

The road map for a Multidimensional Energy Transition

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This paper summarizes the findings of the Global Energy Solutions Initiative (GESI). Under the auspices of the International Energy Forum (IEF) with S&P Global Commodity Insights as the Chief Knowledge Partner, a series of GESI leadership dialogues were held between October 2022 and March 2023 in Africa, Asia, Europe, North and Latin America and the Middle East. The objective of these dialogues was to bring diverse stakeholders and fresh perspectives to facilitate global conversation and encourage a more inclusive approach to developing sustainable energy transitions. The authors express their appreciation to IEF Secretary General Joseph McGonigle and the IEF staff.

Table of Contents

Introduction	3
Key insights from the GESI dialogues	5
The climate and energy narrative	6
A “just transition”	7
Financing low-carbon energy	7
The role of oil and gas	8
Policy tools and frameworks	9
Collaboration and engagement	9
The emissions reduction challenge	9
Focus areas for consideration	11
Unlocking finance	12
ESG and green finance criteria	12
Finance and cost of capital	13
Financing new technologies	13
Meeting the needs of the Global South	14
Affordability and energy security	14
Decarbonization pathways	15
Capacity building in emerging economies	15
Tackling infrastructure and supply chain bottlenecks	16
Energy infrastructure	16
Critical minerals	16
New frameworks and tools	17
The need for new policy frameworks and tools	17
Scenarios and road maps	17
Investment decision approaches and criteria	18
Collaboration, partnerships and engagement	19
Public-private sector collaboration	19
Cross-sector collaboration	19
Government-to-government (G2G) collaboration	19
Engaging the public	20

Introduction

Developments over the past two years demonstrate that the energy transition is more complicated than was previously thought. While the transition proceeds, expectations of a linear global transition have been shaken as climate goals compete with priorities around energy security, energy access and affordability. A series of shocks, crises and tensions in the global energy system point to the need to develop a transition that is inclusive of different situations in different parts of the world, reflects a diversity of policy approaches, is resilient and is equitable.

The energy price spike that began in the late summer and early autumn of 2021 pushed affordability to the fore, leading to policy challenges in many countries. Described as “the first energy crisis of the energy transition,” it resulted from a mismatch between strong demand growth and underinvestment in conventional supplies. The disruption in energy markets arising from Russia’s 2022 invasion of Ukraine — spiking energy prices, shortages, a “cost of living crisis,” economic dislocation — not only reinforced the affordability challenge but also put energy security back on the table as a central concern for governments and the public alike. The risks have increased significantly that recurrent high energy costs will undermine public support and acceptance for policies and investments to enable the transition to a low-carbon economy. The prospects of a linear transition have been further shaken by supply chain disruptions, growing geopolitical tensions, permitting delays and persistent inflation, which is affecting both operating costs and financing.

The emergence of a new North-South divide — between the wealthy countries of the Global North and the developing countries of the Global South — has fostered an increasingly sharp debate over the cost and timing of the energy transition, the relative burdens and its compatibility with priorities of economic growth, poverty reduction and improved health. The trilemma of energy security, affordability and sustainability looks very different in Africa, Latin America and developing countries of Asia compared with Europe or the US, where per-capita incomes are as much as 40 times higher. This divergence makes addressing the gaps in policy, technology and financing a significant challenge across geographies.

And then there are “the new supply chains required for net-zero.” Beginning around 2021 and continuing today, a host of governments and entities — the US, UK, Japan, Canada, the EU, the World Bank, the International Monetary Fund and the International Energy Agency — have raised alarms about the adequacy of mineral supply and processing capacity to meet the needs of rapidly growing renewable power and electric vehicles. This question of “the new supply chains for net-zero” is further complicated by rising geopolitical tensions.

In addition to all this, there is an unfolding shock of a different kind — the end of easy money. Central banks have continued to raise interest rates to tackle stubbornly high inflation. Higher interest rates raise the cost of capital for all energy investments. For developing economies with already high borrowing costs for energy projects, the higher interest rates make it even more difficult to make good projects commercially viable and attract investors. Higher interest rates also raise holding costs and result in potentially lower inventories of oil and risk higher volatility.

These issues are part of the evolving framework for the energy transition. But despite the complexity, the political momentum for energy transition continues. Policy actions in the US and EU have cemented net-zero ambitions with the launch of the RePowerEU plan in Europe and the Inflation Reduction Act (IRA) in the US. The latter has been described as “generational” in its impact. The IRA was just one of the three major pieces of legislation passed by the US Congress and signed into law by President Joe Biden. Along with the Infrastructure Investment and Jobs Act (IIJA) and Creating Helpful Incentives to Produce Semiconductors and Science (CHIPS), this legislation will turbo charge investments in a wide spectrum of clean energy technologies in the US. We are witness to a new era of US industrial policy. Over the next decade, US federal spending on clean energy is expected to rise more than threefold from 2009 to 2017.¹

Additionally, the EU’s Green Deal Industrial Plan is focused on enhancing the competitiveness of Europe’s net-zero industry and accelerating the transition. Its objectives include creating a more supportive environment for scaling up the EU’s manufacturing capacity for the net-zero technologies and products required to meet Europe’s ambitious climate targets.

And, on the ground, the energy transition continues to unfold. According to Commodity Insights data, 301 GW of new renewable power were installed in 2022.² Commodity Insights expects that 70%-75% of the new generating capacity installed between 2023 and 2050 will be renewable power (although this is variable capacity, typically operating at 25%-40% of capacity). Progress is being registered on large-scale battery storage to enable this growing share of variable power to become baseload power. The rollout of electric vehicles is accelerating. In the first half of 2023, 28% of new cars sold in China were EVs; in Europe, 19%; and in the US, 9%.³ Hydrogen, which was hardly on the agenda half a decade ago, has now become a major target for investment and projects, and biofuels and renewable natural gas are also gaining greater scale. Technology advances, government support, regulation, growing private sector support — all of these will continue to push the transition forward.

This paper summarizes the findings from GESI dialogues. It aims to bring attention to the issues to be addressed by policymakers, energy industry leaders and financial institutions and to present different ideas and approaches to enable progress. Its mission is not to offer recommendations or conclusions, but rather to contribute by capturing the wide spectrum of perspectives on the energy transition and what will be required to achieve it.

