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Technology Choices: Event Summary from the Second Convening of the High-Level Panel on Universal Energy Abundance

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Top discussion points

- Universal energy abundance (UEA) will depend on diverse energy portfolios tailored to each country's resources, demand, institutions, and priorities, with electricity addressing a large share of anticipated demand growth directly, although fuels and molecules for feedstocks will remain essential in some sectors.
- Grids, distribution networks, equipment, and skilled workforces are essential to developing energy supply and can become binding constraints if not adequately planned, while transmission and interconnection can unlock otherwise stranded energy supply resources.
- Supply and demand shape each other—reliable supply can unlock previously suppressed demand, while demand planning can inform supply investments.
- Concentrated clean energy supply chains have made technologies more affordable but have also created vulnerabilities; given the long lead times and investment required for diversification, countries wishing to pursue it must begin well in advance of specific needs
- Decision-makers need practical tools to compare technology options for their own markets, along with the institutional capacity to plan, regulate, and deliver them.

This event summary reflects the authors' understanding of key points made in the course of discussions among members at the second meeting of the High-Level Panel on Universal Energy Abundance. This summary does not necessarily represent the views of any individual participant, the Rockefeller Foundation, the Center on Global Energy Policy, or Columbia University. The summary may be subject to further revision.

Introduction

The High-Level Panel on Universal Energy Abundance (UEA) held its second convening in New Delhi, India, on October 29–30, 2026. While the first convening, held in Bellagio, Italy, in May 2026, focused on defining the concept of UEA, the New Delhi meeting explored the technologies capable of delivering it. Panel members noted that developments since May 2026, including the continued disruption in global energy markets, have sharpened attention to energy security. As at Bellagio, the Panel proceeded from the premise that technology choices are sovereign decisions, so the aim was to illuminate the trade-offs involved and consider effective practices for selecting technology, rather than prescribe a particular resource mix.

The meeting focused on four critical areas: energy demand, energy supply, infrastructure, and delivery capacity. Panel members also discussed in depth the constraints that could impede progress toward UEA and ways to address them. The main elements of the Panel's New Delhi discussion are summarized below.

UEA requires a portfolio of technologies that addresses all energy demand

Participants reaffirmed that UEA requires addressing all the energy that a given society needs, rather than focusing on electricity alone. Electricity accounted for 23 percent of total final energy consumption globally in 2025,[1] with demand for manufacturing, heat, and transportation accounting for much of the rest. Some participants cautioned that addressing the whole system risks spreading the Panel too thin. Others argued that electricity deserves special attention because it can be decarbonized more readily than other forms of energy, and because it is expected to account for most energy demand growth, partly because of its greater efficiency. One participant highlighted India's pathway as a case in point: electricity's share of the country's final energy consumption is projected to increase from 21 percent in 2025 to 40 percent in the International Energy Agency's Current Policies Scenario and 60 percent in the Net Zero Scenario by 2070.[2] As participants observed, some sectors remain "sticky": Long-haul aviation and high-heat industrial processes are unlikely to electrify soon given supply chain limitations and costs. Decarbonizing these sectors may depend on green molecules and/or carbon capture, which carry a price premium and usually require multinational cooperation.

Participants favored measuring total energy (e.g., in gigajoules per capita), rather than electricity alone. Given existing data gaps, identifying the metrics needed to measure useful energy, which excludes energy that is ultimately wasted as unused heat, was viewed as the right long-term goal.

Demand is growing fast, and demand and supply shape each other

Participants identified various drivers of demand in low- and middle-income countries, including cooling, urbanization, mining, mineral processing, other industrial activity, electric two- and three-wheelers (and, in some countries, electric cars and trucks), data centers, and the shift to cleaner cooking fuels. Several participants highlighted the growing energy-intensity of mining, particularly in regions where water must be desalinated and pumped to high altitudes or where direct lithium extraction replaces evaporation.

Some participants raised concerns about solar PV systems' potentially competing for land that might otherwise be used for housing or agriculture. Others disputed this view, arguing that land-use demand for solar energy is generally insignificant, with some local exceptions. Approaches such as agrivoltaics keep land productive by allowing it to support both power generation and crop cultivation simultaneously. Several participants highlighted the importance of distributed generation: A household rooftop system can supply electricity for both home consumption and electric vehicle charging, which together account for a meaningful share of total energy demand in many countries. Promoting distributed energy resources can free grid supply for industry and provide grid services. Participants suggested that new policies (including integration rules, virtual power plants, and dynamic pricing) and household financing are needed to enable greater distributed solar generation in many countries.

Participants noted that policy choices steer demand, often inadvertently. A country's choice between blast furnaces and electric arc furnaces for new steel capacity, for example, results in very different energy and emissions profiles. They also noted that consumers often choose technologies more quickly than governments, adopting solar home systems and electric bikes when imported fossil fuels become costly, or the grid is unreliable. Reliable supply, even before it is affordable, can trigger latent demand. Many argued that countries should plan for the demand they want to enable rather than assume demand will follow macroeconomic growth. Participants also identified energy efficiency as an under-discussed lever, alongside circularity (material re-use and recycling), noting that rising demand in a linear economy translates into waste.

