Bridging the $18 Trillion Gap in Net Zero Capital

November 2023

By Rebecca Fitz, Maurice Berns, Pattabi Seshadri, Asheesh Sastry, Jesper Nielsen, Ben Gottesdiener, and Betsy Winnike



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Key Messages

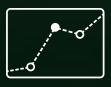
BCG's Center for Energy Impact analysis of global energy sector investment needed through 2030 to reach emissions reduction goals yielded the following key findings:



Capital Challenge. An $18 trillion capital gap exists between current commitments and the investments needed for alignment with net zero goals in 2030. Electricity and end-use sectors account for 90% of that shortfall.



Sector Restructuring. Energy sector deals surpassed $320 billion in 2023 as companies optimize capital structures for energy transition investment. Oil and gas companies are leading with acquisitions, while utilities offload more assets to access capital and focus portfolios.



Transition Barriers. Higher inflation and supply chain disruptions over the past 24 months have significantly hindered energy transition progress, stifling momentum and increasing costs.



Strategic Adaptation. Companies should emphasize refining capital strategies, boosting efficiency, seeking innovative transactions and collaborations, bolstering financial foundations, and fortifying supply chains. These measures are essential to amplify investments, satisfy shareholders, and move toward net zero outcomes.



Investor Behavior. Rising risks drive investors to seek higher returns, favoring businesses that prioritize capital discipline and cost efficiency even in high-growth renewables markets.



Government Role. Policy reforms, subsidies for low-carbon solutions, and expedited project approvals are essential for accelerating investment.

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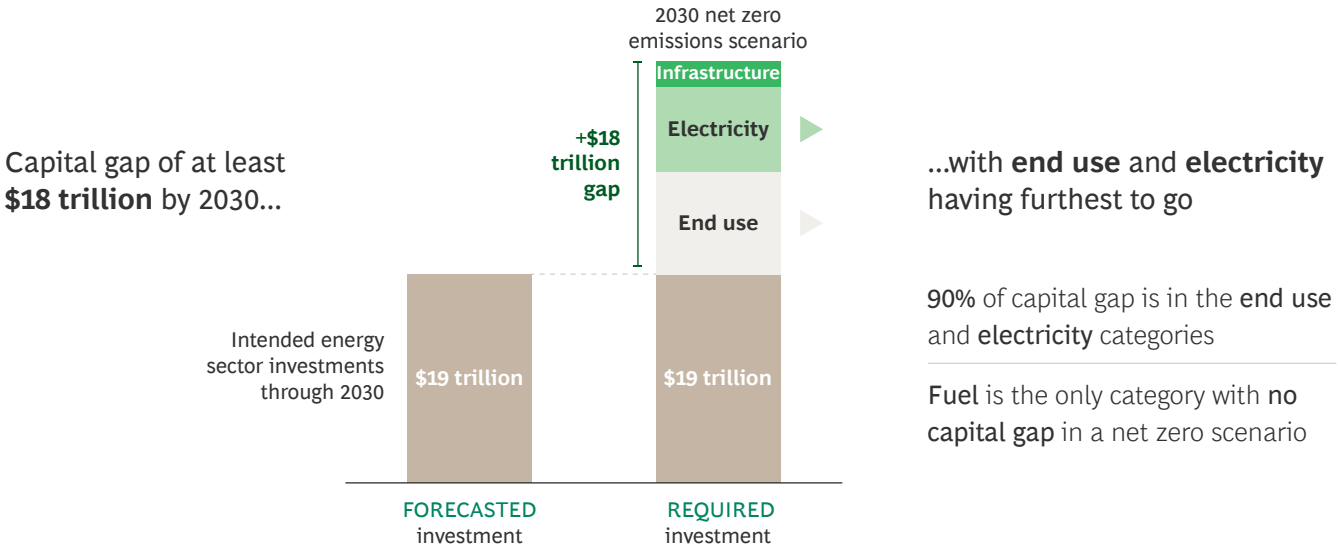
Navigating the path to a 2030 net-zero-aligned scenario reveals a staggering $18 trillion capital gap between current energy transition commitments and the required investment levels.

