WORLD ECONOMIC FORUM

in collaboration with McKinsey & Company

The role of public–private–philanthropic partnerships in driving climate and nature transitions

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Preface

This report was created by the World Economic Forum (WEF) in collaboration with McKinsey Sustainability. It is part of a growing body of research examining ways to advance a more orderly climate and nature-positive transition. It focuses specifically on partnerships between public, private, and philanthropic actors, or "4P models." These partnerships, which often also feature social-sector anchors and executors, are an emerging model designed to address the complex, multistakeholder and system-level shifts required to support climate and nature transitions.

Creating these models can be complex, requiring significant collaborative effort and a long runway. Our research aims to support the creation, sustenance, and scaling of these partnerships by exploring where to focus their efforts and how to ensure their success.

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Several McKinsey colleagues provided valuable input and expertise: Rui Chen, Charlie Dixon, Duko Hopman, Joshua Katz, Jake Wellman, and Dee Yang.

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In brief

Partnerships bringing together the public sector, the private sector, and the philanthropic sector are increasingly emerging to address climate and nature challenges such as tackling the net-zero transition, reducing forest loss, and promoting biodiversity. Such public–private–philanthropic partnerships (4P models) can require considerable effort and commitment to pull together and use to deliver successful impact. This research takes a closer look at existing 4P models and uses a data-driven approach to suggest a framework that could help identify solution focus areas where a 4P construct is most needed, is well suited, and justifies the collaborative effort.

Key findings include the following:

As cross-sectoral and multistakeholder collaborations, 4P models are by nature well suited to addressing complex climate and nature challenges. Such challenges require deep, system-level transformation, which in turn requires an understanding of the needs and constraints of a broad set of actors, the ability to bring these actors together around well-defined objectives, the willingness to take a longer-term perspective, the capacity to run a robust day-to-day operation, and an appetite for experimentation. More than 50 4P models have emerged in the past 20 years, showing early indications of progress but also highlighting the challenges of properly defining, executing, and scaling such partnerships. Examples include a marine conservation grant program funded by savings from a debt-for-nature swap in the Seychelles and a US-government-led partnership to increase energy access and low-carbon growth across sub-Saharan Africa.

A framework resting on three pillars—materiality, suitability, and feasibility—can help identify or assess priority focus areas for 4P models. Based on our analysis of existing models, we propose a systematic approach that highlights a set of global solution focus areas in which 4P models are highly relevant (recognizing the possibility that 4P models might also be successful elsewhere).

— *Materiality.* By materiality, we mean ensuring that 4P models are directed toward areas representing the greatest societal needs and potential for benefit. The need for change implied by the materiality criteria is not merely tied to the size of a solution or the scale of resources required. Materiality focuses on countries, systems, and sectors that have the lowest capacity to respond, greatest needs, and most to gain in terms of livelihood and well-being impacts that may result from addressing planetary challenges.

— *Suitability.* Focusing on suitability ensures that the types of solutions in which 4P models invest time, energy, and resources are well matched to the strengths of this form of collaboration and that the interests of all three types of partners are aligned. Prioritizing solution focus areas involves two criteria. The first is to consider focus areas that are beyond exploratory development but not yet at positive inflection points in widescale, commercial adoption. The second is to give priority to areas where the model itself will have high potential for impact (including urgency and socioeconomic co-benefits), high scalability potential, and additionality of action.

— *Feasibility.* The feasibility of a 4P model must be assessed at the level of the model itself and aligns its scope with its desired ambitions and intended outcomes. Crucially, a 4P model's feasibility will depend on its having a scope that is at once broad enough to be effective and narrow enough to be achievable. In addition, a feasible model can attract an anchor stakeholder willing to experiment with new approaches, have the right level of capital and resources relative to its ambition, and align the three sets of partners on questions of risk, return, and impact.

Applying this framework to more than 130 potential climate and nature solution sets and six global sectors highlights 31 solution focus areas primed for 4P action today. Our analysis is informed by four of the nine planetary boundaries: climate change mitigation, biodiversity loss, forest cover loss, and freshwater consumption.[1] Unsurprisingly, priority solution focus areas that emerge from this analysis are primarily concentrated in the power and the agriculture and forestry sectors and in land conservation. While our analysis prioritizes 31 focus areas, 4P models may well be effective mechanisms outside these focus areas, particularly when considered at regional and national levels (rather than at the global level), as well as within specific sectors and subsectors.

These 31 solution focus areas are associated with 30 percent of global emissions and 30 percent of total land area. Thus, effective action by 4P models could have significant benefit for the world. To illustrate the potential, we present deep dives that examine six of these priorities: phasing out coal power in the Philippines, restoring degraded mangroves in Indonesia, improving pasture and animal health in Brazil, ensuring equitable access to electrified transportation in the United States, increasing the mitigation and resiliency opportunities for rice production in Thailand, and expanding clean cooling in India.

An analysis of 4P models suggests five learnings for successful implementation. First is the value of establishing an anchor partner to convene the others and assure robust governance. Critically, this anchor helps the partnership take an outcomes-focused view and provide some of the start-up capital and runway to the multiyear process of getting a 4P model off the ground, sustaining action, and gradually achieving impact. Second, an effective strategic model is two-pronged, combining opportunistic strategies to take advantage of moments when political will and funding momentum come together with a long-game strategy that addresses the infrastructure, enabling conditions, and behavioral shifts needed to support lasting change. Third, building on a preexisting model where possible, rather than starting from scratch, can leapfrog the start-up and validation process. This approach could include harnessing existing initiatives led by family offices, corporate foundations, city and regional governments, and small and medium-size enterprises. Fourth, considering and communicating the potential of climate and nature solutions to address other sustainable development goals (including health, poverty, and equity) can tap a wider pool of funding and channels of impact. Finally, first-of-their-kind 4P constructs may require substantial resources and a well-functioning operational machine, so they will need an adequate runway before they achieve success.