Many countries' plans emphasize renewables and storage, coupled with complementary resources

Participants noted that most countries already have long-term energy plans, so the key questions are whether those plans are robust, deliverable, and agile, and whether policy remains sufficiently

stable to implement them. In several Asian markets, the energy plans feature rapid growth of renewables and storage, a declining share of coal (although some coal-fired generation capacity is still being built), gas where available or imported, and nuclear playing a more limited role.

Participants indicated that the range of potential energy technology solutions is much broader than it was a decade ago. They cited small modular reactors (with various designs emerging worldwide and commercial units expected within about five years), next-generation geothermal, innovations in oil and gas, and declining costs for large-scale nuclear power based on standard designs. Fusion, which is not yet commercially available, was identified as a technology to watch. Bioenergy was described as locally valuable but not globally scalable. Regarding first-of-a-kind (FOAK) projects, participants discussed the question of how much technology risk a proven design carries in a new market, compared with knowledge, delivery, and workforce risk.

Participants listed the factors that determine technology choices in order of significance, from most to least: availability, affordability ("the most expensive power is no power"), energy security, resilience, and sustainability.

Supply chain concentration is both an enabler and a vulnerability

Supply chain concentration was one of the most debated topics. Some participants stressed that low-cost technology, largely from one country, has made solar, batteries, and electric vehicles accessible worldwide, and that so far there is limited evidence of negative impacts. Others suggested that concentration is itself a risk, citing export restrictions on equipment and technology, procurement and financing constraints on projects, and the potential for dominant suppliers to use their market position to exert political pressure on other countries. Some participants cautioned against blanket statements and noted that all parties have vulnerabilities and are negotiating with each other over terms of trade. Several argued that UEA should be framed in terms of long-term resilience and energy sovereignty rather than short-term efforts to replace existing suppliers, since diversification takes decades and dependence will persist for 10 to 15 years.

Participants discussed possible approaches to managing supply chain concentration. They noted that domestic manufacturers facing lower-cost foreign competitors need sustained and predictable protection, and that capital subsidies alone may not suffice. Trade policy volatility, such as through tariffs, undermines new investment. To mitigate this volatility, participants suggested developing regional supply chains with shared standards and trade agreements, supporting a select number of alternative producers, and encouraging foreign investors to build local ecosystems rather than export-only plants. Examples included demand-led solar development and capability

transfer in nickel and battery processing. A participant from a large market reported that their country's module manufacturing capacity is roughly two to 2.5 times domestic demand, while cell capacity is approaching parity with domestic demand. However, they said efforts to focus on earlier steps in the supply chain, such as wafer production, face the obstacle of export restrictions on manufacturing equipment. Participants noted that supply chains cannot be built overnight, as each link has different lead times, and that the private sector must lead diversification, with governments providing a stable policy environment. Several participants observed an important tension: local manufacturing and jobs add value but can raise the production costs and slow the pace of deployment.

Grids and infrastructure are critical enablers and often the binding constraint

Participants argued that supply alone does not deliver abundance. Needed energy must be available in the right form, quality, and place at the right time. They noted that power transmission capacity is a significant bottleneck for solar expansion in some large markets, that distribution failures cause outages even when generation is adequate, and that grids are not growing as fast as electrification requires. Managing variable and distributed generation adds complexity, and next-generation grid management tools, including digitalization and AI, were all seen as important and promising. Participants observed that even in mature power sectors, regulators are struggling to approve utility-scale batteries and variable generation. They also cited long equipment lead times: new transformers can take up to four years to procure, while those for gas turbines can take four to six years.

Cross-border and national interconnection efforts featured prominently in the discussion. One participant described how a country's regional grids were merged over 10 to 15 years, enabling power to move between sun-rich and sun-poor regions and supporting day-ahead green power markets. Another described a national grid decision between alternating current and direct current, which was settled based on economics, speed, and cost, as technology choices often become political and geo-economic. Participants noted that building cross-border lines has been very challenging historically: a proposed subsea link stalled following a change of government, a Central America–Mexico effort fell short, and some regions have only one or two thin interconnections. Others suggested that grids develop "at the speed of trust," making it beneficial to start with a few initial cross-border links.

A greenfield rail and minerals development corridor was offered as an example of how non-energy infrastructure can create energy demand. In the example cited, the new rail corridor would open significant new energy demand, which could be met by tapping nearby stranded hydropower.

Electrifying the rail line would entail higher upfront costs but would reduce operating costs and help meet emissions requirements in key export markets.