We emphasize the timeliness of this paper. The COP 28 meeting at the end of 2023 will be of singular importance in addressing the questions that emerged in the GESI process and that are reflected in this paper. COP 28 will be the platform both for addressing the greater complexity of the energy transition, including the North-South divide, and at the same time identifying the technologies, policies, opportunities and commitments for meeting the urgent needs of the energy transition. We hope that this paper will contribute to the dialogue at COP 28 and to the overarching endeavor of understanding and meeting the challenges of the energy transition.

1. *Congress’s Climate Triple Whammy: Innovation, Investment, and Industrial Policy*, Lachlan Carey and Jun Ukita Shepard, Aug. 22, 2022, RMI.

2. Renewable power includes solar photovoltaics/concentrating solar power, onshore/offshore wind, biomass and waste, geothermal, ocean and other renewables.

3. See the Commodity Insights [Pulse of Change: BEV and PHEV sales update — Mainland China share remained around 30% in May 2023](#). These figures include battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEV). Sales data was compiled for January–May 2023, except in the US, where data is available for January–April 2023.

Key insights from the GESI dialogues

The GESI dialogues highlighted different perspectives on the opportunities, challenges and constraints in reducing greenhouse gas (GHG) emissions and in implementing and ensuring an orderly and affordable energy transition.⁴ The diverse participation enabled fresh ideas and insights to emerge, as well as new perspectives on existing topics.

Notable discussion points and emerging ideas are summarized in this section. The following overarching themes permeated many of the dialogues and represent observations and comments made by participants:

- First, although the climate science is now clear about the need to reduce emissions, there are significantly divergent views on how to achieve climate goals. This is most notable in the different viewpoints of the Global North and Global South, as well as in disconnects between policymakers and the industrial and financial sectors responsible for implementing the policy goals.
- Second, setting linear, global targets and predefined emissions pathways that do not account for important aspects of the energy trilemma may be counterproductive to meeting climate goals. The current energy transition is complex and multidimensional. Concerns were voiced at the dialogues that focusing on a singular pathway to achieving net-zero emissions by 2050 could undermine achievement of other sustainable development objectives, constrain financing for critical energy projects and put at risk the necessary public support for climate policies. Net-zero targets for many countries go beyond 2050. For example, China, Indonesia and Nigeria have net-zero targets of 2060, and India, 2070. China and India are the first- and third-largest emitters in the world, although both have strong policies promoting energy transition.
- Third, finance is not flowing fast enough, notably to the Global South, for a multitude of reasons. This includes optimistic expectations that “ideal” zero-carbon technologies will become commercially viable relatively quickly and could be deployed at scale around the world. There is a need to prioritize progress over perfection and get finance flowing now to rapidly deploy commercially viable technologies.
- Fourth, many participants expressed questions about the speed and comprehensiveness of the transformation of the global energy system. In prior transitions, externalities such as the impact and cost of emissions were not considered. Moreover, prior transitions led to new energy sources being added to existing sources. No primary energy source has ever been largely or completely phased out, as proposed by some in the current transition. For many participants, these differentiators make this transition more challenging than any previous energy transitions.

“The math of carbon budgets and climate change is unforgiving. But so is the math of meeting the world’s energy needs — and energy demand and emissions are both going up, not down.”

GESI participant

4. Dialogues were held in Cape Town, South Africa, on the sidelines of Africa Energy Week; in Riyadh, Saudi Arabia, on the sidelines of the Future Investment Initiative conference and of the IEA-IEF-OPEC Symposium on Energy Outlooks; in Bali, Indonesia, on the sidelines of the B20/G20; in Washington DC, hosted by the Centre for Strategic and International Studies; in Panama City at the OLADE conference; and in Davos, Switzerland, on the sidelines of the World Economic Forum (WEF). Solution-oriented roundtables were subsequently held in Houston during CERAWEEK by S&P Global.

- Fifth, at the same time, there was much optimism and confidence among many participants that the pace of technology innovation may continue to accelerate and that costs of new technologies such as carbon capture and storage (CCS), hydrogen and storage will decline rapidly within this decade. That would enable these critical technologies to be deployed at scale. Furthermore, innovations in digital technologies and smart grids will support rapid electrification. The impact of artificial intelligence on energy systems is only beginning to be understood. Some participants felt that there would be opportunities for the Global South to leapfrog in deployment of new technologies such as green hydrogen and storage.
- Sixth, although the Global South faces many challenges today, participants were optimistic about the future and keen to engage with industry leaders, policymakers and nongovernmental organizations (NGOs) in the Global North to develop creative solutions for the citizens of the developing economies. There was widespread recognition that the path to net-zero will have to travel via the Global South, and therefore, it is in everyone's interest to collaborate and cooperate for the shared goals to achieve net-zero.

The climate and energy narrative

- There is broad recognition among diverse stakeholders of the urgency of the climate challenge and the need to reduce emissions. However, the prevailing linear energy transition narrative has critical deficiencies, at least from the viewpoint of some participants. These include the needs of the Global South, public concerns over energy affordability and security and the sheer scale and complexity of the global energy system. Recognizing the multidimensional nature of the transition could create a more effective and inclusive outcome.
- Reaching a global consensus on the energy transition appears more challenging owing to major differences on a number of issues. There are divergent viewpoints among stakeholders on aims, priorities and speed of net-zero pathways. This is most apparent in the very different perspectives of the Global North (principally the wealthy OECD countries) and the Global South (developing countries in Africa, Asia and Latin America).
- Some believe that the voice of the Global South has not been given due consideration in global climate dialogues. Developing countries believe that they are not responsible for the bulk of historical emissions and feel they should be able to develop their own natural resources, including hydrocarbons where appropriate, to support their economic growth. It was noted that in many countries in the Global South, energy transition means moving away from wood and waste to liquefied petroleum gas (with better functionality, convenience and avoiding in-door air pollution) and thus “transitioning from not having energy to having energy.” The concept of a wholesale global transition from traditional biomass to renewable energy, without taking local conditions into consideration, was considered impractical by representatives from developing countries.
- Support was expressed for an adaptable approach to energy transition, as each country will have its own opportunities and challenges, and its own way forward. Many believe that there is not a single global one-size-fits-all net-zero pathway. Seeking the application of a single pathway is creating challenges for industries and finance. Developing and evaluating the most effective emission pathway for a specific country, sector or company requires novel and flexible approaches.