This report represents a point-in-time view, based on the needs and realities of today. The solution focus areas will evolve over time and should in no way exclude other ideas that already have momentum or high potential for impact. Our analysis takes a global perspective grounded in country archetypes; in some geographies and markets, different solution focus areas may be pertinent. Nonetheless, our hope is that this research will help inform the growing global interest in harnessing 4P models to address some of our era's most pressing challenges.

[1] Will Steffen et al., "Planetary boundaries: Guiding human development on a changing planet," *Science,* January 2015, Volume 347, Number 6223.

Executive summary

The pressing need for climate and nature action is increasingly felt across the world. In response, governments and companies have been multiplying commitments and actions in areas such as the net-zero transition, biodiversity loss prevention, and broader natural-capital preservation.[2] These have in turn accelerated the momentum for public–private partnerships that combine the public sector's ability to create enabling conditions with the private sector's scaling ability. For their part, philanthropies are increasingly turning their attention to climate and nature, seeing them as key challenges in their own right and as intimately linked to the core issues of equity and development that have long been at the heart of their agendas.

We now see early signs of the public, private, and philanthropic sectors—often alongside a broader range of social-sector actors (including NGOs, nonprofits, think tanks, and community organizations)—embracing such partnerships to tackle systemic climate and nature challenges. These public–private–philanthropic partnerships, or 4P models, have included transactional financing, industry-targeted initiatives, and wide-ranging knowledge-sharing platforms. They often (but not always) focus on emerging economies.

This report suggests a framework for such multistakeholder models. It is based on a data-driven analysis of more than 50 existing partnerships and hundreds of climate and nature solutions, alongside dozens of expert interviews. It is intended to help ensure that time, energy, and resources are directed toward the solution areas that justify the significant collaborative effort 4P models entail.

We identified 31 solution focus areas among almost 135 global climate and nature solution sets that are primed for high and immediate impact through 4P models. Our analysis revealed that solution areas within the power and the agriculture and forestry sectors, as well as those addressing land conservation, consistently demonstrate high potential for impact across multiple geographies. This should not come as a surprise, as these sectors are central to climate and nature transitions, have cascading influence across all parts of the global economy, and feature proven (but not yet widely adopted) climate and nature solutions with high socioeconomic co-benefits and potential for scale.

Collectively, we estimate that these 31 identified areas globally account for about 30 percent of global emissions and 30 percent of total land area (Exhibit 1).[3] Thus, effective action by 4P models could have significant positive impact. In this report, we dive deeper into six of these identified areas around the globe to showcase how solutions such as supporting energy transitions and restoring mangroves can benefit from 4P models.

These partnerships are evolving rapidly, and we continue to build our library of use cases and high-impact solution focus areas. This report seeks to be neither prescriptive nor a comprehensive assessment (see sidebar "Scope and limitations of materiality and suitability analysis"). Nevertheless, we hope it will contribute to identifying and implanting the best ways for different societal actors to collaborate on essential questions relating to the future of the planet.

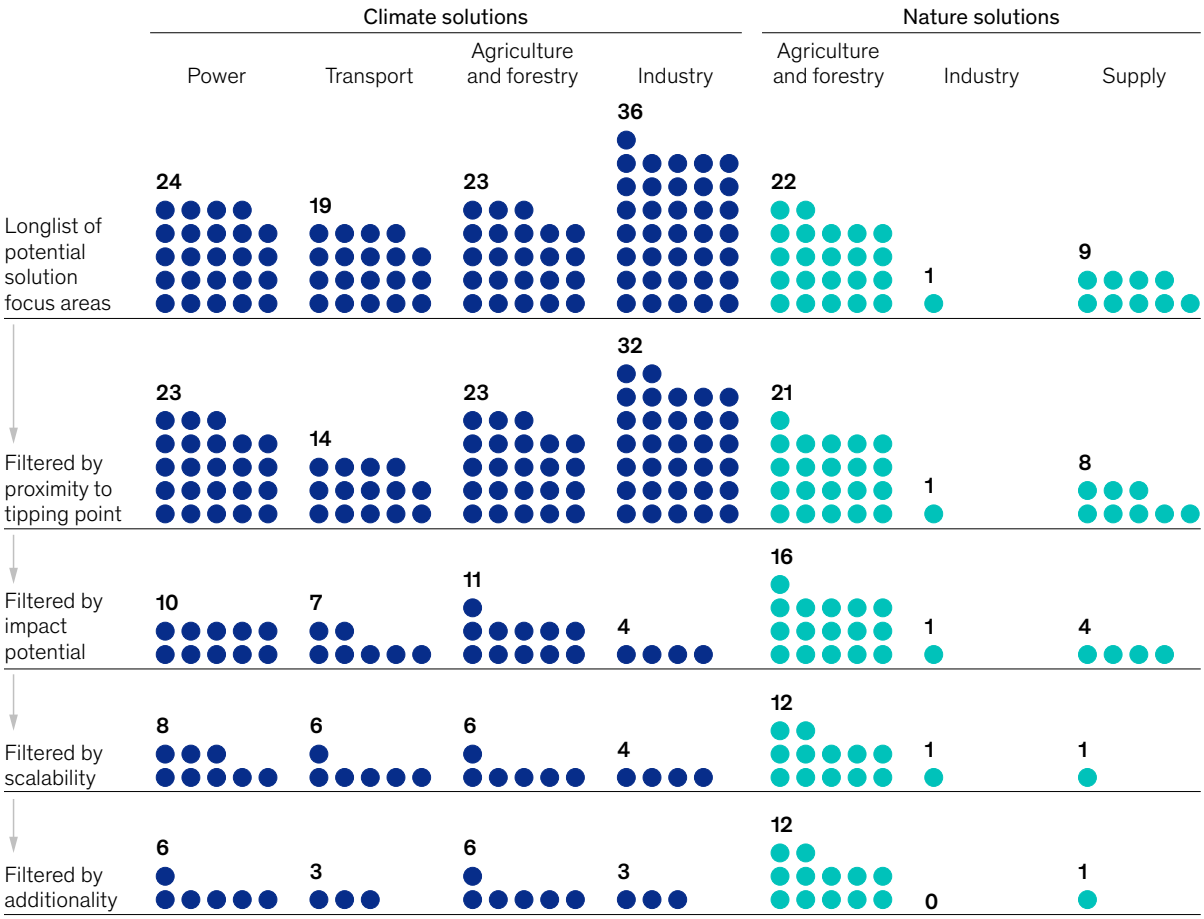
[2] McKinsey has published extensively on these topics. Recent reports include "The net-zero transition: What it would cost, what it could bring," January 2022; "The energy transition: A region-by-region agenda for near-term action," December 15, 2022; and "Nature in the balance: What companies can do to restore natural capital," December 5, 2022.