Participants also noted that consumers often will not wait for large-scale, but slow, institutional responses. When utilities fail to deliver reliable and affordable power, households and businesses turn to alternatives such as rooftop solar and mini-grids, as has occurred in Pakistan and Bangladesh. This self-reliance benefits households and businesses, but if not planned for and approached as a grid-friendly set of assets, it can strain utilities.

Policy tensions regarding climate, fossil fuels, and cost

As with the Panel's first meeting in Bellagio, participants expressed differing views on how climate and other dimensions of sustainability should be considered. Some said pursuing UEA without a climate lens makes no sense; others said affordable and reliable energy would rightly take priority in many countries and that renewables are increasingly the lowest-cost electricity option, while still requiring grids that can absorb them. Several participants argued that decarbonization should be an economy-wide undertaking, encompassing nature-based solutions and carbon removal technologies, rather than a goal confined to the energy sector. One participant observed that in many countries political urgency around climate has softened since 2024, though climate impacts remain and attitudes could shift again. Most agreed that energy technology decisions must be sovereign and that the Panel's role is to spotlight viable, cost-effective pathways and trade-offs—not to tell countries which technologies to choose.

Participants noted that multilateral financing restrictions on various energy technologies shape which energy resources a country can develop. Some argued that gas is the main alternative to coal for industrial heat in cement, steel, and aluminum, and that unused associated gas is often flared in oil-producing countries. They noted that multilateral development banks are beginning to resume support for nuclear energy financing, while multilateral financing for gas projects is still unavailable. Others stressed that permission to invest in domestic fossil resources does not, by itself, deliver UEA.

Countries need tools and capacity to select and deliver energy technologies

Participants argued that cost comparisons, such as levelized cost of electricity, are too blunt an instrument because supply chains, workforce, and project timelines vary across markets. A gap exists in the ability to compare alternative approaches to a specific market's needs as technologies change. Participants suggested that providing countries with open-source tools and data

(including global datasets and AI) so they can conduct analysis themselves, and supporting multi-decade planning of how a region's resources, infrastructure, and demand could evolve, would be valuable. They also stressed that research and development in energy technologies must continue because the abundant energy future will not look like today's system. Many participants expressed guarded optimism about the pace of global energy innovation.

Participants also identified non-technical constraints on delivery, including planning and regulatory capacity, the human capital to plan and operate new technologies, and effective community engagement. They emphasized that a social "license to operate" requires not only formal permitting approvals but also proactive and sustained dialogue with affected communities. Several participants also highlighted the need for greater "policy capacity," meaning the capacity to make effective policy choices.

Looking Ahead

The New Delhi convening showed that technology choices for UEA depend as much on grids, supply chains, planning capacity, and politics as on the technologies themselves. Important questions remain, including how to assess the suitability of technologies for different contexts, how to weigh supply chain risks against cost and speed, and how to reconcile climate goals with near-term development needs. Participants also began exploring ideas to accelerate UEA, which are still in development and will be the topic of further discussions in the coming months. These questions will help shape the next convenings: a discussion of finance in May 2027 and policy implementation in October 2027.

Notes

1. There is considerable regional variation in the rates of electrification, with electricity accounting for over 30 percent of total final consumption in Japan, South Korea, and China, around 20 percent in India and Central and South America, and 12 percent in Africa. For more details, see IEA, Electrification (Paris: IEA, 2026), September 22, 2026, https://www.iea.org/reports/electrification.

2. NITI Aayog, Government of India, "Division Reports," accessed November 10, 2026, https://niti.gov.in/publications/division-reports.

About the Authors

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He has served on numerous national and international advisory and study bodies, including committees of the National Academy of Sciences, the National Petroleum Council, and the Intergovernmental Panel on Climate Change.

He has authored more than 150 peer reviewed articles and is the author of Our Renewable Energy Future: The Remarkable Story of How Renewable Energy Will Become the Basis for Our Lives (World Scientific, 2024), which examines the technological, economic, and policy forces driving the global transition to renewable energy. His work has been published in Science, Nature Energy, Joule, and Energy Policy, among others

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Before his service in the Obama Administration, he founded Eastlink Consulting, LLC where he guided corporate and non-profit clients on commercial energy projects in Europe and Eurasia, and he served as a non-resident senior fellow at the Brookings Institution, researching international energy security issues.

Earlier in his career, Elkind focused on energy, environment and economic issues in the post-Soviet nations in a variety of posts with the Joint Global Change Research Institute, the U.S. National Security Council, Office of the Vice President of the United States, the Department of Energy, and the Council on Environmental Quality.

Elkind holds a Master of Business Administration in Strategy and International Business from the R.H. Smith School of Business at the University of Maryland, a Master of Arts in Russian History and a Certificate in Soviet Studies from the W. Averell Harriman Institute at Columbia University, and a Bachelor of Arts with Distinction in History from the University of Michigan. He is also a distinguished associate with the Energy Futures Initiative Foundation; a founding principal of Acceleration Energy LLC; and a senior advisor with WestExec Advisors, a Washington, DC-based strategic advisory firm.

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