Financing the net-zero transition: From planning to practice

McKinsey & Company

IIF Institute of International Finance

McKinsey & Company
McKinsey & Company is a global managementconsulting firm deeply committed to helping institutions in the private, public, and social sectors achieve lasting success. For more than 90 years, our primary objective has been to serve as our clients' most trusted external adviser. With consultants in more than 100 cities and in over 60 markets across industries and functions, we bring unparalleled expertise to clients all over the world. We work closely with teams at all levels of an organization to shape winning strategies, mobilize for change, build capabilities, and drive successful execution.

Context

Reaching net-zero greenhouse-gas emissions by 2050 is essential to mitigate the negative impacts of climate change on global standards of living, livelihoods, and natural resources.[1] As enablers of the global economy, financial institutions have a key role to play in channeling financing to the right place at the right time. However, in the context of an evolving regulatory and economic playing field, the financial sector needs to review how it can engage in transition finance and foster real emissions reductions.

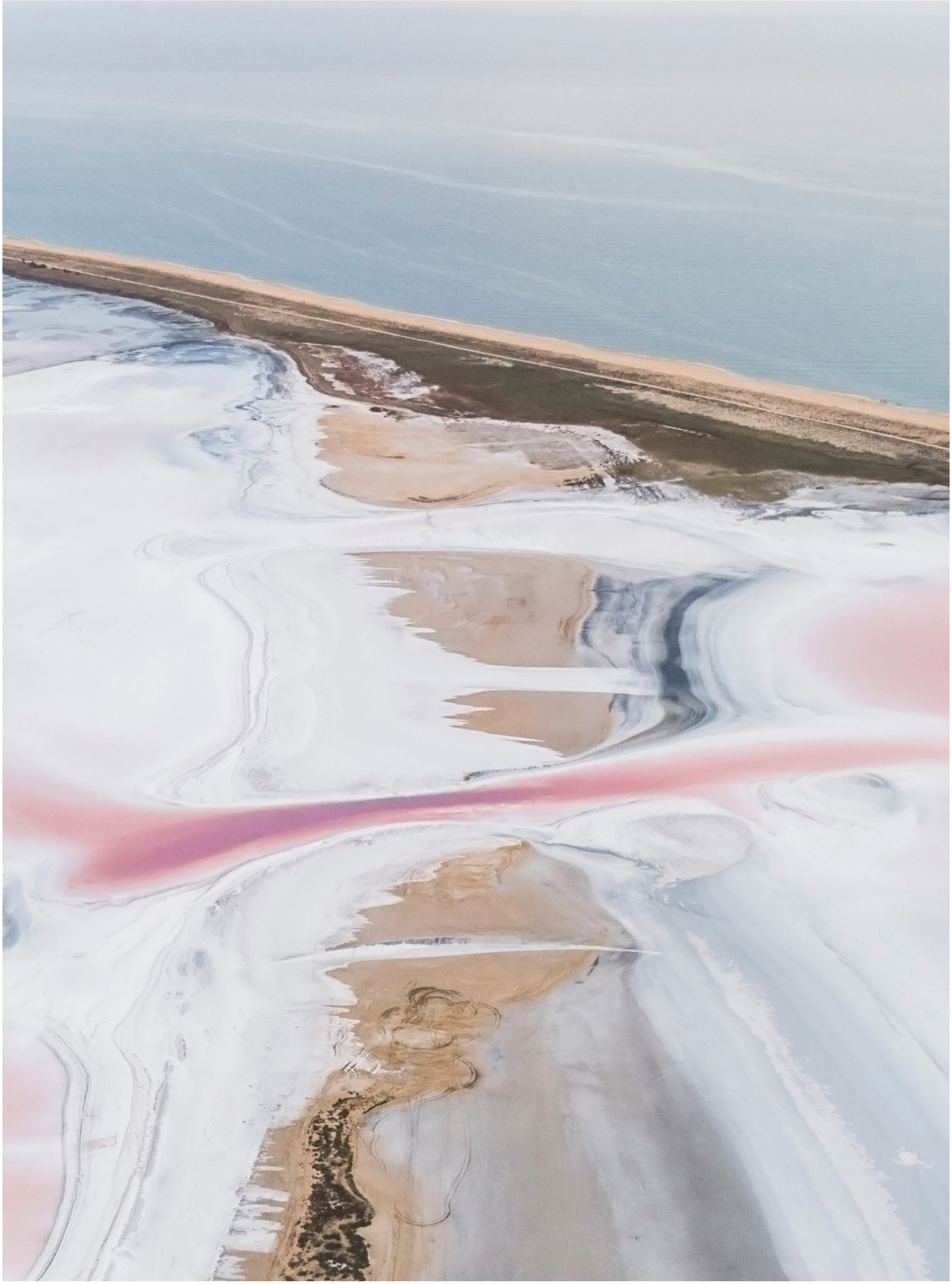
This report seeks to contribute to the debate by sizing transition finance needs and opportunities in a scenario where net zero is achieved by 2050. The report also summarizes the challenges facing financial institutions and outlines potential ways to harness the net-zero opportunity.

The work presented here is the result of a collaboration between the Institute of International Finance (IIF) and McKinsey & Company. In fall 2022, with the support of McKinsey, the IIF convened a series of workshops on transition planning and practice across Europe and North America. IIF members, including banks, asset managers, insurers, credit rating agencies, public-sector entities, and other stakeholders, came together to share their experiences in financing the transition. The insights that emerged, together with the institutional knowledge and expertise of the IIF and McKinsey, informed efforts presented here to outline common challenges, discuss emerging practices, and set out the latest thinking on accelerating transition planning and financing across the industry.

About the authors

Mark Azoulay is a partner in McKinsey's London office, where **Daniel Mikkelsen** is a senior partner and **Anna Lazzarin** and **Elodie Muchembled** are consultants. **Daniel Stephens** is a senior partner in the Washington, DC, office, and **Joseba Eceiza** is a partner in the Madrid office. **Sonja Gibbs** is the managing director and head of sustainable finance at the Institute of International Finance, where **Jeremy McDaniels** is a senior advisor on sustainable finance.

McKinsey would also like to thank other advisers who challenged our thinking and added new insights: Juan Aristi Baquero, César Augier, Alessandro Casoli, Sudeep Doshi, Stephanie Hauser, Mekala Krishnan, Cindy Levy, Angela Luget, Cor Marijs, Erik Ringvold, Hamid Samandari, and Dee Yang. The IIF would like to thank all those who took part in its workshop series during fall 2022. We would also like to convey special thanks to Alice Carr, Anja Ludzuweit, Curtis Ravenel, Tony Rooke, Joy Williams, and other colleagues from the Glasgow Financial Alliance for Net Zero (GFANZ).



Contents

Executive summary

The transition to net-zero global greenhouse-gas (GHG) emissions by 2050 would require $275 trillion of investment in physical assets—a massive commitment that will lead to an almost unprecedented reallocation of capital.[2] In the near term, significant investment will be required in clean power, necessary to run electric vehicles and to decarbonize buildings, while emerging markets and developing economies (EMDEs) need committed finance to ensure the transition plays out across global value chains.

With a supportive environment in place, private financial institutions may facilitate as much as $3.5 trillion of annual financing opportunities between 2022 and 2050. Commercial banks could capture $2.0 trillion to $2.6 trillion of this opportunity, while asset managers, private equity, and venture capital funds would provide $950 billion to $1.5 trillion. Strategically, financial institutions have a chance to grow the business while providing vital resources to decarbonize the economy.

While the scientific case for decarbonization is clear, the means of achieving it continue to face headwinds. We explore these in the first part of the report. First and foremost, the frameworks that define transition finance have evolved independently in terms of scope, level (product, sectoral, institutional), sectoral eligibility, and thresholds. These variations are undermining attempts to reconcile definitions and guidelines. Moreover, current incentives are not fully aligned with the practicalities of achieving the transition, with emission reductions (for example, through divestment from high-emitting assets) being rewarded more than financing of emissions, despite the latter being a key enabler of the transition. Finally, data quality, analytical tools, and climate-related capabilities are lacking across the industry.

Given the size of the task, and considerable impediments to progress, much work is required. At a minimum, enabling capital deployment will require collaboration, dedicated fiscal and regulatory tools, and risk-sharing mechanisms such as blended finance.

If the financial industry is to effectively capture the net-zero opportunity, it must get a grip on the many variables at play. As a first step, institutions need to define net-zero targets and timelines. These should encompass three dimensions to support the transition: reducing emissions through investment in green assets; financing the transition from carbon intensive assets to green assets; and the decommissioning of highly polluting assets. Setting meaningful ambitions requires institutions to measure their baseline emissions, project portfolio momentum, select a reference scenario, and agree on

targets—all while ensuring that relevant stakeholders are on board.

The next step should be formulating a strategy for implementation. As part of that process, institutions will need dedicated tools to understand their portfolio exposures. Policies and processes can then be drafted to guide capital allocation and investments, integrate transition priorities into products and services, develop targeted financing solutions, and adapt risk appetite and related policies.

Through these processes, institutions can engage clients to drive the transition in the real economy. In effect, this will mean building tools and frameworks to support client engagement and help monitor client progress. One example discussed in the report is tailoring the relationship manager coverage model to best serve clients on sustainability topics.

In addition, institutions need to define metrics and targets to assess and monitor their own progress, allowing for imperfect data resources. Data sharing, transparency, and rigorous monitoring are vital to ensure that institutions are on track to meet their targets.

Finally, astute decision making is key. The right governance structures are required to enable leaders to oversee and monitor initiatives and to provide incentives in line with their objectives. Making the net-zero goal a core part of the organizational culture will be instrumental in ensuring that it influences day-to-day operations. New skills and capabilities will be required, both internally and to support clients, and institutions that devise a dedicated talent strategy will create a competitive advantage in moving their agendas forward.

With a supportive environment in place, private financial institutions may facilitate as much as $3.5 trillion of annual financing opportunities between 2022 and 2050.

$3.5T

Getting to net zero by 2050

RESETTING THE PLANET TO STOP CLIMATE CHANGE WAS NEVER GOING TO BE CHEAP.

To get emissions to net zero, $275 trillion would need to be spent on physical assets alone between 2021 and 2050. That is about $9.2 trillion per year, or about 30 percent more ($3.5 trillion) than the $5.7 trillion allocated today. These huge cash requirements present financial institutions with a significant opportunity. Moreover, the financing would need to be front-loaded: most of it is required in the next five to ten years.[3]

Of the trillions of dollars required to finance the green transition, about one-third would go toward legacy obligations and two-thirds to new technologies. We estimate that about $2.8 trillion would support critical high-emission assets that cannot be completely phased out (see box "Our methodology").[4] Demand for these assets would decline but not entirely. The remaining $6.4 trillion would finance low-emission green assets or assets transitioning to be less carbon-intensive[5] (Exhibit 1).

More than 85 percent of investment in low-emission assets, or about $170 trillion, would be in three sectors: mobility, power, and buildings. In the mobility sector, about $62 trillion would support the development of electric vehicles (EVs), while $3 trillion is required for EV and hydrogen infrastructure. About $57 trillion would be needed for the power sector, including for generation, storage, transmission, and distribution. A portion would be required to upgrade existing transmission and distribution grids. Power sector investment is particularly important because gas consumption is likely to rise globally over the next decade. Additionally, investment in power is essential to unlock decarbonization in the mobility sector. Finally, in the buildings sector, $46 trillion would be needed for heating[6] and cooking equipment, alongside infrastructure retrofits.

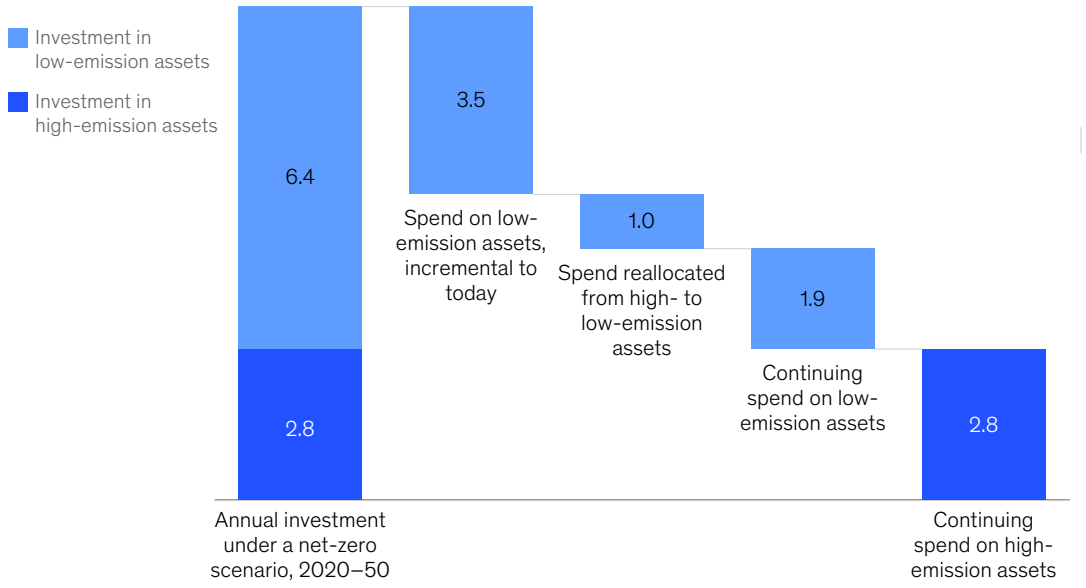
Net-zero budgets vary across geographies. In developed economies, the largest proportion of spending will be required in mobility, while emerging markets and developing economies (EMDEs) require a lot of financing in the power sector (Exhibit 2). This is because many EMDEs still rely on fossil-fuel assets, while investment in renewable-electricity production is more advanced in developed markets.[7]

Absolute funding needs under a net-zero scenario would be concentrated in developed markets but would represent a more significant share of GDP in EMDEs. In developing regions, spend on energy and land would form a substantially larger share of national GDP: more than 10 percent in sub-Saharan Africa, India, Asian countries (excluding China and Japan), and Latin America (Exhibit 3A). Compared with developed markets, China, and India, EMDE investment would be back-loaded (Exhibit 3B).[8] This would be due to later commitments and the challenge of rapidly mobilizing private capital in these regions, as well as the cost of technology, regulatory environments, and possible carbon taxes.

Globally, most investment to achieve net zero by 2050 would be in technologies that are in the early stages of adoption or are undergoing final testing for commercial viability[9] (Exhibit 4). About one-third (32 percent) of investment would be concentrated in battery electric vehicles (BEVs)[10] and fuel cell electric vehicles (FCEVs). Under a 2050 net-zero

Exhibit 1. **Solving the net-zero equation would require an approximate $9.2 trillion annual investment in energy and land-use systems.**

Average annual investment under the NGFS[1] Net Zero 2050 scenario, 2020–50, $ trillions



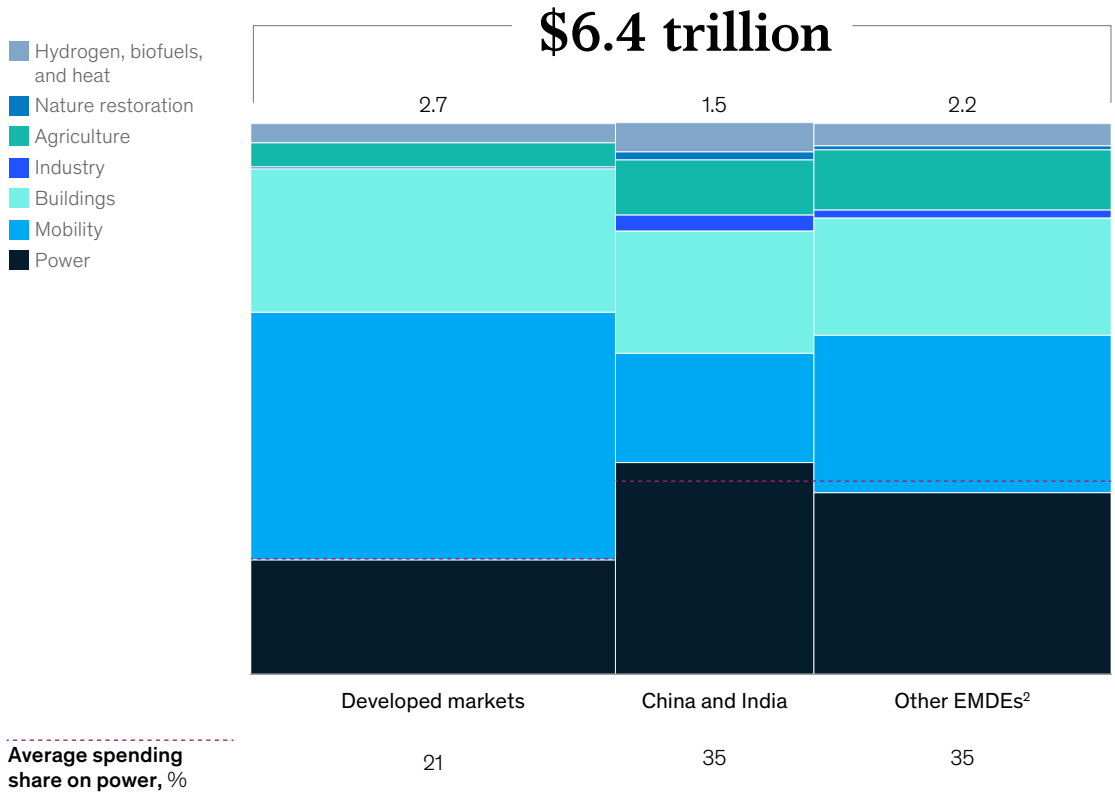
Note: Investment amounts compared with today's investment in the same systems.
[1]Network for Greening the Financial System.
Source: McKinsey Center for Future Mobility; McKinsey Decarbonization Pathway Optimizer; McKinsey Energy Insights; McKinsey Global Institute; McKinsey Nature Analytics; NGFS scenario analysis 2021 Phase 2 (Net Zero 2050 scenario); REMIND-MAgPIE model; VIVID Economics; World Bank Open Data; McKinsey analysis

scenario, more than half of global investment in BEVs and FCEVs would be deployed between 2041 and 2050. Europe and the United States would capture a quarter of this investment, and Japan would be a significant focus (with BEFs and FCEVs representing 43 percent of the country's total net-zero investment). Despite China's leading role in producing lithium-ion batteries,[11] investment in BEVs and FCEVs would account for just 18 percent of the country's net-zero investment by 2050.

Twenty-five percent of global investment in low-emission assets would need to be allocated to power transmission and distribution, alongside wind and solar power generation. These technologies are currently mostly at the demonstration or early adoption stages of their life cycles. Some are particularly promising, such as thermal energy storage (TES) technologies (for example, medium-pressure steam), which could enable the cost-efficient electrification of most heat applications and are already commercially available with various easy-to-customize uses. TES business cases demonstrate profitability at an internal rate of return of 16 to 28 percent, subject to local market conditions.[12] This investment will need to be front-loaded in the near term, especially in the case of solar, where nearly 50 percent of investment will be deployed by 2030. Technology for wind power generation is more advanced and will reach full maturity in 2026. This will attract significant investment between 2031 and 2040, especially in Asia (India, Japan, and other countries). Last, power transmission and distribution investment will be concentrated in China and the United States (19 percent and 16 percent of total investment in these technologies, respectively, will be in these two countries).