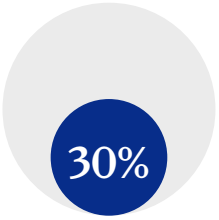
[3] The emissions number was calculated based on the emissions associated with the relevant subsector in prioritized geographies. For example, the calculation for the transport solution focus areas includes emissions from fuel combustion in countries that are fossil fuel resource producers, service-based economies, and downstream-emissions manufacturers (see Appendix A for country descriptions). The land number was calculated based on the relevant land area covered by the prioritized hot spots.

Exhibit 1

Thirty-one solution focus areas are associated with 30 percent of global emissions and 30 percent of global land area.

Number of potential solution focus areas, by solution type and sector





share of global emissions associated with the **18 climate solution** focus areas well-suited to the 4P model

share of global land area associated with the **13 nature solution** focus areas well-suited to the 4P model

Scope and limitations of materiality and suitability analysis

This report presents a point-of-time view of 4P models and their areas of focus, and these may change over time. The global solution focus areas identified by the analysis are not meant to preclude the potential of new models to succeed, nor to exclude other ideas that already have momentum. In some geographies and markets, the answers will be different. Rather, this analysis seeks to highlight solution areas requiring urgent intervention and where 4P models could unlock major systems change.

Further, our research has limitations and continues to evolve, and this report should not be taken as our final word on the topic. For example, this analysis prioritizes the largest areas for 4P model intervention. This inherently requires setting thresholds for the various criteria. Changing these thresholds—particularly as new information becomes available—would affect which solution focus areas are prioritized (see Chapter 3 for a discussion of alternative prioritization).

Moreover, this analysis has been ordered sequentially, which is not always how ideas are prioritized in the real world. Solution focus areas that seem less suited based on one part of the framework but more suited based on the remaining criteria could still result in a successful 4P model. For example, some 4P models focus on decarbonizing shipping. Although shipping did not pass the first stage of our suitability analysis, existing 4P models show that it would pass through the remainder of the framework. Similarly, 4P models that focus on early-stage technologies also would not pass the first stage of our suitability threshold but may prove viable.

Accordingly, this list of solution focus areas is not meant to be exclusionary. Rather, when ideas emerge organically, organizations could take these ideas through the rest of the framework to ensure impact, particularly in areas that attract significant interest across the public, private, and philanthropic sectors.

Climate and nature challenges lend themselves to multistakeholder collaboration

Solving climate and nature challenges entails deep, system-level transformation. This in turn requires an understanding of the needs and constraints of a broad and diverse set of actors, the ability to bring those actors together to address well-defined objectives, the willingness to take a long-term perspective that allows for action today with benefits in the future, the capacity to run a robust day-to-day operation with a team whose duties include ensuring the partnership stays on track with its initiatives, and an appetite for experimentation and risk-taking. By their very nature, 4P models are well suited to address these issues, because they bring together many actors, each with different capabilities and strengths:

— *The public sector* can enact policies, put in place incentives, regulations, and support mechanisms, and invest funds to support solutions and create stable and positive enabling conditions for further investments.

— *The private sector,* including corporations supported by investors, can establish the required business models and mobilize resources to grow and deploy solutions at scale.

— *Philanthropic sectors* can leverage their higher risk tolerance, longer time horizons, and knowledge of intergenerational and equity issues to invest in solutions that are not yet widely adopted. Philanthropies can also bring an end-to-end cross-sectoral view to enable closer collaboration across actors.

— *The broader social sector (for example, NGOs/non-profits such as advocacy organizations, think tanks, and service providers),* when brought into the partnership, can ensure solutions are delivering impact for all stakeholders, including women, children, indigenous communities, and those whose voices are less often heard.

More than 50 such 4P models within the climate and nature space have emerged in the last two decades, providing a sign of early progress in tackling some issues jointly. The Initiative 20x20 4P model has convened 150 partners and aims to change the dynamics of land degradation in Latin America and the Caribbean and advanced restoration across the region. The partnership has committed $2.5 billion of private capital to support government commitments to protect and restore more than 50 million hectares of land.

