur, an obvious question is what is standing in the way. In aggregate, two leading issues are involved: a lack of political will and money.

Regarding the latter, 58 percent cite at least one cost issue, shown in the figure on page 45 in orange because it was not a single response option but rather represents how many people said rising cost pressures, high borrowing costs, or both. (Multiple responses were permitted, allowing the sum of all response option percentages to exceed 100). Specifically, 42 percent of respondents list rising cost pressures in general as an impediment to the goal, and 37 percent point to high borrowing costs. The high up-front expense associated with renewables make the latter a particularly powerful barrier.

The most frequently mentioned issue—by two-thirds of respondents—is a lack of political will. This impediment is as multifaceted as cost, according to respondents’ comments. Explaining their answer, respondents gave a wide variety of interpretations to the phrase including: a lack of popular support in one or more countries, often because of perceived economic costs or rejection of the scientific consensus; a lack of agreement between governments, particularly between those in the Global North and South; a lack of willingness by politicians to make difficult decisions or ignore lobbyists; and an abundance of other priorities.

On this question of impediments to net zero, some groups show a stronger consensus worth noting. Among those who believe that net zero will not be reached, but achieving it would have a positive or no effect on economic growth, 79 percent name

...continued on page 45



Construction is underway to build a 700-km long power line to transport energy from wind turbines, Germany, September 12, 2023.

REUTERS/Kai Pfaffenbach





# Public funds alone can't solve the climate crisis

by Mafalda Duarte

Financing climate action, particularly in the developing world, is a crucial investment in humanity's shared future. We know, and the science confirms, that the world has a rapidly narrowing window to speed up and scale up investments in solutions that developing countries need for the future we all deserve.

But no one can solve today's problems with yesterday's thinking. This challenge demands twenty-first century approaches and partnerships. Equally important, the public and private sectors must work in tandem to meet the moment.

Governments and businesses alike should understand that investing in developing countries is a practical imperative. With rapidly expanding populations,<sup>1</sup> the largest real gross domestic product (GDP) growth percentages,<sup>2</sup> and rising demand for energy,<sup>3</sup> developing countries are defining our collective prosperity and well-being.

These facts sum it up quite well. Our climate crisis originates from roughly forty wealthy economies' industrial transitions. Meanwhile, 150 emerging economies, home to 97 percent of projected population growth, have not even begun or completed their own transitions.<sup>4</sup>

Low- and middle-income countries have the duty to meet the needs of their people, and it is the world's collective obligation and interest to help them do so in harmony with our climate goals. Without international support to make greener

investments, their development may rely longer than the science says it should on legacy energy sources and other investments that lock in unsustainable, carbon-intensive growth and cause a spike in carbon-dioxide (CO<sub>2</sub>) emissions.<sup>5</sup>

Private financiers have a compelling economic motive to drive climate action. To reach net zero by 2050, the United Nations (UN) estimates that the world will need \$90 trillion in infrastructure investments—a golden opportunity for companies around the world.<sup>6</sup> Clean energy spending is moving accordingly, set to surpass \$2 billion this year and overtake fossil fuel investment for the first time ever. Additionally, more and more communities are funding measures to build resilience to climate impacts.<sup>7</sup>

While private capital flows for low-carbon and resilient investments are climbing, they are still woefully inadequate. Private investment in climate reached a recent high of \$250 billion, less than 0.5 percent of the \$90 trillion referenced earlier.<sup>8</sup> Public sector entities like governments and multilateral institutions are deploying more—some \$850 billion in 2021—but, taken together, this is still a drop in the ocean relative to scale of the challenge.

Additionally, most of these investments are still concentrated in developed countries. For instance, despite a clean energy finance gap of around \$1.7 trillion annually, developing countries

1 Roland Berger. "97% of population growth to be in developing world." Consultancy UK, June 24, 2015. <https://www.consultancy.uk/news/2191/97-percent-of-population-growth-to-be-in-developing-world>.

2 International Monetary Fund. "Real GDP growth." IMF, 2023. [https://www.imf.org/external/datamapper/NGDP\\_RPCH@WEO/OEMDC/ADVEC/WEOORLD](https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOORLD).

3 International Energy Agency. "World Energy Outlook 2021. Energy consumers of tomorrow." IEA, 2021. <https://www.iea.org/reports/world-energy-outlook-2021/energy-consumers-of-tomorrow>.

4 Carl Haub. "World Population Trends 2012." Population Reference Bureau, June 18, 2012. <https://www.prb.org/resources/world-population-trends-2012/>.

5 Graham Mott, Carlos Razo, and Robert Hamwey. "Carbon emissions anywhere threaten development everywhere." United Nations Conference on Trade and Development, June 2, 2021. <https://unctad.org/news/carbon-emissions-anywhere-threaten-development-everywhere>.

6 United Nations. "Climate Action Fast Facts." United Nations. <https://www.un.org/en/climatechange/science/key-findings>.

7 Jonathan Barnes, Clare Shakya, and Helen O'Connor. "Adaptation finance must reach and pass the US\$40 billion target." International Institute for Environment and Development, November 2, 2022. <https://www.iied.org/adaptation-finance-must-reach-pass-us40-billion-target>.

8 Torsten Ehlers, et al. "How to Scale Up Private Climate Finance in Emerging Economies." International Monetary Fund Blog, October 7, 2022. <https://www.imf.org/en/Blogs/Articles/2022/10/07/how-to-scale-up-private-climate-finance-in-emerging-economies>.

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**Private financiers have a compelling economic motive to drive climate action.**

—Mafalda Duarte

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only attracted \$544 billion in 2022, according to a UN report.<sup>9</sup> The adaptation finance gap is even more alarming, recently estimated to be at least ten to eighteen times greater than current international finance flows.<sup>10</sup>

The status quo is increasingly setting us off track. Financial institutions oversee some \$510 trillion in financial assets.<sup>11</sup> Institutional investors, like sovereign wealth funds and pension funds, hold an estimated \$110 trillion under management.<sup>12</sup> Unlocking even a fraction of those resources for climate investments would go a long way toward reducing emissions and safeguarding communities against climate change impacts.

How can we attract more private investment where it counts the most? Private financiers are often deterred by barriers such as sovereign and currency risks or limited data and track records. These are serious obstacles, but they are not insurmountable with strategic partnerships and innovative finance mechanisms.

I lead the Green Climate Fund (GCF), the largest multilateral climate fund primed and uniquely positioned to steer private finance toward climate investments. GCF’s flexible, patient, risk-sharing, concessional capital enables private companies to enter new markets and new sectors, and to reap the benefits of investments they wouldn’t otherwise consider.

We mitigate perceived and real risks by sharing risk with private sector partners when entering new or incipient markets.

Our efforts are paying off. Private sector commitments comprise 36 percent of our portfolio, with \$5 billion in direct GCF financing, which is enabling \$22 billion in total investment from the private sector. Even better, 60 percent of these target the least developed countries, small island developing states, and vulnerable nations.

Our private partners span from Fiji Development Bank to Macquarie, Acumen, and Credit Agricole. In Kenya, for example, we’re working with Acumen to help thousands of farmers and local ventures access tailor-made financial resources, technical know-how, and new market opportunities. The result has been impressive. In Kenya, beneficiary farmers now sell about 400 tons of produce every month despite the challenges facing Kenya’s climate-sensitive agricultural sector, which contributes 20 percent to national GDP.