Exhibit 2. **Mobility will attract most investment in developed economies, while emerging markets and developing economies need to channel capital to decarbonizing power.**

Annual investment need for low-emission assets by region and sector,[1] 2022–50, $ trillions



[1]Based on the Network for Greening the Financial System's (NGFS) Net Zero 2050 scenario.
[2]Emerging markets and developing economies.
Source: NGFS Net Zero 2050 scenario; *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022

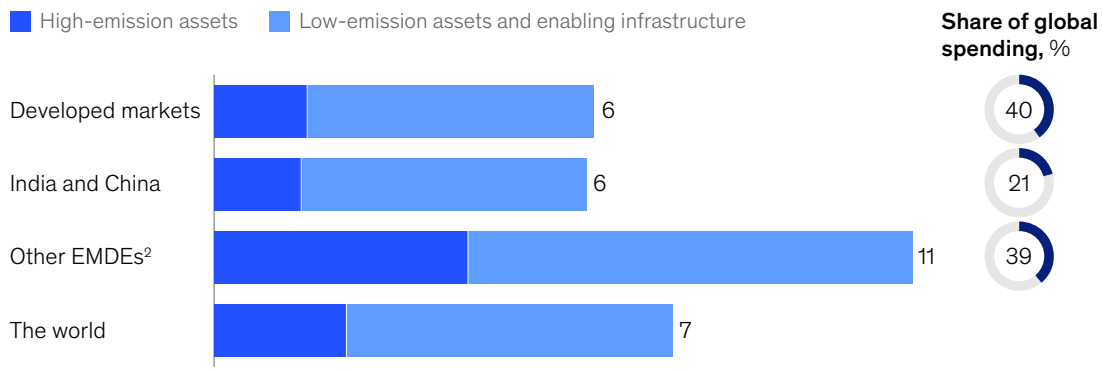
The buildings sector will attract 17 percent of global investment in low-emission assets, especially to develop heat pumps and district heating technologies.[13] These technologies are at the early-adoption stage and will be fully mature by 2040. Most of the investment (80 percent) will be deployed as technologies mature between 2030 and 2050.[14] One-quarter (27 percent) of investment in heat pumps will be in the United States. China, Europe, and the former Soviet Union countries will capture about 70 percent of investment in district heating between 2022 and 2050.[15]

Some regions and sectors are faced with significant step-up investment needs, representing the gaps between a Current Policies scenario and a net-zero scenario

Spending would need to rise across regions by 2050.[16] In the NGFS Current Policies scenario, accounting for the likely evolution of spending, population, and GDP growth, the United States, Europe, and China could face financing step up needs of $15 trillion, $12 trillion, and $11 trillion, respectively, between 2022 and 2050, or an average of two percentage points as a proportion

Exhibit 3A. **Emerging and developing markets would spend more to decarbonize and secure low-emissions growth.**

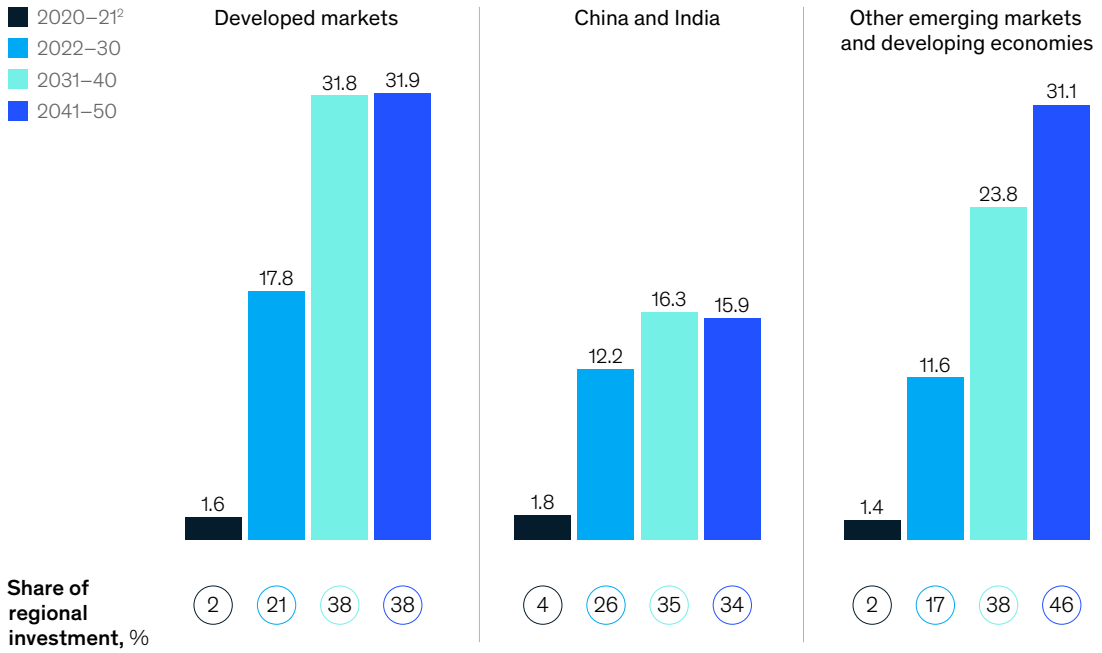
Spending for energy and land-use systems,[1] % of 2022–50 GDP



[1]Spending values based on the Network for Greening the Financial System's (NGFS) Net Zero 2050 scenario.
[2]Emerging markets and developing economies.
Source: NGFS Net Zero 2050 scenario; *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022

Exhibit 3B. **Physical-asset investment in emerging and developing economies would grow more significantly after 2030, compared with other economies.**

Share of investment in low-emission assets by region,[1] 2020–50, $ trillions



Note: Figures may not sum to 100%, because of rounding.
[1]Share of investment based on the Network for Greening the Financial System's (NGFS) Net Zero 2050 scenario.
[2]Historic investment.
Source: NGFS Net Zero 2050 scenario; *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022

Exhibit 4. **The technologies that require the most investment to reach net-zero emissions by 2050 are currently in the early-adoption stage or in the final stages of commercial-viability testing.**

Share of investments in low-emission technologies and average technology maturity, 2022–50

Investments, %	32	25	17	26
	Electric-vehicle technologies	Clean-power generation and transmission	Technologies to decarbonize heating	Other low-emission technologies
Maturity of subsector technologies (1 to 11), average TRL[1] in 2022	• BEV[2] 8 • FCEV[3] 8	• Solar PV[4] 8 • Transmission and distribution 8 • Wind 9	• Heat pump 9 • District heating 9	• Other 7

Note: The key technology risk measure used in this report is the IEA TRLs. The technology risk factor captures the fact that a technology is not fully mature yet (intrinsic factor rather than relative to fossil fuel alternative). According to the IEA, the only renewable technologies that are fully mature are hydropower and geothermal generation (source: IEA ETP Clean Energy Technology Guide). The TRLs reported here are the average of multiple technologies. For example, for wind this includes both onshore wind and offshore floating wind. Investment characteristics reflect the return profile, technology risk, and market risk of each opportunity. The return profile reflects the cost-competitiveness of low-emission levers compared to high-emission levers, which is determined based on abatement cost curves and on projected carbon taxes. Technology and market risk estimates used in McKinsey's Transition Finance Model are based on McKinsey experts' input and the IEA ETP Clean Energy Technology Guide.
[1]Technology readiness level (index of 1–11, where 1 is the initial idea stage and 11 is full maturity). The TRL reported here is an average of multiple technologies. For example, wind includes both onshore wind and offshore floating wind.
[2]Battery electric vehicle.
[3]Fuel cell electric vehicle.
[4]Photovoltaics.
Source: *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022; the study is based on NGFS Net Zero 2050 Scenario; technology analysis based on McKinsey's Transition Finance Model (TFM) and TRL projections for net-zero technologies

Our methodology

All investment figures presented in this report are based on a simulation of one hypothetical, relatively orderly path toward 1.5°C using the Net Zero 2050 scenario from the Network for Greening the Financial System (NGFS). Our analysis is not a projection or a prediction and does not claim to be exhaustive; it is meant to provide an order-of-magnitude estimate of the economic transformation and societal adjustments associated with the net-zero transition. For more information, see *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022, in particular the technical appendix. Spend estimates are higher than some others in the literature because they include spend on high-carbon technologies, agriculture, and other land use, and they take a more expansive view of the spending required in end-use sectors. The report builds and expands upon the vast external literature on the net-zero transition to offer a more detailed and granular view of the nature and the magnitude of economic changes that it would entail. Because of this, estimates of the annual spending on physical assets under a net-zero transition scenario presented in this paper exceed total spending estimates provided by other analyses. The analysis in this report assumes an evolution of carbon taxes globally in line with *Net zero by 2050: A roadmap for the global energy sector,* International Energy Agency (IEA), 2021.

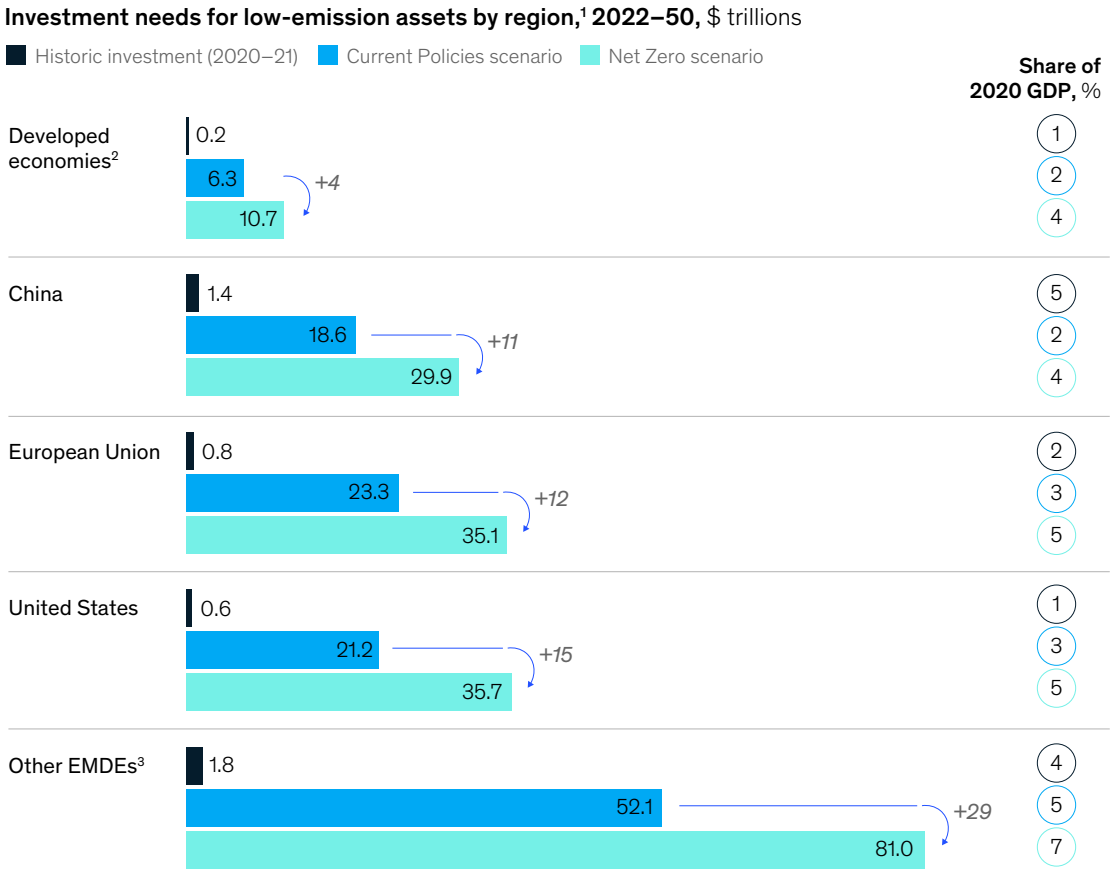
The NGFS Net Zero 2050 scenario reaches net-zero CO_2 emissions by 2050 for the economy as a whole; this means there are some low residual gross CO_2 emissions in hard-to-abate sectors and some regions that are counterbalanced by CO_2 removals. The transition is assessed along two dimensions: energy and land-use systems accounting for about 85 percent of global emissions, and 69 countries making up about 95 percent of global GDP.[1] The analysis first calculates changes in important variables affecting demand in each energy and land-use system (for example, changes in power production by source), and then it assesses the implications for capital stock and investment, producer and consumer costs, and employment based on information about decarbonization technologies and their capital and operating costs, labor intensity, and effects on value chains.

[1] *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022.

of GDP (Exhibit 5).[17] However, some EMDE countries may have much higher investment needs to get to net zero. For example, investment in low-emission assets in India by 2050 could be 9 percent of GDP, compared to 5 percent in the Current Policies scenario. By contrast, the gap between investment needs and the current trajectory is relatively small (about 1 percent of GDP) in Japan, Canada, Australia, and New Zealand.

In addition to funding under the Current Policies scenario, $66 trillion of new funding would be required in the power, mobility, buildings, and hydrogen, biofuels, and heat supply sectors between 2022 and 2050 (Exhibit 6A). Capital flows to the power sector would need to rise by an additional $26 trillion by 2050, with 60 percent used to decarbonize power generation. Most of the funding (77 percent) needs to be mobilized

Exhibit 5. **Developed economies, emerging markets, and developing economies would face a financing gap in the tens of trillions of dollars.**



Note: Figures may not sum to 100%, because of rounding.
[1]Investment needs based on Network for Greening the Financial System's (NGFS) Net Zero and Current Policies scenarios.
[2]Japan, Canada, Australia, New Zealand.
[3]Emerging markets and developing economies.
Source: McKinsey Global Institute, *The net-zero transition: What it would cost, what it could bring*, January 2022; NGFS Net Zero 2050 Scenario

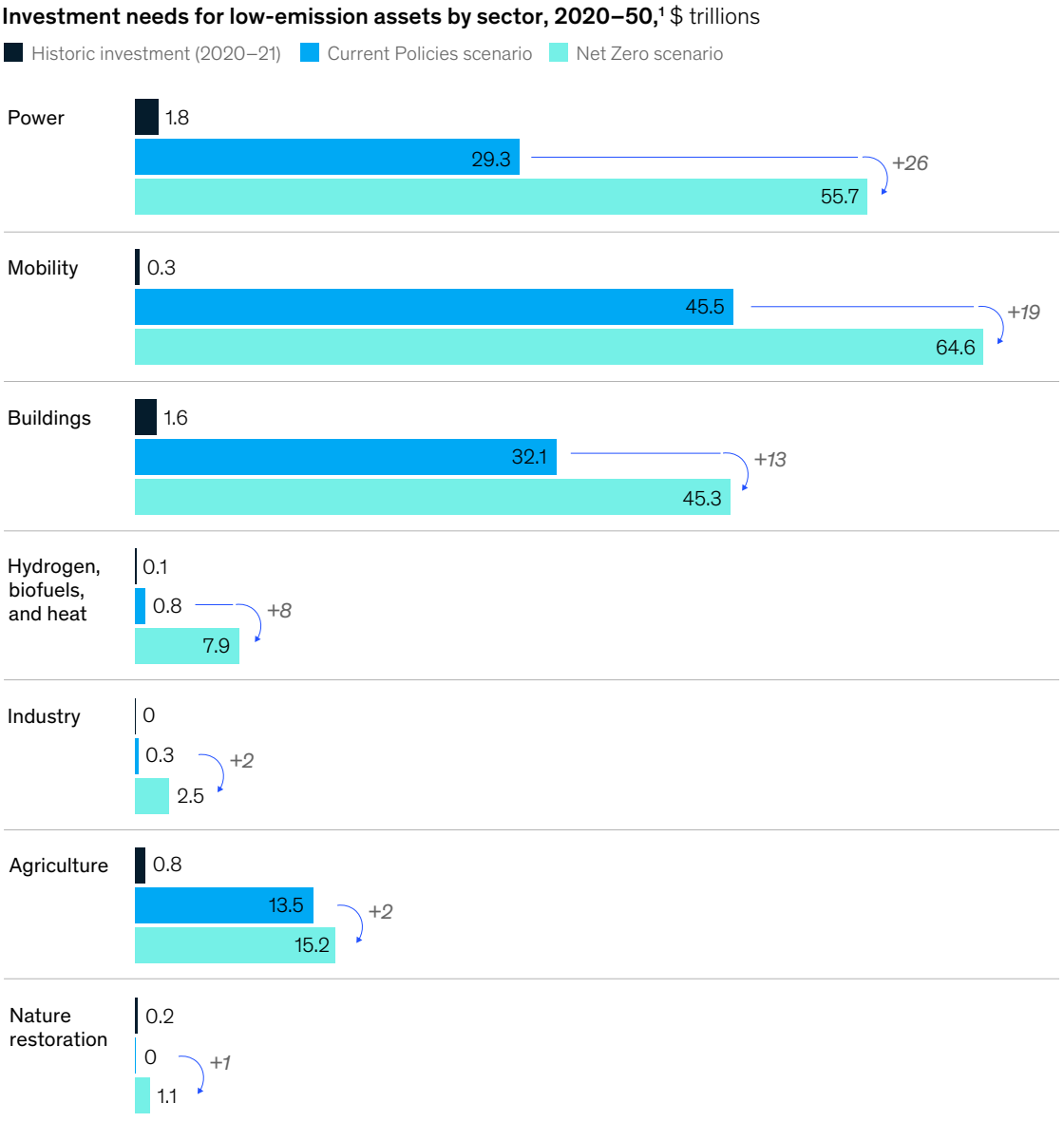
by 2040, both to phase out fossil fuels and to enable end users to transition to a new energy mix (Exhibit 6B). In technologies for power generation, investment in nuclear will need to accelerate. This is specifically to accelerate testing of Gen IV reactors, which is currently limited, while Gen III+ reactors have already been deployed at scale and are well understood. In a net-zero scenario, nearly 50 percent of total investment needs for nuclear should be deployed by 2030. By contrast, the Current Policies scenario would require only 37 percent of total investment for nuclear to be deployed by 2030. In the mobility sector, an additional $19 trillion would need to be deployed by 2050, split between the development of electric vehicles and infrastructure. In buildings, there is a $13 trillion opportunity to increase investment in heating (both residential and commercial) and retrofits. Finally, an extra $5.1 trillion and $1.6 trillion need to be deployed for the development of biofuels and hydrogen, respectively. While this is a relatively small investment, upstream production of these sustainable fuels will be necessary to shift downstream sectors such as industry, buildings,

and mobility away from fossil fuels. Furthermore, auxiliary infrastructure such as electric charging stations for BEVs and hydrogen fueling stations for FCEVs will act as key enablers to unlock decarbonization in the mobility sector.

Barriers to investment are higher in some geographies and sectors, as well as for immature technologies

Some of the sectors and geographies in need of financing face barriers to investment that can

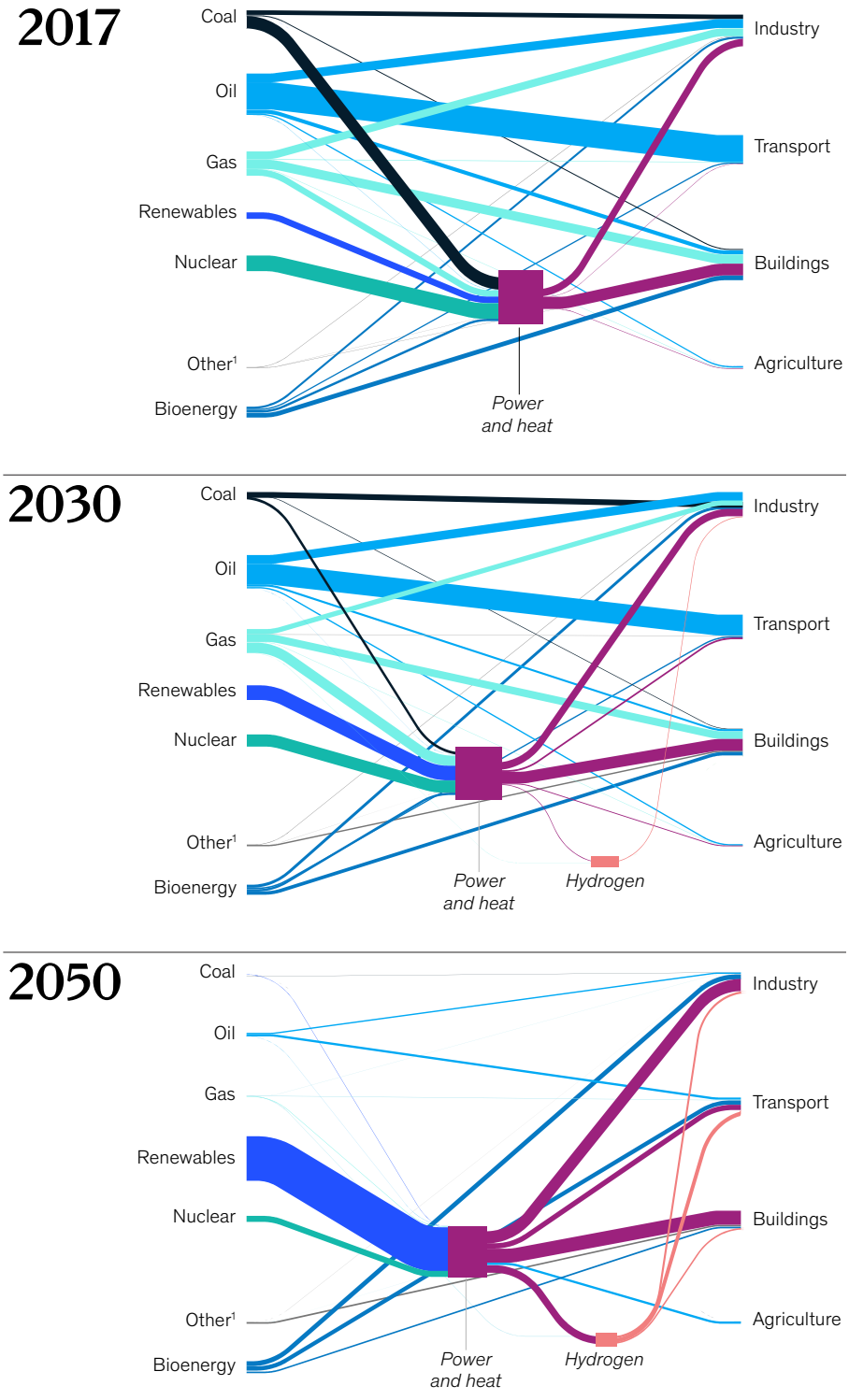
Exhibit 6A. **To reach net-zero 2050 goals, the power, mobility, buildings, and hydrogen, biofuels, and heat sectors would require an additional $66 trillion.**



Note: Figures may not sum to 100%, because of rounding.
[1] Investment needs based on Network for Greening the Financial System's (NGFS) Net Zero and Current Policies scenarios. Investment in hydrogen, biofuels, and heat does not account for the investment in power needed to produce these fuels, which is captured in the investment in power.
Source: *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022; NGFS Net Zero 2050 Scenario