According to the Asian Development Outlook 2023 Thematic Report, “A billion people in the [Asia] region were still living on less than purchasing power parity of \$3.20 a day in 2017 and 940 million lack reliable power supply. Meeting development goals while avoiding catastrophic climate risks cannot be achieved without transforming Asia’s growth patterns.”

A “just transition”

- The concept of a “just transition” has different meanings in different parts of the world. In the US, it refers to the environmental and employment needs of poor and minority communities in areas of energy production and ensuring that workers in fossil fuel industries and communities dependent on these industries have opportunities for alternative livelihoods. This is exacerbated by a view that energy assets in the US are disproportionately located in poor communities. In Europe, a just transition also means recognizing and addressing differences among regions in terms of energy production and consumption. For the developing world, a just transition seeks to ensure that economic development and poverty alleviation are given due consideration in energy policy and investment decisions. A better understanding of the varying concepts of “justice” in energy therefore requires a broad global perspective that encompasses energy industry workers levelling up in advanced societies and industrialization and access to energy in the Global South. From this perspective, some participants in GESI dialogues starkly asserted that policymakers and investors should be more concerned about “stranded lives” than “stranded assets.”
- A just transition requires “just finance.” Some dialogue participants argued that finance provided by multilateral development banks and other institutions should not be predicated on prescriptive decarbonization actions, such as refusing to finance natural gas pipelines or shutting down coal-fired power plants when there are no affordable and socially viable alternatives. Just finance should include broader considerations of national economic development and poverty alleviation.

Financing low-carbon energy

- In developed markets, investors are seeking clean energy investments, but there is a shortage of commercially attractive projects as measured against the amount of money available. The incentive-based approach and the large capital available through the US IRA has been welcomed by US domestic and some international companies, and this is reflected in the strong uptake of applications. As of this writing, according to the Commodity Insights assessment, more than \$400 billion of new capital investments based on the IRA have been announced.⁵ Moreover, according to some estimates, total government funding for the IRA could be three times the stated \$370 billion. Nevertheless, multiple implementation challenges remain, including issuing the detailed supporting tax guidance, streamlining permitting processes to enable projects to progress and availability of trained workers.⁶ Further, the international reaction to the IRA has been mixed, with some countries and companies asserting that it disadvantages their own domestic industries, draws investment away and risks increasing global trade frictions.
- One of the biggest challenges to the financing of clean energy projects is the risk premiums and high cost of capital, particularly in the Global South. In these projects, investor risks are primarily policy-driven. Companies have limited experience, tools and methodologies to assess and manage risk in a business environment heavily influenced by policy uncertainties rather

5. See the Commodity Insights [Investor Sentiment: Oil fundamentals punch through negative energy sector outlook of 1H2023](#).

6. Comments reflect the situation at the time of the dialogues; progress has been made recently on these issues by the Biden administration.

The International Energy Agency’s *Africa Energy Outlook 2022* states, “More than 5,000 billion cubic metres (bcm) of natural gas resources have been discovered to date in Africa which have not yet been approved for development. These resources could provide an additional 90 bcm of gas a year by 2030, which may well be vital for the fertilizer, steel and cement industries and water desalination... Africa’s industrialization relies in part on expanding natural gas use.”

The IEA *Critical Minerals Review 2023* notes that “Critical minerals, essential for a range of clean energy technologies, have risen up the policy and business agenda in recent years.... but a combination of volatile price movements, supply chain bottlenecks and geopolitical concerns has created a potent mix of risks for secure and rapid energy transitions.”

than conventional market forces. Unless new approaches are developed, investors will continue to apply high hurdle rates, constraining energy investments in the Global South.

- Finance is required to flow into all elements of the zero- and low-carbon energy value chains. This includes critical mineral supply chains, which are currently, for a number of minerals and metals, highly concentrated and vulnerable to shortages and disruptions.
- Policymakers and investors will have to find ways to resolve the “mining paradox” whereby mining of minerals critical for electrification of the energy system is described as a “dirty” activity. As a result, mining is off limits for sustainable finance and incurs local opposition and delayed permitting. The time required to open a new tier 1 mine is typically 16 to 20 or more years. Demand will grow substantially in the coming decades for minerals such as copper, lithium, cobalt and nickel. S&P Global research shows that energy transition demand for copper will double over the next 12 years, while demand for the other three critical minerals is expected to grow 23 times over the same period in the US.⁷ As a result, future shortage of metals and/or price spikes will become almost inevitable unless financing and permitting obstacles are urgently tackled.
- To facilitate the development of carbon hubs and a carbon management industry, the business model needs to evolve. Carbon would need to come to be viewed as a product with value rather than a problem to be solved. This will encourage more robust and standardized carbon pricing mechanisms, facilitate new commercial models and support the development of innovative new businesses.

The role of oil and gas

- There was considerable discussion about the future role of oil and gas. Since the primary aim of the energy transition is to reduce global warming, some participants in the GESI dialogues argued that the focus should be on emissions, not fuel sources, and climate policies should be technology/fuel agnostic. Governments should set a level playing field and let the market decide. Expressed differently, it was argued that an objective should be to decarbonize fossil fuel use rather than “stopping fossil fuels.” Nevertheless, other participants highlighted that the technologies to do this are not (yet) available at the required scale. There was much discussion as to whether and when global fossil fuel demand will peak — and then begin to decline — and of the rate of decline.
- Continued investment in new oil and gas will be required to avoid significant supply-demand imbalances, given the natural decline rates of existing production. Some participants highlighted that, without new investment, existing oil and gas output could decline by more than 75% by 2050. Ensuring adequate oil and gas investments while recognizing that demand will decline over the longer term will require innovative investment approaches.
- There is growing recognition that the oil and gas industry needs to be part of the climate dialogue and a key driver of climate solutions, given that it provides 55% of the world’s energy today and has the balance sheets, engineering capabilities and ability to execute at scale. The industry’s expertise is particularly important in technologies such as CCS, offshore wind and low-carbon hydrogen.