During a recent visit, I met Josephine, a coffee farmer, near Nairobi. With a solar-powered irrigation pump, she transformed her farmland, built a home, and now contributes significantly to her community. Funds like GCF bring the world community together to create millions of stories like Josephine’s, while safeguarding a future that belongs to all of us.

To win the race against the climate crisis, we need trillions of dollars in investments—and all eight billion of us working as one to get there. We do not have a moment to waste.

*Mafalda Duarte is the executive director of the Green Climate Fund.*

9 United Nations Conference on Trade and Development. “UNCTAD calls for urgent support to developing countries to attract massive investment in clean energy.” UNCTAD, July 5, 2023. <https://unctad.org/news/unctad-calls-urgent-support-developing-countries-attract-massive-investment-clean-energy>.

10 United Nations Environment Program. “As climate impacts accelerate, finance gap for adaptation efforts at least 50% bigger than thought.” UNEP, November 2, 2023. <https://www.unep.org/news-and-stories/press-release/climate-impacts-accelerate-finance-gap-adaptation-efforts-least-50>.

11 Jonathan Woetzel, et al. “The rise and rise of the global balance sheet: How productively are we using our wealth?” McKinsey Global Institute, November 15, 2021. <https://www.mckinsey.com/industries/financial-services/our-insights/the-rise-and-rise-of-the-global-balance-sheet-how-productively-are-we-using-our-wealth>.

12 “The \$110 Trillion Trend Wall Street Can’t Ignore.” Cision PR Newswire, November 3, 2020. <https://www.prnewswire.com/news-releases/the-110-trillion-trend-wall-street-cant-ignore-301165506.html>.

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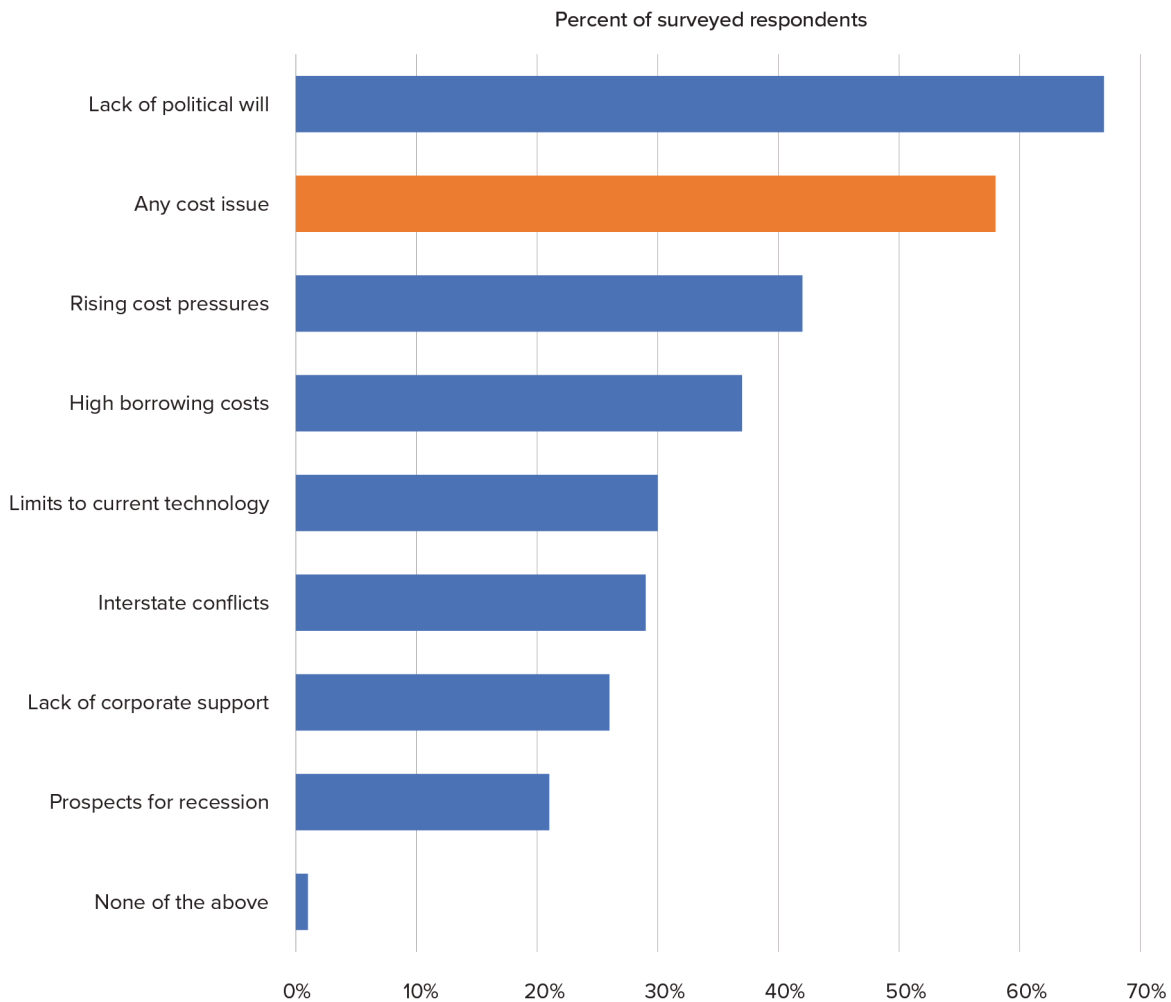
political will as an important impediment. Among the rest of those surveyed, it is still the leading choice but selected by only 59 percent, roughly even in this group with some form of cost (55 percent). Presumably because of the nature of the polarizing political climate in the United States and the associated debate around climate change in the country, 73 percent of American respondents are similarly likely to see political will as an issue, compared to just under 60 percent in Europe and the Global South.

Respondents from each sector also are more likely to see impediments within their own fields, but to demonstrably differing degrees. Those who work in energy production, for example, are more likely than the average respondent to see limits to current technology as slowing the transition, with 39 percent of

those in low-carbon industries and 36 percent in oil and gas selecting this option. Those surveyed from finance more frequently point to cost issues, with 48 percent doing so for rising overall pressure and 40 percent for borrowing costs. Most striking, 79 percent of those in government believe that political will is a leading impediment.

The outliers are the subset of respondents who think peak oil is decades off and that achieving net zero would negatively affect the economy. Only 43 percent of this group cite political will as an impediment and instead point to rising cost pressures (59 percent) and the limits of current technology (51 percent). To judge from their written comments, this is because high costs will lead to the abandonment of support for net-zero targets. Other respondents agree

**Which of the following are likely to impede global energy systems from reaching net zero by 2050? (Multiple selections permitted)**



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.

that costs could damage public support but see this as an issue of political framing. For example, enhancing messaging to more effectively earn public buy-in for the idea that paying the transition costs is insurance against the worst impacts of climate change.

## POPULAR SUPPORT FOR THE ENERGY TRANSITION

Popular support for the drive to reach net zero must broaden, deepen, or do both for momentum to build even further toward climate policies that will accelerate the energy transition. Respondents ranked various factors that are important for making progress on this front.

That concern about climate change should have the highest number answering extremely important to this question is predictable. However, by some metrics, economic opportunity is an even more important driver of support, with 77 percent saying that it is very or extremely important. National security also is a salient issue, with over two-thirds (68 percent) calling it very or extremely important. Finally, most respondents believe that a coming generational shift (66

percent) will reshape attitudes further in favor of the energy transition.