In sub-Saharan Africa, the decade-old Power Africa describes itself as a US-government-led partnership that brings together political leaders, companies, and financial institutions to increase energy access and low-carbon economic growth in the region. In the last ten years, according to its website, Power Africa has supported 37.5 million new connections and has closed on 14,000 megawatts of clean energy projects.

The 4P model, while most often deployed in emerging economies, can also be effective in advanced economies. Breathe London, whose pilot was funded by the Clean Air Fund, aims to improve air quality in the city of London. Current partners listed on its website include Bloomberg Philanthropies, Clarity, the Mayor of London, and the Social Innovation Partnership. The work from Breathe London and other cities will be expanded on through Breathe Cities, an initiative between Bloomberg Philanthropies, C40 Cities, and the Clean Air Fund to improve air quality across cities globally.[4]

For all their successes, the examples to date also bring to light the challenges of properly defining and executing such partnerships. Among the issues are the time and resources inherent in bringing multiple stakeholders to the table. By design, 4P models require multiple actors to come together simultaneously with aligned interests and a willingness to roll up their sleeves to act and experiment with novel approaches. Many 4P models have taken years to get off the ground or found it hard to maintain both funding and action momentum over the many years it can take to seed 4P model action and see its fruits. These challenges highlight how 4P models are an effective mechanism only under the right conditions. In the face of the huge climate and nature issues that must be addressed in this decade, 4P partnerships can make important contributions but must be carefully targeted to where they are most critically required and best suited.

Materiality, suitability, and feasibility provide a framework for evaluating priority areas

Based on the findings of our analysis of 4P models, we propose a framework to evaluate the materiality, suitability, and feasibility of such partnership concepts (Exhibit 2). Materiality and suitability are assessed at the level of the solution

[4] "Breathe Cities: New initiative to tackle air pollution in cities around the world," Clean Air Fund, June 26, 2023.

Exhibit 2

Our framework uses the criteria of materiality, suitability, and feasibility to evaluate public–private–philanthropic partnership models.

Evaluation framework

Materiality
Identifying industry and geographic hot spots with the highest return on the action, with meaningful co-benefits for resiliency, livelihoods, and well-being

Suitability
Determining solution focus areas that are in proximity to a positive tipping point, with impact potential, scalability, and additionality

Feasibility
Confirming the proposed model has a motivated anchor stakeholder, is appropriately scoped, and has alignment of expectations

focus area of a potential partnership, while feasibility is evaluated in the context of a particular partnership concept, considering the geography, scope, and other design choices the partnership would entail.

Materiality: Significant impact and meaningful co-benefits

Prioritizing materiality ensures that any 4P models—which come with high transaction costs in terms of time, energy, and financial and human resources to form and run partnerships—are directed toward areas with the greatest need and potential for positive impact on people and planet. Our analysis suggests that the most critical dimension here is to choose solution focus areas that have the highest return on the action with meaningful co-benefits for resilience, livelihoods, and well-being (see Exhibit 3, which shows the opportunity level by country archetype and sector).

Exhibit 3

Agriculture, forestry, and power emerge as critical across both climate and nature.

Climate solutions

Opportunity level by country archetype and sector

Low High Prioritized hot spot

Country archetype	Power	Transport	Agriculture and forestry	Industry	Buildings	Removals
	Sector					
Agriculture-based economies						
Forestry-intensive countries						
Emissions-intensive producers						
Fossil fuel resource producers						
Downstream-emissions manufacturers						
Service-based economies						

Nature solutions

Opportunity level by nature theme and sector

Low High Prioritized hot spot

Nature theme		Power	Agriculture and forestry	Industry	Supply	Buildings
		Sector				
Forests		N/A		N/A	N/A	
Biodiversity		N/A		N/A	N/A	
Freshwater system	High demand, low supply					N/A
	High demand, high supply					N/A
	Low demand, low supply					N/A
	Low demand, high supply					N/A

Source: Curtis, et al. (2018); Mair, et al. (2021); Allan et al. (2022); Jung et al. (2021); Strassburg et al. (2020), WRI Aqueduct Global Maps 3.0 Data

To maximize impact return relative to effort, 4P models would gain from focusing on the most significant climate and nature challenges in geographies with the lowest capacities to address them. Existing 4P models illustrate this prioritization, with 87 percent focused on emerging economies, which can be less able than advanced economies to deliver solutions independently. Our analysis also suggests that solution focus areas that spur progress on co-benefits—including climate adaptation, economic development, and health—in addition to mitigation could give rise to broader coalitions of stakeholders and be better received by local communities. About 40 percent of existing climate and nature-focused 4P models, for example, reference socioeconomic co-benefits in their mission statements, which reflects the growing interest of all three sets of stakeholders in finding solutions that address both people and climate and nature challenges.