Electricity and end-use sectors account for 90% of that shortfall. (See Exhibit 1.) With companies in the industry poised to drive 80% of planned energy transition investments through 2030, their strategies and execution plans are paramount.

However, their journey is riddled with hurdles. In the present climate, higher inflation, persistent supply chain pressures, and rising capital costs cause significant bottlenecks, slowing the pace of the energy transition. The setting is also reshaping investor behavior; companies face more demanding calls for higher returns, more disciplined capital management, and more efficient resource allocation, even within the high-growth renewables space.

The energy sector's response has been proactive. A flurry of transaction activities signals a strategic push to fine-tune capital frameworks for the energy transition; so far in 2023, total energy sector deals exceed $320 billion. Oil and gas companies have emerged as dominant buyers, while utilities are using carve-outs to raise funds and recalibrate. As capital markets evolve, only projects that strike the right balance between risk and returns will receive sufficient funding. Regions where stakeholders effectively align policy directives and market mechanisms will be the prime recipients of future investments.

Exhibit 1 - There Will Be a Capital Gap of at Least $18 Trillion Through 2030, with Electricity and End Use Having Furthest to Go



Sources: Company-stated investment plans; analyst consensus forecasts; IEA; BCG CEI analysis.

To flourish in the face of growing capital demands, energy companies must reassess portfolios, create innovative capital strategies and new partnerships, optimize their financial structures, and emphasize stringent cost and supply chain efficiencies. This report highlights the sector's crucial capital allocation dynamics and the implications for competitive success in the energy transition.

Follow the Capital: Tracking the Investment Landscape of the Energy Transition

BCG's Center for Energy Impact recently analyzed the investment plans of the world's leading energy companies, governments, and private equity players to compare real-world energy transition investments with net-zero scenario benchmarks. See the appendix, "About the Analysis."

The study reveals two major trends. One is that energy companies and governments aim to inject an impressive $19 trillion into the energy transition over the next seven years. (See Exhibit 2.) This includes nearly $2 trillion in new government spending, spurred by US and European legislative initiatives. Company targets suggest a 15% increase in energy expenditures between 2023 and 2027, with an increasing share allocated to low-carbon investments.

Yet, the shadows of the war in Ukraine loom large. The repercussions, marked by skyrocketing commodity prices in 2022 and 2023, have tightened capital availability, particularly for European utilities—the linchpins of European decarbonization efforts. These financial headwinds, coupled with higher inflation and capital costs, have curbed enthusiasm for new investments.

Notably, these influences show up differently across regions and energy sectors.

Oil and gas firms are bolstered financially and are eying strategic investments. Driven by the surge in 2022 commodity prices, O&G companies are now flush with cash to support investments. However, hefty dividend obligations require these businesses to adopt a balanced approach to their capex ambitions. Responses to BCG's 2023 Oil & Gas Investor Survey underscore this perspective: 83% of investors advocate for disciplined capex expansion, and 70% prioritize dividend growth in capital allocation. Forecasts indicate that the 50 largest oil and gas companies have earmarked $2.2 trillion for capex through 2027, alongside plans to dedicate $2 trillion to dividends and buybacks. (See Exhibit 3.)

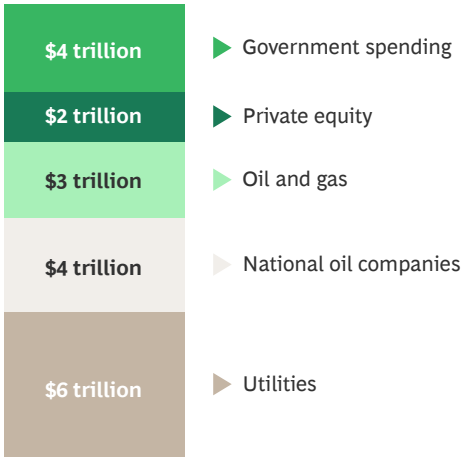
Reenergized financials and positive stock trajectories have prompted the industry to view M&A as the next big investment frontier. The sector announced over $130 billion in transactions in October 2023 alone, with deals focused on scale and consolidation of lower-cost oil and gas resources. In addition, many of the oil and gas majors are using M&A to build low-carbon portfolios, expanding positions in biofuels, carbon capture and storage, hydrogen, and electric vehicle charging. As the sector's M&A momentum continues, companies should recognize that seamless post-merger integration will be critical for value creation.