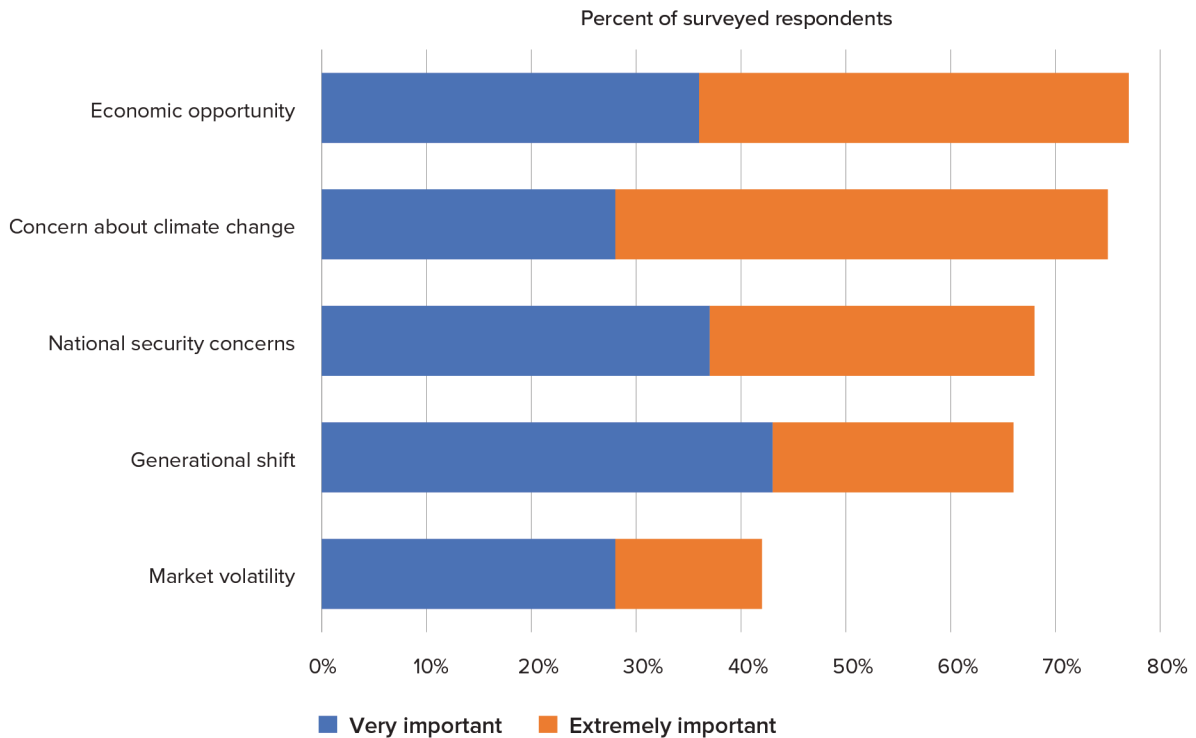
Despite inevitable minor variations—89 percent of US respondents, for example, think that economic opportunity is very or extremely important to increasing popular support—little variation occurred on this question by demographic groups.

Through written comments, some respondents indicated that general support is already substantial, but “the problem is active obstruction by a minority of people and companies.” Moreover, a subset of net-zero skeptics say that economic opportunity and national security are not at all important to increasing popular support for the transition, which perhaps indicates that these issues will not be effective at swaying the minority that is hindering the energy transition. This group of respondents add that focusing on these issues could even turn people against the drive to net-zero if it fails to deliver on economic and security promises.

Beyond these facets, if two-thirds of respondents are correct, yet another variable could affect the pace of the energy transition one way or the other: extreme weather.

...continued on page 50

### How important are each of the following for increasing popular support for the energy transition to net-zero emissions? (Proportion answering very or extremely important)



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.



# A new generation of nuclear reactors is poised to set the United States—and the world—on the path to net zero

by John Wagner

Nearly seventy-five years ago, the US Atomic Energy Commission set out to prove that nuclear power could be harnessed to produce electricity for peaceful applications. To do so, it created the National Reactor Testing Station in Idaho. The station, now known as Idaho National Laboratory (INL), fulfilled the commission's promise. With public and private sector partners, the initiative achieved many firsts, including the first nuclear electricity, the first city powered by nuclear, the first demonstration of the principle of breeding (producing more fuel than is consumed in a reactor), the first submarine reactor, and the first mobile nuclear power plant. Fifty-two unique test reactors were designed, built, and operated, giving birth to the US Nuclear Navy and the global, commercial nuclear energy industry. This rich legacy of achievement has made the world safer, cleaner, more prosperous, secure, and resilient.

And yet, it might surprise some to learn that although there are four remaining test reactors operating at INL, the US Department of Energy's laboratory for nuclear energy research and development, it has been fifty years since a new, unique reactor began operations on the site. That's about to change.

Over the next decade, more than a dozen advanced reactor concepts will be demonstrated in the United States, including microreactors, small modular reactors, and university test reactors.

Ten years ago, this timeline would have been unthinkable. What has changed is a growing awareness about climate change and the imperative to combat its devastating impacts by producing clean, secure, flexible, and resilient energy.

This requires more nuclear energy—a lot more. Earlier this year, a DOE "Liftoff" report identified the potential for nuclear to scale to 300 gigawatts (GW) by 2050 to address the broader need in the United States for approximately 550–770 GW of additional clean, firm capacity to reach net-zero emissions.<sup>1</sup>

This is consistent with what the US-based Nuclear Energy Institute (NEI) found when it polled member utilities. NEI utilities see a role for nearly 100 GW of new nuclear electricity by 2050 to support their decarbonization goals—more than double the current US nuclear electricity capacity.<sup>2</sup> Analyses from the Intergovernmental Panel on Climate Change points toward the need to materially increase global nuclear capacity by 2050.<sup>3</sup>

This represents a profound challenge, but also an opportunity for nuclear power to address the global need for clean, firm, secure, and flexible energy in the next few decades.