7. See the S&P Global [Inflation Reduction Act: Impact on North America Metals and Minerals Market](#).

The UN Conference on Trade and Development *World Investment Report 2023* highlights that developing countries need renewable energy investments of about \$1.7 trillion each year but attracted only \$544 billion in clean energy foreign direct investment in 2022. The report also notes that investment needs in power grids, storage and energy efficiency vastly exceed requirements in renewable energy generation.

Policy tools and frameworks

- The “energy trilemma” of energy security, affordability and sustainability is certainly on the agenda, in part driven by new geopolitical rivalries and conflicts. Energy strategies and policies are being realigned with the new geopolitical risks; policymakers will need new frameworks, models and tools for this new geopolitical environment.
- Current frameworks and models tend to be narrowly focused on specific elements of the energy trilemma and specific impacts (climate, societal or economic). More holistic models, which consider the full range of socioeconomic impacts of energy and climate policies, would help policymakers understand the broader implications. Multidimensional frameworks and models are needed to fully understand a multidimensional transition.
- At present, there is a lack of a global road map that recognizes and explicitly models the priorities, challenges and constraints that were highlighted in the GESI dialogues: a net-zero road map that is tested against realities and that captures the differing pathways for developing countries. Such a road map would help policymakers and investors better align policies, strategies and plans with net-zero goals of the Global South.

Collaboration and engagement

- Conversations around energy transition are taking place in silos, and constructive, solution-oriented dialogue among different stakeholders needs to be augmented. There is a genuine need for more listening, education and understanding. Governments, industry and investors need to do more to engage with the general public. And governments could be more transparent with the public about the choices, costs and tradeoffs of this energy transition.
- Meeting the global climate challenge will require a big step up in collaboration within and between governments and among government, industry and finance. While some areas would benefit from greater global standardization, the more urgent request was deemed to be for policy coherence and stability within countries.

The emissions reduction challenge

The Paris Agreement in 2015 created a new framework for emissions reductions and focus on climate change, with an ambition to limit global warming to well below 2 degrees C, and ideally 1.5 degrees C, compared with preindustrial times.⁸ This has led to actions and commitments around the world by a wide spectrum of countries and companies, including ambitious declarations to achieve net-zero emissions.

8. According to Climate.gov, Earth’s temperature has risen by about 1.1 degree C since the preindustrial era. <https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature>.

All countries ranked in the top 10 of the WEF’s *Energy Transition Index 2023* are from Western and Northern Europe, and account for 2% of energy-related CO₂ emissions, 4% of total energy supply and 2% of global population. There was only one country from Africa in the top 50.

But here is the dilemma: While there is a growing sense of urgency from the general body of climate science, the realities of the global energy system and the diverse status of global economies create challenges to meeting these goals. According to S&P Global Commodity Insights, the current Nationally Determined Contributions (NDCs) would reduce global emissions by only 10% in 2030 relative to 2019 levels. This compares with the 43% reduction that the Intergovernmental Panel on Climate Change (IPCC) sets as the benchmark required to align with a 1.5 degrees C pathway.⁹

Nevertheless, net-zero declarations continue to grow: 158 countries have stated net-zero targets, with 28 countries embedding the targets into national law. Policy developments with the launch of RePower EU and Green Deal Industrial Plan in Europe, and the troika of the IRA, the IJIA and CHIPS in the US will turbo charge investments in a wide spectrum of clean energy technologies and mark the launch of a new era of industrial policy, aimed at substantially reducing emissions within this decade.

Despite the rise in climate ambition and supporting policies, in the last 30 years the share of hydrocarbons in the global primary energy mix has hardly changed, from 81% to 80%. Global GHG emissions are estimated to have increased by 0.9% in 2022, hitting a new record of 52 gigatonnes. Energy demand has continued to grow in most emerging and developing economies as hundreds of millions more people with increased access to reliable and affordable energy have achieved improved living standards.

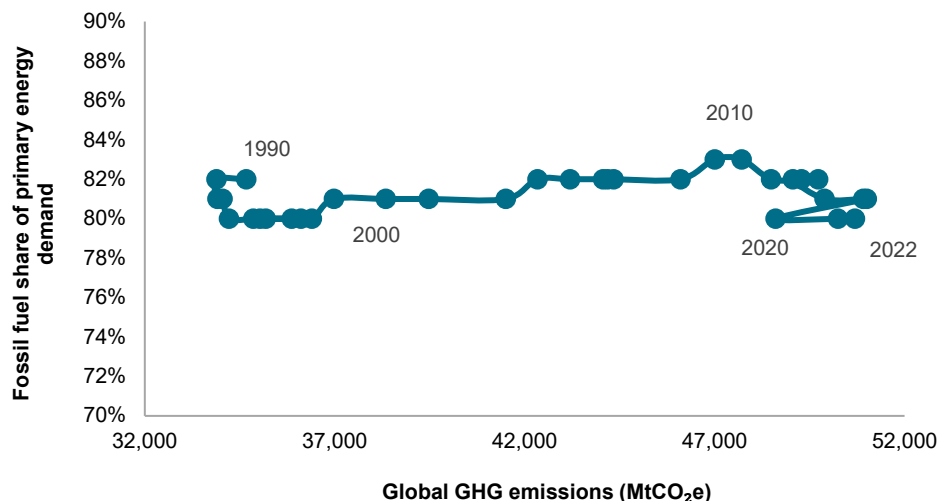
So, the challenge is how to bend the emissions curve while ensuring economic growth. The climate policies of the Global North will be insufficient to achieve the global goal of net-zero unless there are reductions in emissions from fast-growing developing economies.

The widening gap between current emissions trajectories and the pathway required to achieve net-zero by 2050 is illustrated by emissions scenarios developed independently by the IEA and by Commodity Insights.¹⁰

Current trajectory/baseline scenarios project that emissions will fall by less than 25% by 2050; achieving the 1.5 degrees C goal will likely require a reduction of 90% or more.