Exhibit 2 - The Projected Cumulative Investment in the Energy Transition Through 2030 Is $19 Trillion



$19 trillion

of capex is forecasted through 2030, from a broad mix of global investors



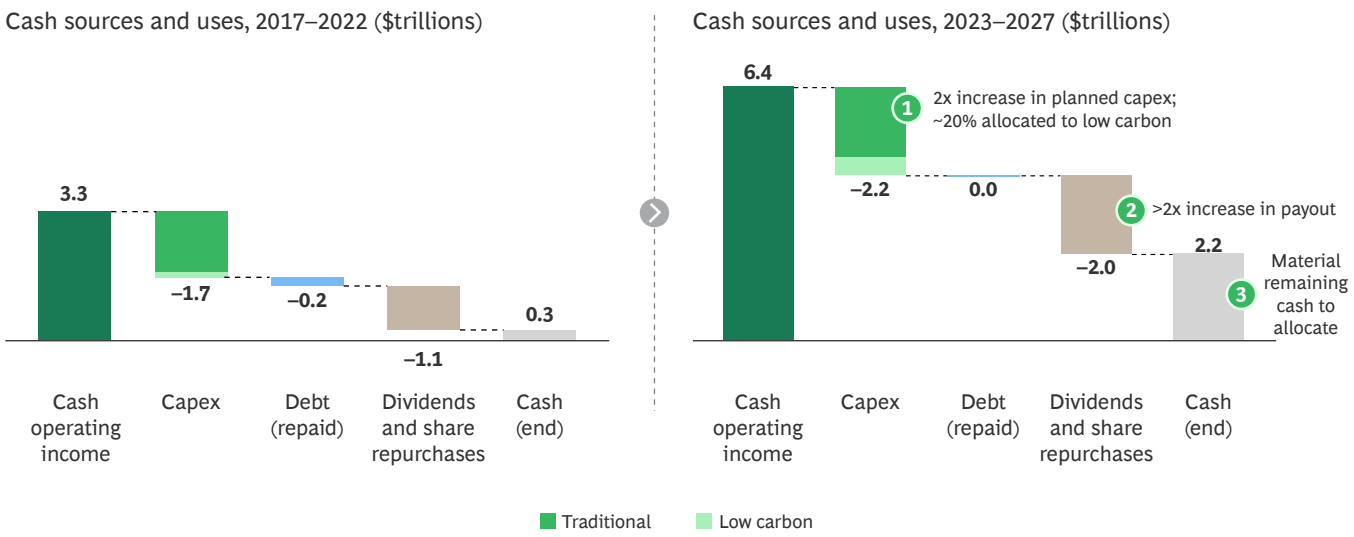
Sources: Company-stated targets; analyst consensus forecasts.

Over the next seven years, energy companies and governments aim to inject an impressive $19 trillion into the energy transition.



Exhibit 3 - Oil and Gas Companies Have Cash Reserves for Strategic Investments

Past and future sources and uses of cash for the 50 largest oil and gas companies by market cap



Sources: S&P Capital IQ; company-reported targets; BCG CEI analysis.

Note: "Low carbon" is defined as investment in renewable energy storage; biofuels; batteries and storage; carbon capture, utilization, and storage; and end use.

Utilities are reshaping capital strategies to support future investment. The utility sector stands at the forefront of energy transition investment because grid investments are vital to all net zero pathways that rely on electrification. Utilities will account for approximately 30% of global energy sector capex through 2030, but a capital gap of over $10 trillion persists. To accommodate the needed transition, grid investments must triple—rising to a level that mirrors forecasted investment in new wind and solar development.