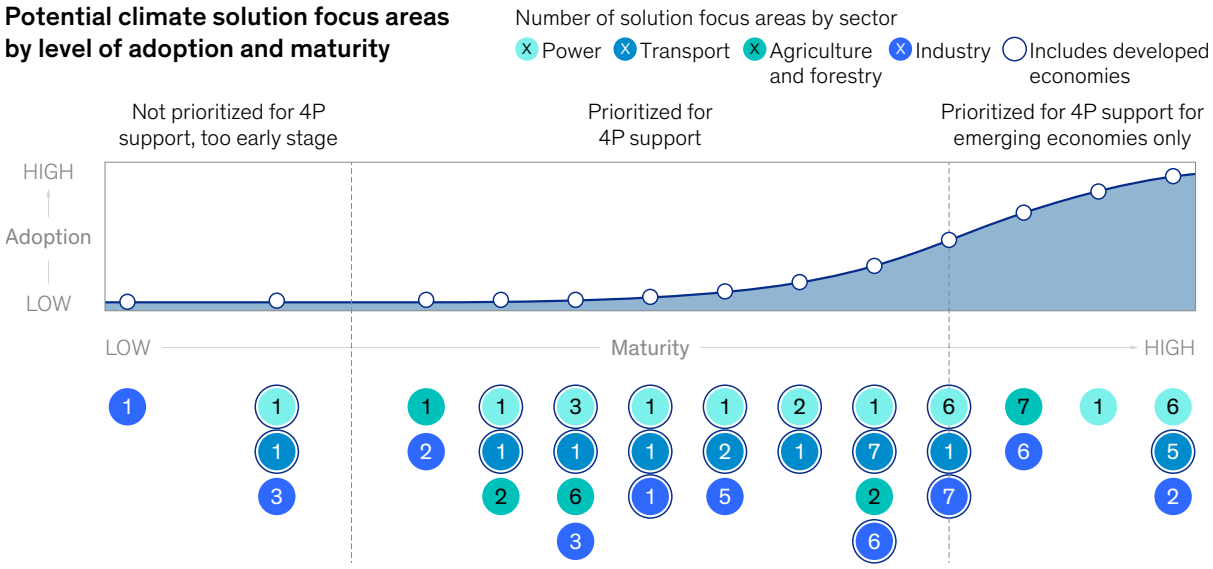
Suitability: Matching needs to capabilities

The second part of our three-part framework is suitability. Focusing on suitability ensures that the time, energy, and resources invested in developing and scaling partnerships are well matched with the strengths of this form of collaboration and where the partners' interests are aligned. Solution areas that are mostly likely to align commercial and impact interests across each partner's interests are areas that have been proven but are still building toward positive tipping points of adoption and scale. Such solution areas constitute the most common examples of 4P models. More than 95 percent of reviewed 4P models focused on rolling out established—but not necessarily commercially viable—technologies, rather than on innovating (Exhibits 4 and 5). These partnerships (81 percent of the models reviewed) mainly seek to address challenges by unlocking investment, supporting the creation of new markets, or both.

Additional proxies for suitability include the capacity and potential to scale and replicate across multiple sectors and geographies. Seventy-one percent of 4P models either have evolved or aimed at the outset to have a multinational focus, enabling the spread of successful models and learnings from one geographic context to others.

Exhibit 4

More than 90 percent of climate solution focus areas that were analyzed are close to positive tipping points.

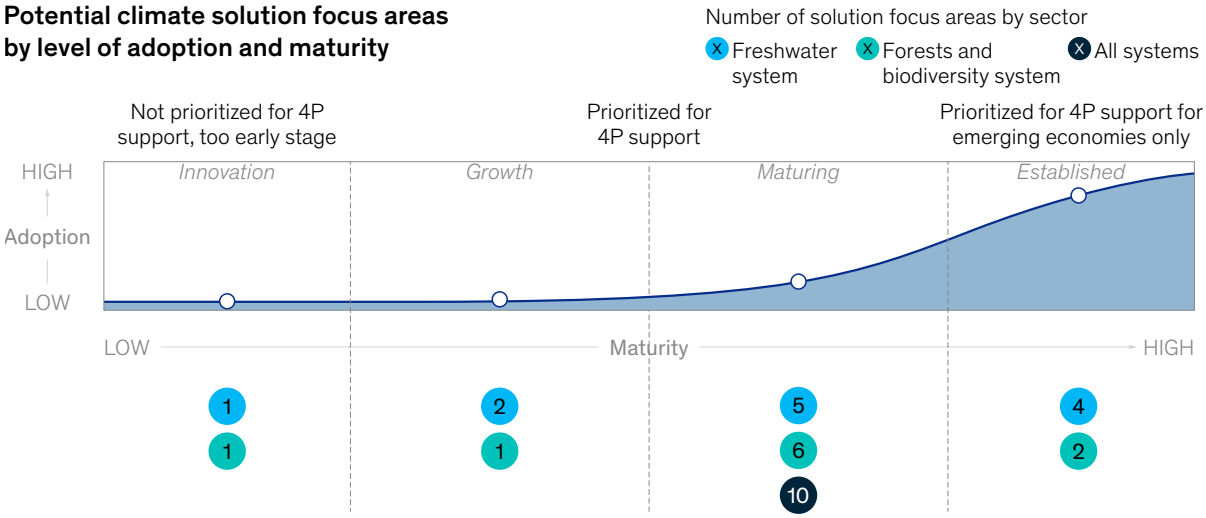


Note: "Positive tipping point" is defined as the point at which a solution begins to precipitate positive feedback loops, virtuous cycles, or the mainstreaming of new approaches.
Source: IEA Technology Readiness Level

Exhibit 5

More than 90 percent of nature solution focus areas that were analyzed are close to positive tipping points.

Potential climate solution focus areas by level of adoption and maturity



Note: "Positive tipping point" is defined as the point at which a solution begins to precipitate positive feedback loops, virtuous cycles, or the mainstreaming of new approaches. Solution focus areas were ranked by category, so maturity can only be compared between categories.
Source: IEA Technology Readiness Level

Feasibility: Anchor partner, resources, and alignment

The third part of the framework is feasibility. Once materiality and suitability have been established around the 4P model's intended ambition, the feasibility layer of the framework starts to evaluate whether the model in consideration is set up for success. Three high-level dimensions of feasibility are most critical: first, the presence of at least one anchor partner who is willing to put real time and resources into forming and driving the partnership; second, alignment of the capital, governance, and resources provided by the partners with the scale of solution(s) in focus; and third, formal alignment across all participants on what constitutes success, including acceptance of associated risk, return, and impact. Put simply, these criteria bring into view whether the 4P model will have adequate runway and momentum—and whether it is rightsized to its ambitions.