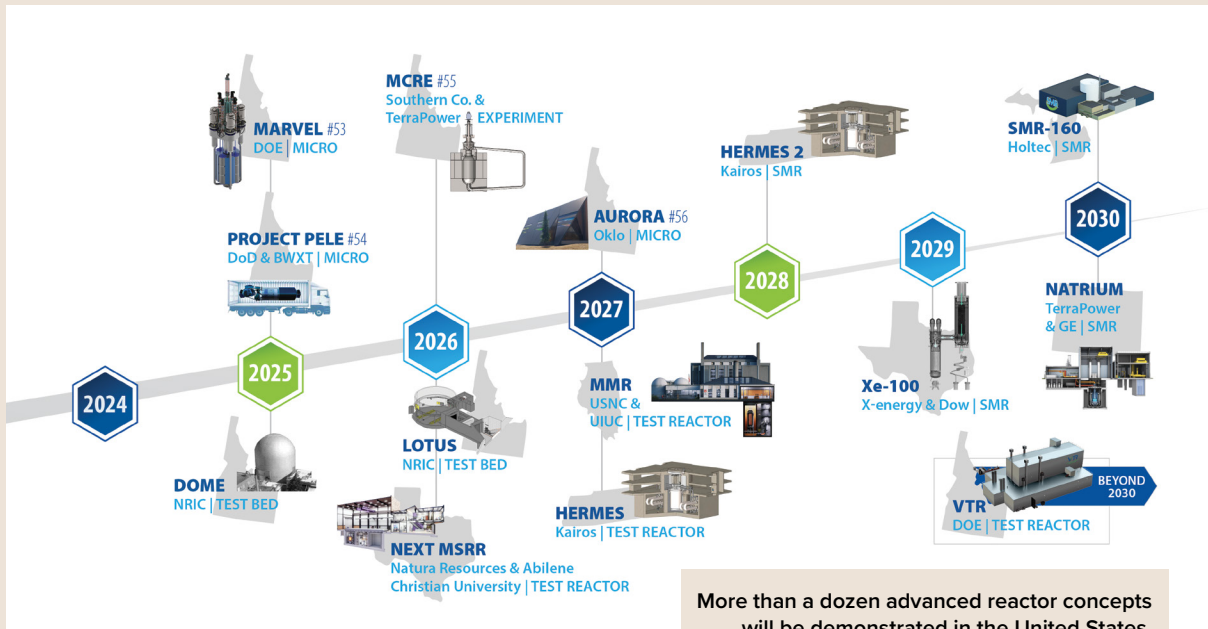
INL's strategy—coordinated with numerous partners—is to start small. This means making systems that are simple and inexpensive as compared to current generation power reactors. To do this and to enable the successful scale-up in size, complexity, and capacity of nuclear power, the United States needs to do the following: build supply chains for advanced nuclear technologies, including a domestic supply of fuel; develop a knowledgeable and capable workforce; and revamp its regulatory system to enable timely deployment of advanced technologies.

At INL, that strategy (see figure on p. 48) begins with MARVEL, an 85-kilowatt thermal DOE test reactor that will provide a research-and-development platform for researchers and industry to

1 Julie Kozeracki, et al. Pathways to Commercial Liftoff: Advanced Nuclear. United States Department of Energy, March 2023.

2 The Nuclear Energy Institute. "Value of Advanced Nuclear." NEI. <https://www.nei.org/advanced-nuclear-energy/value-of-advanced-nuclear#:~:text=NEI%20surveyed%20utility%20members%20and,to%20about%20330%20new%20SMRs>.

3 Valérie Masson-Delmotte, et al. Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. IPCC, 2018.



More than a dozen advanced reactor concepts will be demonstrated in the United States.

understand the use of microreactors for a wide variety of potential applications, while providing information to support licensing, environmental assessments, improved performance, and deployment. MARVEL will also advance US capabilities to support subsequent reactor projects.

Next up will be Project Pele, a partnership between DOE, INL, the US Department of Defense, and BWXT that will help US armed forces reduce their dependence on diesel fuel. Pele will pave the way for small, advanced reactors for other military applications, as well as private sector applications.

After Pele, INL, working with Southern Company and TerraPower, will conduct the Molten Chloride Reactor Experiment (MCRE), which will be the world's first fast-spectrum salt system to achieve criticality—meaning it will be able to sustain a fission chain reaction. Additionally, the Oklo Aurora microreactor could be demonstrated on the INL site as early as 2027.

A key aspect of INL's strategy is to use decommissioned reactor facilities as test beds, via the National Reactor Innovation Center. The decommissioned Experimental Breeder Reactor-II, which is being repurposed for Demonstration and

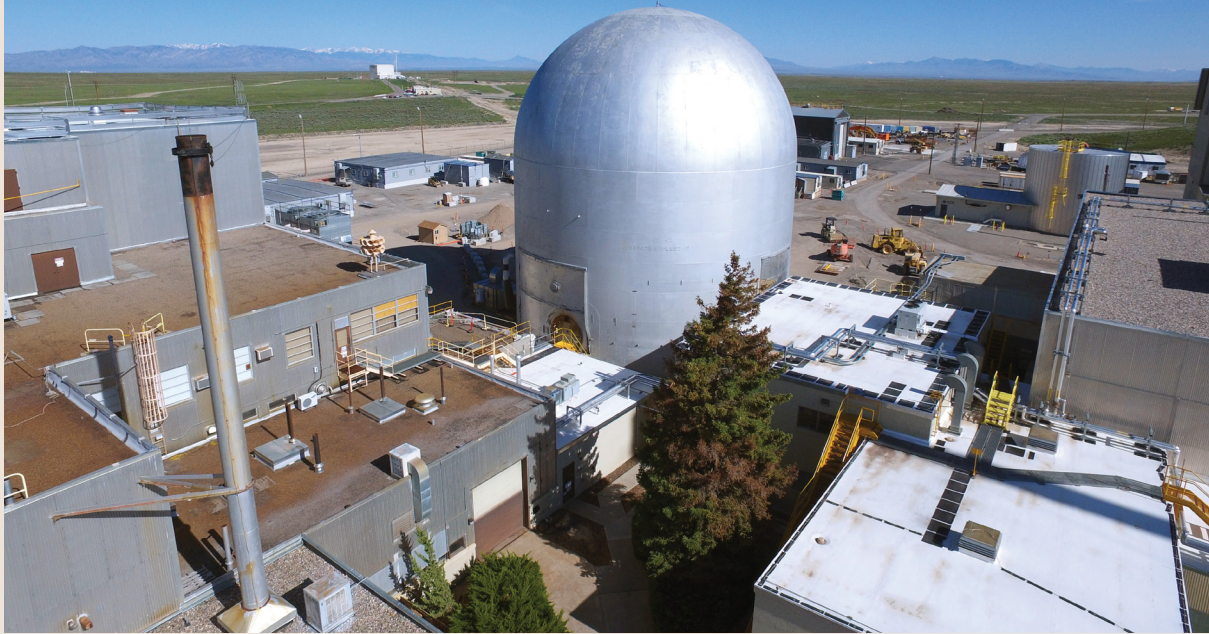
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**It's time for the United States to honor its rich legacy of achievement by providing the research foundation to deploy the advanced nuclear technologies the world desperately needs to power a clean and prosperous future.**

—John Wagner

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A decommissioned reactor is being repurposed for Demonstration and Operation of Microreactor Experiments (DOME).



Idaho National Laboratory

Operation of Microreactor Experiments (DOME), is scheduled to be completed by 2025. Another test bed, LOTUS, which will host MCRE, is scheduled to be operational by 2027. These test beds will streamline testing of advanced reactor technologies, strengthening the relationship between the national labs and the private sector, and supporting the ultimate objective of deploying advanced reactors into the global market.

As shown in the figure, many reactor projects are planned to follow, demonstrating technologies for a variety of applications. These include the TerraPower Sodium reactor in Wyoming, which will repower a coal generation site and the X-Energy reactor in Texas, which will support decarbonization of the energy-intensive industrial sector. Note that the figure is not all-inclusive, as the situation is dynamic and numerous additional reactor demonstration projects in the United States and beyond are working toward demonstration.

Over seven decades, the nation has made incredible progress advancing nuclear energy to its current state. It's time to take the next step. With the combined efforts of government, industry, and academic partners, it's time for the United States to honor its rich legacy of achievement by providing the research foundation to deploy the advanced nuclear technologies the world desperately needs to power a clean and prosperous future.

At INL, we approach each day as though the world depends on our success. Failure is not an option. Not this time. Not if we want to offer our children, grandchildren, and future generations their best opportunity for security, prosperity, and environmental sustainability.