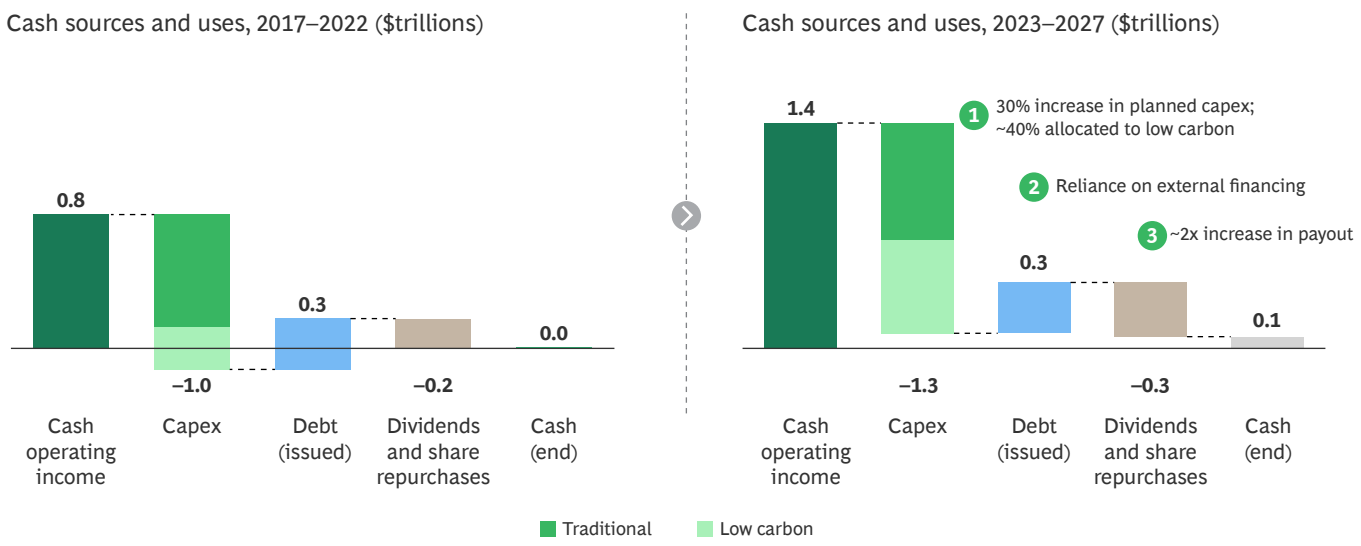
However, utilities' financial models, which traditionally depend on debt to fund elements of their capex program, are under pressure. Forecasts indicate that the 50 largest global utilities must secure over $300 billion in external capital to fund $1.3 trillion in capex through 2027. (See Exhibit 4.) But the blend of increased leverage and regulated returns makes these companies especially vulnerable to interest rate hikes, complicating capex growth plans.

Moreover, rising wholesale power prices, interest rates, and inflation lead to heftier utility bills for consumers. In attempting to shield consumers from these hikes, regulatory bodies may restrict the amount that utilities can invest, which could hamper capex escalation. Several US states have limited utilities' capex growth proposals and imposed caps on related rate hikes.

To overcome these headwinds, utilities are restructuring to reduce debt and cater to financing requirements. A key option available to them is to divest. In the past two years, divestitures represented over 70% of all major Utility deals globally.

Exhibit 4 - Power and Utilities Companies Depend on Borrowing to Finance Capex Expansion Goals

Past and future sources and uses of cash for the top 50 P&U companies by market cap



Sources: S&P Capital IQ; company-reported capex targets; BCG case experience.

Note: "Low carbon" is defined as investment in renewable energy storage, biofuels, batteries and storage, carbon capture, utilization, and storage, and end-use.

Two primary approaches to divestiture stand out. The first involves carve-outs, which make up 70% of the divestiture value. These efforts aim to streamline portfolios and emphasize regulated assets. For example, Con Edison sold its Clean Energy Businesses for $6.8 billion, moving its portfolio toward regulated assets with more predictable returns. Similarly, as part of an effort to shift its portfolio toward electricity, National Grid sold an 80% stake in its UK gas transmission and metering business to a consortium of infrastructure investors led by Macquarie for roughly £7.7 billion.