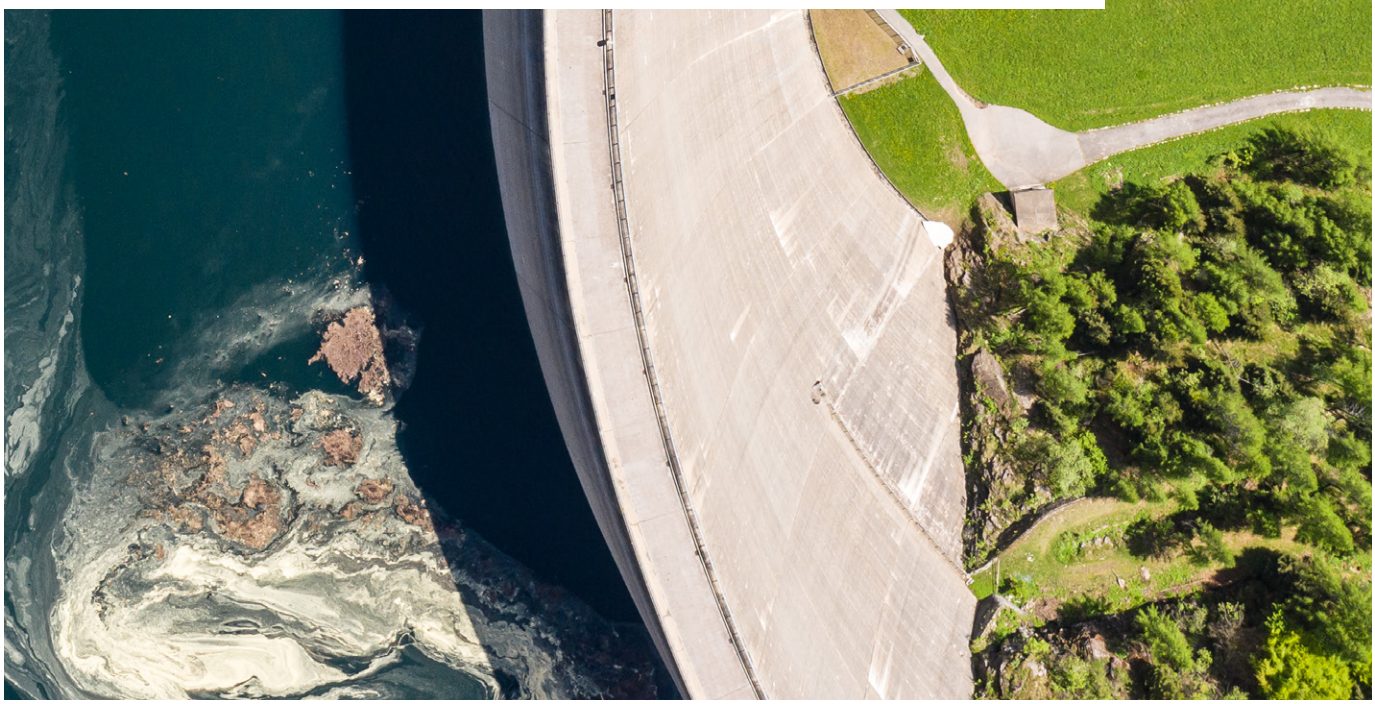
Exhibit 6B. **The energy system would need to be reconfigured to phase out fossil fuels and focus instead on renewables and hydrogen.**

Primary energy demand, petajoules



[1] Other miscellaneous sources, such as nonrenewable waste.
Source: *Net-Zero Europe: Decarbonization pathways and socioeconomic implications*, McKinsey, December 2020

GLOBALLY, MOST INVESTMENT TO ACHIEVE NET ZERO BY 2050 WOULD BE IN TECHNOLOGIES THAT ARE IN THE EARLY STAGES OF ADOPTION OR ARE UNDERGOING FINAL TESTING FOR COMMERCIAL VIABILITY.



largely be broken down into geography-specific barriers, technology barriers, and sector-specific barriers. These all translate into challenges to capital mobilization.

Geography-specific barriers (such as business environment, capital markets maturity, currency risk, infrastructure risk, and capabilities) make it difficult to channel finance toward regions exposed to transition risk. An unstable or unsupportive business environment will create challenges to investment. Equally, a lack of clear government incentive to engage in the net-zero transition could create an impediment. Crucially, in EMDEs, carbon-intensive sectors are often key drivers of employment and generate significant tax revenues, making it difficult to phase out heavily emitting assets. This conflict can result in a lack of clear signals to the private sector and misaligned incentives. For example, scaling offshore wind power generation could unlock decarbonization in many EMDEs, but unfavorable business environments often make it difficult for investors to obtain the necessary permits to build infrastructure. Additionally, deploying nuclear energy for decarbonization faces controversy in many countries, and supporting the development of nuclear technologies can expose investors to reputational risks.

Value chain stakeholders often require policy signals to price or otherwise value emission reduction; for example, in the form of carbon pricing or subsidies for renewables. Uncertainty about current and future policies (including relating to the duration of incentives, potential technology-specific government support, or environmental and emissions standards) may prevent investors from adequately valuing and funding decarbonization solutions.

In some cases, fossil-fuel subsidies pose an additional constraint on decarbonization. While renewables have become competitive in countries that together are home to two-thirds of the world population (including many EMDEs),[18] fossil-fuel subsidies continue to hinder renewables deployment across both developed markets and EMDEs. In 2020, 15 EU states gave more subsidies to fossil fuels than to renewable energies, despite their climate commitments.[19] More broadly, 63 percent of the G-20's public finance for energy was spent on fossil fuels in 2019–20, with the largest subsidies going to China, Indonesia, and the United Kingdom. Fossil-fuel subsidies are also prominent in some Middle East and North African countries, including Egypt, Jordan, Morocco, Libya, and Tunisia.[20] Employment may not necessarily suffer from scaling back fossil-fuel subsidies, as the net-zero transition will create 15 million (direct and indirect) net jobs globally by 2050. These will be concentrated across specific sectors and geographic regions.[21] In EMDEs, business environment risks are also sometimes accompanied by inflation, currency risk, and interest rate risk. Additionally, capital markets in these regions tend to be less mature. Infrastructure might also be less advanced than in other geographies. Finally, EMDEs may face capability constraints, slowing the flow of investment-ready projects. Risks and performance vary across EMDEs, requiring investors to develop locally specific knowledge (see box "Charting sovereign risk in emerging markets: The IIF Emerging Markets ESG Scorecard"). Admittedly, some of these barriers exist for all investment, but they exacerbate barriers specific to financing the transition.

Sector-specific barriers are linked to technology maturity and supply chain risks, potentially hindering the decarbonization of high-emitting sectors. Some sectors are particularly constrained by technology immaturity. In the industry and buildings sectors, technologies such as hydrogen and electrification for steel production, as well as technologies for retrofitting, fall into this category. Sectors in which decarbonization solutions face a broad base of upstream and downstream dependencies, such as enabling infrastructure and energy and material inputs, face high supply chain risks. For example, shipping decarbonization

WHILE RENEWABLES HAVE BECOME COMPETITIVE IN COUNTRIES THAT TOGETHER ARE HOME TO TWO-THIRDS OF THE WORLD POPULATION (INCLUDING MANY EMDES), FOSSIL-FUEL SUBSIDIES CONTINUE TO HINDER RENEWABLES DEPLOYMENT ACROSS BOTH DEVELOPED MARKETS AND EMDES.

depends on the production of low-carbon fuels, the development of storage and bunkering infrastructure at ports, and the production and uptake of ships for a given fuel type.

Technology barriers often lead to a gap in cost and returns parity with incumbent technologies, which creates disincentives to the deployment of key decarbonization technologies. Key decarbonization technologies (such as renewables, hydrogen, and biofuels) pose a series of risks to potential investors. These vary by development stage, as do the types of investors who could take them on. In the development stage, the risks relate to the viability of the business models of technologies. Given the innovative nature of these technologies, there is often uncertainty around the feasibility of the technology, market and revenue profiles, and regulation. For example, technology risk is low for carbon-intensive hydrogen and scaled production methods such as steam methane reformation, but it remains elevated for less carbon-intensive hydrogen production technologies, such as alkaline electrolyzers, which are unscaled. Additionally, the market for alkaline electrolyzers is nascent, fragmented, and subject to price volatility. Once technologies are proven and are deployable at scale, business model risks still apply, but new barriers to investment may emerge. These may relate to the need to assess creditworthiness in unscaled situations and a lack of lender expertise.

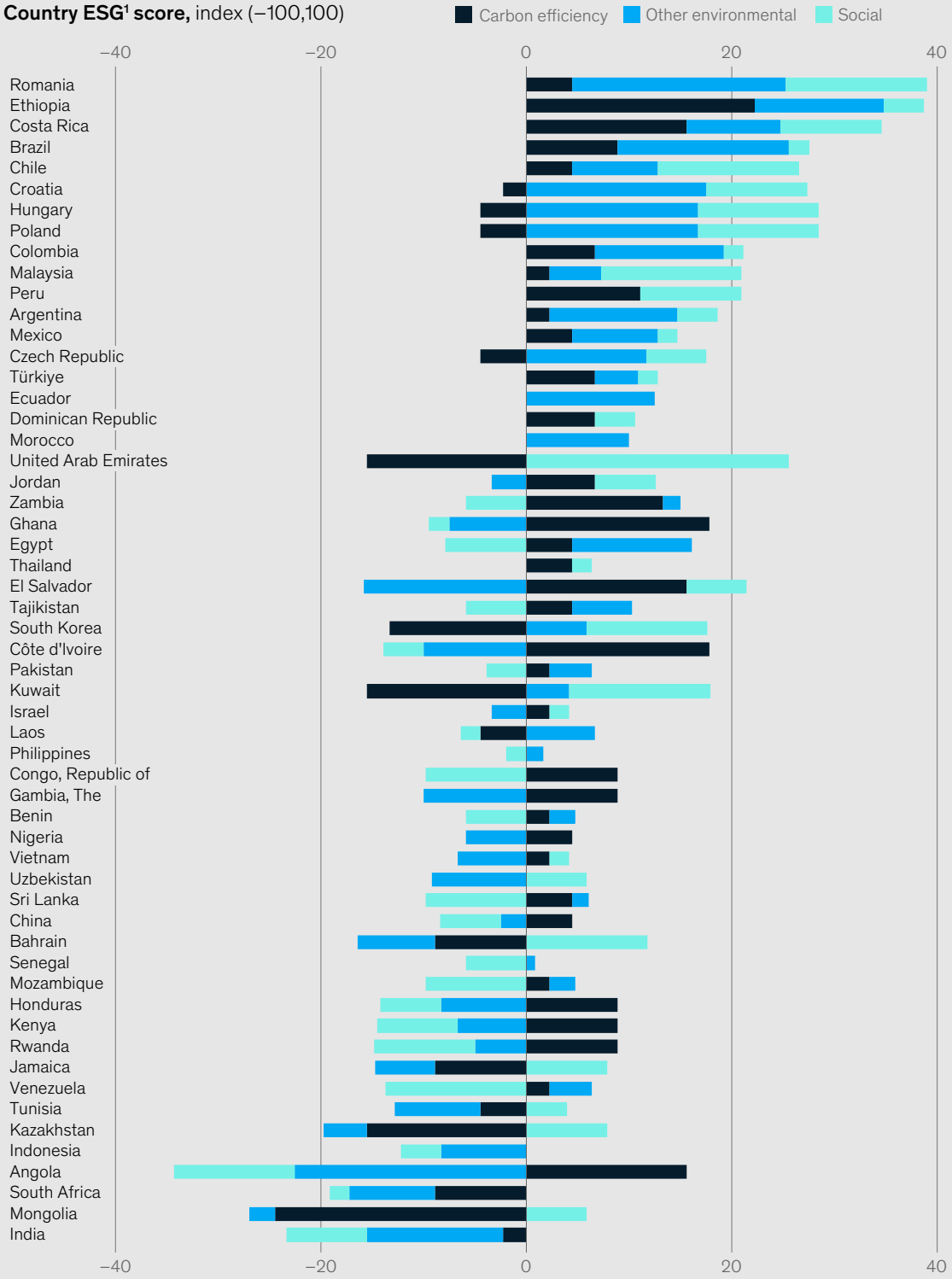
Among the providers of technologies necessary for decarbonizing the economy, most are young companies. Makers of solutions such as long-duration energy storage or carbon capture and storage tend to have limited scale, undiversified businesses, small balance sheets, constrained revenue and earnings, and limited track records of credit performance. These are all important metrics for lenders. Additionally, lenders frequently lack expertise in nascent technologies. As a result, the supply of financing may be constrained. Furthermore, available debt may be unsuitable. For example, hydrogen production requires long-term finance at low interest rates. Additionally, new technologies might struggle to meet technical

Charting sovereign risk in emerging markets: The IIF Emerging Markets ESG Scorecard

Climate risk and transition risk are beginning to feature more prominently in the sovereign-debt space, including in emerging markets. As highlighted in the recently updated Principles for Stable Capital Flows and Fair Debt Restructuring,[1] sovereign borrowers are seeing growing pressure from creditors seeking greater transparency on environmental, social, and governance (ESG) priorities, targets, and outcomes. The IIF's EM ESG Scorecard, built on an analysis of carbon efficiency, non-climate environmental performance, and social indicators (some of the key factors affecting sovereign climate transition outcomes), offers a useful analytical tool and framework for comparing sovereign ESG metrics across emerging and developing economies (exhibit).

[1] *The principles for stable capital flows and fair debt restructuring*, IIF, April 2021.

Exhibit. **Emerging markets vary widely in their commitment to environmental, social, and governance factors.**



Note: The IIF's ESG Country Scorecard examines how countries rank relative to peers on carbon efficiency, environmental protection, and social factors.
[1]Environmental, social, and governance.
[2]Includes demographics, gender inequality, Gini coefficient, human development, and press freedom.
[3]Includes agro-efficiency, biodiversity, deforestation, exported impact, and pollution.
[4]Includes CO_2-to-energy ratio, CO_2-to-imports per capita ratio, energy-to-GDP ratio, fuel exports, and renewables.
Source: Institute of International Finance

underwriting criteria and offer reliable offtake agreements. These challenges may often mean that critical decarbonization solutions cannot achieve cost parity with incumbent technologies and must rely on a combination of public funding, economies of scale, and investment in operational improvement to approach feasibility.

Uncertainty around the materialization of future demand may limit investor confidence. Technological performance, compatibility or path dependence with existing value chains, and uncertainty about policy and regulatory prospects can all complicate demand growth expectations. Unpredictable future demand and cash flows may also act as disincentives.

Nevertheless, projects are becoming more bankable due to recent policy shifts, declining technology costs, and corporate momentum. Several governments are expanding subsidies, tax credits, and guarantees to enable funding of the low-carbon transition. For example, in the United States, extensions and changes to tax credit programs under the Inflation Reduction Act are expected to almost double new solar and wind capacity in the country by 2030. The Department of Energy's Loan Programs Office also provided a first-of-its-kind loan guarantee of more than $500 million for hydrogen and energy storage facilities.[22] Amid falling prices, renewable technologies now account for the bulk of new power generation capacity.[23] The costs of utility-scale solar declined by 80 percent over the past decade,[24] and lithium-ion battery costs have fallen by 97 percent since 1991.[25] Many large companies have set net-zero targets and are investing through various enablement schemes (see box "Voluntary carbon markets—an adjacent opportunity").

The net-zero transition provides an opportunity for financial institutions to play a key role in decarbonizing the real economy and unlock growth, but they must collaborate with policy makers

The total annual opportunity for private financial institutions under a net-zero-by-2050 scenario may amount to $3.5 trillion of direct financing opportunities per year. This is based on the understanding that about 55 percent of investment needs can be met by private capital.[26] Between 2022 and 2050, the opportunity for commercial banks would be $2.0 trillion to $2.6 trillion annually, while asset managers, private equity, and venture capital funds could capture between $950.0 billion and $1.5 trillion annually (Exhibits 7A and 7B).[27] A significant proportion of the opportunity for private financial institutions is concentrated in the mobility, power, and buildings sectors (33 percent, 27 percent, and 27 percent of total private investment, respectively).[28] This is calculated based on institutions' potential to engage in the investment capital spending required by regions and sectors. It considers projected technology development profiles, market maturity, and risk/return profiles, and matches these to investors' risk/return profiles.

Multiple stakeholders must collaborate to finance the transition. Financial institutions are uniquely placed to tackle the large-scale capital reallocation required. However, they will require the proactive involvement of governments and multilateral institutions, which can apply policy, fiscal, and regulatory tools to encourage and facilitate capital deployment. In particular, public institutions can play a crucial role in helping financial institutions manage risks, for example through guarantees, insurance, and clear regulatory signals.

Blended finance could unlock further opportunities for the private sector, especially in EMDEs. Public investment can help crowd in

Voluntary carbon markets—an adjacent opportunity

Voluntary carbon markets (VCMs), which link demand from companies to decarbonize with suppliers of solutions, will play an important role in enabling net-zero emissions.

The supply of voluntary carbon credits has grown, with supply in some market segments outpacing demand. In other areas, such as carbon removal technologies, supply has yet to scale to meet corporate needs. Voluntary carbon credit prices vary significantly by location and project type, with most credits ranging from $1 to $9 per ton. These prices are lower than those seen in compliance carbon markets (where prices range from $10 to $150 per ton).[1] VCMs are expected to grow from $2 billion[2] in 2021 to more than $50 billion[3] by 2030, but for now they remain relatively small and fragmented.[4]

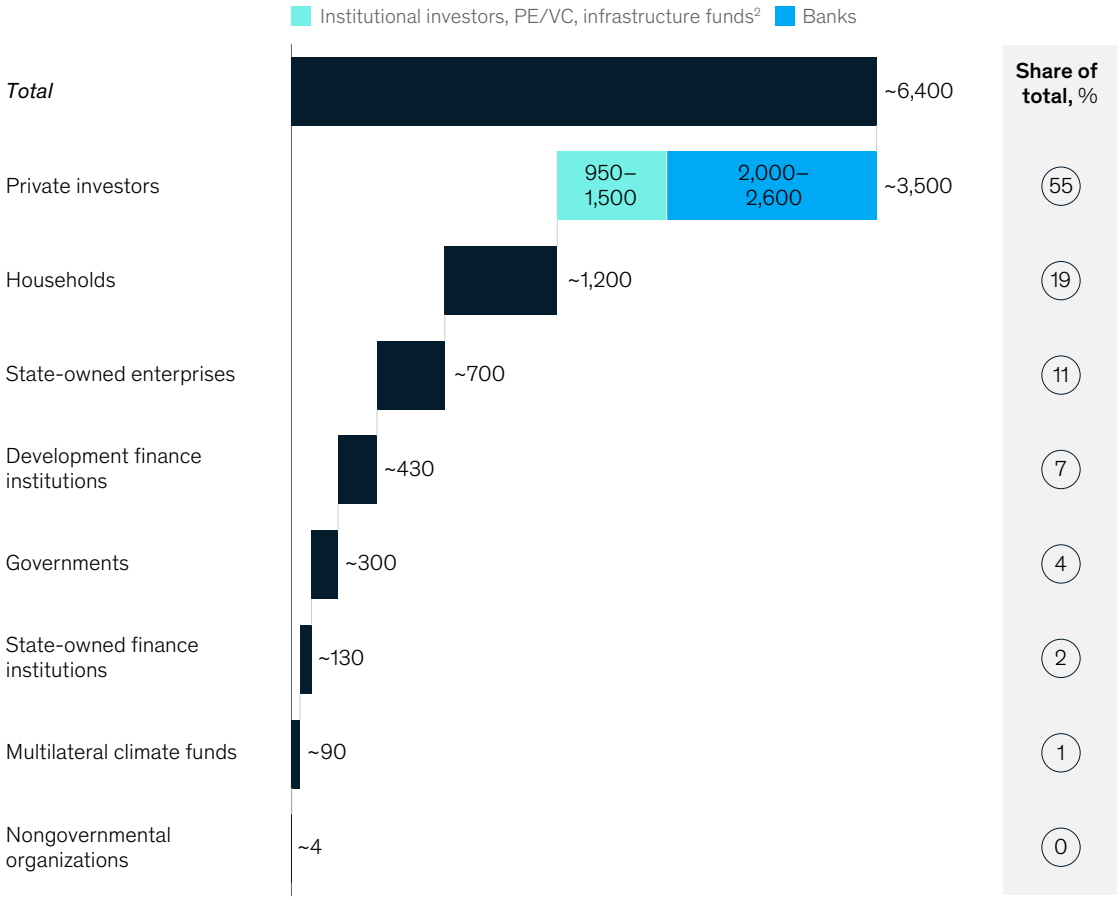
The rules around VCMs continue to mature. The Integrity Council for the Voluntary Carbon Market recently closed a public consultation on its draft Core Carbon Principles and Assessment Framework,[5] a global threshold standard for high-quality carbon credits. On the demand side, the Voluntary Carbon Markets Initiative is developing standards for how carbon credits should be considered in the context of different types of net-zero claims.[6]

Regulators are also examining their potential role in VCMs. The US Commodities Futures Trading Commission in October 2022 closed its request for information on all aspects of climate-related risk, including VCMs.[7] The International Organization of Securities Commissions has published a discussion report for public consultation that closes in February 2023.[8] These bodies can provide guidance that could help market participants navigate VCMs in the future.