In large measure, closing the gap between climate ambition and actual emissions trajectories will be dependent on scaling low-carbon technologies and on continuing advances in technologies. According to Commodity Insights, investment in renewable power and energy

Global greenhouse gas emissions vs. fossil share of primary energy demand, 1990–2022



Data compiled June 15, 2023.
 MtCO₂e = metric tons of carbon dioxide equivalent.
 Source: S&P Global Commodity Insights.
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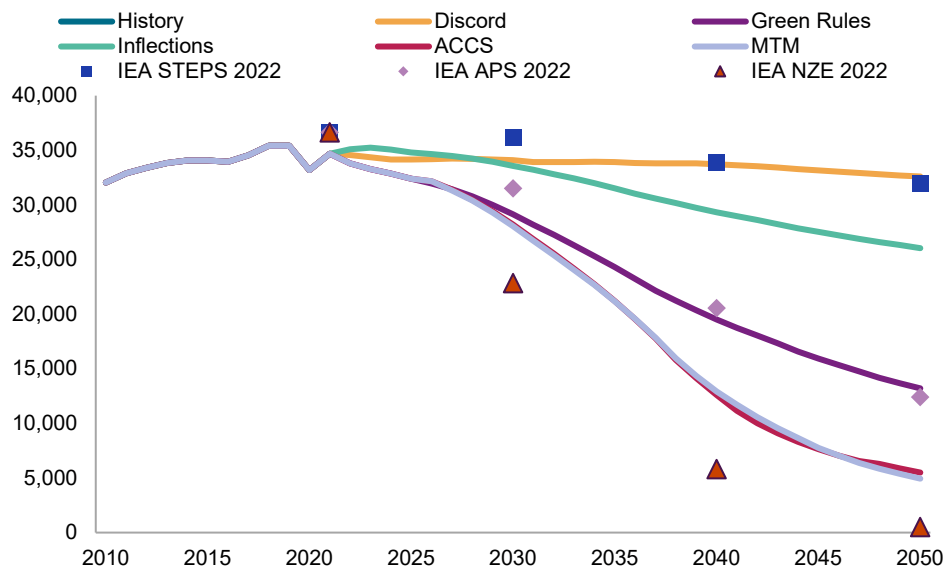
9. *Climate Change 2022: Mitigation of Climate Change*, Working Group III contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

10. IEA NZE 2022 and S&P MTM and ACCS scenarios are back cast from a 1.5 degrees C objective, i.e., what would be required to achieve this goal? Other scenarios are forward projections based on current or anticipated changes to policies and markets.

storage amounted to around \$477 billion in 2022 and will average \$700 billion per year through to 2030 — with the majority of investments currently centered in a handful of countries and regions (China, European Union, and North America).¹¹ Nevertheless, there could be a \$25 trillion cumulative funding gap between forecast spending and the investment needed to achieve net-zero by 2050.¹²

A further manifestation of the current gap is in funding pledged for mitigation and adaptation for developing countries. At COP27 in November 2022, the Parties acknowledged the lack of progress on the collective climate finance pledge of \$100 billion (made originally at COP15 in 2009) and urged developed countries to meet the goal. Furthermore, developing countries continue to express frustration at the lack of capital available for conventional energy development that they state is needed to promote economic growth and reduce energy poverty. Reflecting the fact that energy security was a top priority for nations ahead of COP27, the Implementation Plan emphasized the need to move toward “low-emission” energy in addition to renewable energy.

Energy-related CO₂ emissions, 2010–50 (MtCO₂e)



Data compiled July 1, 2022.
Source: S&P Global Commodity Insights.
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Focus areas for consideration

The main purpose of the GESI dialogues was to explore the issues and challenges around transitioning the global energy system to a lower carbon future while maintaining stability, security and affordability of energy supplies. During this exploration process many ideas were expressed around potential focus areas for solutions. In this section we summarize the key ideas expressed by participants grouped in five broad areas:

- Unlocking finance
- Meeting the needs of the Global South
- Tackling infrastructure and supply chain bottlenecks
- New frameworks and tools
- Collaboration, partnerships and engagement

The authors have not assessed the costs and feasibility of the ideas aired in the discussions and summarized here, so they are **offered as questions and subjects for consideration** rather than recommendations from the initiative.

11. See the Commodity Insights [How will global investments in clean energy evolve to 2030?](#)

12. See the Commodity Insights [Energy Transition: Gaps in the Pathways](#).

Unlocking finance

ESG and green finance criteria

– Do “sustainable” finance criteria need to be more holistic and pragmatic?

Industry and finance could jointly create achievable, holistic criteria that consider a broad range of UN Sustainable Development Goals (SDGs) and not just emissions, and that recognize the need for “sustainable”, “viable” and “orderly” energy transitions. This means giving consideration to energy access and affordability as well as climate. For example, putting greater emphasis on emission outcomes rather than fuels would support a more balanced approach considering all aspects of the energy trilemma and might better facilitate funding for critical technologies such as carbon capture, utilization and storage (CCUS) and direct air capture (DAC). Would using the term “energy transformation” (making energy sources clean) rather than “energy transition” be a helpful step, emphasizing a focus on emissions and a goal to decarbonize emissions from fossil fuel use rather than to “stop investment in all fossil fuels”?

– Would harmonization and greater inclusivity of ESG/green finance assessment methodologies improve their usefulness?

The myriad different taxonomies and criteria appear to be constraining investment. Greater harmonization would be beneficial. However, it is also important to acknowledge the differences among business sectors in their ability to decarbonize, and therefore the need to accept diverse pathways and timelines towards sustainability.

– Would more granular and flexible benchmarking criteria improve assessment of companies’ decarbonization performance?

This includes considering the specific locations in which companies operate and the nature of their operations. Industry and investors could jointly establish realistic emission pathways tailored to each sector and region, ensuring that different approaches and strategies can be recognized and valued appropriately. Taking these factors into account means, for example, that different benchmarks would be applied to a company predominantly operating in sub-Saharan Africa compared to a company operating in Europe.

– What should be the role of natural gas in sustainable emissions pathways?

This is most pertinent where gas is displacing coal, or where the development of local gas resources will significantly boost economic development and poverty reduction, or where gas is needed for power generation to balance the variability of renewable power. Gas is also an important fuel for industrial applications, heating and cooking. There was broad consensus that gas has a significant role to play for the foreseeable future if methane emissions associated with gas value chain are brought down as agreed under the Global Methane Pledge. There will be increasing need for elimination of flaring, venting and fugitive emissions — and (longer term) CCUS.