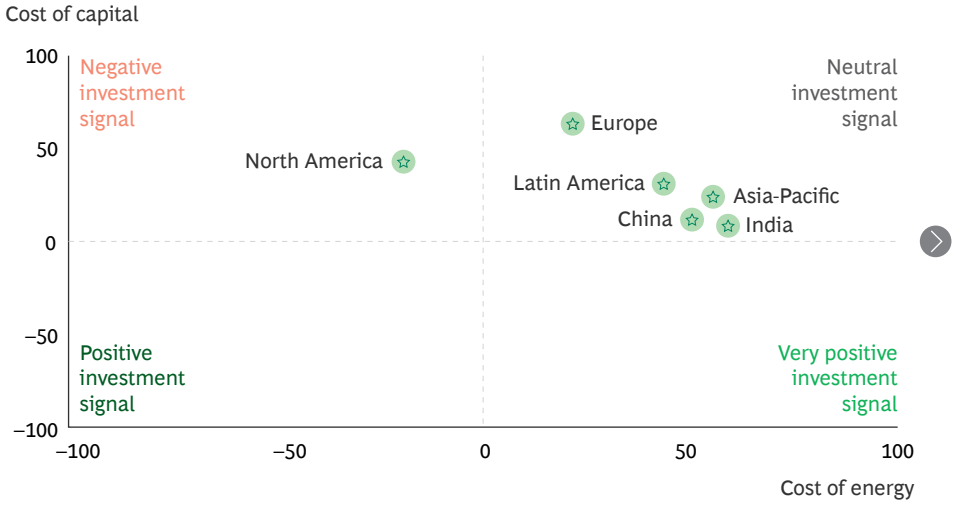
The second approach to divestiture involves utilities selling minority stakes to raise capital and set benchmarks for undervalued assets. A notable example of this type is NiSource's sale of a portion of NIPSCO to Blackstone, valuing the subsidiary at a significant premium.

As utilities evolve to meet their capex needs, further portfolio adjustments and external capital collaborations will be vital to their success.

Early signs point toward consolidation in renewables to support continued investment. Proponents of the energy transition have celebrated the rapid rise in renewables, but businesses in the sector—especially the wind sector—are now grappling with significant challenges. Inflation, higher interest rates, and persistent supply chain disruptions have resulted in cancellation of major projects such as Ocean Wind 1 and 2 and SouthCoast Wind offshore in the US (See Exhibit 5.) Others, such as Vattenfall's Norfolk Boreas in the UK, have been paused, due in part to cost increases of up to 40%. As the industry shifts to installing advanced wind turbines, technical issues and immature supply chains have escalated costs and delayed projects. This tumultuous environment has damaged the equity story of renewable companies, putting off investors and restricting available financing.


Higher inflation, persistent supply chain pressures, and rising capital costs cause significant bottlenecks, slowing the energy transition.

Exhibit 5 - Investment Environment for Renewables Are Adversely Impacted by Higher Cost of Capital, Especially in North America



North America:
Rising cost of capital hinders investments as cheap gas weakens the push for a fuel switch

Rest of world:
Higher capital costs deter investment, yet soaring energy prices spur renewables to offset gas/coal expenses

Sources: Refinitiv; BCG CEI analysis.

Note: Cost of energy and cost of capital are expressed on a relative basis (deviation from the 2015–2023 mean). The reference cost of energy for North America, Europe, Asia-Pacific, and Latin America is the regional natural gas price; the reference cost of energy for India and China is the price of coal. "Asia-Pacific" excludes China, India, and Japan.

In response, project developers have pivoted to introducing inflation-linked contract clauses and seeking higher prices on power purchase agreements. Bidding patterns reflect increased caution; the latest UK offshore wind auction attracted no bidders, and a recent US Gulf of Mexico auction drew just two bidders.

Another notable shift involves the renewables industry's move toward consolidation to help drive capital efficiency. This trend, especially pronounced in the US in response to Inflation Reduction Act incentives, has included deals such as Brookfield's $2.8 billion acquisition of Duke's US renewables and Invenergy's $1.5 billion purchase of AEP's assets. These moves catapulted both firms into the US's top ten companies as measured by renewable capacity. Asia, too, has witnessed a surge in renewables consolidation, including Shell's $1.6B acquisition of India's Sprng Energy, which boosted Shell's regional renewable capacity sixfold.