1 Ecosystem Marketplace, ecosystemmarketplace.com/. Accessed on January 4, 2023.
2 Annabelle Palmer, "Sovereign carbon credits unsettle voluntary carbon markets," Environmental Finance, October 2022.
3 Christopher Blaufelder, Cindy Levy, Peter Mannion, and Dickon Pinner, "A blueprint for scaling voluntary carbon markets to meet the climate challenge," McKinsey, January 29, 2021.
4 Voluntary carbon markets chartbook Q2 2022, IIF, July 2022.
5 "The core carbon principles," Integrity Council for the Voluntary Carbon Market, 2022.
6 *Voluntary Carbon Markets Integrity Initiative*, vcmintegrity.org/. Accessed on January 4, 2023.
7 "CFTC extends public comment period on request for information on climate-related financial risk," Commodity Futures Trading Commission, July 18, 2022.
8 *Voluntary carbon markets: Discussion paper*, International Organization of Securities Commissions, November 2022.

private money where risks are higher than normal (see box "Blended finance opportunities in Asia"). Blended finance can play a role in sweetening individual projects and portfolios through risk mitigation, credit enhancement, and improved returns. It can be applied through a variety of instruments. For example, grants are a simple but effective way to increase returns. Equity and debt from public blended-finance sources can support private-sector investment in new technologies or for the early retirement of high-emitting assets. Guarantees and insurance can be targeted to reduce specific risks, such as political risk or off-taker risk, which are especially relevant in EMDEs. By enhancing credit profiles, these mechanisms facilitate the deployment of private

Exhibit 7A. **Private financial institutions could finance about 55 percent of net-zero investment needs.**



The analysis in this report assumes an evolution of carbon taxes globally in line with the International Energy Agency (IEA) 2021 report *Net zero by 2050: A roadmap for the global energy sector*. Opportunities for financial institutions outlined in this section hold under the NGFS Net Zero 2050 Scenario and the assumptions behind McKinsey's Transition Finance Model (TFM). The TFM performs a theoretically optimal allocation by matching investment characteristics with investor preferences. Investment allocation is based on the historical role of different capital sources in green finance, adjusted to account for the evolution in the risk/return profile of such opportunities in the climate scenario under consideration. The TFM assumes that individuals and companies are forward looking and have perfect foresight. They choose which technology to invest in based on the total cost of ownership (that is, the relative cost of low- and high-emission technologies). Individuals and companies consider carbon tax commitments by governments to be fully credible. The TFM also assumes that the global economy can meet the investment needs of the transition. That is, there are no limits to the supply of capital (the supply side of capital markets is not modeled); there are no limits to the provision of capital to any world region; there are no budgetary constraints for governments. The TFM allows us to assess how the investment allocation changes for different assumptions regarding the carbon tax level, the discount rate, learning rates, and energy prices. The TFM does not model the investment needs required to reach given climate goals. These are an exogenous input in the TFM. The TFM does not model agents' spending choices for different price levels. Instead, agents' choices are embedded in the investment inputs used by the TFM. The TFM does not explicitly model government policies other than carbon taxes and subsidies. Last, the TFM does not model the supply constraints of capital markets or technology deployment assumptions.

Note: All figures are approximates; totals may not add up due to rounding.

[1]Investment needs based on the Network for Greening the Financial System's (NGFS) Net Zero 2050 scenario.

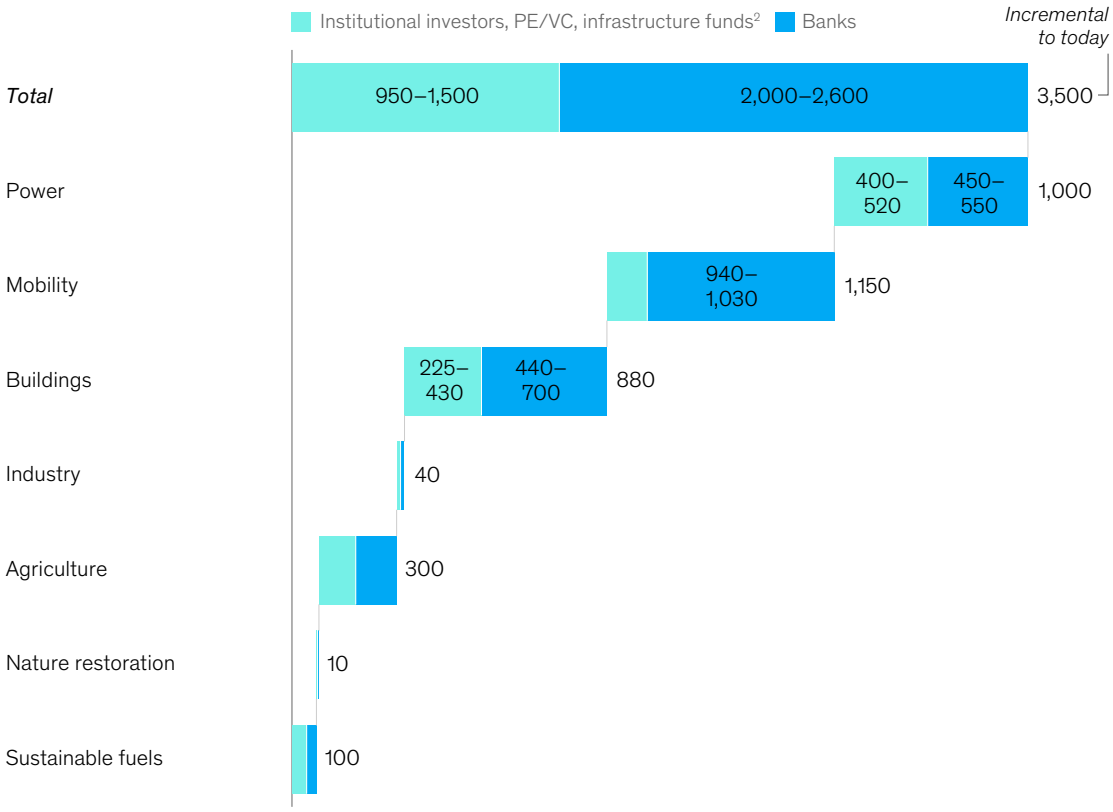
[2]PE is private equity, and VC is venture capital. For institutional investors and PE and VC funds, we are assuming a best-case scenario in which they can meet all investable equity in private corporations globally. This may not be possible in all markets, especially in emerging markets and developing economies where capital markets are less developed.

Source: McKinsey's Transition Finance Model (TFM); NGFS Net Zero 2050 Scenario

capital in regions that would otherwise struggle to access financing. In addition, technical assistance can boost returns and reduce risk while also generating long-term impact through upskilling and demonstration effects. Blended finance is not a silver bullet—the economics of projects depend on a wider set of awareness, policy, regulatory, and market development actions. However,

Exhibit 7B. **The investment needs of the power, mobility, and buildings sectors make up most of the $3.5 trillion from private investors.**

Average annual investment needs for low-emission assets,[1] 2022–50, $ billions



The opportunity for private sector investment includes both investments that would be supplied by the private sector (without public intervention) and investments that are crowded in by public sector investments. The analysis in this report assumes an evolution of carbon taxes globally in line with the International Energy Agency (IEA) 2021 report *Net zero by 2050: A roadmap for the global energy sector*. Opportunities for financial institutions outlined in this section hold under the NGFS Net Zero 2050 Scenario and the assumptions behind McKinsey's Transition Finance Model (TFM). The TFM performs a theoretically optimal allocation by matching investment characteristics with investor preferences. Investment allocation is based on the historical role of different capital sources in green finance, adjusted to account for the evolution in the risk/return profile of such opportunities in the climate scenario under consideration. The TFM assumes that individuals and companies are forward looking and have perfect foresight. They choose in which technology to invest based on the total cost of ownership (ie, the relative cost of low- and high-emission technologies). Individuals and companies consider carbon tax commitments by governments to be fully credible. The TFM also assumes that the global economy is able to meet the investment needs of the transition. That is, there are no limits to the supply of capital (the supply side of capital markets is not modeled); there are no limits to the provision of capital to any world region; there are no budgetary constraints for governments. The TFM allows us to assess how the investment allocation changes for different assumptions regarding the carbon tax level, the discount rate, learning rates, and energy prices. The TFM does not model the investment needs required to reach given climate goals. These are an exogenous input in the TFM. The TFM does not model agents' spending choices for different price levels. Instead, agents' choices are embedded in the investment inputs used by the TFM. The TFM does not explicitly model government policies other than carbon taxes and subsidies. Lastly, the TFM does not model the supply constraints of capital markets or technology deployment assumptions.
Note: All figures are approximates; totals may not add up due to rounding.
[1]Investment needs based on the Network for Greening the Financial System's (NGFS) Net Zero 2050 scenario.
[2]PE is private equity, and VC is venture capital. For institutional investors and PE and VC funds, we are assuming a best-case scenario in which they can meet all investable equity in private corporations globally. This may not be possible in all markets, especially in emerging markets and developing economies where capital markets are less developed.
Source: McKinsey's Transition Finance Model (TFM); NGFS Net Zero 2050 Scenario

when complemented by these, it can effectively improve the bankability of projects and create new opportunities for private investors. For these reasons, it will be important to optimize rollout and effectiveness globally.

Blended finance opportunities in Asia

In the Asia–Pacific (APAC) region,[1] blended finance has the potential to unlock 40 percent of annual net-zero capital for low-emission assets ($900.0 billion out of the $2.4 trillion annual investment).[2] Investment opportunities that could be harnessed using blended finance include near-bankable projects, which may carry moderate risk but sufficient returns.[3] Between 2021 and 2030, the largest annual capital expenditure needs in the APAC region that could be met through blended finance include wind power generation, power transmission and distribution, solar photovoltaic panels, crop production, electric vehicles, commercial heating, and retrofits (exhibit).

Wind power generation in the APAC region requires $240 billion in annual investment between 2021 and 2030, about 52 percent of which can be met through public and private investment. Blended finance has the potential to unlock an additional $115 billion. Retrofits are another example of blended-finance opportunities in Asia because they exhibit relatively high expected returns and low risk. Retrofits in the APAC region represent a $120 billion annual investment opportunity between 2021 and 2030, 25 percent of which could be met through blended finance. Investment in these technologies could be provided through a mix of private investment and public blended-finance instruments. Direct public blended-finance instruments include grants as well as debt and equity. Public blended-finance instruments that enable the deployment of private investment include guarantees, insurance, and technical assistance.[4] The public-to-private leverage ratio of these public blended instruments would be 1.0 to 1.5 for investment grants and for debt and equity, and 1.0 to 2.3 for technical assistance, guarantees, and insurance.

By contrast, carbon capture, utilization, and storage (CCUS) technologies and hydrogen for industrial clusters are examples of emerging low-emission opportunities in Asia where risk-adjusted returns are just above the threshold required to attract blended-finance investment. Given that these technologies are not forecast to achieve scale until after 2030, investment volumes are expected to be lower ($40 billion annual investment opportunity between 2021 and 2030, a quarter of which could be provided through blended finance). For these technologies, blended-finance instruments would need to be structured to place greater emphasis on return support and direct investment.

[1] Asia–Pacific is defined as all ten countries in the Association of Southeast Asian Nations (ASEAN) region plus China, India, Japan, South Korea, Australia, and New Zealand (excluding Pakistan, Bangladesh, and Central Asia).

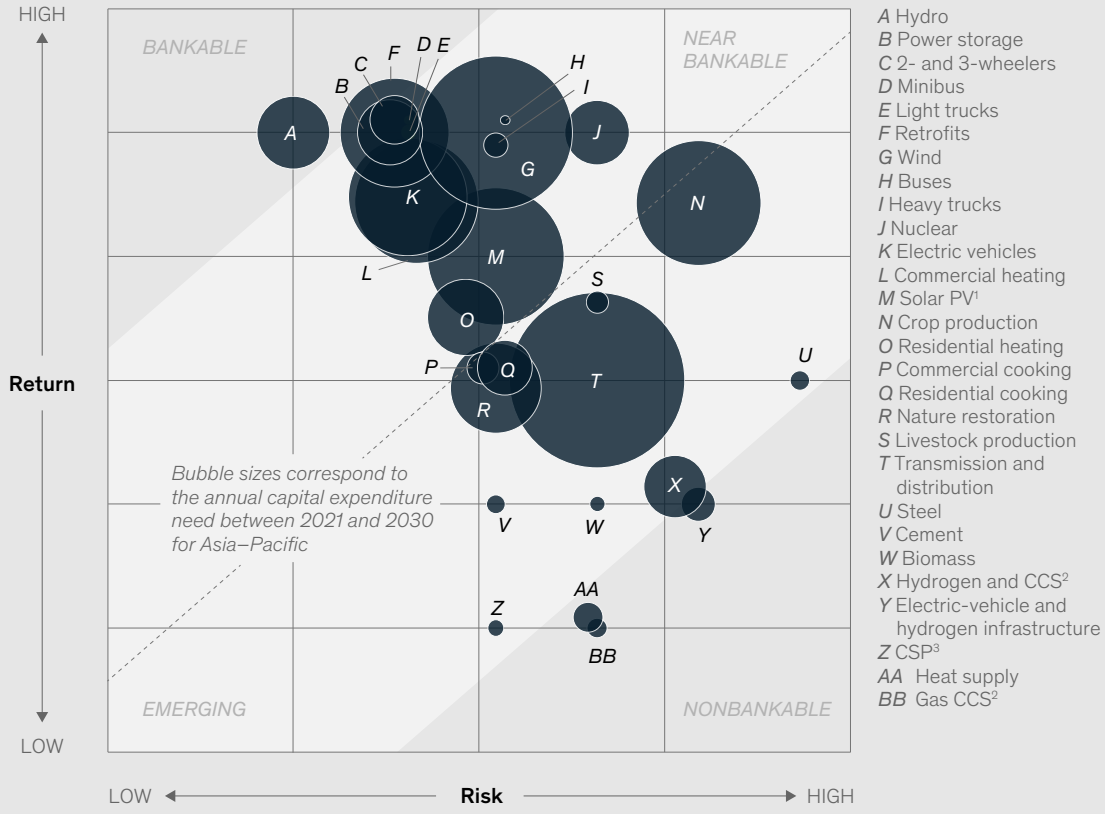
[2] This is in addition to the opportunity for private investors discussed earlier in this chapter.

[3] Return is calculated as the difference between marginal abatement cost and expected regional carbon price. Risk is estimated using quantitative country-specific development indicators and Technology Readiness Level.

[4] Unlockable blended finance is the total of public blended-finance direct-investment instruments and mobilized private finance. Public blended finance enabling investment instruments mobilize additional private investment but do not contribute toward blended capital investment directly.

Exhibit. **Blended finance has the potential to unlock about 40 percent ($900 billion annually) of net-zero capital needs in Asia.**

Average annual investment under the NGFS[1] Net Zero 2050 scenario, 2020–50, $ trillions



Note: Return is calculated as the difference between marginal abatement cost and expected regional carbon price. Risk is estimated using quantitative country-specific development indicators and technology readiness level.
[1]Photovoltaics.
[2]Carbon capture and storage.
[3]Concentrated solar power.
Source: *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022; McKinsey analysis based on the McKinsey Transition Finance Model (TFM)

Challenges for financial institutions

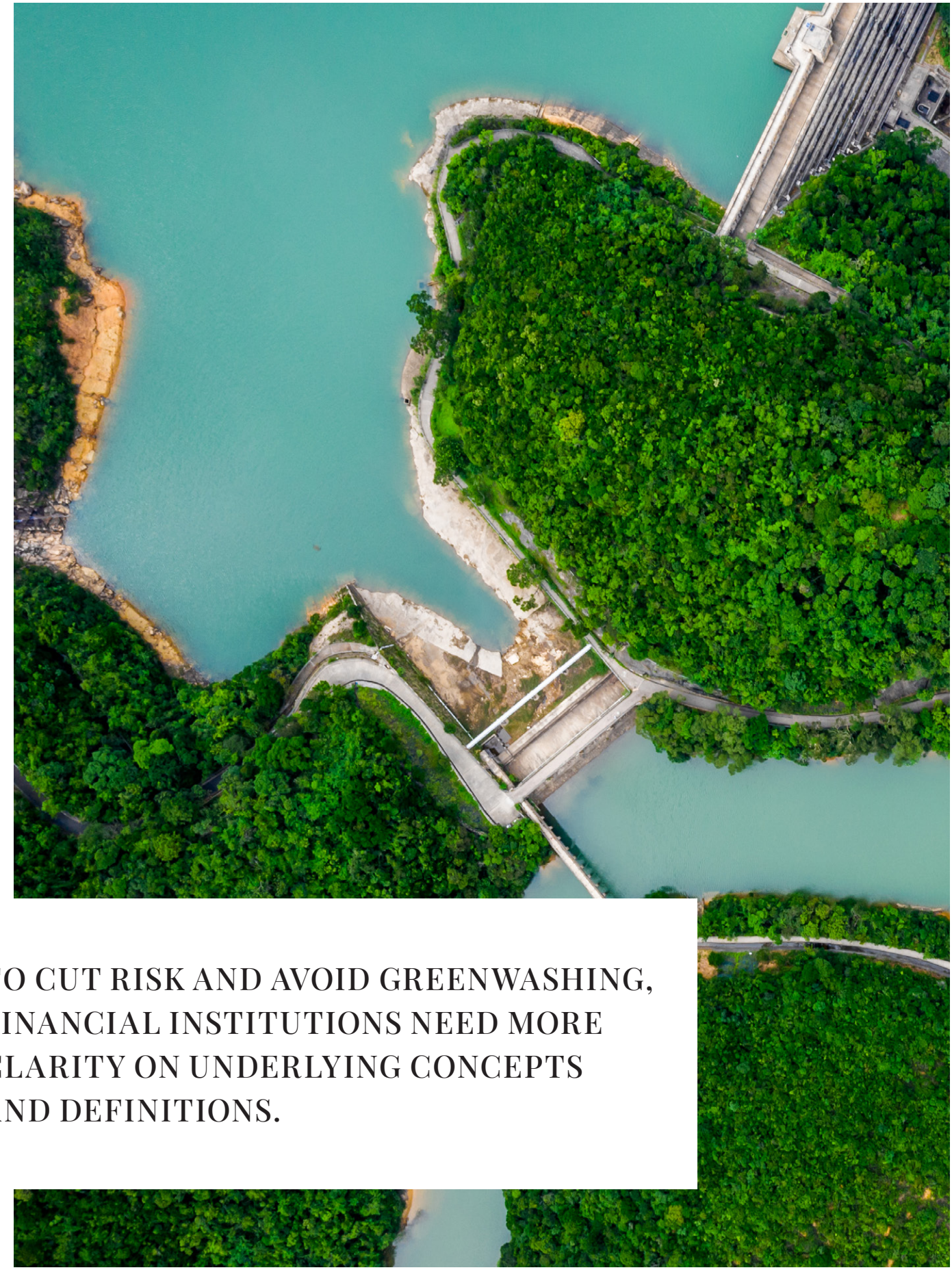
FINANCIAL INSTITUTIONS FACE AN ARRAY OF CHALLENGES AS THEY SCALE UP CAPITAL TO SUPPORT THE NET-ZERO TRANSITION AND MANAGE RISKS

Many financial institutions have set net-zero targets. At the time of writing, more than 550 financial institutions, representing more than $175 trillion in assets, have joined the Glasgow Financial Alliance for Net Zero (GFANZ).[29] More than 195 financial institutions have either set targets in line with the Science Based Targets initiative (SBTi) or will do so in the next two years.[30] Thirty leaders of major financial institutions have joined the Global Investors for Sustainable Development initiative.

These metrics demonstrate widespread ambition and commitment, but financial institutions continue to face headwinds in translating initiatives into real impact. For example, activities including transition planning, implementation, financing, advisory, and engagement have led to a proliferation of frameworks and approaches. To cut risk and avoid greenwashing, financial institutions need more clarity on underlying concepts and definitions.

Different frameworks for defining and characterizing transition finance—focusing on product, sectoral, and institutional levels—have developed in parallel. Institutions must grapple with informational resources and rules, including local guidance on the issuance of securities and sale of financial products, jurisdictional taxonomies and thresholds for sectoral transitions, scenario-based sectoral pathways, and institutional frameworks for transition planning in line with net-zero goals. Against this background, there is little room for global standards to evolve.

Transition frameworks take different approaches to characterizing pathways that might include purely green assets, enabling non-green assets that could be transitioned to green assets,[31] or associated with managed phaseouts. For example, the International Energy Agency (IEA) focuses on investment in assets that "provide emissions reductions but do not themselves deliver zero emissions energy or energy services."[32] Along similar lines, a review conducted by the OECD found that transition finance is generally understood to target "entities or economic activities that: (i) are emissions-intensive, (ii) may not currently have a low- or zero-emission substitute that is economically available or credible in all relevant contexts, but (iii) are important for future socio-economic development."[33] Instead, GFANZ looks at products and services that are necessary to support an orderly, real economy transition to net zero as described by four key financing strategies that finance or enable: "1) entities and activities that develop and scale climate solutions; 2) entities that are already aligned to a 1.5 degrees C pathway; 3) entities committed to transitioning in line with 1.5 degrees C–aligned pathways; or 4) the accelerated managed phaseout of high-emitting physical assets."[34] Other entities, such as the UNSG HLEG-



TO CUT RISK AND AVOID GREENWASHING, FINANCIAL INSTITUTIONS NEED MORE CLARITY ON UNDERLYING CONCEPTS AND DEFINITIONS.

NZCNSE[35] and the UK Transition Plan Taskforce,[36] do not provide specific guidelines on the scope of finance for the transition but require institutions to be transparent about the definitions they adopt.

Other differences in frameworks pertain to sectoral eligibility and thresholds. For instance, product standards developed by the International Capital Market Association[37] allow all sectors to be eligible for carbon-intensive investment, while the Climate Bonds Initiative[38] and the European Union (EU) Taxonomy Regulation[39] provide sectoral guidance for the activities they classify as transitional. These frameworks also differ in their approaches to labeling of financial products.