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*John Wagner is the director of Idaho National Laboratory, the US Department of Energy's center for nuclear-energy research and development.*

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One respondent summarized the finding this way: “extreme weather events, their cause and effects due to the changing environment, will quickly become more apparent to more leaders as the rest of this decade plays out.”

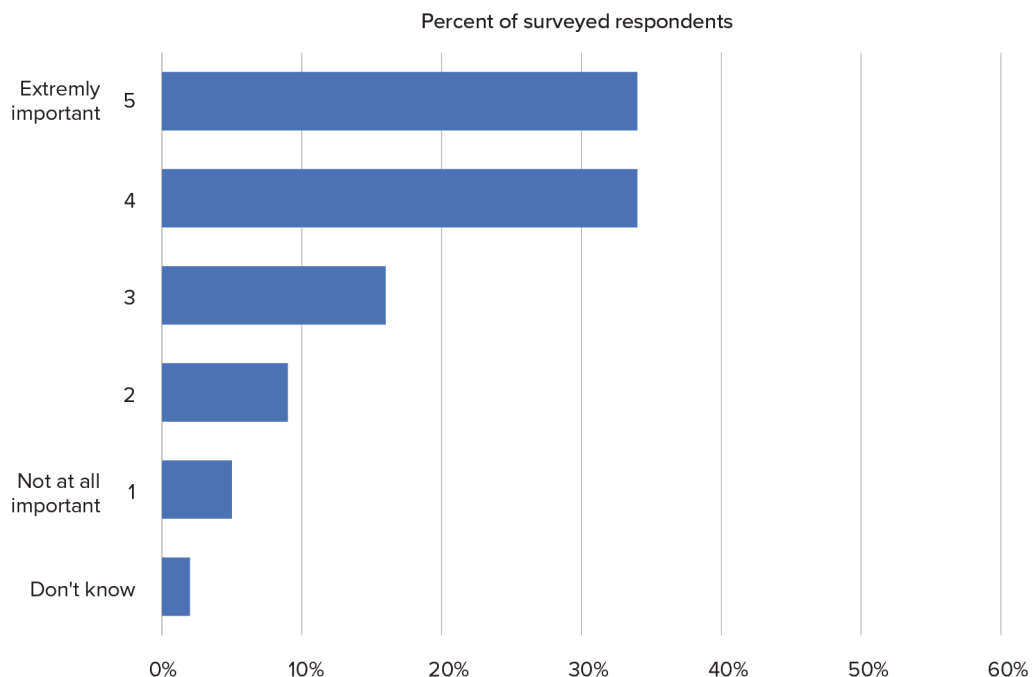
Just as important, however, will be how these events are framed in the public mind. One respondent said that extreme weather events “increase public awareness.” Another added, “people are starting to see more of the events predicted by scientists.” Others went further still, calling repeated occurrences of extreme weather, “the wake-up call for mankind for whom lessons learnt are very easily forgotten unless reminded often.” One went so far as to say that people “will believe it is a punishment.” In effect, the impact of these events on the speed of the energy transition will be via their influence on popular opinion and political will.

However, the degree of this impact remains uncertain. Among the subset of respondents who are bearish on peak oil and think net zero will create economic drag, only 32 percent of this group say that worsening weather conditions are very or extremely important to the pace of the transition, and 47 percent say that they are not at all important.

Those in all others groups of survey participants, however, are more likely to agree with the common opinion that extreme weather events are already increasing and will only grow more frequent. For them, the framing is an explanation of what is already happening, a vivid reminder to the public and policy-makers alike of the importance of realizing the energy transition. And while most respondents do not think the world will reach net zero by 2050, there remains a silver lining—a majority also believe that reaching it would have economic benefits, undeterred by the perils of climate change.

Overall, 56 percent say that the effect on the economy would be positive, more than twice the 27 percent who see a negative one. The other 16 percent expect that it would have no net effect. In last year’s survey, 52 percent expected that achievement of net-zero would have a positive impact on the economy, or at least no strong effect of any kind. The other 48 percent predicted a negative one. This suggests a shift toward support for the economic case for the energy transition. Because the pool of respondents are largely based in the United States, it would not be unreasonable to infer that some of this effect might be a result of the economic benefits derived from the US Inflation Reduction Act.

**How important are extreme weather events to the pace of the energy transition?  
(Scale of 1 = Not at all important to 5 = Extremely important)**



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.



The only notable geographic difference in the figures are found in the MENA region. There, 48 percent of respondents expect that net-zero success would harm gross domestic product against 32 percent who say it would be beneficial. This presumably reflects a lack of confidence in the ability of many of these countries to move economic activities away from fossil fuel production in the coming decades.

Those who see economic damage arising from pursuit of net-zero emissions, however, say that until renewables are as inexpensive as fossil fuels, then their use will represent a cost to the economy. Most importantly, these respondents are not convinced by the arguments of those who advocate for state-driven investment as a path to growth. One noted that, “some research suggests that net-zero initiatives increase innovation and, thus, economic growth. However, those studies do not address the inflationary impact associated with the shift toward renewables. Nor do the studies address the potential adverse impact on productivity associated with a rapid shift toward intermittent energy sources.”

Respondents who see economic gains arising from reaching net zero, on the other hand, widen the lens on their various arguments. They take into account the benefits of the energy transition on curbing climate

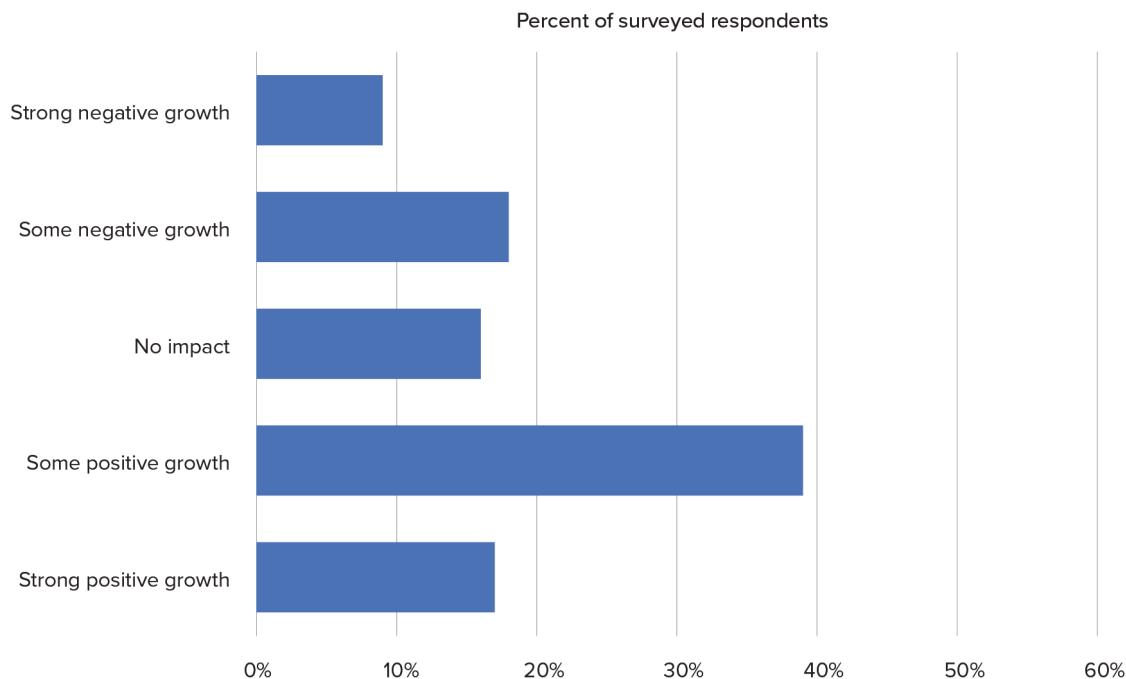
impacts, including avoiding costly damage exacted by more extreme weather events, gaining productivity due to improved human health, and reducing overall energy costs to the economy from mature renewable generation. As one respondent explained: “The huge investment required will create job opportunities and economic activity.”