On the first question of anchor stakeholders, our analysis suggests that at least one motivated actor is needed to put 4P models together and/or drive action. Philanthropic actors play this anchor role frequently but not exclusively. The anchor must be willing to experiment with approaches and models beyond what they have historically attempted. For example, the Drive Electric Campaign emerged from ClimateWorks Foundation's work in transportation. It made significant investment to convene key stakeholders, which ultimately led to the formalization of the campaign with a broader coalition of philanthropic partners.[5] In the case of larger 4P models, a social-sector actor or jointly established operating body drives action by leveraging funding from the public, private, and/or philanthropic sector either at the outset or soon following the partnerships' establishment. Often, the anchor is a philanthropic actor, but there are examples of the private sector taking this role. For example, BlackRock is the anchor in the Climate Finance Partnership (CFP), which aims to accelerate the flow of capital into climate-related investments in emerging markets.[6]

[5] "Ending polluting road transport in time to avoid a climate crisis," The Audacious Project, September 20, 2021.
[6] "Climate Finance Partnership," BlackRock, 2023.

Second, partnerships need to ensure that the scale of capital and efforts matches the scale of impact and solutions at hand. A smaller-scale 4P model may be better suited to address a single challenge in a specific market. For example, the Seychelles Conservation and Climate Adaptation Trust, a fund created from a debt-for-nature swap in the Seychelles, says that it supports ocean conservation and adaptation through the disbursement of typically less than $1 million in annual grants. That initiative operates at a much smaller scale than, for example, Initiative 20x20, which seeks to restore 50 million hectares of land in Latin America and the Caribbean by 2030 and has more than 85 partners that represent more than $3 billion in private investment.[7]

The third dimension, that of alignment, underscores the need to align on a joint definition of success at the outset and prepare for the risk, return, and impact implications for each actor. In the case of scaling or managing larger 4P models that feature multiple partners with varying objectives and tolerances, flexible participation structures can help address potential misalignment. For example, the Food and Land Use Coalition has established multiple core partnership platforms but also notes on its website that it welcomes affiliate platforms to encourage a diversity of collaborators and participants.

Out of 134 solution focus areas analyzed, 31 are primed for impact through 4P models

The systematic approach we use analyzed 134 solution focus areas and identified 31 of these as primed for impact through 4P models. Our analysis covers climate change mitigation, biodiversity loss, forest cover loss, and freshwater consumption—four planetary boundaries for which sufficient data for quantitative comparisons exists.[8] Through a review of six country archetypes (which we defined) and 18 industries in six economic sectors, we identified 29 hot spots that met the materiality indicator of featuring high-need areas with low capacity to meet these challenges and significant socioeconomic co-benefits.

Within these 29 hot spots, we identified and evaluated 134 potential solution sets for suitability with 4P models. These included 102 climate solution focus areas and 32 nature solution focus areas. Of these, 31 solution sets were found to have high potential at a global level, primarily in the power sector, agriculture and forestry sector, and land conservation space.

Collectively, these solution focus areas could have a substantive impact. We estimate that these 31 areas globally account for about 30 percent of global emissions and 30 percent of total land area.

Successful 4P models require careful implementation, applying lessons learned from experience

Looking across the range and variety of 4P models already in operation today, we identify five key lessons among others.

First, it is important to establish an anchor stakeholder and robust governance. Forming novel 4P models in high-need geographies and systems will require an anchor partner who can take a long-term view and provide some of the start-up capital and runway to the multiyear process of getting a 4P model off the ground and into action through a strong central secretariat and a set of robust operational procedures.

Second, it is judicious to seize the moment and momentum of change. Specific strategy and results frameworks for 4P models are not well established, given the nascency of the model itself, but broader best practice entails

[7] "Restoring Latin America's landscapes," Initiative 20x20, accessed September 8, 2023.
[8] For details of our prior research on planetary boundaries, see "Nature in the balance," December 2022; Richardson et al., "Earth beyond six of nine planetary boundaries," September 2023.