For operators, scaling up promises improved market risk management, greater cost discipline, and all the benefits of economies of scale. Meanwhile, developers gain purchasing might, more streamlined operations, and opportunities to offload operational assets.

Yet consolidation is only one facet of capital optimization. Given the external pressures on capex agendas, renewables businesses must explore a holistic range of strategies to finance their goals while keeping investors on board.

End-use sectors face a $9 trillion energy transition capital gap. Critical industries such as producers of steel, cement, and aluminum will play a pivotal role in driving the energy transition. But to do so, they must invest in energy efficiency, shift from fossil fuels to hydrogen and other alternatives, and expand into areas such as carbon capture, utilization, and storage (CCUS). Close coordination with the supply chain and careful strategic timing of these investments are crucial to ensuring that supply initiatives will meet demand-side needs.

Nevertheless, a massive $9 trillion investment shortfall in these areas is expected through 2030. Most prospective investments—including 93% of proposed carbon capture projects—remain in the planning stages, awaiting clearer financial returns and grappling with high costs. Other challenges include bureaucratic hurdles, insufficient infrastructure, and weak business cases. To bridge this gap, companies are aligning investments with areas where they can maximize subsidies, sharing risks with new partners, curating complementary portfolios, and evaluating many early-stage projects. This broad approach is necessary to expedite essential capex in these areas.

Strategic Imperatives: Shaping the Energy Transition Through Corporate Action

The energy sector stands out for its intense capital demands, marked by a capital intensity rate that is more than double that of other industries. Accounting for approximately one-third of the world's yearly capex, it encompasses diverse peer groups, segments, and stakeholder interests. Yet organizations throughout the sector share a mission to amplify investments, satisfy shareholders, and navigate toward net zero outcomes.

To accelerate the energy transition, every company in this sector should treat six actions as mandatory:

Refine capital allocation. Evaluate and enhance current allocation processes to weigh trade-offs between traditional investments and low-carbon alternatives, ensuring a comprehensive approach to decision making. Look for processes that need revamping. In particular, low-carbon investments are much more sensitive to cost-of-capital increases than traditional energy sector investments are. Improved cost-of-capital assessments across global portfolios would paint a more detailed picture of favorable assets.

Focus on efficiency. Emphasize cost and capital efficiency in energy transition investments. Such an approach may entail completely transforming the way a company runs major capital projects and operations. For example, companies are evaluating the factory model that has successfully reduced costs in the US shale sector for use in large-scale renewables and other low-carbon settings.

Explore strategic M&A and divestitures. Mergers and acquisitions may work for some companies, while others may benefit from divestments that enable them to concentrate their resources more effectively.

Forge new partnerships. Explore alternative deal structures such as minority shareholdings, joint ventures, strategic partnerships, and corporate venturing. These structures can be complex, but they offer strategic flexibility that is essential for navigating capital constraints in certain areas of the energy sector. They also promote specific collaborations to advance decarbonization efforts.

Strengthen the balance sheet. A volatile market forces companies to adopt robust financial strategies. The disparity in valuations between US oil and gas majors and their European counterparts highlights the importance of financial resilience, as does the surge in total shareholder returns by more debt-averse utilities in 2023.

Stress-test the supply chain. It is crucial to rigorously evaluate supply chains for cost efficiency, carbon intensity, and resilience. Reevaluating supplier relationships and identifying dependencies can cut costs and minimize risks.

Fundamentally, the energy sector's transition demands innovative financial strategies and a comprehensive approach to portfolio management.