– Could changes to funding rules within multilateral development banks (MDBs) accelerate decarbonization?

MDBs could take a holistic approach to funding oil and gas projects instead of a blanket moratorium. There are oil and gas investments that would be critical for meeting SDGs or help reduce emissions by transitioning from coal to gas or by eliminating use of diesel for power generation. Such projects could provide significant near-term benefits at relatively low cost.

“We should be more concerned about stranded lives than stranded assets”

GESI participant

“ESG assessment methodologies need to better recognize the complexity of the global energy system, and the regional differences in decarbonization pathways”

GESI participant

The 2023 *Global Gas Flaring Tracker* report from the IBRD/World Bank highlights that “Global gas flaring decreased by 3% to 139 bcm in 2022 from 144 bcm in 2021, the lowest level since 2010. If put to productive purposes, the amount of gas flared in 2022, could generate as much electricity as sub-Saharan Africa currently produces in a year”.

Finance and cost of capital

- What new approaches are needed to assess and manage credit risk and reduce cost of capital for renewable energy projects, especially in the Global South? One of the challenges hindering the flow of finance into zero- and low-carbon projects is the limited understanding of risks and the commercial dynamics of these projects among banks and other financial institutions, compared to conventional fossil fuel projects. This can be addressed by increased awareness and knowledge-building to ensure that financial institutions can accurately assess and manage risk.
- Could regional funding pools facilitate energy development in the Global South? For example, a new energy fund for Africa. Such regional sources of finance can better assess credit risks for sustainable investments and potentially reduce the associated cost of capital. Pooling regional resources and expertise would also provide a centralized mechanism to facilitate and support private investments in renewable energy projects.
- Are new risk assessment methodologies needed for clean energy projects? A significant amount of funding is available for low-carbon projects, but there is a shortage of bankable projects that meet current risk criteria. This is in part because renewable energy projects typically can carry significant policy risks, which companies struggle to price and manage compared to conventional market risks. To increase the portfolio of projects, investors will need to be willing to make decisions based on a different and potentially greater set of uncertainties.
- How to address the problem of lack of assured offtake agreements constraining investment? This is especially relevant for projects involving low carbon hydrogen for which many new projects are being announced. Will market demand materialize at sufficient speed to support a multitude of projects, and what are the methods to stimulate sustainable market demand?
- Seed money from MDBs could unlock many multiples in private finance — but more effective collaboration will be required to achieve this. MDBs can also assist developing countries in building stronger institutional frameworks and reducing risks associated with renewable investments.
- The challenge of timing and supply chains. Participants observed that some renewables projects are being delayed owing to rising supply chain costs and are behind held in abeyance on the expectation that supply chain costs will fall. Developers will have to assess the degree of cost risk they are willing to assume if solar and wind deployment is to continue at the required pace. Onshoring and “friend” shoring of clean energy supply chains may also cause delays in project execution and increase costs.
- Transparent and competitive bidding processes could reduce the (perceived and actual) country risk of projects in the Global South. Such a level-playing field where different investors and technologies have an equal opportunity to participate will facilitate financing from MDBs and private capital.

“85% of global renewable energy investment benefitted less than 50% of the world’s population and Africa accounted for only 1% of additional capacity in 2022”, *IRENA World Energy Transitions Outlook 2023*

Financing new technologies

- **Can the IRA be adopted as a template for supporting clean energy technologies in wealthier nations?** Financing “first-of-a-kind” or other commercially risky projects presents significant challenges, emphasizing the need for strategic investments and funding sources that understand

the unique nature of these initiatives. Currently, the “carrot” approach of the IRA appears to be more effective at driving investment into clean energy projects than regulatory “sticks”. Mechanisms such as the IRA could enable new technologies to be de-risked in the richer Global North (through piloting and scale up) before deployment in the Global South.

- **New business models may be needed to drive deployment of emerging technologies.** Even where technologies are on the path to scale, business models to commercialize them at scale may not yet be fully road-tested and available. A prime example is the creation of CCUS value chains.
- **Should there be more focus on, and funding for, carbon removal technologies?** There is growing realization, as highlighted by the IPCC, that carbon removal and utilization/storage technologies must be part of the technology mix for net-zero, as emissions mitigation efforts alone will fall short. For such technologies to be viable at scale, current CO2 capture costs will have to fall, carbon prices will have to rise, and/or significant subsidies provided — and technology development to proceed.
- **Maintaining a balanced and realistic perspective on technology is necessary.** Being overly optimistic about future technology deployment and waiting for an ideal solution can delay meaningful short and nearer-term investments — “the perfect is the enemy of the good”. Immediate progress will require prioritizing quick wins, balancing innovation and practicality, and action sooner rather than later. This includes focusing on enhancing energy efficiency and lowering the carbon intensity of existing operations.
- **How to ensure investment that is needed urgently across the entire low carbon energy value chain?** The financing challenge is not limited to end-use deployment. Adequate investment in research and development, infrastructure, and supply chains is crucial to drive innovation and facilitate the transition. Capacity ramp-up, and funding, is required in all supply chains.

“Government policy support is key to de-risking of new low carbon technologies provided it is appropriately targeted and formulated”

GESI participant

“Energy transitions are fundamentally technology transitions”

GESI participant

Meeting the needs of the Global South

Affordability and energy security

- **Affordability and energy security are critical in the Global South.** People and politicians in the Global South are very price sensitive as energy accounts for a significant proportion of the cost of living, balance of payments and has great political and social sensitivity. Participants highlighted that affordability and availability take precedence over sustainability, especially in today’s inflationary environment. This means that reliable and affordable resources such as domestic coal is preferred over cleaner but more expensive and imported LNG. Countries in the Global South define “energy security” more broadly as providing stable, reasonably-priced energy supplies.