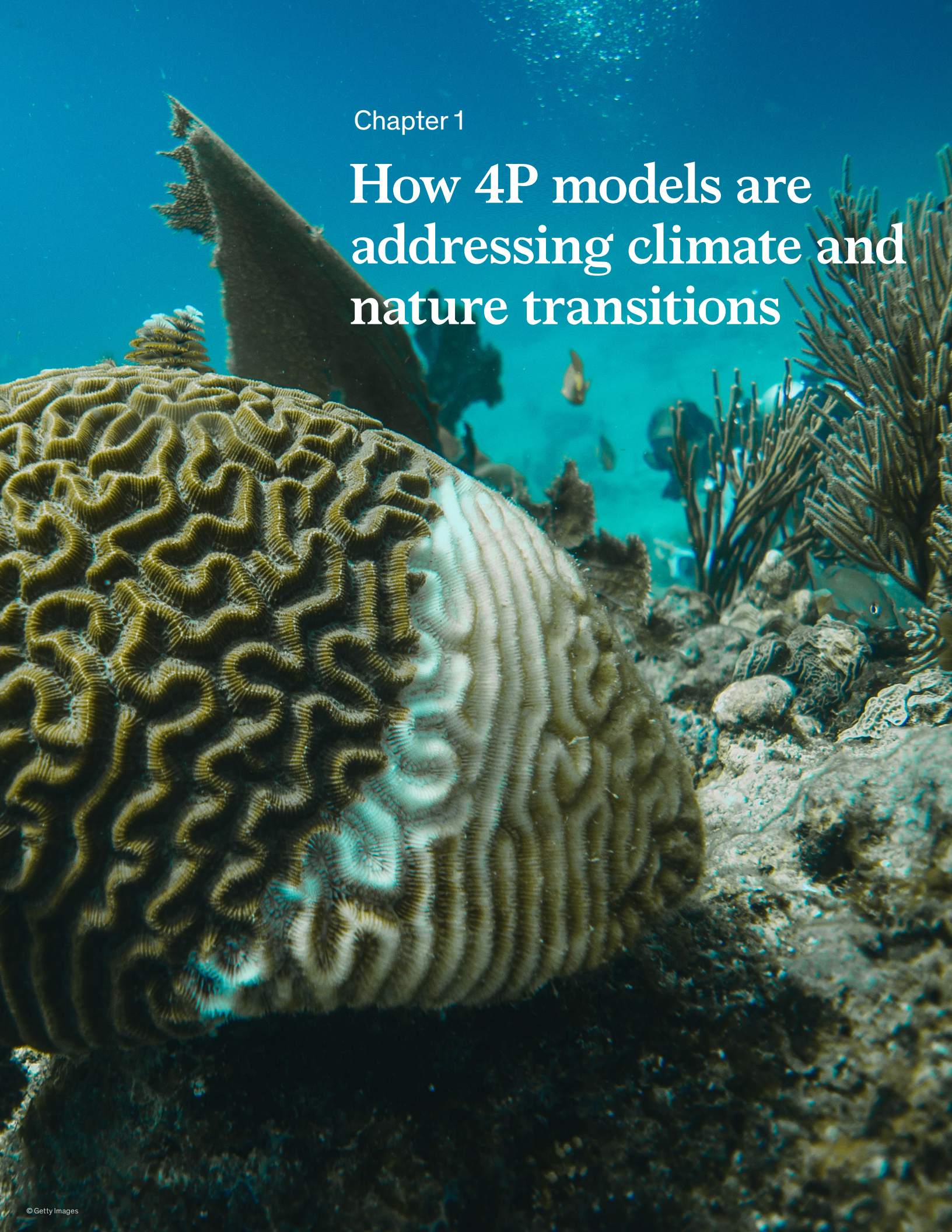
creating a two-pronged strategic model. One prong is a shorter-term opportunistic strategy that takes advantage of moments when political will and funding momentum come together. The other is a long-game strategy for building the infrastructure, enabling conditions, and behavioral shifts required to support lasting change.

Third, 4P models can benefit from building on a preexisting base. Refining, expanding, or scaling existing 4P models to meet emerging strategic priorities may be more effective than starting from scratch. They also may be more conducive to harnessing smaller pockets of funding from new sources such as family offices, corporate foundations, city and regional governments, and small and medium-size enterprises.

Fourth, it is valuable to build a wide tent. For access to a wider pool of funding and channels of impact, 4P models should consider and communicate the potential of climate and nature solutions to address other sustainable development goals—for example, health, poverty reduction, and equity. This is not merely a matter of communication but also can affect both the what and the how of the partnership.

Finally, building first-of-their kind constructs requires significant resources, including capital and institutional capacity. Not all structures may be capable of scaling appropriately, so the right resources must be deployed to achieve impact. This lesson is particularly relevant for novel Just Energy Transition Partnerships (JETPs), which have attracted significant interest and capital aimed at transforming the globe toward low-carbon pathways while promoting an equitable transition for the people affected by this pathway. Thus far, JETPs have managed to enable the decommissioning of only a single plant responsible for 5 percent of the project's 2035 target.

By building on the most effective elements of public–private partnership models, leveraging the distinctive strengths of each actor, and incorporating broader knowledge of intergenerational and equity issues, we believe that 4Ps can indeed make a significant contribution to tackling some of the most pressing issues of our time.



Chapter 1

How 4P models are addressing climate and nature transitions

Multistakeholder models involving collaborations between public, private, and philanthropic partners (4P models) have been forming to address complex challenges across industries and geographies, with each partner playing a specific role. Along with the roles of public, private, and philanthropic actors, the basic 4P model frequently involves the broader social sector beyond just philanthropy—in particular, there are often not-for-profit organizations playing an implementing partner role (for example, NGOs engaged in direct service delivery, advocacy, research, and so on). The broader social sector can contribute complementary benefits by providing expertise and/or execution and advocacy capacity. With or without broader social-sector involvement, a 4P model's aim is to drive greater impact than possible if each of the three sectors were to act in isolation.

The 4P model builds on the most effective elements of two-way public–private partnerships (PPPs), which have long been used to achieve socioeconomic impacts, including in the climate and nature spaces. PPPs build on the public sector's critical role in creating market-enabling conditions for novel climate and nature solutions and the private sector's capacity to finance, deploy, and scale these solutions through the appropriate business models. For example, the World Bank Group has developed the Scaling Solar program, which aims to create a market for solar power in relevant countries through privately funded solar projects. The first project, initially signed between Zambia's Industrial Development Corporation and the International Finance Corporation, led to a competitive bidding program. Two solar power plants, adding 76 megawatts of solar power, have now been in operation since 2019 with one of the lowest solar power tariffs in Africa.[9]

Public–private partnerships are a well-established and proven cross-sectoral collaboration method that often should not be replaced by 4P models. But depending on the added value philanthropy can bring in terms of such criteria as risk tolerance, equity, flexibility, and systems thinking, 4P models can expand on the activities of PPPs and have greater impact (see sidebar "Conditions under which 4P models might outperform PPPs").