## LOOKING AHEAD, INVESTMENT PRIORITIES DIVERSIFY

In past surveys, hydrogen and energy storage have been most commonly identified as the sectors that will see the greatest growth in investment. This year, storage and hydrogen are again among respondents’ top-three picks, along with solar. Nevertheless, as the accompanying chart illustrates, those surveyed did not focus on one or two dominant answers, demonstrating an all-of-the-above approach. Very similar levels of expectation exist for a wide range of technologies, with eight being selected by 8 percent to 16 percent. Fossil fuels, a new response option for this year, came in at 9 percent.

The only important variations within the survey data are those related to the sector in which respondents work. In some cases, these differences are largely pre-

### What do you think would be the impact of achieving net-zero emissions by 2050 on global economic growth?



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.

dictable. Of those who work specifically in the nuclear industry, for example, 33 percent expect research into that form of energy to see the biggest increase in investment. In the United States, this could certainly be a reflection of the Department of Energy’s plans over the next ten years, when “more than a dozen advanced reactor concepts will be demonstrated in the United States, including microreactors, small modular reactors, and university test reactors,” as Director of Idaho National Laboratory John Wagner wrote in his essay.

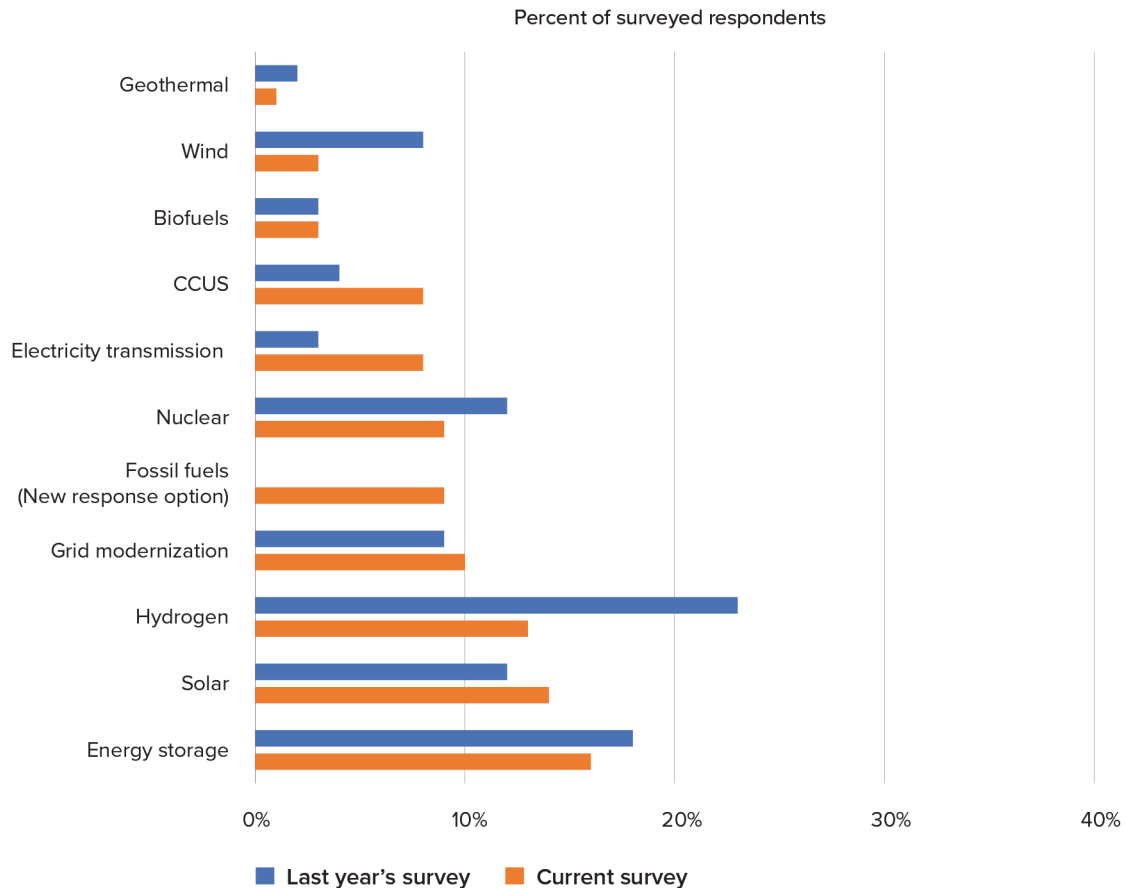
More revealing is how the data show awareness among energy producers of weaknesses that their forms of energy have in contributing to the energy transition. Of renewables respondents, for example, 30 percent say that electricity storage will be the leading focus of research. For those in oil and gas, the leading choice is carbon capture and storage, named

by 21 percent—or more than three times the proportion among other respondents.

The relatively even distribution of expectations across technologies shows that respondents expect investors will pursue a wide range of options in search of a low-carbon future. Indeed, projections predict clean energy will account for the lion’s share of growth in electricity capacity over the next few years. As Sebastian Kind, CEO of the renewables non-profit organization called RELP, wrote in his essay, “In the world’s rapid pursuit of a modern clean energy economy, renewable energy capacity expansion from 2022 to 2027 is estimated at 2.4 terawatts, representing over 90 percent of global electricity capacity expansion.” While an impressive figure, Kind and our other authors say that much more must be invested, particularly in emerging markets and developing economies, to ensure the transition is just.

...continued on page 56

### Which segment of the energy sector will see the greatest growth in investment in 2024?



SOURCE: 2024 GLOBAL ENERGY AGENDA SURVEY.



# Accelerating clean energy deployment in emerging markets

by Sebastian Kind

Renewable energy resources have the potential to reduce significantly and economically the greenhouse gas emissions from fossil fuel-based electricity generation. They have matured into commercially competitive and technologically advanced sources of clean electricity. The world must rapidly expand renewable capacity to meet the carbon-cutting ambitions mandated internationally by the Paris Agreement. However, achieving mass deployment in emerging markets and developing economies (EMDEs) requires more than technological maturity and competitive pricing.