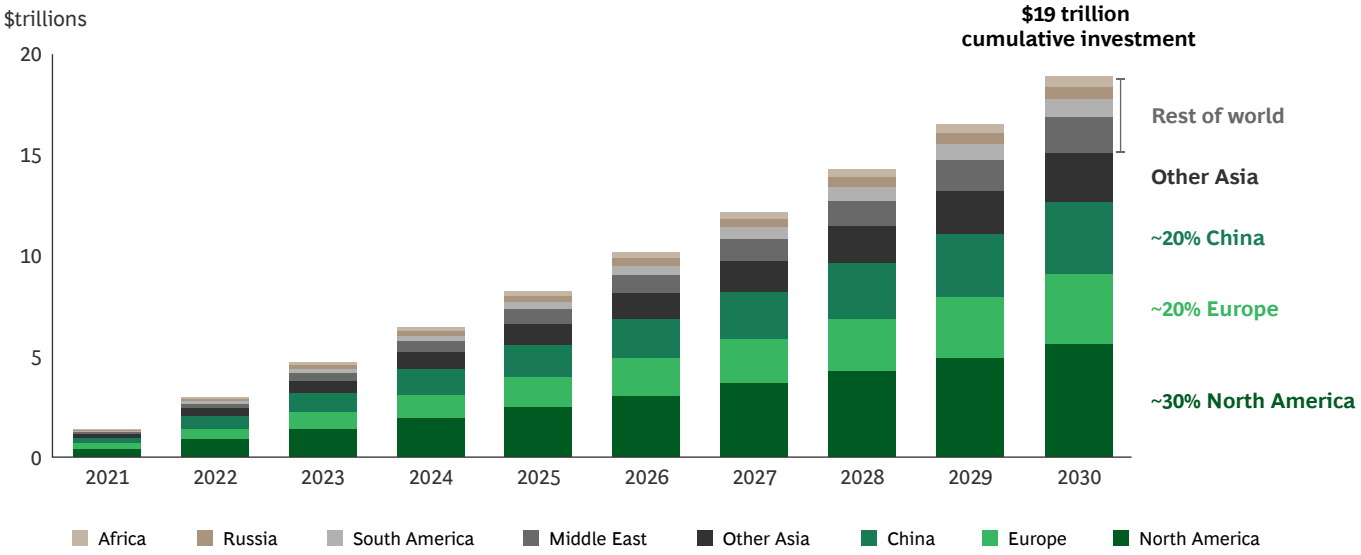
The Pivotal Role of Policymakers in Accelerating Transition Investment

Investments are most effective in areas where market structures and policy guidelines work together to produce favorable risk-to-reward profiles for capital.

Currently, the US, Europe, and China are at the forefront of incentivizing low-carbon energy investments. (See Exhibit 6.) Through the Inflation Reduction Act and the Infrastructure Investment and Jobs Act, the US government has mobilized over $1 trillion in investments through 2030, primarily via tax incentives, to target low-carbon sectors ranging from solar and wind to CCUS and hydrogen. This approach of incentivizing green investments has impelled international investors to shift more green capital to the US.

Exhibit 6 - North America, Europe, and China Account for About 70% of Forecasted Capital Investment

Cumulative modeled investment from energy sector, energy-focused private equity and venture capital, and governments[1]



Sources: Company-stated targets; modeled assumptions; BCG CEI analysis.

[1]Energy sector investment from largest 260 energy companies.

Europe, with its Green Deal Industrial Plan, is following the US's lead. BCG has identified up to €773 billion in potential subsidies for clean technologies throughout Europe. A distinguishing aspect of Europe's strategy is its implementation of carbon pricing, aimed at steering investment decisions toward greener solutions.

Asia has adopted a government-led approach to the transition, with state-owned entities at the forefront of many relevant investments. For example, multiple national oil companies have developed approaches to the energy transition that build on national energy strategies with government backing. Japan, South Korea, and India have launched a host of energy transition incentives and subsidies to spark capital deployment across the private sector.

However, policymakers must do more to bridge the investment gap. BCG's Blueprint for the Energy Transition outlines six essential steps for public sector leaders to take. They encompass electricity market modifications to produce adequate pricing signals for new investments; faster approval processes for projects, particularly grid expansions; enlarged green investment subsidies through incentives and research grants; and revised liability guidelines to enhance investor confidence.

Policymakers must also ensure that the energy transition is inclusive. A glaring imbalance exists in energy transition funding, with developing areas facing a funding gap twice as large as that of their developed counterparts. Elevated interest rates further hinder investment. Yet innovative ventures such as the Just Energy Transition Partnerships in countries like South Africa and Vietnam are showing progress.