Decarbonization pathways

- **Multiple transition pathways for the Global South.** A “horses-for-courses” approach recognizes that each country will have its own opportunities and challenges, and its own way forward. Regional energy pathways for poorer countries could focus on basic needs in terms of energy access and affordability — and once these are assured, consider more challenging climate goals. To meet these needs, many countries in the Global South want to be enabled, and supported, to build their economic and industrial capacity through conventional fossil fuels, especially gas, both to meet economic growth needs and reduce burning of wood and waste. “Technology leapfrog” from traditional biomass to renewables may be appropriate in some circumstances but appears to be a difficult transition pathway for many low-income economies.
- **To what degree will the Global South be able to set its own pathways?** Can the countries of the Global South develop regional solutions to harness and develop their own energy resources in a sustainable manner? For example, by aligning energy development with social and environmental goals, a regional program could support Africa’s energy transition while addressing the unique challenges and needs of the continent.
- **Should financial support to energy projects in the Global South be conditional on the type of fuel or technology?** Should “just finance” eschew prescriptive and burdensome conditions around use of fossil fuels? And should alternative approaches such as the Just Energy Transition Partnership (JETP) be explored? Some participants considered JETP problematic due to its narrow focus on eliminating (low cost) coal, including where reliable and affordable replacements may not be readily available. Making renewable energy more competitive in the Global South, e.g., through reducing cost of finance, was suggested as a more effective solution.
- **Should more funding be directed towards climate adaptation efforts in the Global South?** These regions are often vulnerable to the impacts of climate change and require financial support to adapt and build resilience in infrastructure, communities and ecosystems.
- **Policymakers and project developers could gain public support by tackling local air pollution alongside carbon emissions reduction.** Linking carbon emissions solutions to other imperatives like pollution will offer immediate and tangible benefits and secure wider local support. It is important to ensure that social, local environmental, and climate agendas are in sync.
- **The aggregation of local small-scale renewable energy generation, storage, and demand response initiatives could provide a route to financing.** By combining and scaling up individual microprojects, more substantial and financially viable projects can be established.

“Africa is endowed with rich natural energy resources, including renewables. But it needs to carbonize before it can decarbonize”

GESI participant

Capacity building in emerging economies

- **Reducing risks and facilitating investments in cleantech projects requires capacity-building in multiple areas, including logistics, legal, policy and regulatory capacity.** Support could also include collaboration in soft financing mechanisms in low carbon such as technology transfer and research and development, in addition to direct financing.

– **How can the necessary new skill sets be developed in local populations?**

Efforts need to be stepped up significantly in training local staff — to develop, finance, implement, operate and maintain new low carbon energy systems. This will require cross-sectoral collaboration between governments and industry.

Tackling infrastructure and supply chain bottlenecks

Energy infrastructure

– **Governments need to streamline regulatory and permitting processes.**

The protracted and uncertain permitting processes in many countries for key energy infrastructure such as siting, pipelines and transmission lines are causing significant delays and leading to project cancellations. Permitting and local challenges need to be appropriately and equitably resolved in a timely way if energy sustainability, affordability and security goals are to be met.

– **New commercial models are needed to tackle the “gridlock” of connecting renewable power.** Waiting times for grid connection for wind and solar farms have reached 10 years or more in some countries, which is severely impacting the rate of grid decarbonization. This is partly due to permitting delays but also due to the very different geographical footprint of renewable power compared to conventional fossil fuels.

– **Deployment of distributed generation and improvements in local grid efficiencies is essential to support the growth of renewable energy systems.** While the needs for expanding transmission grids receive significant attention, it is important not to overlook the development of local distribution networks and distributed generation. Neglecting this aspect can lead to downstream bottlenecks and hinder the effective integration of renewable energy sources.

“Current permitting processes in the US score 5 out of 10 at best”

GESI participant

Critical minerals

– **How will a projected global supply shortage of critical minerals and the current supply chain risks impact the energy transition?** Governments are starting to give this urgent attention but delays in addressing the issue, especially around permitting may result in future price spikes, shortages and cost increases for key metals — and thus act as a brake on the energy transition.

– **Resolving the ‘mining paradox’ will be important for an orderly and timely energy transition.** Mining and metals investments are seen by some only through a “sustainability lens” and not as a key part of the decarbonization solution. They are therefore shunned by ESG-oriented investors and other investors under ESG pressures. However, it was proposed that ESG investors should take a more holistic view on the “net carbon benefits” from mining and processing the minerals critical to the energy transition. Mining companies will need, in turn, to convey their actions and progress more clearly on sustainable operating practices.

“A circular economy approach is needed for critical minerals: move towards 100% recovery of mineral ores, minimize waste generation, recycling”

GESI participant

- **Industrial consumers, particularly in the OECD, will need to accelerate efforts to develop long-term sourcing strategies and plans for critical minerals.** Reducing supply chain risks will require diversification of globally concentrated supply sources.

New frameworks and tools

The need for new policy frameworks and tools

- **Policymakers would benefit from new frameworks to progress the energy transition within the new geopolitical environment.** For example, will the “electrify everything” approach need to be reassessed when supply chains appear vulnerable to geopolitics and capacity bottlenecks? Should there be more focus on technologies with less geographically concentrated, and therefore less geopolitically vulnerable, supply chains such as hydrogen and CCUS?
- **Stakeholders need a more complete macroeconomic and socioeconomic understanding of the multidimensional energy transition and its implications.** Issues should not be addressed in silos but rather considered in an integrated manner, recognizing the interdependencies and synergies among different aspects of the energy transition. It will therefore be important for policymakers to adopt more holistic models that capture systemic interactions and systemwide impacts. There needs to be deeper macroeconomic understanding of the energy transition to avoid adverse supply shocks and economic disruptions that undermine public support.
- **Mechanisms are needed to support appropriate levels of investment in oil and gas supply to avoid future shocks and disruption while also providing for carbon abatement.** There is much debate about future oil and gas demand. While a smaller part of the overall mix in the future, oil and gas is expected to continue to play a significant role in meeting energy needs. About half the automobile fleet in 2050 will likely be oil-powered because of the time it takes to turn over the auto fleet, and natural gas will be required in an electrified world to stabilize systems relying on renewables — at least until long duration storage becomes commercially viable and implemented at scale. In addition, the annual 4%-5% natural decline in existing oil and gas resources requires ongoing investment. The fear of “stranded assets” is one factor causing historically low investment in new oil and gas supply.