The lack of a standardized approach to determining the scope of transition finance and eligible instruments and sectors has emerged as one of the key points of debate in international financial regulatory dialogue in 2022, with tracks of work under way within the G-20 Sustainable Finance Working Group, the International Platform on Sustainable Finance, OECD, and elsewhere.

The relationships among entities setting ground rules, national regulation, and third-party assessments are often complex, indirect, and in flux (Exhibit 8). This ingrained fragmentation is a potential brake on ambition amid rising concern over greenwashing.

Current incentives are not aligned with the practicalities of achieving the transition

There is an emerging understanding, reinforced by analysis from the IEA,[40] GFANZ,[41] and the McKinsey Global Institute,[42] that reducing emissions in the real economy requires capital to be channeled not only to green solutions but also to carbon-intensive sectors, provided individual firms have adequate transition plans in place. This may require an array of financing approaches across the green to carbon-intensive spectrum in the short and medium terms.

These realities are raising challenging questions, including whether established sets of metrics are fit for purpose in a transition financing context. For instance, metrics linked to financed emissions, while relevant for a number of applications, including mapping the overall emissions profile of a financial institution's portfolio, could potentially provide incentives for divestment from high-emitting sectors or companies.[43] Frameworks developed by entities such as GFANZ and its constituent entities have made efforts to address these challenges, but residual risks remain, including relating to reputation.

The absence of a targeted framework of incentives that creates enabling conditions for the managed phaseout of high-emitting assets further exacerbates the difficulty of investing in this space. Recent public–private partnerships, including Just Energy Transition Partnerships,[44] have highlighted some of the considerations associated with the early retirement of high-emitting assets. For example, these assets often provide significant local employment and critical services. Additionally, managed phaseouts could create the risk of sudden value loss due to stranding, and cash flows may be affected.[45]

Unlocking net-zero opportunities requires different types of capital, but the number of investable opportunities is currently limited

As described in the previous section, our analysis indicates that different sources of capital are better suited to different types of financing applications, considering sectoral, firm, and project-level characteristics, including levels of technology maturity. On the investor side, the suitability of a given transition investment will be affected by factors including risk appetite, return expectations, investment horizons, and existing climate or sustainability-related policies. Venture capital

Exhibit 8. **Many organizations are involved in writing the rules of the road for the net-zero transition.**

Multilateral recommendations

UNSG HLEG NZ Commitments of NS Entities[1]
- "Integrity Matters" Report

UNFCCC[2] **Race To Zero campaign**
- Race to Zero Criteria V3.0

Guidance on net-zero transition planning and finance for financial institutions

Financial-sector alliances

GFANZ
- WS1.1 Recommendations and Guidance on Financial Institution Net-zero Transition Plans
- WS1.2 Guidance on Use of Sectoral Pathways for Financial Institutions
- WS1.3 Expectations for Real-economy Transition Plans
- WS1.4 Portfolio Alignment Measurement: Enhancement, Convergence, and Adoption

Net Zero Asset Owner Alliance (NZAOA)
- Target-setting Protocol

Net-Zero Banking Alliance (NZBA)
- Guidelines for climate target setting for banks, clarifications
- Transition Finance Guide

NZ Insurance Alliance (NZIA)
- Target-setting Protocol (Consultation completed, release date unknown)

Other Alliances (TBD)

Other initiatives

IICGG
- IIGCC/TPI Pilot Indicators to Assess Banks on Transition to Net Zero

Science Based Targets initiative (SBTi)
- Science-based Targets for FIs
- Draft "Net Zero Foundations" for FIs

SMI
- FSTF Net Zero Practitioner's Guide

Inputs and data

Macroeconomic scenarios and pathways

NGFS
- Phase II Reference Climate Scenarios

IEA
- Net zero by 2050 Roadmap

IPCC
- 1.5°C Sectoral Transformation Pathways

Data Sources

GFANZ
- Net Zero Data Public Utility

Other initiatives
- CA100+ Net Zero Company Benchmark
- World Benchmarking Alliance Climate and Energy Benchmark

Guidance on real economy sectoral transition pathways

GFANZ
- WS1.2 Transition pathways & finance needs in Aviation, Steel, Oil & Gas

Science-based Targets Initiative (SBTi)
- Sectoral Decarbonization Approach
- Net Zero Standard for Corporates

NZAOA
- **Sectoral Pathways to Net Zero Emissions:** Energy, Utilities, Transport, Steel, Cement

Climate Action 100+
- **Global Sector Strategies:** Net Zero transitions in Aviation, Steel, Food & Beverage, Electric Utilities
- Standard for Net Zero for mining sector

NZBA
- **NZBA Sector Guidance:** Oil & Gas, Power, Real Estate, Auto & Trucks, Iron & Steel, Coal Mining, Agriculture, Shipping, Aluminum, Aviation, Cement

Transition Pathway Initiative (TPI)
- **TPI Tool and Database:** GHG management and carbon performance across 11 sectors

UNEPFI[3]
- **Sector Briefs:** Oil & Gas, Agriculture, Real Estate, Industrials, Transport, Metals & Mining, Power Gen, Tech & Services

Other Real Economy Net Zero Initiatives
- Mission Possible Partnership (MPP)
- World Business Council for Sustainable Development (WBCSD)

Use of carbon offsets

GFANZ and Constituent entities
- NZAOA, NZBA position papers on offsets

Global and jurisdictional regulatory, supervisory, and policy frameworks

Global Standards and Frameworks
- ISSB Standards
- NGFS WS1 Guidance supervisory consideration of transition plans

National-level frameworks
- UK requirements to disclose transition plans by 2023
- UK Transition Plan Taskforce report consultation

Disclosure policy frameworks and proposals
- EU CSDDD[4]
- EU ECB: Statements on need for regulation of transition plans
- EU EFRAG[5]
- HKMA: Sound practices supporting the transition to carbon neutrality
- US SEC: proposed climate risk disclosure rule

[1]United Nations' High-level Expert Group on the Net Zero Emissions Commitments of Non-state Entities. [2]United Nations Framework Convention on Climate Change. [3]United Nations Environment Programme Finance Initiative. [4]EU Corporate Sustainability Due Diligence Directive. [5]EU European Financial Reporting Advisory Group.
Source: Institute of International Finance

funds are better positioned to hedge the risk of investing in early-stage development technologies. Once technologies are proven, private equity funds, infrastructure funds, and corporate capital may join, bringing the capital required to scale. Debt providers, including banks, private debt funds, and the bond markets, may be more risk averse and therefore attracted to proven technologies. The industry needs to design innovative solutions that match capital to needs.

As risk appetites evolve and financial learning accelerates, different types of financial institutions might end up competing over the same financing opportunities. Asset managers and insurers often use intermediaries to invest in transition finance opportunities. However, they may in due course go direct to market and compete with intermediary investors. This would complement growing reputational and stakeholder pressure to deploy capital in support of the transition. However, the number of quality, investable opportunities may be insufficient. Additionally, the volume of capital in play may lead to green-asset price inflation.

Institutions need better data and new tools and capabilities to capture opportunities

Data are a critical enabler for transparency and accurate steering of capital allocation decisions. But data quality and availability remain a persistent challenge. The quality and availability of climate data remain a persistent challenge for most financial institutions. This stems partly from divergent requirements for corporate disclosures as well as a lack of common approaches for counterparty data collection. For example, the feedback from the European Central Bank stress test in July 2022 revealed that more than 70 percent of climate data is based on proxies, resulting in significant deviations.[46] Significant efforts are required to improve data quality and accessibility.

High-complexity, continually evolving ecosystems and technologies for decarbonization require financial institutions to build technical capabilities across their organizations. Climate-related investment needs and opportunities tend to be highly technical, requiring deep expertise within a specific sector, regulatory context, and technology. Specific knowledge is needed to effectively engage with each decarbonization theme. Private equity firms and venture capital funds that specialize in energy assets are ahead of the curve, but the rest of the industry needs to play catch-up. In particular, banks may need to acquire more climate-related credit expertise. In a recent survey just 11 percent of banks said their internal climate-related capabilities were "adequate to a great extent," while 50 percent said they had moderate climate-related capabilities, and about 40 percent said they had some capabilities.[47]

To address these challenges, institutions may consider developing transition plans that cascade ambition across the organization. Transition plans can help financial institutions capture business opportunities. Guidelines such as those published by GFANZ,[48] the Net-Zero Banking Alliance (NZBA),[49] and the UK Transition Plan Taskforce[50] offer a preliminary overview of what should be included. However, institutions need to experiment in adapting the guidelines to their own circumstances.

The industry has made progress in transition planning and practice, but further efforts are required

IN LATE 2022, WITH THE SUPPORT OF MCKINSEY & COMPANY, THE IIF CONVENED A SERIES OF EIGHT WORKSHOPS ACROSS EUROPE AND NORTH AMERICA FOCUSED ON NET-ZERO PLANNING AND PRACTICE.

They were hosted by IIF member institutions and brought together key players from the industry (IIF members, including banks, asset managers, insurers, credit rating agencies, public-sector entities, and other stakeholders) to share their experiences in addressing the challenges of financing the transition.

Workshops were structured to reflect jurisdictional transition dynamics, local and regional financial-market contexts, the current levels of development of transition planning and practice in financial and corporate sectors, and evolving policy and regulatory expectations.

The workshops revealed that the financial industry is making progress on developing and implementing transition plans, with many financial institutions now seeking to operationalize their net-zero targets across business areas and functions, including the development of new products and services, client engagement and advisory, and broader stakeholder relationship management. However, further work is needed to fully operationalize transition plans, reflecting the current state of frameworks and methodologies, persistent data availability and quality challenges, and the evolving policy and regulatory environment.

As described in the previous section, there are multiple market-based and official-sector frameworks that financial institutions may consider to inform their transition planning and finance activities. However, lessons learned are limited at present, reflecting the fact that many institutions are in the early stages of developing their strategies. Challenges, emerging approaches, and insights are clustered in five key areas: foundations, implementation strategy, engagement strategy, metrics and targets, and governance.

VARIOUS PORTFOLIO ALIGNMENT TOOLS ARE AVAILABLE, REQUIRING NUMEROUS DESIGN JUDGMENTS.

Foundations: Organization-wide net-zero objectives, targets, timelines, and priority approaches

A key first step is to set foundational goals for alignment of business activities with the needs of a net-zero future, reflecting science-based pathways for emission reduction. Leading market-based frameworks require firms to codify their net-zero strategies through organization-wide objectives and targets, with clear timelines and priority sectors and activities.

Current challenges

Setting targets is an essential first step for unlocking long-term business growth. Financial institutions that take early action to embed transition targets and financing goals into their core strategies will be well positioned to harness growth opportunities and manage risks.

Evolving voluntary requirements for net-zero target setting pose an array of challenges to institutions seeking to formalize their net-zero ambitions. The overlapping nature of guidance pertaining to net-zero targets and related expectations (including the development of transition plans and disclosures on progress toward interim targets) has resulted in a situation where financial institutions may face trade-offs when considering which frameworks to apply and in what manner. Indeed, frameworks for assessing targets are still being developed in certain areas (for example, standards for net-zero-aligned insurance underwriting), and common approaches are lacking. For instance, there is limited agreement on how institutions should reconcile the need to reduce financed emissions with financing reduced emissions. There are also conflicting timelines between industry initiatives, different deadlines for setting targets, and diverse requirements such as minimum coverage.

Various portfolio alignment tools are available, requiring numerous design judgments. For example, it is tough to build a portfolio management tool that prioritizes engagement over divestment.[51] Institutions may need to evaluate counterparties on their rates of transition rather than on today's emissions in absolute terms, account for their different decarbonization rates, and make projections about their future transition performance. Additional or complementary requirements developed by industry alliances (for example, NZBA, UNEP Finance Initiative) further complicate the menu of methodological guidance.

The process of setting credible, influential targets is a resource-intensive exercise. Institutions face a steeper learning curve than they used to and a higher bar for their ambitions, in the scope of business lines or portfolios covered by targets. These shifting goalposts may create particular challenges for firms in emerging market jurisdictions, including where official guidance is not in place or reflects timelines beyond 2050.

The potential evolution of compliance expectations. In an evolving regulatory landscape, institutions are wary of making binding commitments. This may be especially relevant in the context of increased scrutiny announcements and the risk of greenwashing. The concern is aggravated by a potentially insufficient stakeholder appreciation of the importance of transition financing alongside green financing. A further open question pertains to the inputs of central banks and supervisors as they seek to deepen their understanding of the dynamics of climate-related financial stability risks.[52]

Different types of financial institutions face different levels of scrutiny and recognition mechanisms for reporting reduced emissions. Some institutions face more stringent scrutiny than others, leading to different reward and recognition mechanisms. For example, banks face stricter requirements on reporting Scope 3 emissions than private equity firms. Less scrutiny discourages transparency and implies the absence of a reward mechanism.

Financial institutions may lack internal capabilities to analyze climate data, build in-house scenarios, and set science-based targets. Building internal capabilities and engaging resources is key for financial institutions to make informed decisions when setting targets. While externally developed scenarios (such as the International Energy Agency Net Zero Emissions by 2050 Scenario) are used for comparability of targets, these may need to be supplemented with in-house scenarios that reflect how the transition will affect the business. For instance, assumptions on how the transition will play out (for instance, development of CCUS, assumptions on new exploration) need to be aligned with business strategy to inform useful, institution-specific decisions.

Emerging practices and insights

Validating underlying targets with internal and external stakeholders. Many financial institutions currently do not seek assurance. Those who do typically seek "limited assurance" rather than "reasonable assurance," which limits the scope of independent assurance (what is covered and the amount of testing effort required).[53] However, some institutions set out detailed internal validation processes prior to announcing their targets, aiming to ensure that the risks are fully accepted across the organization. Senior representatives across business areas (including the lines of business, sustainability, finance, risk, legal, and investor relations departments) can be allocated oversight and decision-making responsibilities for methodological choices in target-setting processes, with finance and risk functions involved in validation of internal data used to calculate metrics underlying different targets. The model used to estimate financed emissions and emissions reduction is governed through the institution's model governance framework and should go through an extensive validation process. An independent third party can be appointed to audit the methodological choices, model, outputs, and proposed disclosures prior to disclosure. Finally, finance, legal, and investor relations can conduct an extensive internal review process of the proposed disclosures.

Setting targets at multiple levels within the organization. Recognizing the complexity of financing the transition, some institutions have set targets at multiple levels, including portfolio, sub-portfolio, sector, and asset class.

Benchmarking against other institutions. By comparing themselves with peers, institutions can validate their approaches. Firms can leverage publicly available information such as company websites, SBTi, the Partnership for Carbon Accounting Financials (PCAF), or industry forums including GFANZ.

Case study: UBS

Case study provided by UBS. Further background is found in the UBS Climate Report 2021.

Since UBS launched its first climate strategy in 2006, the company has continued to evolve its approach to one of the critical challenges of our time. UBS has actively supported efforts to transition to a lower-carbon economy; for example, the company has been a member of the Task Force on Climate-related Financial Disclosures since its inception in 2015 as an initial member of both the Net Zero Banking Alliance (NZBA) and Net Zero Asset Manager Initiative (NZAMI).

In 2021, UBS extended its climate strategy by committing to reach net-zero greenhouse-gas (GHG) emissions resulting from all aspects (Scopes 1, 2, and 3) of its business by 2050, with intermediate milestones. Specifically, UBS focuses its ambitions on:

- achieving net-zero GHG emissions resulting from all aspects (Scopes 1, 2, and 3) of its business by 2050, with intermediate milestones established to ensure progress
- mobilizing capital toward investment in a low-carbon economy
- assisting financing clients with their transition to a low-carbon economy

For initial target setting under NZBA standards, UBS identified three priority sectors: fossil fuels, power generation, and real estate (commercial and residential). The exhibit below shows respective 2020 baselines and the targets UBS has set for 2030. These sectors represent a substantial share of both UBS's loan book and its overall financed emissions.

The targets are in relation to benchmark scenarios that portfolios should follow to support temperature objectives outlined by the Paris Agreement. The benchmark scenario is derived from the International Energy Agency (IEA) 2021 Net Zero by 2050 data, which are widely accepted by the scientific community among the models that limit global warming to 1.5°C.

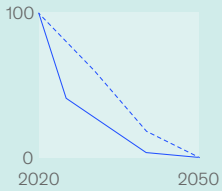
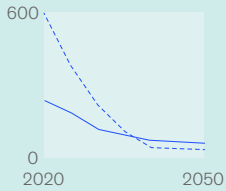
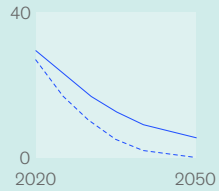
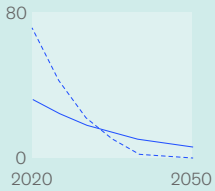
For the fossil-fuel and power generation sectors, proposed reductions represent commitments in line with the IEA scenario. With regard to the fossil-fuel sector, emission reductions are measured in absolute terms, including exploration, production, and refinery activities, as well as integrated companies operating across the value chain. The power generation sector is assessed with an intensity metric that monitors emissions related to the production of electricity and promotes a move toward an increasing share of renewable-energy sources.

To estimate its emission baselines, UBS relied on data disclosed by clients, data from specialized third-party providers, and internal data. Current limitations on the availability of emission data required the company to include approximations in the calculations—for example, by applying proxy values where specific data is not yet available. The company expects the availability and quality of emission data to improve in the next few years, and it may adjust calculations accordingly.

In a nod to transparency, UBS gave its shareholders a say on climate vote in 2021. The company recognizes that meeting the ambition of the Paris Agreement requires regulatory frameworks that support the transition to a low-carbon economy. As the world drives toward a low-carbon future, UBS will adjust its ambition as warranted in response to new regulatory and technological developments.

Exhibit. UBS plans to address emissions in its lending book through several initiatives.

Emissions associated with financing of fossil fuels, power generation, and real estate (commercial and residential) and UBS's targets for 2030

Financing/ lending IEA Net Zero Emissions by 2050 Roadmap UBS	Fossil fuel, kt CO_2e (base: 100)	Power generation, kg CO_2e/MWh	Residential real estate, kg CO_2e/m^2	Commercial real estate, kg CO_2e/m^2
				
Lending volume 2020, $ billions	1.2	0.9	151.1	43.7
Lending volume 2021, $ billions	0.7	1.2	155.9	44.7
Emissions baseline 2020	3,781 kilotons CO_2e	238 kilograms (kg) CO_2e/MWh	30 kg CO_2e per square meter (m^2)	32 kg CO_2e/m^2
Emissions target 2030 versus baseline 2020, %	–71	–49	–42	–44
Notes	Reduction of absolute emissions (Scopes 1, 2, and 3)	Reduction of emissions intensity (Scopes 1, 2, and 3)	Reduction of emissions intensity (Scopes 1 and 2)	Reduction of emissions intensity (Scopes 1 and 2)

Note: These priority sectors represent both a substantial share of UBS's loan book and overall financed emissions. UBS is committed to the net-zero transition and is setting ambitious targets for each of the sectors above. At the same time, meeting the ambition of the Paris Agreement with a 1.5°C limit in global warming will require regulatory frameworks that support the transition to a low-carbon economy. As the world drives toward a low-carbon future, UBS will adjust its ambitions where warranted in response to new regulatory and technological developments.
Source: UBS

McKinsey & Company

Priorities for the way forward

Despite a fragmented and uncertain environment, financial institutions can take steps to set transition targets and timelines.[54]

Use target setting to address three key dimensions: managed phaseouts, carbon-intensive-to-green assets, and green assets. This could be done through portfolio ratios and include a breakdown of instrument types and quality. Targets should reflect:

- the phaseout of exposures to highly emissive activities with milestones and timelines to reduce financed emissions
- growing volumes of transition finance, financing the greening of carbon-intensive assets
- growing volumes of financing of green assets to finance emission reductions

Start by measuring financed emission baselines and projecting a portfolio momentum case. Measuring a baseline involves developing a clear view on emission volumes and risks, including the breadth of sector coverage, asset class coverage, the parts of the value chain included, GHG included, the scope of emissions, and the time period for the baseline. To this end, the industry should agree on a standard methodology for baseline assessment that is rigorous, publicly transparent, and consistent. Various emerging industry standards (such as those created by PCAF, SBTi, and the Paris Agreement Capital Transition Assessment) provide guidance.

Beyond a baseline assessment, financial institutions need to understand the trajectory of portfolio emissions at different milestones (2025, 2030) if no action is taken to curb financed emissions. A good momentum case needs to be derisked and account for realistic assessments of how quickly a sector or large counterparties will decarbonize. In parallel, understanding the risks associated with passive portfolio management is key to fully assessing the cost of inaction.