In the race for energy transition investments, there is an urgent need for global policymakers to address existing challenges and ensure a fair and efficient shift to low-carbon energy.

The energy transition's immense capital demands underscore the need for companies and policymakers to adopt robust and innovative approaches. As the world advances toward its net zero goal, harmonizing investment strategies with collaborative solutions is paramount. Although the energy sector is already making strides, consistent policy support and forward-thinking financial maneuvers are crucial to bridging the existing gaps and ensuring an ordered, equitable, and sustainable shift to a greener future.

Appendix

About the Analysis

BCG's Center for Energy Impact conducted an extensive analysis that forecasts a total investment of $19 trillion in the energy sector through 2030. Of those funds, 80% will come from private capital and the remaining 20% from government spending and subsidies to stimulate private sector investment.

According to the analysis, the world's largest energy companies—including international and national oil and gas companies, multi-utilities, and electric utilities—will provide more than two-thirds of the forecasted investment. The projected capital flow across the energy sector breaks out as follows:

- The oil and gas sector will account for more than one-third ($7 trillion) of the spending, with utility companies contributing another third (32%).
- Governments are expected to contribute approximately $4 trillion, or 20% of total energy sector spending, with the US and Europe leading in contributions.
- Private equity, infrastructure funds, and venture capital firms will provide about $2 trillion in capital through 2030.

The analysis took a bottom-up approach, modeling sources and uses of cash and planned investment in the energy sector through 2030. The study covered 260 of the world's largest energy companies across major industry subsectors, as well as energy- and infrastructure-focused private equity and venture capital deals. The analysis also modeled global energy transition investments by governments, examining the financial impact of various policy and subsidy programs.

The objective of the study was to explore the capital structures of the companies that will drive investment in the energy transition and to examine how those companies plan to balance capital investment with shareholder remuneration targets. In support of this effort, the analysis compares company- or country-stated, publicly available targets against the baseline of the IEA net zero scenario.

The energy sector's transition demands innovative financial strategies and a comprehensive approach to portfolio management.



About the Authors



Rebecca Fitz is a partner and associate director in Boston Consulting Group's Center for Energy Impact, in Washington, DC. You may contact her by email at fitz.rebecca@bcg.com.



Maurice Berns is a managing director and senior partner and chair of BCG's Center for Energy Impact in London. You may contact him by email at berns.maurice@bcg.com.



Pattabi Seshadri is a managing director and senior partner in BCG's Dallas office and is global leader of the firm's Energy practice. You may contact him by email at seshadri.pattabi@bcg.com.



Asheesh Sastry is a managing director and senior partner in the firm's Singapore office and is the Asia-Pacific leader of the firm's Energy practice. You may contact him by email at sastry.asheesh@bcg.com.



Jesper Nielsen is a managing director and senior partner in BCG's London office. He leads the firm's business in M&A and post-merger integration in Europe, South America, and Africa. You may contact him by email at nielsen.jesper@bcg.com.



Ben Gottesdiener is a consultant in BCG's Center for Energy Impact. He is based in New York. You may contact him by email at gottesdiener.ben@bcg.com.



Betsy Winnike is a lead knowledge analyst in BCG's Center for Energy Impact in Washington, DC. You may contact her by email at winnike.betsy@bcg.com.

For Further Contact

If you would like to discuss this report, please contact the authors.

Acknowledgments

The authors would like to thank Alex Ohm, Alex Goh, Vertika Srivastav, Sandy Kwa, and Toong Yuen Chong for their contributions to this analysis.

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The Center for Energy Impact

The Center for Energy Impact (CEI) shines light on the energy transition, focusing on the actions required to achieve global transformation. CEI applies a holistic perspective to understanding and shaping bold responses to one of the most critical and complex challenges of our time.

Our deep expertise spans markets and economics, carbon and technology, capital and investors, the macrodynamics of geopolitics and resilience, and the microdynamics of politics and specific policies. We offer nuanced, constructive ideas and solutions covering the future availability, economics, and sustainability of the world's energy sources—and the implications for energy companies, industries, investors, consumers, and governments. The CEI team is committed to facilitating informed, innovative discussions to make our world sustainable.

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