Scenarios and road maps

- **Better understanding and utilization of scenarios** will enable policymakers to effectively address the challenges and complexities of the energy transition. This entails recognizing the drivers, identifying gaps, and exploring potential solutions within different scenarios. The potential impact of scenarios on economic growth needs to be carefully analyzed.
- **There is a need for energy transition scenarios/road maps that reflect the Paris ambition while capturing the complexities and constraints to achieving it.** These include issues of energy access and affordability (especially in the Global South), availability and rate of deployment of

finance, supply chain capacities, geopolitical drivers and constraints, competitiveness and deployment rate of new technologies, permitting delays, indigenous peoples' concerns and local challenges. Additionally, accepting that considerable use of CCUS, negative emission technologies (NETs) and nature-based solutions (NBS) will be needed longer term to achieve the goals of the Paris Agreement. Such pragmatic transition scenarios can help support a robust policy framework for an orderly and balanced transition — one that can also deliver energy security and affordability while occurring at a much faster pace than past transitions.

- **In particular, realistic forecasts for the supply and demand of critical minerals should be incorporated into transition scenario models.** This entails considering various factors such as mining production capacities, timelines to bring new mines and processing capacity onstream, geopolitical dynamics, and technological advancements that may affect demand and availability. Adequate minerals supply is often treated as a given in scenario models.

Investment decision approaches and criteria

- **New investment decision frameworks may be needed** whereby organizations accept emission reduction goals as a given and seek the most economic ways to achieve them. Conventional project investment metrics such as internal rate of return hurdle rates may be of less relevance when there is an overarching non-financial objective.
- **Companies may need new approaches to assess and manage policy risk** in a business environment heavily influenced by policy rather than market forces. Businesses must adapt to the dynamic policy landscape and develop strategies to navigate potential regulatory changes and uncertainties.
- **Is there a need for a broader decision metric than levelized cost of electricity (LCOE)?** When assessing power project economics, policymakers may need to look beyond LCOE and conduct a comprehensive analysis of the entire value chain. By evaluating the lifecycle costs and benefits, including social and environmental aspects, investors can gain a more complete understanding of the overall economic implications. Projects may be evaluated both against alternatives and against the cost of inaction.
- **Better models could enable investment evaluation across all SDGs.** To achieve a comprehensive understanding of the implications of an accelerated energy transition, it would be constructive to generate holistic and integrated frameworks and models that encompass multiple SDGs. This includes such goals as universal energy access, poverty reduction, and improved health. Capturing economywide impacts requires integrating economic, energy, industrial, mobility and social aspects. Incorporating a wide range of factors enables more informed decisions about the allocation of resources.

“Energy transition roadmaps must have an element of wealth creation into local economies, not just focus on reducing emissions.”

GESI participant

Collaboration, partnerships and engagement

Public-private sector collaboration

- **What should be the role of governments in identifying the most effective approaches to achieve emissions goals?** The US government is adopting a hands-on approach with the IRA, which is supporting a range of technologies. Will such an approach help to accelerate collaboration between industry and finance across a wide range of key technologies — renewables, carbon removal, storage, hydrogen — in the effort to accelerate technology scale-up and deployment?

Cross-sector collaboration

- **Financial investors need to work with industry to jointly develop new evaluation models for decarbonization projects** to demonstrate their long-term value proposition and risk manageability. To overcome information asymmetry, industry can help investors understand the technology parameters and risk criteria for new technology projects such as CCUS and hydrogen which have little or no historical data (banks better understand the parameters and risks of oil and gas projects through extensive historical data).
- **More collaboration forums and mechanisms are needed between energy suppliers and energy buyers.** Energy suppliers and buyers have complex interactions as they impact each other's Scope 2 and 3 emissions. One example of such a collaboration is the Asia Clean Energy Coalition, launched by a group of manufacturers with the aim of driving better alignment among energy buyers, project developers, financiers and policymakers.

Government-to-government (G2G) collaboration

- **G2G collaboration efforts such as the Clean Energy Ministerial** could provide a growing platform for knowledge sharing around what works in practice. An example is the UK partnering with other governments to share policy frameworks, business models, and model contracts for CCUS and hydrogen, based on the development of the UK's hub-based model.
- **Other governments will be looking carefully at the learnings from the design and implementation of the US IRA.** One clear question is the impact of an incentive-based policy approach versus a regulatory compliance approach. Also, the learnings from the practical application of the IRA will be studied closely, since on-the-ground project delivery is the ultimate yardstick of success.
- **More G2G collaboration is needed around carbon markets and carbon accounting.** Efforts should be directed to creating more robust carbon markets, which would have a meaningful impact on emissions. Regulators will need to facilitate the standardization and development of methodologies for carbon accounting including standard assessment of carbon intensity of products. This will become a critical issue with the wider roll out of the EU Carbon Border Adjustment Mechanism (CBAM), which is likely to stir much discussion and debate with the Global South.

“To encourage investment, carbon needs to be viewed as a valuable tradable product rather than waste”

GESI participant

- **Cross-regional interconnection of power grids will move to the front as issues, but their implementation is complex.** This will become increasingly important as renewable power takes a larger share of the energy mix. However, development of such grids will encounter many challenges, including regulatory and legal, coordination and sovereignty, and investment.
- **To support the COP process, should forums of the major global emitters collaborate to jointly tackle the issues?** Besides COP, other forums including the G-20 and the Major Economies Forum on Energy and Climate (MEF) are likely to be necessary to reach meaningful consensus around some objectives, road maps and actions.

Engaging the public

- **More regular and timely engagement with publics** will help reduce the information asymmetry around the challenges of energy transition. Publics require more clarity and information from their governments about costs, prices, timelines and impacts. This will mean more transparency from governments about costs and dislocations from energy transitions, and more discussion around what is, and is not, doable. Energy transition should not be seen as a threat to jobs in economies heavily dependent on fossil fuels. Bringing NGOs and publics into the conversation about the actual mechanics of the energy transition would be constructive.

Despite the numerous challenges, many dialogue participants expressed a sense of optimism. Renewable energy is now competitive in many locations, deployment of clean technologies is rising rapidly, action on methane emissions is progressing at pace, and there is a sense of growing pragmatism among policymakers. The broadening of the energy transition dialogue — bringing out different perspectives and the diverse pressures shaping them — was seen as a positive step.

“The battle for hearts and minds will be waged and won with the public”

GESI participant

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