Throughout these steps, institutions need to be transparent about data limitations.[55]

Select a reference scenario to align the portfolio. A thoughtful choice of a reference scenario for a given sector requires consideration of three issues: temperature ambition, core scenario, and scenario expansion. Off-the-shelf scenarios often lack the necessary detail to set targets for the institution's priority sectors or geographies, or include assumptions that differ from in-house views.[56]

Determine whether and how to achieve ambition pathways and capture opportunities. Having set out their ambitions, institutions can assess which levers are available to reduce financed emissions (both tactical and strategic). This involves understanding the business implications of potential targets, assessing the extensive involvement of the business and risk, identifying execution levers required to achieve sectoral targets, purposefully identifying growth opportunities, building capabilities to understand decarbonization technologies, and explicitly addressing the use of carbon credits. In parallel, institutions can estimate the business impact of target setting on revenues and the associated emission-reduction potential. The risks associated with the projected course of emission reduction should also be assessed.[57]

Set financed emissions targets (if desired) based on reference scenarios, and embed execution and opportunity creation into the organization. Setting meaningful financed emission-reduction targets involves defining target metrics for financed emissions, the level of granularity, and how to handle decarbonization financing. Throughout this exercise, data sources and proxies are necessary to quantify the emissions intensity of projects and assets. Data limitations (across sectors) should be acknowledged transparently, and remediation plans should be put in place. Targets need to include an exit date or a timeline for ramping down

financed emissions volumes. Interim milestones must be established alongside regular progress reports. Targets and milestones should be embedded in the organization's long-term strategy, reflecting the strategic nature of the commitment. Finally, creating opportunities within the business requires embedding targets into credit policies, data, and incentives; measuring, reporting, and adjusting financed emissions; optimizing the balance sheet for emissions; involving the board and management; acquiring and retaining talent and expertise; obtaining and managing climate data; and building client engagement.[58]

Be transparent about the frameworks, guidance, and other resources employed to define the core elements of transition plans. These might include product standards, taxonomies, sectoral pathways, and scenarios. Institutions should provide visibility on the definitions and methodology adopted for classifying products and services as transition finance. This will build transparency on the nature of their engagement, the assets that are included and excluded, their categorization (in terms of how green they are), and the role they will play in supporting the transition.

Acknowledge the roles that can be played by different types of financial actors in helping catalyze the transition, regardless of size and scale of impact. As discussed elsewhere in this report, achieving the transition to net zero requires efforts across the whole economy. For the financial sector, this means that all actors have a role to play. Large institutions can be leaders in setting industry-wide standards and practices, while small and medium-size institutions can play a role in driving decarbonization in specific sectors or within client bases. This diversity in roles should be valued and acknowledged within the industry as targets are codified.

Implementation strategy to provide guidance on translating objectives into tangible actions

With targets set and plans in development, the next challenge facing many financial institutions will be implementation. Here, we focus on core implementation activities, including the development of frameworks for guiding capital allocation and investment, integration of transition priorities for existing products and services, development of new targeted financing solutions, and adaptation of risk appetite and related policies. Understanding where institutions currently stand on exposure to climate risk, identifying new business opportunities, and developing processes that embed net-zero targets are important steps for enabling such activities.

Current challenges

The absence of a clear definition of what financing the transition entails makes it difficult to develop plans to deploy capital effectively. In a context of policy and regulatory uncertainty, institutions are concerned that they will not be able to identify real opportunities and instead inadvertently engage in greenwashing. Climate-related activism has increased significantly, and regulators are increasingly engaged and are threatening legal consequences such as fines.

Steering and decision-making processes do not include financed emissions. Financed emissions are often not integrated into financial planning, portfolio management, and capital steering processes. Crucially, this can prevent the implementation of dedicated actions to meet net-zero targets.

Current accounting methodologies may discourage institutions from financing green assets. Current methods (such as PCAF) to measure the emissions reduction of an investment are complex and narrowly defined. While they are meant to be a record only, they represent a

significant data burden for financial institutions, with no clear reward from reporting the reduction in emissions from green assets. Furthermore, outside of very clearly defined low-emission projects (such as renewables), quantifying emissions reduction becomes more difficult. This may dissuade institutions from investing in green assets because there can be a perceived mismatch between the effort required—given the difficulty of structuring and managing green products—and the recognition. Coupled with the ease of divesting and the lack of incentives to work with clients to decarbonize their activities, firms may feel they face significant challenges in financing the transition.

Emerging practices and insights

Developing approaches to evaluate portfolio exposure. Firms are increasingly adopting sectoral heat maps and climate change scenario analyses to identify high-risk sectors and relevant risk events, and to quantify impacts on portfolios. Some banks have included specific weights in internal risk-weighted asset calculations (not regulatory) to increase the risk weighting of climate-intensive assets.

Aligning risk processes to net-zero ambition. Institutions are making efforts to include climate risk in institutional risk appetite frameworks.

Creating tools to improve visibility on portfolio risk across the institution and facilitate the inclusion of risk considerations in capital allocation decisions. Financial institutions are building dashboards and other tools to make portfolio risk exposure more transparent. Institutions are increasingly adding climate to the criteria used to decide how to engage existing clients. Some have introduced scorecards to assess clients based on physical and transition risks.

Introducing incentives to nudge investment in the right direction. Institutions have adopted various forms of carbon pricing in the investment decision-making process, aiming to direct capital toward assets supporting the transition.

Becoming a one-stop shop and bringing actors together to create decarbonization solutions. Financial institutions are proactively engaging stakeholders along the supply chain to create green solutions for clients and facilitate uptake. For example, commercial banks have convened utilities and home charging installation companies to codesign a business model that offers clients a single package to switch to an electric vehicle (a package including financing, renewable energy, and home charging stations). Similarly, some banks have built platforms to guide homeowners through their energy efficiency upgrades, as well to identify options for financing energy efficiency at home. Securitizing projects with small ticket sizes (for example, retrofitting individual buildings) is one way to increase the opportunity size and thereby attract institutional financing. Moreover, financial institutions can use different instruments to serve different players. For example, equity-release loans can help individual households retrofit their homes, while sustainability-linked loans or bonds can offer incentives to commercial real estate companies to decarbonize their portfolios.

Setting up funds dedicated to climate and decarbonization or earmarking a share of generalist funds to support transition finance. Some institutional investors have set up dedicated funds to raise and deploy capital for climate solutions. Some generalist funds have specified a percentage of the fund to be invested in decarbonization or in a specific decarbonization solution such as renewable energy.

Case study: Goldman Sachs

Case study provided by Goldman Sachs.

As a financial institution, Goldman Sachs believes it can achieve the greatest impact in helping to advance climate transition through its holistic client engagement strategy,[1] which includes partnering with clients to support them with new sustainability-linked financing solutions, strategic advice, or co-investing alongside clients in cutting-edge clean-energy companies. At the same time, the company identifies gaps in the ecosystem where it believes collaboration is needed and engages with strategic partners whose strengths and areas of focus complement its own. This helps Goldman Sachs address some of the largest challenges, which can only be resolved through coordinated partnership.

Annual clean-energy investment in emerging and developing economies needs to reach at least $1 trillion by 2030 to put the world on track to reach net-zero emissions by 2050.[2] To address this investment gap, Goldman Sachs announced a partnership with Bloomberg Philanthropies and the Asian Development Bank (ADB) in September 2021 to launch a Climate Innovation and Development Fund to deploy capital and catalyze investment in clean-energy projects across South and Southeast Asia, with a special focus on India and Vietnam.[3] Structured as a blended-finance facility, the fund has been seeded with $25 million of grant capital from Goldman Sachs and Bloomberg Philanthropies and has the potential to unlock up to $500 million in private-sector and governmental investment in critical solutions to accelerate technologies and markets for a net-zero future. Managed by the ADB, the fund targets projects with direct, measurable, and positive climate-related outcomes, including clean-energy systems, sustainable transportation, and energy efficiency. Further, the fund is pursuing project types and financing models that are replicable and have a high potential to scale up in the broader market once initial transactions demonstrate success.

In fourth quarter 2022, the fund announced its initial investment in India and Vietnam. In India, the fund mobilized approximately 14 times its investment capital to support the purchase of 255 electric buses to replace existing diesel buses operating on 56 high-traffic intercity routes, as well as the construction of charging infrastructure including solar-plus-battery solutions at bus depots to maximize potential emissions reductions.[4] The project is expected to reduce approximately 15,000 tons of CO_2 emissions per year—a particularly critical decarbonization effort in the country given that the road transportation sector in India is largely fossil-fuel based and creates nearly 12 percent of the country's emissions.

In Vietnam, the fund mobilized a $135 million total financing package for the first domestic car company and electric vehicle manufacturer. The funding was to support the manufacture of the country's first fully electric bus fleet and the first national electric vehicle charging network.[5] The project aims to build up to 140 electric buses and 150,000 charging ports across 2,000 to 3,000 stations throughout the country. Deploying first-of-a-kind technologies in new regions where there are regulatory uncertainties is highly risky, and the first two investments would not have been possible without the fund's grant capital.

---

1 *Accelerating transition: Task Force on Climate-Related Financial Disclosures report 2021*, Goldman Sachs, December 2021.
2 *Financing clean energy transitions in emerging and developing economies*, IEA, June 2021.
3 "Bloomberg Philanthropies and Goldman Sachs deploy $25 million to advance clean energy solutions in South and Southeast Asia," Goldman Sachs, September 21, 2021.
4 "ADB, GreenCell sign $40 million financing for safer e-buses in India, especially for women commuters," Asian Development Bank, November 7, 2022.
5 "ADB leads $135 million climate financing package to support electric mobility in Viet Nam," Asian Development Bank, October 24, 2022.

Priorities for the way forward

Understand portfolio exposures to climate risk. It is crucial for financial institutions to systematically identify and quantify their portfolio exposures to climate risk at counterparty and aggregate levels. This will help them set baselines against which they can monitor transition plan implementation. The process will require existing and new tools and capabilities, including risk taxonomies, qualitative heat maps, dedicated climate risk stress tests, and scenario analyses, as well as adjusted probabilities of default for calculations of capital adequacy.

Identify new business opportunities, from portfolios to counterparties. A key dimension is proactive action to develop understanding of clients' transition needs. Prioritizing opportunities based on targets, priority sectors, and partnerships can help institutions target business cases with the greatest potential for decarbonization and value generation. Once priority opportunities are identified, institutions can design and launch dedicated financing products and adjust the pricing to support client transition and create incentives for uptake. Innovative products such as green trade loans,[59] green revolving facilities,[60] and sustainability-linked supply chain financing products are still nascent, but many firms have obtained benefits from learning by doing, even in the face of challenges that may raise transaction costs. In many cases, institutions can create value through their expertise in structured products and solutions.

Embed net-zero targets in capital allocation processes while recognizing differences between, and limitations of, the metrics underlying integration. Monitoring mechanisms and controls are key metrics relevant to net-zero targets and need to be integrated in financial planning and portfolio management for transition-related capital steering processes. However, there are open questions regarding the relevance of emerging transition metrics to evaluating the alignment of different business areas. Once appropriate metrics are established, financial institutions can pursue an array of actions to adjust portfolio management, capital allocation, and transaction approval processes to reflect transition goals, while optimizing both revenues and emissions. First, institutions can include emissions as a new constraint or key metric in strategic financial planning. Second, they can adopt scorecards that assess and rate a counterparty's climate risk based on quantitative and qualitative factors. Finally, they can cascade emissions targets and hurdle rates to business units through an annual financial-planning process.

Integrate climate considerations into core risk-management processes. Many financial institutions are exploring how best to reflect net-zero targets and transition plan priorities into risk appetite statements and frameworks. More precision will be required to distinguish risk profiles and diversify across projects, borrowers, sponsors, technology, and geographies. Furthermore, they need limits in relation to climate risks at the company, sector, portfolio, and business-unit level. Stress testing should be conducted regularly, and firms should integrate analytical modeling to gauge the financial impact of a net-zero strategy and proactively identify and mitigate vulnerabilities.

Adopt a systemic view to build solutions at the macro level and reduce risks across the value chain. Bringing together different supply chain stakeholders at the macro level would reduce the perception of risk for investors and increase the flow of capital toward new solutions (for example, ammonia for shipping and carbon capture and storage for gas plants). This holistic ecosystem approach would ensure the development of enabling infrastructure and inputs. For example, the Sustainable Aviation Buyers Alliance accelerated

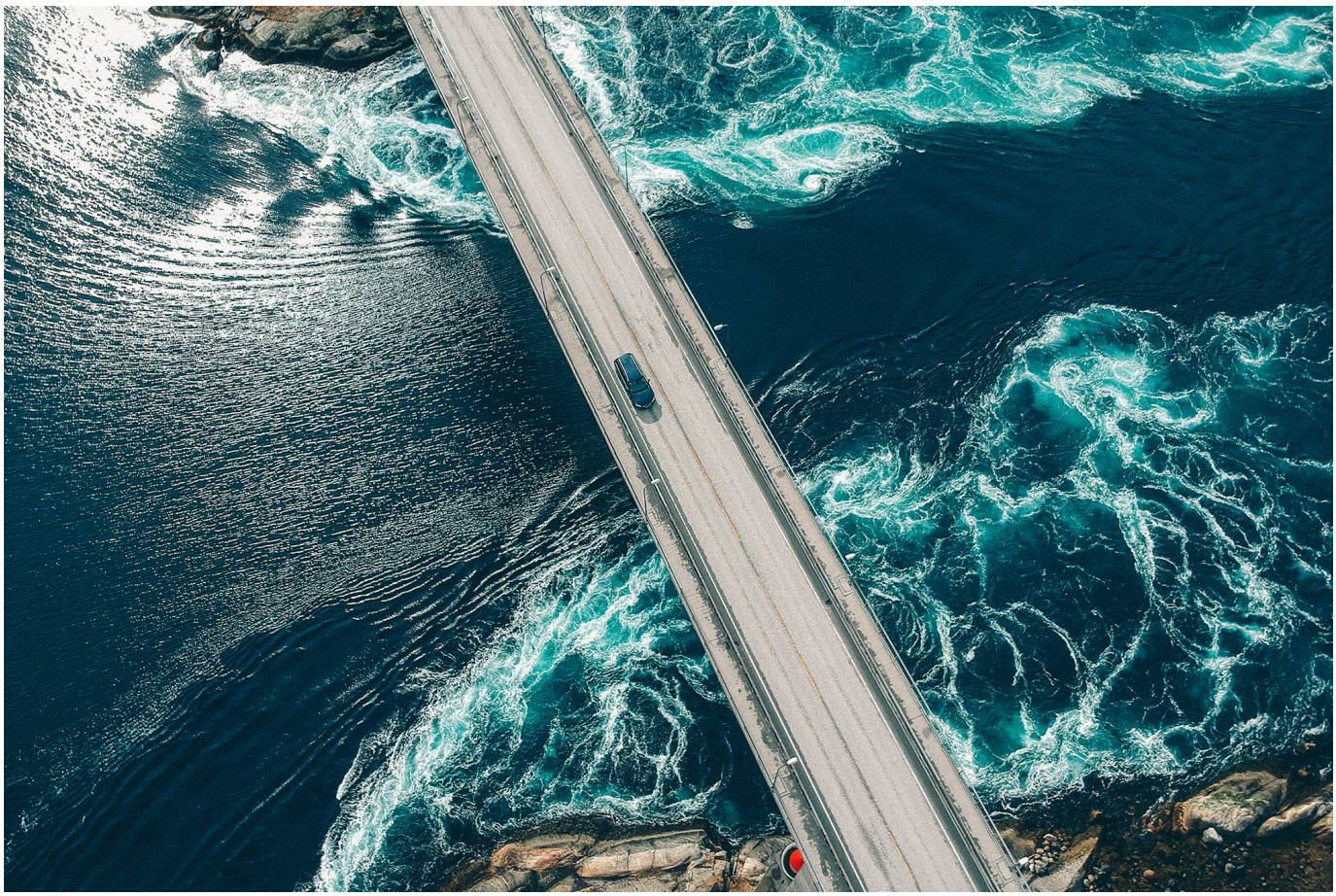
investment in the production, innovation, and adoption of sustainable aviation fuel by supporting and aggregating sustainable-aviation commitments. It also established a certification system for buyers, making it easier to navigate the investment landscape.[61]

Engagement strategy to drive transition in the real economy

Financial institutions can and should play a pivotal role in clients' net-zero transitions. They need to develop strategies for engaging clients and portfolio companies.

Current challenges

Asset managers are often constrained in their ability to steer investment by engaging clients. Depending on jurisdictional rules, asset managers' fiduciary obligations may compel them to respond to priorities that are set by their clients rather than being able to dictate where investment should be directed.[62] In the absence of demand for transition finance by their clients, asset managers are constrained in their ability to channel capital into support of the transition. This also applies to private equity firms and venture capital funds, which have a relatively short investment time horizon (five to seven years). Often, returns on investment in



the transition take longer to materialize, leading to a perception that, in the short term, there is no incentive to make investment decisions in line with net zero. Some investors may even see investing in net zero as clashing with their fiduciary obligations. Additionally, investors such as asset managers generally do not have a direct relationship with the businesses they invest in and are therefore less able to exert influence than banks.

Some institutions' largest clients may also be the largest emitters in their portfolios. This raises the stakes of starting a conversation with clients about their emissions profile and makes it particularly difficult to stop supporting high-emitting clients that are unwilling to transition.

At present, there is no common understanding of how financial institutions should engage clients that have not yet developed transition plans. Some financial institutions are exploring how to value commitments by firms to develop plans, or do so in the future, pending resolution of technical or capacity gaps. However, there appears to be some variation in how financial institutions engage with—or disengage—clients that are not taking credible steps toward transition. Some institutions decide to act as supporters of clients that seem uneasy initiating their transition journey, for example, by sharing data and best practice and engaging in a conversation. Others choose to focus on clients that are taking concrete steps.

Some institutions are not able to fully assess clients' transition plans. Some institutions are not yet able to fully account for counterparties' climate targets in credit assessments and do not assess clients' plans for transition. These shortfalls are primarily driven by capacity constraints of clients or internally, or both.

Emerging practices and insights

Approaching client advisory as a key channel to help facilitate the transition in the real economy. Some institutions are taking steps to enhance client advisory as a core element of their strategy to meet net-zero targets.

Develop engagement strategies that account for clients' willingness to transition. Some institutions have ranked clients based on a qualitative assessment of willingness to transition and have leveraged this scale to make decisions on future support. This approach has enabled institutions to engage clients in sectors that are hard to decarbonize rather than simply backing away from "dirty" assets.

Tailoring the relationship manager (RM) coverage model to best serve clients on sustainability topics. Institutions have taken various approaches to modifying their RM coverage models. Some have built centers of excellence that are embedded in business units and are dedicated to building expertise. Others have created teams that are dedicated to preparing client discussions on the transition—for example, through preparing pitch books for carbon-intensive clients detailing financing options for a green transition. Overall, institutions are increasingly active in engagement, especially at the smaller end of the client spectrum (small and medium-size enterprises or households).

Building tools to facilitate client engagement. Some banks have made dedicated tools (such as platforms) available to clients. For example, some have built sustainability assessment platforms on which clients can monitor key metrics and get tailored offers. One bank set up an interactive platform that provides clients with business cases for house refurbishments and other retrofitting interventions. Crucially, this can improve the service provided while also favoring long-term business growth for the institution.

Case study: CPP Investments

Case study provided by CPP Investments.

The Canada Pension Plan Investment Board, operating as CPP Investments, unveiled its Abatement Capacity Assessment Framework in October 2021.[1] The framework helps the boards and management teams of portfolio companies better understand their capacity to economically abate greenhouse-gas (GHG) emissions as well as their projected capacity under various carbon price scenarios.

"The inspiration for creating the abatement capacity assessment was a by-product of conversations that we were having with directors across our public and private portfolio companies. And really, the conclusion was that developing a decarbonization strategy is the boardroom equivalent of eating an elephant. It's complex, and it's massive," says Richard Manley, CPP Investments' chief sustainability officer and head of sustainable investing.

The Abatement Capacity Assessment Framework suggests that companies conduct "abatement capacity assessments" and report "projected abatement capacity." The former is the process of allocating current GHG emissions to specific decarbonization drivers, such as efficiency, greening of the grid, and deployment of technology to abate emissions under current and future carbon price assumptions. Once 100 percent of GHG emissions have been attributed, they are translated into a pro forma matrix of "projected abatement capacity." This matrix can provide a clear view of which emissions are economically viable to abate now, which emissions would become economic to abate at higher carbon prices, and which emissions are currently uneconomical to abate even at $150 per metric ton of CO_2 equivalent (exhibit).

The CPP Investments Insights Institute released a follow-up report, *The decarbonization imperative*,[2] in November 2022. This report showcased the first time the framework was put into practice, which took place at the Trafford Centre, a CPP Investments portfolio company that ranks as a top-three shopping destination in the United Kingdom.

In the span of ten weeks, a team determined that Trafford could reduce 56 percent of its Scopes 1 and 2 emissions by 2030 by implementing economically viable measures such as regulating and automating energy consumption with automated temperature control, lighting levels, and management systems, as well as roof renovations to improve efficiency. The company's board is also exploring the introduction of a large-scale solar panel transformation to support further abatement.

CPP's framework could provide users with proven, probable, and still-to-be-determined GHG abatement capacity for any issuer, in any sector, with operations in any geography. By providing standardized disclosure about a company's current and projected ability to abate its GHG emissions based on current pricing, technology, and regulations, the Abatement Capacity Assessment Framework could give investors a greater degree of confidence in a company's commitment and ability to transition to a low-carbon future. The framework also gives investors such as CPP Investments a robust and standardized rationale to push for action on forward-looking commitments, like net zero, from the boards of portfolio companies that use this tool.

[1] *The future of climate change transition reporting*, CPP Investments, October 2021.
[2] *The decarbonization imperative*, CPP Investments, November 2022.