Statistics from reputable sources illustrate the pivotal role of renewable energy in accelerating the energy transition. In 2022, global investment in the low-carbon energy transition totaled \$1.1 trillion, a substantial increase from the \$267 billion recorded in 2011.<sup>1</sup> These investments encompassed a wide range of projects, the majority of which were in renewable energy and electrified transport but also included energy storage, hydrogen production, nuclear energy, recycling initiatives, and carbon capture and storage (CCS) projects. In this active investment climate, renewable energy attracted the largest slice of the pie: \$495 billion in commitments. Meanwhile, global spending on electric cars exceeded \$466 billion in 2022, up 54 percent relative to 2021. Growing electrification highlights that developing renewable energy isn't solely a means of enhancing sustainability within the power sector, which accounts for less than 25 percent of overall energy consumption, but also of transforming the entire energy landscape.<sup>2</sup>

In the world's rapid pursuit of a modern clean energy economy, renewable energy capacity

expansion from 2022 to 2027 is estimated at 2.4 terawatts, representing over 90 percent of global electricity capacity expansion. This marks an 85 percent acceleration compared to the preceding five years, and is nearly 30 percent higher than the 2021 International Energy Agency report forecasted. This surge is primarily driven by China, the European Union, the United States, and India. Consequently, renewables are poised to become the world's primary energy source, contributing 40 percent to global electricity generation by early 2025, surpassing coal. It is the only electricity generation source that the International Energy Agency (IEA) expects to grow, while coal, natural gas, nuclear, and oil generation shares are expected to decline.<sup>3</sup>

To foster this growth, countries are employing various frameworks, including targets, renewable portfolio standards, feed-in policies (tariffs and premiums), auctions, tenders, renewable energy certificates, net metering, and other policies that encourage electricity consumers to produce and consume renewable energy onsite. Additionally, fiscal and financial incentives such as grants, rebates, and tax credits play a pivotal role in incentivizing business-development decisions and encouraging consumer behavioral change. It's worth noting that these mechanisms have facilitated substantial clean electricity project deployment in developed countries, China, and India, but many developing regions lag behind due to more challenging regulatory, legal, and political environments. The challenges these countries face create both actual and perceived risks that deter investors from entering the market.

The renewable energy sector requires substantial upfront capital investment, often pro-

1 "Global Low-Carbon Energy Technology Investment Surges Past \$1 Trillion for the First Time," BloombergNEF, January 26, 2023, <https://about.bnef.com/blog/global-low-carbon-energy-technology-investment-surges-past-1-trillion-for-the-first-time/>.

2 Ibid.

3 "Renewables 2022 Analysis and Forecasts to 2027," International Energy Agency, 2022, <https://www.iea.org/reports/renewables-2022>.

vided in foreign currencies that can cause volatility with local currency revenue streams. The cost of electricity from renewable sources is significantly influenced by the consequent cost of capital. EMDEs face inherent weaknesses, contending with higher capital costs, shorter debt tenures, elevated interest rates, and greater equity return requirements. Moreover, access to international capital markets is limited or simply null.

EMDEs interested in surmounting these challenges and enabling a rapid and sustainable expansion of renewable energy must cultivate a favorable environment for long-term international investors. A renewable energy program is not

going to solve a country's macro issues, but it can be sufficiently shielded to generate the necessary investor confidence. This entails establishing clear and comprehensive regulatory frameworks, transparent competitive procurement processes, and effective guarantee schemes. However, there is no one-size-fits-all solution, as countries encounter diverse challenges rooted in political, economic, technical, and institutional barriers, which will make the energy transition happen at different speeds and costs.

Still, EMDEs can take concrete steps to enhance their investment environment. Here are some critical measures.



Wind turbines with a sunset in the Western Cape, South Africa

SHUTTERSTOCK/Dawid Fourie Photography



**Renewables are poised to become the world's primary energy source, contributing 40 percent to global electricity generation by early 2025.**

—*Sebastian Kind*



1. Re-evaluate the electricity regulatory framework to identify necessary amendments for the integration of renewable energy.
2. Clearly define and identify the public agencies responsible for overseeing different aspects of renewable energy project development.
3. Streamline permitting procedures to expedite implementation timelines.
4. Conduct a comprehensive risk assessment to identify and quantify the likelihood and potential impact of key risks affecting renewable energy projects.
5. Define the renewable energy auction format and prepare the requisite documents and contracts.
6. Implement a periodic (annual or biannual) schedule of renewable energy auctions.
7. Devise effective de-risking mechanisms to bolster project bankability.

Of all of these factors, project bankability is often the hardest to pin down. A successful de-risking approach to promote clean infrastructure investments should include two essential elements. The first is to design bankable power purchase agreements featuring robust components

such as a twenty-year tenure, hard currency payments, protection against certain main country risks, lender step-in rights, investors' protection termination clauses, and efficient dispute resolution mechanisms. The second is to implement a robust guarantee scheme to mitigate investment risks, foster competition, reduce financing costs, and lower energy prices. Ideally, this scheme should include an energy payment guarantee (liquidity guarantee) to ensure timely offtaker payments and cover any payment delays, along with an early termination guarantee to mitigate political and regulatory risks. This guarantee scheme should be integrated into the procurement program, allowing bidders to price in the offers the de-risking benefits.

Renewable energy resources are technologically and economically advanced and well poised to accelerate the energy transition. However, to supercharge renewable energy deployment in all markets, especially in EMDEs, improved contractual frameworks, regulatory reform, and innovative financial instruments are essential.

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*Sebastian Kind is the founder of RELP. NGO, and its CEO and chairman since 2020. He has served as the chairman of the International Renewable Energy Agency (Council 2017–2018), and the under secretary of state for renewable energy in Argentina (2016–2019).*



## CONCLUSION

**T**HE WORLD ENTERS 2024 SEEMINGLY hardened by a half decade of geopolitical and economic stress. Unlike in 2022, when Russia's invasion of Ukraine dominated the agenda, an amalgamation of sustained (and fresh) conflict, coupled with perceptions of anemic economic growth, leaves 2023 with no single signpost to point toward. According to respondents in this year's *Global Energy Agenda* survey, however, the international community is increasingly alert to these challenges and how they impact the energy transition. Moreover, driven by a mix of apprehension of climate change and enthusiasm for the promise of a sustainable future, respondents remain by and large committed to pursuing a net-zero energy system.

Doubts about the energy transition may abound, but pessimism appears to be a function of timeliness, not the end state of the global energy mix. Over the

course of several years, the *Global Energy Agenda* has seen predictions of peak oil demand moderately push toward later next decade, while acceptance of natural gas has vacillated with current events. In that same period, respondents have continuously embraced the notion of net zero, warming to the policies and technologies that will enable a future consistent with long-term climate goals. COP28, which is conceivably the biggest energy story of 2023, reinforces this perspective. The UAE was the first COP presidency to marshal a global commitment on moving away from fossil fuel, brokering a deal between Saudi Arabia, the United States, and China that would ultimately serve as the foundation of a consensus agreement between all 196 countries participating in the Dubai conference,<sup>9</sup> and emphasizing that, to varying degrees, even major oil and gas producing economies are onboard with the energy transition.

9 Maha El Dahan, David Stanway, and Valerie Volcovici, "How the World Agreed to Move Away from Fossil Fuels at COP28," Reuters, December 14, 2023, <https://www.reuters.com/business/environment/how-world-agreed-move-away-fossil-fuels-cop28-2023-12-14/>.



Oil storage silos, wind turbines, and solar panels in Eemshaven, the Netherlands.

SHUTTERSTOCK/Make more Aerials

In the coming year, the unity on display during COP28 will be an important facet of sustaining the pace and scale of change to the global energy system. With more than four billion people casting votes in elections in 2024,<sup>10</sup> this unity is not guaranteed. Approximately half of voters this year live in countries that have free and fair electoral systems, creating an astounding potential for political change. Given the economic and security ramifications associated with the energy transition, it will be impossible to divorce progress on net-zero emissions from the immediate political landscape. The degree to which countries adhere to net-zero solidarity will largely hinge on how leaders elected in 2024 shape the global energy future. For example, will these elections forge stronger partnerships critical to enhancing secure clean energy supply chains? Will the developed world honor its commitments to help the Global South affordably

deploy energy technologies crucial to achieving international climate goals?