Exhibit. **Users can adapt this template to report their projected abatement capacity.**

As featured in CPP Investments Insights Institute's report *The decarbonization imperative*

For reference						**For input (current numbers are placeholders)**				
Illustrative example:		Scope 1	Scope 2	Scope 3	Total	Scope 1	Scope 2	Scope 3	Total	
GHGs[1] (tGHGe)	G	G_1	G_2	G_3	Gt	1,500	800	2,500	4,800	
Efficiency	E	E_1	E_2	E_3	Et	400	100	1,100	1,600	33%
Investment (demand)	ID	ID_1	ID_2	ID_3	IDt	200	50	100	350	7%
Investment (Supply)	IS		IS_2	IS_3	ISt	-	50	100	150	3%
Renewables	R	R_1	R_2	R_3	Rt	100	200	1,000	1,300	27%
Current (proven) PAC	**C**	**C_1**	**C_2**	**C_3**	**Ct**	**700**	**400**	**2,300**	**3,400**	**71%**
as % of total		*C_1/G_1*	*C_2/G_2*	*C_3/G_3*	*Ct/Gt*	*47%*	*50%*	*92%*	*71%*	
Economic @:										
US$100 tCO_2e	Ec@100	$Ec_{100\text{-}1}$	$Ec_{100\text{-}2}$	$Ec_{100\text{-}3}$	$Ec_{100\text{-}t}$	50	200	-	250	5%
US$150 tCO_2e	Ec@150	$Ec_{150\text{-}1}$	$Ec_{150\text{-}2}$	$Ec1_{50\text{-}3}$	$Ec_{150\text{-}t}$	200	200	100	500	10%
Internal shadow price	Ec@Int	$Ec_{Int\text{-}1}$	$Ec_{Int\text{-}2}$	$Ec_{Int\text{-}3}$	$Ec_{Int\text{-}t}$	200	-	-	200	4%
Long-term (probable) PAC	**L**	**L_1**	**L_2**	**L_3**	**Lt**	**450**	**400**	**100**	**950**	**20%**
as % of total		*L_1/G_1*	*L_2/G_2*	*L_3/G_3*	*Lt/Gt*	*30%*	*50%*	*4%*	*20%*	
Closure/abandonment	A	A_1	A_2	A_3	At	150	-	100	250	5%
Transformative technology	T	T_1	T_2	T_3	Tt	150	-	-	150	3%
Offsets via removal credits	O	O_1	O_2	O_3	Ot	50	-	-	50	1%
Uneconomic PAC	**U**	**U_1**	**U_2**	**U_3**	**Ut**	**350**	**-**	**100**	**450**	**9%**
as % of total		*U_1/G_1*	*U_2/G_2*	*U_3/G_3*	*Ut/Gt*	*23%*	*0%*	*4%*	*9%*	

Note: Figures may not sum to 100%, because of rounding. To address the consistency and comparability of this framework, all capacity assessments must be reported as regionally relevant (ie, the metrics reported are required to account for regional regulation, costs, subsidies, carbon prices, etc.). Gt = Scope 1 + Scope 2 + Scope 3 greenhouse-gas (GHG) emissions. To the extent that companies are not yet able to report all three, there exists the ability to start reporting Scopes 1 and 2. Many of these data are already reported via CDP and company filings. Adding Scope 3 data when suppliers and customers report their Scopes 1 and 2. Et = Percentage of Gt projected to be addressable by "Efficiency" initiatives (eg, stopping methane leaks, building management, using shore power, behavioral change, etc). IDt = Percentage of Gt projected to be addressable by "Investment (Demand)" that reduces demand for processes that produce emissions; ie, abatement solutions that are economic at current costs, carbon prices, and prevailing regulation (eg, switching to electric vehicles, heat pumps, retrofitting, etc). ISt = Percentage of Gt projected to be addressable via "Investment (Supply)" that increases supply of renewable energy accelerating the decarbonization of Scopes 2 and 3 emissions ahead of the forecasted greening of the grid (eg, investments in rooftop solar, captive wind, and power purchase agreements). Rt = Percentage of Gt projected to be addressable via a shift to "Renewables" for power generation or electricity consumed from the grid. Many companies already report indirect emissions from electricity consumption, so some of this data is already available. Ct = Et + It + Rt = "Current Projected Abatement Capacity" to abate Gt. We expect the reporting convention would default to reporting this as a percentage of total emissions (i.e., in the example above, the company's Current Projected Abatement Capacity is 71%). Ec100-t = Percentage of Gt projected to be "Economic to abate at US$100/$tCO_2e$" carbon price. This would allow the company to apply a higher carbon price to current technology costs and regulation to determine the incremental % of abatement that would become economic at this standard carbon price assumption. Ec150-t = Percentage of Gt projected to be "Economic to abate at US$150/$tCO_2e$" carbon price. As above, but for a higher carbon price. EcInt-t = Percentage of Gt projected to be "Economic to abate at company's internal shadow price." As above, but this optional metric allows a carbon price specified by the company that reflects its view of an appropriate carbon price to be used in its financial decision-making. Lt = Ec100-t + Ec150-t + EcInt-t = "Long-Term Projected Abatement Capacity" attributable to solutions that would become economic at pre-determined future carbon prices and an optional company-specific internal shadow carbon price that are well within the bounds of those deemed necessary to support a net-zero outcome. While Current and Long-term Projected and Abatement Capacity should be reported independently, we expect that market convention would add the two to sum "Projected Abatement Capacity" refer to that as a percentage of total emissions (ie, in the example above, the company's PAC is 91%). Ut = At + Tt + Ot = Currently "Uneconomic Projected Abatement "Capacity," the percentage of Gt that would require the "Abandonment/Closure of Assets," deployment of "Transformative Technology," and "Offsetting" using removal credits. This is the residual Gt not projected to be addressable by Ct + Lt and would require closure, innovation in transformative technologies or removal via permanent verifiable solutions.

[1]Greenhouse-gas emissions.

Priorities for the way forward

Understand where clients stand on emissions. As a first step, institutions need to define clients' starting points to better understand where they are on their transition journeys. They should first assess the current status based on key metrics (for example, to measure financed emissions or profitability), and they should also employ annual transition risk questionnaires.

Make client engagement a central component of transition plans. Financial institutions should fully integrate client engagement on climate topics in their growth strategy transition plans. For example, this might be achieved through the development of dedicated targets and KPIs for RMs. Asset managers can actively work with clients,[63] and concerns can be expressed through company advisers, through brokers, or publicly. Resolutions can be submitted at general meetings and communicated with nonexecutive directors or board chairs. Voting can be used to state concerns. Finally, divestment (partial or full) is a possibility.

Verify the credibility of client climate data. Verification of client responses is key and makes for a critical consideration when building the engagement strategy.

Outline a strategy to support client transition and help realize the lowest-cost and highest-value emission-reduction opportunities. Institutions can proactively engage clients to support them in building their transition ambitions and plans. This entails supporting clients in the identification of new opportunities as well as pricing green assets to create incentives for client take-up. Asset management firms can do this by developing credible and widely recognized products, which could also help cement investor demand.

Further tailor the RM coverage model to better support clients on sustainability-related topics. Embedding sectoral expertise in RM coverage should be a priority. This can entail upskilling RMs, building centers of excellence to support RMs, and developing tools to help manage client relationships on sustainability topics. For banks, this may involve defining clear coordination mechanisms and shared incentives across RMs and bankers. RMs also could be sectorized in core countries, or hubs, with global heads of sectors ensuring coordination across hubs. Alternatively, RMs covering client headquarters and local subsidiaries could specialize by sector. This last option requires larger efforts and more costs to build capabilities. For asset managers, fund managers could be trained on transition issues, reporting, and instruments. Excellence could be promoted through dedicated roles across fund managers or through centralized units.

Build a standardized framework to assess the credibility of transition plans and help facilitate monitoring of clients' progress. Assessing counterparty climate commitments is key for financial institutions to achieve their climate targets. By assessing transition plans and understanding key risks and financing needs, banks can effectively engage with counterparties. Client transition plans should appropriately cover the counterparty's key climate risk or contribution to climate change. Institutions can assess risks through scenario analyses and modeling of underlying vulnerabilities and drivers. When acted upon, plans should also sufficiently reduce emissions or transform revenue segmentation in line with the institution's own climate targets. Institutions should assess the targets set by their counterparties against best-practice-alignment methodologies (such as SBTi) on a sector-specific basis, considering target type, scope, boundary, time frame, and progress to date. Finally, the plan should be achievable amid sufficient counterparty action, technological capabilities, and financial investment. Institutions should consider whether the counterparty has access to the necessary decarbonization technologies and committed capital expenditure investment to finance the transition, as well as whether it has accounted

for possible dependencies and established appropriate government structures. Institutions should update client assessments annually and periodically.

Develop and adopt forward-looking metrics and internal carbon prices to help generate the necessary data and better value transition-related investment opportunities. Accurate, forward-looking metrics will enable market participants to effectively price the implicit risks of no transition or a disorderly transition. This would favor the quantification of returns on investment in line with net zero, which could help align institutions' fiduciary obligations and the transition.

Metrics and targets to assess and monitor progress toward net-zero objectives

Financial institutions need to develop credible metrics and targets to assess and monitor progress toward their net-zero objectives. These will be contingent on disclosure guidelines, data availability, and in-house modeling capabilities.

Current challenges

The fragmentation in market-based and official-sector transition frameworks poses challenges for the comparability of transition plans. Given the unlikelihood of a globally applicable transition taxonomy, and the diverse and evolving supervisory and regulatory perspectives on transition finance, institutions operating internationally need to adjust their measurement and reporting to meet the requirements of various stakeholders.

High-quality, available data are a key enabler to accurately report and inform decision making, but they are lacking in most institutions. Companies and financial institutions struggle to reconcile different sources of data to generate sector- and portfolio-level insights. Additionally, the lack of compulsory third-party verified and standardized reporting creates a fragmented landscape. The combination of minimal data governance, frequent use of proxies, the lack of golden sources, and limited verification increases the challenges of evidence-based decision making.

Emissions reports may need to be restated as methodologies continue to evolve. As new methodologies are developed, there may be an increase or decrease in the volume of emissions stated on an institution's portfolio. This uncertainty creates a disincentive for companies and institutions to invest in better-quality reporting.

Emerging practices and insights

Supporting public data-sharing initiatives that could be instrumental in unlocking data access. Financial institutions are collaborating with governments, rating agencies, and multilateral institutions to build platforms that will facilitate access to quality emissions data by asset. A recent highlight is the Net-Zero Data Public Utility, announced by the Climate Data Steering Committee in the lead-up to the 2022 United Nations Climate Change Conference (COP27). This would be a free open-data platform to tackle gaps, inconsistencies, and lack of accessibility.[64]

Prioritizing standardization while acknowledging that existing metrics are imperfect. Organizations tend to report data in different ways, leading to incomparable targets and progress. Some institutions strive for standardization in measurement and reporting, adopting available metrics while acknowledging that they are imperfect and might evolve.

Leveraging data quality scores to measure emissions per assets. Despite the uncertainty behind data quality metrics such as PCAF scores—especially for Scope 3 emissions—some institutions still use them to assess emissions intensity. Institutions can decide on the depth of

their internal modeling exercises based on their capabilities and the quality of available data.

Sharing data along the supply chain. Sharing data in the supply chain can help customers measure their own emissions, thereby improving the emissions profile of a portfolio. These initiatives can also facilitate sharing of best practices on target setting and transition finance, driving progress toward real-economy reductions.

Priorities for the way forward

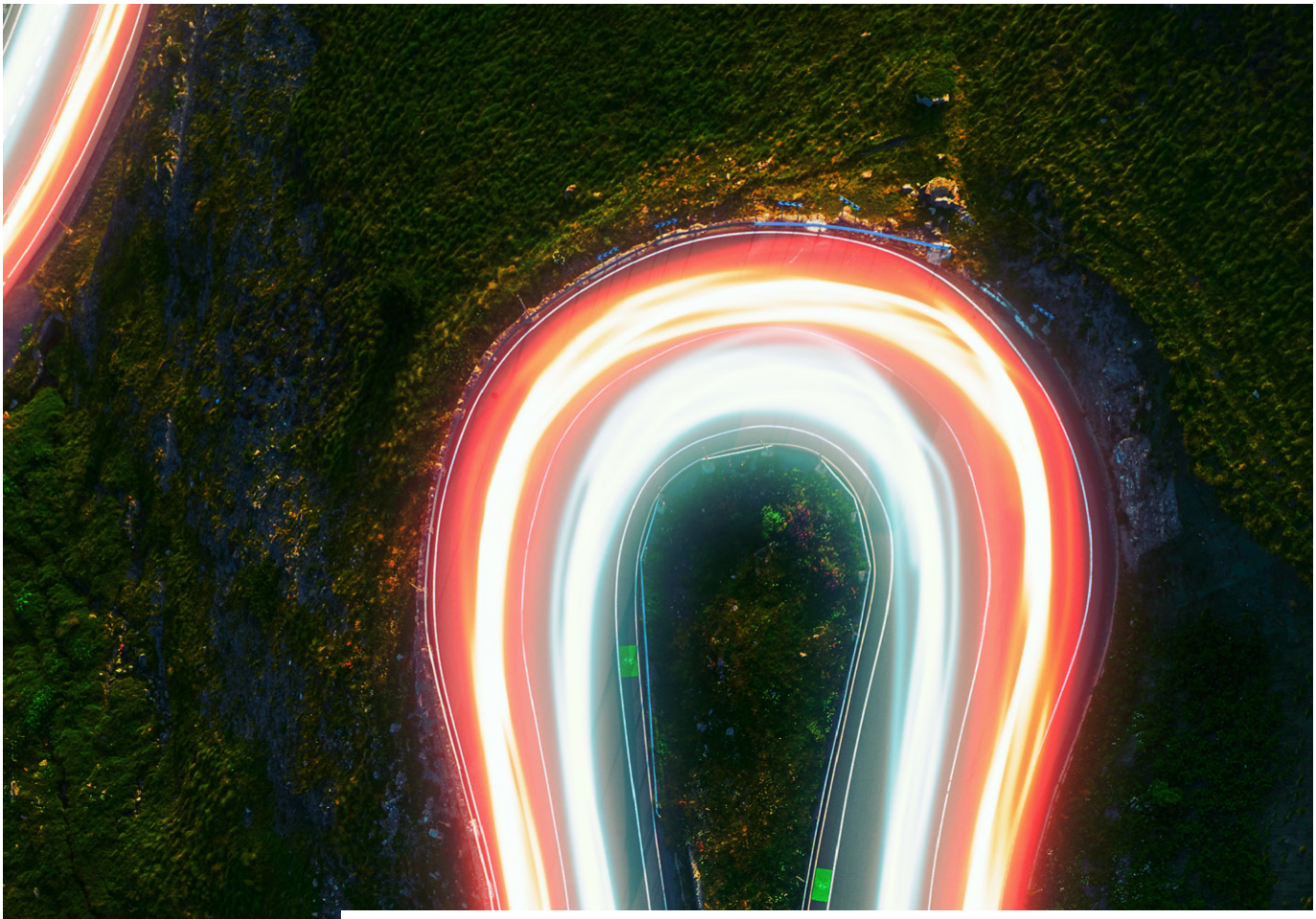
Develop metrics and strategies for collecting data to enable monitoring and reporting. Strategies should include guidance on gathering, validating, and managing data on emissions and emission-reduction pathways. Institutions should standardize net-zero data requests and integrate climate data into centralized storage architecture with clear ownership. They should establish guidelines to define the retention policy of historic data, which are needed for traceability and potential adjustments. Moreover, emissions data should be integrated into multiple end-user applications to improve visibility and accessibility. When institutions generate data and metrics, they should focus on granularity and look forward to make later reconciliation easier. As data quality improves, precise records of financed emissions at different points in time and for different sectors will facilitate measurement of progress against targets. In parallel, firms should develop robust, consistent, and transparent metrics in line with their targets. Standardized metrics to measure emissions would facilitate comparison and boost transparency.

Conduct regular and rigorous monitoring to ensure you are on track to meet targets. Institutions should monitor both top-line emissions and individual levers. This can help them verify whether strategies to reduce emissions have worked and identify action areas. Effective monitoring can be supported by dedicated tools such as net-zero reporting dashboards.

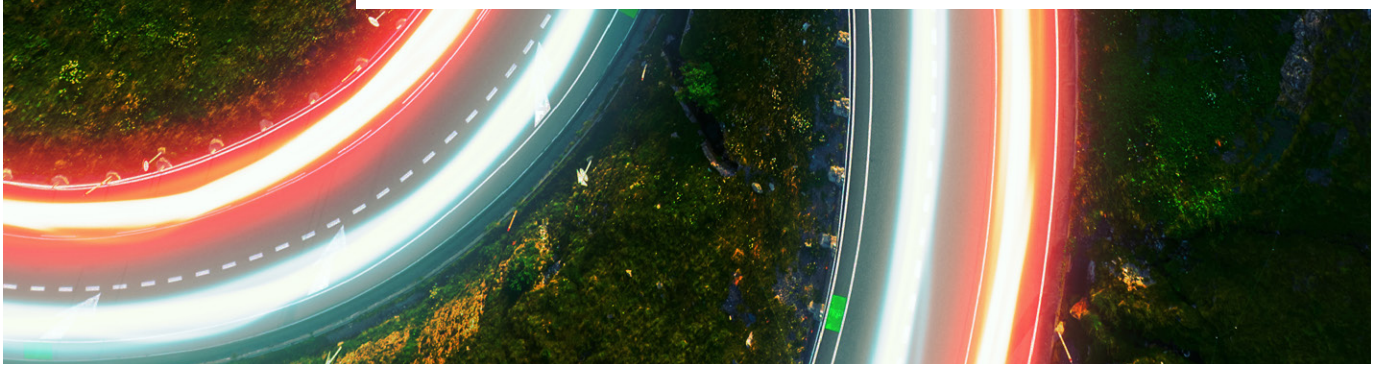
Define objectives, methodologies, and a clear cadence for assessing metrics and targets, and create forums for review. Financial institutions need to review existing reporting processes and consider how transition finance reporting could be integrated into existing processes. The objective should be to minimize duplication and leverage existing resources and capabilities, where available. Ideally, net-zero targets should be embedded into existing reporting processes such as risk management information, monthly financial reports, and portfolio dashboards. Institutions should embed transition reporting into annual disclosures by aligning timelines, reporting formats, and review processes. This synchronization should help business units learn from one another. Clear reporting and disclosure rules need to be aligned across different functions, and reporting processes should be automated where possible. Third-party verification of emissions quantification and reporting progress against targets should be implemented to ensure the accuracy, transparency, and consistency of disclosures (in line with the Global Reporting Initiative, the Task Force on Climate-Related Financial Disclosures, CDP, or NFRD).

Use data sharing and transparency to foster industry-wide progress toward financing the transition. Open-source data platforms, cross-institutional modeling tools, and third-party verified reporting are key resources to accelerate transition planning across the financial sector.

Develop industry-accepted frameworks on emissions of financial products to facilitate measuring. Current data limitations make it difficult for financial institutions to quantify the emission profiles of underlying financial products. An indicative framework could help clarify current accounting methodologies and attach the right incentives to each product. Particular attention should be devoted to assets that may suffer from an incentive mismatch, such as green finance instruments.



LOOKING ACROSS EMERGING APPROACHES, FINANCIAL INSTITUTIONS ARE SETTING UP GOVERNANCE STRUCTURES TO CLARIFY ROLES AND RESPONSIBILITIES. SOME ARE ALSO ADDRESSING ISSUES OF REMUNERATION, SKILLS, AND CULTURE.



Governance structures for oversight and incentives for transition plans

Specific governance structures are necessary to oversee, encourage, and support the implementation of a firm's transition plan. Looking across emerging approaches, financial institutions are setting up governance structures to clarify roles and responsibilities. Some are also addressing issues of remuneration, skills, and culture.

Current challenges

Achieving targets requires new capabilities among relationship managers and frontline staff. Climate-related investment needs and opportunities tend to be highly technical, requiring deep expertise within a specific sector, regulatory context, and technology. For example, emerging supervisory expectations and regulations are evolving rapidly, with the potential for complex, overlapping, and misaligned frameworks across jurisdictions and at subnational levels. Expertise in understanding the implications of this evolving landscape is a critical capacity gap for some institutions; very few firms have upskilled second and third line of defense control and audit functions (including internal and external audit) to assess and control transition-relevant information and disclosures. Although it is critical to manage the risks of transition-related disclosures, talent scarcity and lack of knowledge on sustainability topics pose challenges to institutions trying to bring capabilities up to scale.

Operationalizing targets across business units is challenging. Operationalizing targets in siloed centralized units or in centers of excellence is unhelpful. It is thus critical to engage business units and align their processes with net-zero targets. This entails two difficulties. First, business units need to continue to operate smoothly when introducing transition plans. This is particularly challenging when the introduction of targets and transition priorities may constrain business growth or require significant reorientation of sectoral client engagement strategies. Second, there is a challenge in co-defining adequate objectives for business units to introduce carbon budgets across the institution.

Emerging practices and insights

Involving business units in the target-setting exercise. Doing so has enabled some institutions to agree on more realistic targets and to obtain buy-in from the start.

Designing incentives and rewards across organizations to foster the right net-zero governance structure and clearly communicate the objectives of the strategy to achieve net-zero targets. One financial institution created performance management systems for RMs to reflect the organization's transition finance goals. Some institutions have sought to identify motivated and well-performing RMs to appoint as champions.

Introducing climate change voting policy at the board level. Some asset management firms have voted against company directors where they do not perceive sufficient change plans. This sends a message to the market that financial institutions now seek reporting on climate performance from the companies they invest in, and companies should be held reasonably accountable for these targets.

Partnering with external stakeholders to streamline upskilling and capability building.

Making net zero a key topic for training. This can embed it in organizational culture, build climate literacy, and strengthen understanding of the implications of the transition for different job roles. For example, RMs can improve client engagement with more knowledge.

Engaging shareholders in the process of developing transition plans. Showcasing transition plans as a long-term growth platform for the business rather than as a constraint on margins can help garner shareholder support.

Priorities for the way forward

Assign clear roles and responsibilities across functions (including for executive council members) and activity type (one-off activities such as making decisions on methodologies and business-as-usual activities such as disclosure). These should be split across the board, risk, group sustainability, finance, business lines, and data and architecture. Additionally, governance structures should integrate climate considerations in the three lines of defense (3LoD) model to facilitate effective risk management.

Create incentives and remuneration to help disperse net-zero targets across all levels of the organization. Net-zero targets should be embedded into performance management systems at all levels. Moreover, incentives should be set across the hierarchy. One bank introduced variable remuneration based on corporate social responsibility (CSR) for its executive management and management committee. All staff are annually reviewed against CSR KPIs.

Clarify the significance of supporting the transition in the context of organizational culture, which will ground the net-zero agenda in day-to-day activities. A key first step can be the establishment of formal board policies for the transition, which may entail establishing a mandate for a board-level subcommittee with responsibility for transition plan implementation. To support further integration of transition priorities, many institutions are scaling up capacity building to better shape individual skill sets in areas including client relationship management, risk assessment, and scenario analysis.

Set up oversight mechanisms to track progress with a clear cadence for assessment and review. Oversight mechanisms should include a clearly defined escalation process. There should be regular (at least monthly) net-zero governance meetings (at the group and business unit level) to review progress toward net-zero targets against a set timeline. These meetings would also serve to identify opportunities and risks and to enable corrective action, as well as to review business commentary on quarterly net-zero updates and discuss levers available for achieving targets. Net-zero reporting timelines and processes should be aligned with existing reporting (making transition finance policy part of annual disclosures).

Continue assessing capability gaps to ensure agility in response to changing market and policy conditions, and dynamic factors affecting the transition. This can be achieved through both internal capacity building (as noted above) and targeted hiring for technical, regulatory, and scientific knowledge. External partnerships, including with research institutions, can help decision makers increase their familiarity and gain access to both sector and local market knowledge, before developing core internal expertise based on refined investment priorities. At a practical level, developing or acquiring industry expertise can enable firms to create competitive advantages in certain transition financing areas, perhaps achieving lower-risk premia or enhanced due diligence.

Endnotes

1 Network for Greening the Financial System (NGFS) Net Zero 2050 scenario. Accessed on January 4, 2023.

2 This is a scenario-based result, using the NGFS Net Zero 2050 scenario, not a projection. See *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022.

3 Ibid.

4 The analysis divides high-emission assets from low-emission assets and enabling infrastructure. Low-emission assets have a relatively low emissions footprint; the term does not always mean carbon neutral. This segmentation was done to allow us to size the scale of capital reallocation needed for the net-zero transition. In doing so, we recognize that the demarcation between high and low emissions is not always clear. High-emission assets include oil, gas, and coal extraction; refining without carbon capture and storage (CCS) and carbon capture, utilization, and storage (CCUS); gray-hydrogen production; steel and cement production without CCS; internal combustion engines; and fossil-fuel heating and cooking equipment (such as boilers and gas stoves).

5 For example, wind, solar, hydro, geothermal, biomass, and nuclear production assets; biofuels; green-hydrogen production; blue-hydrogen production with CCS; oil, gas, and coal extraction with CCS/CCUS; electric and hydrogen vehicles; steel production using electric arc furnaces and direct reduced iron running on hydrogen and biogas, or blast oxygen furnaces with CCS; cement production with biomass or coal and gas kilns with fly ash and/or CCS; electric charging stations and hydrogen refueling stations; heating using low-carbon electricity or biomass; heat pumps; non-fossil-fuel-based cooking; retrofits for energy efficiency; GHG-efficient farming (such as electric tractors); and land restoration and afforestation.

6 Investment in cooling is captured in the power sector (within demand for electricity).

7 For example, the IEA estimates that from 2020 to 2025, the increase in renewables-based generation in the European Union and the United Kingdom will be more than nine times the rise in electricity demand, and close to three times the increase in US demand. See *Renewables 2020: Analysis and forecast to 2025*, IEA, November 2020.

8 Throughout this report, historic investment figures are past forecast investment and not actual investment.

9 Maturity is determined based on the IEA's ETP Clean Energy Technology Guide. See ETP Clean Energy Technology Guide, IEA, last updated September 21, 2022.

10 Except for batteries for two- and three-wheelers, which are still very immature.

11 Robert Rapier, "Why China is dominating lithium-ion battery production," *Forbes*, August 4, 2019. Accessed on January 4, 2023.

12 Long Duration Energy Storage Council and McKinsey & Company, *Net-zero heat Long Duration Energy Storage to accelerate energy system decarbonization*, November 2022.

13 District heating refers to an underground infrastructure distributing thermal energy to multiple buildings from a central energy plant. Technologies include, for example, advanced heat exchangers and proportional hydraulic control. See ETP Clean Energy Technology Guide, September 2022.

14 The key technology risk measure used in this report is the IEA's Technology Readiness Level (TRL) index, which runs from one, the initial idea stage, to 11, full maturity. The TRL assesses whether a technology is fully mature (intrinsic factor rather than relative to fossil-fuel alternative). According to the IEA, the only renewable technologies that are fully mature are hydropower and geothermal generation. See ETP Clean Energy Technology Guide, September 2022. The TRLs reported here are the average of multiple technologies. For example, for wind this includes both onshore wind and offshore floating wind.

15 Investment characteristics reflect the return profile, technology risk, and market risk of each opportunity. The return profile reflects the cost competitiveness of low-emission levers compared to high-emission levers, which is determined based on abatement cost curves and on projected carbon taxes. Technology and market risk estimates used in McKinsey's Transition Finance Model (TFM) are based on McKinsey expert input and the ETP Clean Energy Technology Guide.

16 Analysis was done by comparing the Net Zero 2050 and Current Policies scenarios developed by the Network for Greening the Financial System (NGFS) and leveraging the Vivid Economics Transition Finance Model. The Current Policies scenario takes into account future projections for GDP growth and population growth, assuming current policies remain unchanged until 2050.

17 Other developed economies include Canada, Australia, New Zealand, and Japan. Other EMDEs include India, Latin America, the Middle East and North Africa, non-EU Europe, the countries from the reforming economies of the former Soviet Union, Southeast Asia, and Asia (excluding China).

18 *Mobilizing capital into emerging markets and developing economies*, Bloomberg NEF (commissioned by GFANZ), November 2022.

19 *Energy taxation, carbon pricing and energy subsidies*, European Court of Auditors, January 2022.

20 Richard Bridle, Lucy Kiston, and Peter Wooders, *Fossil-fuel subsidies: A barrier to renewable energy in five Middle East and North African countries*, Global Subsidies Initiative and International Institute for Sustainable Development, September 2014.

[21] *The net-zero transition: What it would cost, what it could bring*, McKinsey Global Institute, January 2022. The study is based on the NGFS Net Zero 2050 scenario.

[22] "Advanced clean energy storage," Loan Programs Office, June 2022.

[23] *Electricity market report – January 2022*, IEA, 2022.

[24] "Documenting a decade of cost declines for PV systems," National Renewable Energy Laboratory, February 10, 2021.

[25] David L. Chandler, "Study reveals plunge in lithium-ion battery costs," MIT News, March 23, 2021.

[26] The opportunity for private-sector investment includes both investment that would be supplied by the private sector (without public intervention) and investment crowded in by public-sector investment. The analysis in this report assumes an evolution of carbon taxes globally in line with *Net zero by 2050: A roadmap for the global energy sector*, IEA, 2021.

[27] Investment that can be captured by private investors includes investment in assets that are already in the money as well as assets for which investment will be crowded in through the participation of the public sector. For institutional investors, private equity, and venture capital funds, we are assuming a best-case scenario in which they can meet all investable equity in private corporations globally. This may not be possible in all markets, especially in EMDEs, where capital markets are less developed.

[28] Opportunities for financial institutions outlined in this section hold under the NGFS Net Zero 2050 scenario and the assumptions behind McKinsey's Transition Finance Model (TFM). The TFM performs a theoretically optimal allocation by matching investment characteristics with investor preferences. Investment allocation is based on the historical role of different capital sources in green finance, adjusted to account for the evolution in the risk/return profile of such opportunities in the climate scenario under consideration. The TFM assumes that individuals and companies are forward-looking and have perfect foresight. They choose which technology to invest in based on the total cost of ownership (that is, the relative cost of low- and high-emissions technologies). Individuals and companies consider carbon tax commitments by governments to be fully credible. The TFM also assumes that the global economy is able to meet the investment needs of the transition. That is, there are no limits to the supply of capital (the supply side of capital markets is not modeled); there are no limits to the provision of capital to any world region; there are no budgetary constraints for governments. The TFM allows assessment of how the investment allocation changes for different assumptions regarding the carbon tax level, the discount rate, learning rates, and energy prices. The TFM does not model the investment needs required to reach given climate goals. These are an exogenous input in the TFM. The TFM does not model agents' spending choices for different price levels. Instead, agents' choices are embedded in the investment inputs used by the TFM. The TFM does not explicitly model government policies other than carbon taxes and subsidies. Last, the TFM does not model the supply constraints of capital markets or technology deployment assumptions.

[29] *Financial institution net-zero transition plans*, Glasgow Financial Alliance for Net Zero (GFANZ), June 2022.

[30] "Companies Taking Action," Science Based Targets. Accessed on January 4, 2023.

[31] In this report, we generally define carbon-intensive-to-green investment as investment for the redevelopment or retrofit of a carbon-intensive asset with the scope of making it green. Examples include financing the application of carbon capture technology to cement production and offering tailored solutions for residential or commercial building decarbonization.

[32] *World Energy Outlook 2021*, IEA, 2021.

[33] *OECD guidance on transition finance: Ensuring credibility of corporate climate transition plans*, OECD, 2022.

[34] *Financial institution net-zero transition plans*, GFANZ, November 2022.

[35] *Integrity matters: Net zero commitments by businesses, financial institutions, cities and regions: Report from the United Nations' High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities*, UN, 2022.

[36] *Consultation: The Transition Plan Taskforce disclosure framework*, UK Transition Plan Taskforce, November 2022.

[37] *Climate transition finance handbook 2020*, International Capital Market Association, 2020; *Sustainability-linked bond principles*, ICMA, June 2020.

[38] *Financing credible transitions: How to ensure the transition label has impact*, Climate Bonds Initiative, September 2020.

[39] *Transition finance report*, EU Platform on Sustainable Finance, March 2021.

[40] *World Energy Outlook 2021*, IEA, 2021.

[41] *The managed phaseout of high-emitting assets*, GFANZ, June 2022.

[42] *The net-zero transition*, January 2022.

[43] *NZBA transition finance guide*, Net-Zero Banking Alliance (NZBA), United Nations Environment Programme Finance Initiative, October 2022.

[44] *Achieving a just energy transition: A framework for company action*, Council for Inclusive Capitalism, 2022.

[45] *The managed phaseout of high-emitting assets*, GFANZ, June 2022.

[46] *Climate risk stress test: Final results,* European Central Bank, July 2022.

[47] McKinsey Climate Risk Survey 2021.

[48] *Financial institution net-zero transition plans*, GFANZ, June 2022.

[49] *NZBA transition finance guide*, NZBA, October 2022.

[50] *Consultation: The Transition Plan Taskforce disclosure framework*, UK Transition Plan Taskforce, November 2022.

[51] *Measuring portfolio alignment: Technical considerations*, Portfolio Alignment Team, 2021.

[52] *Climate and capital: Views from the Institute of International Finance*, IIF, July 2022.

[53] For example, Santander; see *Environmental, social and governance supplement 2021*, Santander, 2021.

[54] For additional information on target-setting approaches, see "Managing financed emissions: How banks can support the net zero transition," McKinsey, November 24, 2022.

[55] Ibid.

[56] Ibid.

[57] Ibid.

[58] Ibid.

[59] "Trade loans," Barclays, accessed January 4, 2023; "Green trade finance," HSBC, accessed January 4, 2023.

[60] A type of finance ring-fenced funding to be used specifically for green projects that have a positive environmental impact. See "CaixaBank participates in Kingsfisher's new £550m revolving credit facility linked to sustainability targets," CaixaBank, July 21, 2021.

[61] "Sustainable Aviation Buyers Alliance," RMI. Accessed on January 4, 2023.

[62] *Oxford Business Law Blog*, "Can investors save the planet? - NZAMI and fiduciary duty," blog entry by Tom Gosling and Iain G. MacNeil, November 21, 2022.

[63] *Engagement blueprint: Our vision for active ownership at Schroders*, Schroders, February 2022; "Responsible investing: Our approach and credentials," Legal & General Investment Management; "A framework for our clients: How to invest in the net zero transition," BlackRock.

[64] *Sustainable Futures*, "COP27: Week 1 recap," blog entry, Linklaters, November 16, 2022.

Bibliography

Asian Development Bank, "ADB, GreenCell sign $40 million financing for safer e-buses in India, especially for women commuters," Asian Development Bank, November 7, 2022, adb.org/news/adb-greencell-sign-40-million-financing-safer-e-buses-india-especially-women-commuters.

Asian Development Bank, "ADB leads $135 million climate financing package to support electric mobility in Viet Nam," Asian Development Bank, October 24, 2022, adb.org/news/adb-leads-135-million-climate-financing-package-support-electric-mobility-viet-nam.

AON, *Utilizing insurance solutions to help reduce risks in carbon offset transactions*, 2021.

Barclays, *Trade loans*, barclayscorporate.com/solutions/corporate-banking-solutions/trade-solutions/trade-loans/#:~:text=Green%20trade%20loans%20can%20be,payment%20from%20goods%20is%20received. Accessed on January 4, 2023.

BlackRock, *A framework for our clients: How to invest in the net zero transition.* blackrock.com/corporate/investor-relations/transition-investing. Accessed on January 4, 2023.

BloombergNEF (commissioned by GFANZ), *Mobilizing capital into emerging markets and developing economies*, November 2022.

CaixaBank, "CaixaBank participates in Kingsfisher's new £550m revolving credit facility linked to sustainability targets," July 21, 2021, caixabank.com/comunicacion/noticia/caixabank-participates-in-kingsfishers-new-550m-revolving-credit-facility-linked-to-sustainability-targets_en.html?id=42907#.

Chandler, David L., "Study reveals plunge in lithium-ion battery costs," MIT News, March 2021. news.mit.edu/2021/lithium-ion-battery-costs-0323.

Climate Bonds Initiative, *Financing credible transitions: How to ensure the transition label has impact*, September 2020.

Commodity Futures Trading Commission, "CFTC extends public comment period on request for information on climate-related financial risk," July 18, 2022, cftc.gov/PressRoom/PressReleases/8557-22.

CPP Investments, *The decarbonization imperative*, November 2022. cppinvestments.com/insights-institute/the-decarbonization-imperative.

CPP Investments, *The future of climate change transition reporting*, October 2021, cppinvestments.com/insights-institute/climate-change-transition.

Council for Inclusive Capitalism, *Achieving a just energy transition: A framework for company action*, 2022.

Ecosystem Marketplace, ecosystemmarketplace.com/. Accessed on January 4, 2023.

European Central Bank, *Climate risk stress test: Final results*, July 2022.

European Court of Auditors, *Energy taxation, carbon pricing and energy subsidies*, January 2022.

EU Platform on Sustainable Finance, *Transition finance report*, March 2021.

Glasgow Financial Alliance for Net Zero (GFANZ), *Financial institution net-zero transition plans*, June 2022.

GFANZ, *The managed phaseout of high-emitting assets*, June 2022.

GFANZ, *Our progress and plan towards a net-zero global economy*, November 2021.

Global Subsidies Initiative and International Institute for Sustainable Development, *Fossil-fuel subsidies: A barrier to renewable energy in five Middle East and North African countries*, September 2014.

Goldman Sachs, *Accelerating transition: Task Force on Climate-Related Financial Disclosures report 2021*, December 2021.

Goldman Sachs, "Bloomberg Philanthropies and Goldman Sachs deploy $25 million to advance clean energy solutions in South and Southeast Asia," September 21, 2021, goldmansachs.com/media-relations/press-releases/2021/climate-innovation-fund-launch-25million-funding.html.

Gosling, Tom, and MacNeil, Iain G., "Can investors save the planet? - NZAMI and fiduciary duty," *Oxford Business Law Blog*, November 21, 2022.

HSBC, *Green trade finance*, business.hsbc.com.cn/en-gb/campaigns/sustainable-finance/green-trade-finance. Accessed on January 4, 2023.

HSBC Sustainability Tracker, sustainabilityassessment.business.hsbc.com/en-gb. Accessed on January 4, 2023.

IEA, ETP Clean Energy Technology Guide, September 2022, iea.org/data-and-statistics/data-tools/etp-clean-energy-technology-guide.

IEA, *Electricity market report – January 2022*, 2022.

IEA, *World Energy Outlook 2021*, December 2021.

IEA, *Net zero by 2050: A roadmap for the global energy sector*, October 2021.

IEA, *Financing clean energy transitions in emerging and developing economies*, June 2021.

IEA, *Renewables 2020: Analysis and forecast to 2025*, November 2020.

Institute of International Finance (IIF), *Climate and capital: Views from the Institute of International Finance*, July 2022.

IIF, *The principles for stable capital flows and fair debt restructuring*, April 2021.

IIF, *Voluntary carbon markets chartbook Q2 2022*, July 2022.

Integrity Council for the Voluntary Carbon Market, *The core carbon principles*, 2022, icvcm.org/the-core-carbon-principles/.

International Capital Market Association, Climate transition finance handbook 2020, December 2020.

International Capital Market Association, *Sustainability-linked bond principles*, June 2020.

International Organization of Securities Commissions, *Voluntary carbon markets: Discussion paper*, November 2022, iosco.org/library/pubdocs/pdf/IOSCOPD718.pdf.

Linklaters, *Sustainable Futures*, "COP27: Week 1 recap," blog entry, November 16, 2022, sustainablefutures.linklaters.com/post/102i1mn/cop27-week-1-recap.

Legal & General Investment Management, *Responsible investing: Our approach and credentials*, lgim.com/uk/ad/responsible-investing/. Accessed on January 4, 2023.

Loan Programs Office, "Advanced clean energy storage," June 2022, https://www.energy.gov/lpo/advanced-clean-energy-storage.

Long Duration Energy Storage Council and McKinsey & Company, *Net-zero heat Long Duration Energy Storage to accelerate energy system decarbonization*, November 2022.

McKinsey & Company, Climate Risk Survey 2021.

McKinsey & Company, *Managing financed emissions: How banks can support the net zero transition*, November 2022.

McKinsey & Company, *A blueprint for scaling voluntary carbon markets to meet the climate challenge*, January 2021.

McKinsey Global Institute, T*he net-zero transition: What it would cost, what it could bring*, January 2022.

McKinsey Transition Finance Model.

National Renewable Energy Laboratory, "Documenting a decade of cost declines for PV systems," February 10, 2021, nrel.gov/news/program/2021/documenting-a-decade-of-cost-declines-for-pv-systems.html.

Net-Zero Banking Alliance, United Nations Environment Programme Finance Initiative, *NZBA transition finance guide*, October 2022.

OECD, *OECD guidance on transition finance: Ensuring credibility of corporate climate transition plans*, October 2022, doi.org/10.1787/7c68a1ee-en.

Palmer, Annabelle, "Sovereign carbon credits unsettle voluntary carbon markets," Environmental Finance, October 2022, environmental-finance.com/content/analysis/sovereign-carbon-credits-unsettle-voluntary-carbon-markets.html.

Parkes, Rachel, "Delta places huge order for sustainable aviation fuel made with 839 MW of green hydrogen," *Recharge*, September 6, 2022, rechargenews.com/energy-transition/delta-places-huge-order-for-sustainable-aviation-fuel-made-with-839mw-of-green-hydrogen/2-1-1291711.

Portfolio Alignment Team, *Measuring portfolio alignment: Technical considerations*, 2021.

Rapier, Robert, "Why China Is dominating lithium-ion battery production," *Forbes*, August 4, 2019, forbes.com/sites/rrapier/2019/08/04/why-china-is-dominating-lithium-ion-battery-production/?sh=5b64d0433786.

Santander, *Environmental, social and governance supplement 2021*, 2021, santander.co.uk/assets/s3fs-public/documents/santander_esg_2021_interactive.pdf.

Schroders, E*ngagement blueprint: Our vision for active ownership at Schroders*, February 2022.

"Companies Taking Action," Science Based Targets, sciencebasedtargets.org/companies-taking-action#anchor-link-test. Accessed on January 4, 2023.

Sylvera, sylvera.com/. Accessed on January 4, 2023.

Sustainable Aviation Buyers Alliance, rmi.org/saba/.

UK Transition Plan Taskforce, *Consultation: The Transition Plan Taskforce disclosure framework*, November 2022.

UN, *Integrity matters: Net zero commitments by businesses, financial institutions, cities and regions: Report from the United Nations' High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities*, November 2022.

Voluntary Carbon Markets Integrity Initiative, vcmintegrity.org/. Accessed on January 4, 2023.

McKinsey & Company

January 2023