With global diplomacy on climate change maturing alongside clean energy technology, world leaders are in a strong position to shepherd the net-zero future that has, until recently, felt out of reach. This does not imply it will be easy. International affairs are likely to remain uncertain, volatile, and disruptive. This past year, however, provided a blueprint for persevering through such adversity and achieving new benchmarks in support of the energy transition. It will be the responsibility of a new cohort of elected officials to seize on the progress to date, making each vote in 2024 the defining feature of this year's *Global Energy Agenda*.

<sup>10</sup> "2024 Is the Biggest Election Year in History," *Economist*, November 13, 2023, <https://www.economist.com/interactive/the-world-ahead/2023/11/13/2024-is-the-biggest-election-year-in-history>.

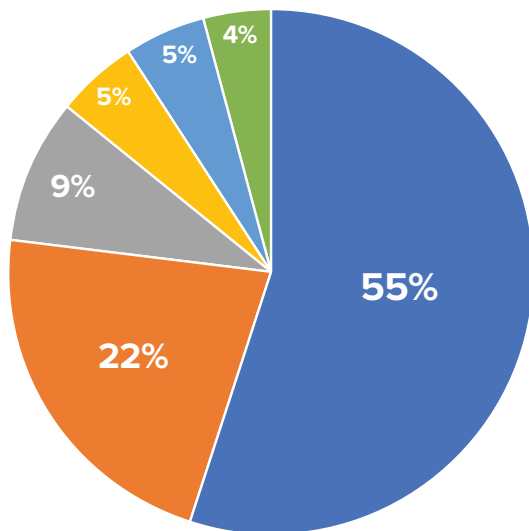
# APPENDIX: ABOUT THE SURVEY POOL

This year, 612 experts from across the energy field, broadly defined, took part in the Atlantic Council’s fourth annual *Global Energy Agenda* survey.

## BY GEOGRAPHY

### In what country do you live?

The respondents form a globally diverse group from seventy-five countries. While more than half (55 percent) are based in the United States, 22 percent are in Europe, 9 percent in Latin America, 5 percent each in the Asia-Pacific region and MENA. The remainder are spread across the rest of the world.



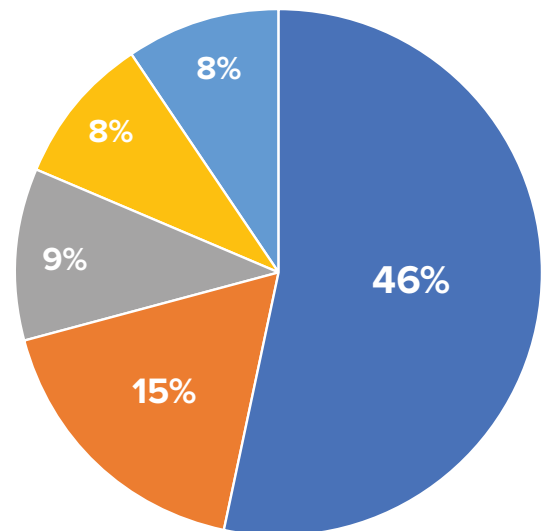
- United States
- Europe
- Latin America
- MENA
- Asia-Pacific
- Other

(Grouped by regions outside of the United States)

## BY SECTOR

### In which sector do you work?

For the purposes of analysis, respondents are grouped by employment categories including: academics, researchers, consultants, and the media; government employees; low-carbon producers, which include those working in renewables, nuclear energy, and advanced energy technologies; finance; and oil, gas, or refining.



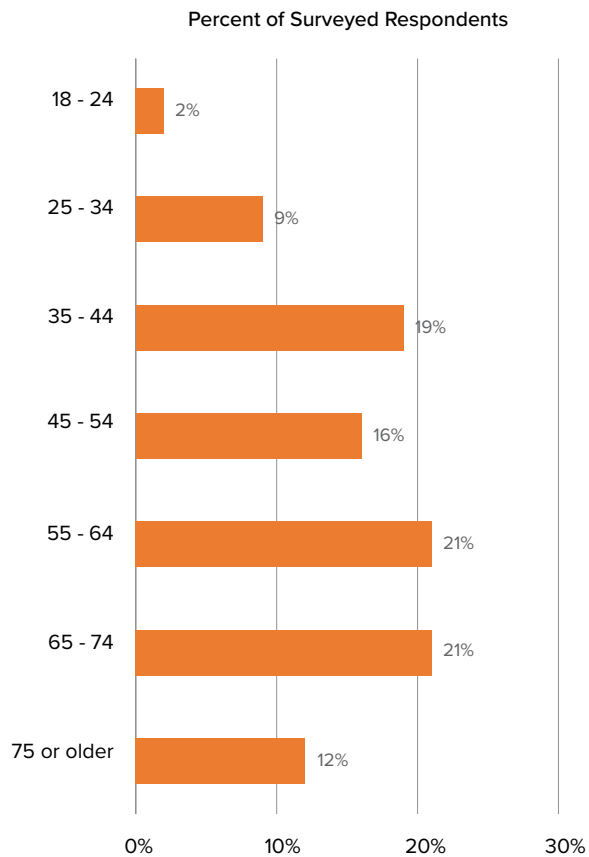
- Academics, think tanks, consulting, media
- Government
- Low-carbon generation
- Finance
- Oil and gas



## BY AGE, EXPERIENCE, AND GENDER

### What is your age?

Respondents range from 18 years to over 75, with a mean age of 55. Given this age distribution, it is not surprising that many of our respondents are experienced in the industry. Overall, 43 percent have worked on energy issues, policies, and/or technologies for more than 16 years, and a further 31 percent for more than five. Similarly, 56 percent report that they are at the executive or management level of the organization in which they work.





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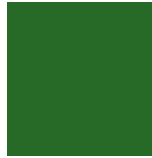
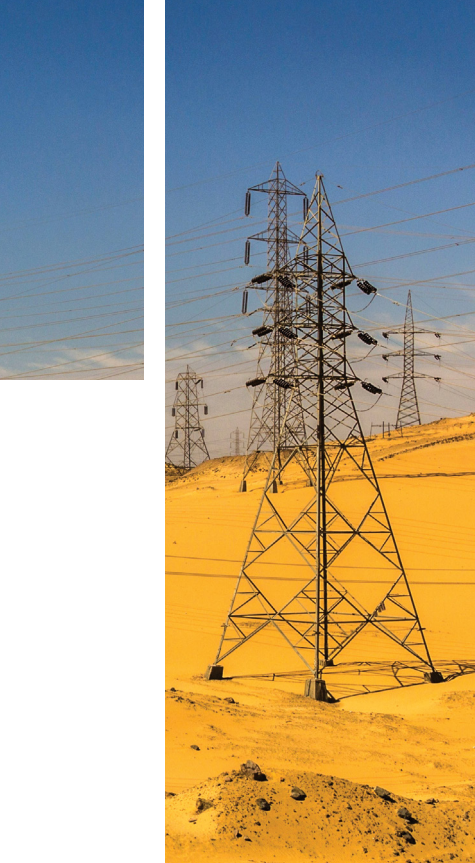
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