[9] "Active Engagements: Zambia," Scaling Solar, not dated.

Conditions under which 4P models might outperform PPPs

When might a 4P model add value relative to public–private partnerships? Our analysis suggests four conditions to consider when evaluating the 4P option:

— *Risk tolerance.* Philanthropy has a higher risk tolerance than other sectors, so 4P models can derisk investments that the public and private sectors would not otherwise support. However, these models should be used only when additionality is clear.

— *Equity.* The influence of both the public and philanthropic sectors can prioritize development outcomes for marginalized and vulnerable groups, especially if the social sector also is involved.

— *Flexibility*. The three sectors acting together can be more agile in adapting to different funding needs and take a longer view where they are closely aligned and well structured, including with an anchor stakeholder.

— *Systems thinking.* Philanthropic organizations already focus on intersectional systems, with investments across systems and stakeholders. This characteristic, when taken into account, can be an advantage for addressing particularly complex challenges that lend themselves to 4P models.

Because 4P models leverage all three sectors—public, private, and philanthropic—they can be more suitable than other types of partnerships to address specific climate and nature challenges. Interviews with 4P model practitioners have identified their models' unique ability to develop novel financing mechanisms, build greater capacity at local levels, and influence political will through diverse perspectives.

Partners in the 4P model play distinct roles

Within a 4P model, the three primary sectors and NGO implementing actors naturally tend to play different roles.

Public sector

The public sector plays several distinct roles: creating conditions for change, contributing capital, and promoting equity and other nonfinancial returns. It is often the party best suited to creating the enabling conditions required to deliver systems-level change, including policy changes, financial and nonfinancial incentives, market signals, and forcing mechanisms (such as mandates). The public sector also tends to be the largest source of concessionary capital—in the form of domestic capital or bilateral and multilateral development aid—with large budgetary and financial resources, financed through tax revenues and sovereign debt. Moreover, it can seek outcomes unconnected to financial returns and is directed to promote equitable socioeconomic outcomes. Multilateral organizations are able to work across countries, which could amplify scaling potential.

Private sector

The private sector, including corporations sponsored by investors, is the agent of financial capital, deployment, and scale. Private-sector actors can move quickly to allocate capital, make capital investments, and develop the business and operating models required to change production and consumption patterns. Business models brought by the private sector, of which return-seeking capital is core, ensure the long-term sustainability of the model. Where technological solutions are mature enough and investments have been sufficiently derisked, the private sector can often replicate and deploy solutions across industries and geographies, thereby influencing global value chains at scale.

Philanthropic sector

Philanthropic actors are powerful conveners, providing neutral forums to bring together stakeholders that are unfamiliar or otherwise competitive with each other. The sector is often (though not always) comfortable with longer time horizons and has strong insights into intergenerational and equity issues core to impact. Moreover, philanthropic capital—whether in the form of grants, first loss capital, or technical assistance—can support early-stage technological innovation or derisk solutions ready to scale, offering risk-tolerant concessionary capital. Finally, philanthropy's intersectional focus on systems change allows these institutions to bring together seemingly disparate solutions toward even greater impact.

NGOs and other implementing partners offer complementary resources to help 4P models grow and scale. These organizations offer an additional forum in which stakeholders can convene, with many already holding extensive membership across sectors, often among individuals who may not be well represented by existing government and private-sector institutions. Depending on the nature of the actor, the NGO community holds extensive know-how, technical and research capabilities, local market understanding, and advocacy skills to direct agendas and support a range of stakeholders. These actors will often play a critical role as the day-to-day coordinator and executor for philanthropies in 4P models.

Some established 4P models are already reporting progress toward objectives

Among the public–private–philanthropic partnerships that have emerged in the past two decades, we have identified more than 50 showing early indications of progress and shared interest. These partnerships corroborate the value of such collaborations on a broad range of climate and nature issues.

Our research analyzed publicly available data about more than 50 4P models.[10] We categorized the models in terms of six primary impact levers: enabling next-generation technologies, creating markets, targeting policy barriers, unlocking investment, shifting behaviors, and sharing knowledge (Exhibit 6; see also sidebar "Existing 4P models: Approaches

[10] 4P models were identified through interviews with relevant stakeholders, programs from large philanthropies in the climate and nature space, and press releases around partnership formation coming out of large climate events (for example, COP27). Newly formed 4P models that have yet to finalize full membership structure were included as long as there have been public announcements of the partnership. This analysis was completed across publicly available data only (including websites and press releases) and was not validated with organizations.

and focus areas"). Typically, the 4P models utilize several of these levers at once, creating a multifaceted approach to challenges. For example, financial levers such as creating markets or unlocking investments might be combined with development of enabling environments—say, by targeting policy barriers. Participation in 4P models can also expand the capabilities of the members themselves, including through sharing knowledge.

Exhibit 6

Public–private–philanthropic partnership (4P) models can use multiple levers to initiate change across systems.

Impact lever	4P model using the lever
Enabling next-generation technologies	**Breakthrough Energy Catalyst** aims to accelerate the deployment of essential technologies by funding first-of-a-kind commercial-scale energy projects
Creating markets	**Tropical Forest Alliance** supports the establishment of deforestation-free supply chains for palm oil, beef, soy, and pulp/paper
Targeting policy barriers	**Southeast Asia Energy Transition Partnership** aims to accelerate the energy transition across Southeast Asia by engaging with actors at the local, regional, and national level, with efforts across policy, investment, and technology
Unlocking investment	**Climate Finance Partnership** mobilizes additional private-sector funding for climate change mitigation in emerging markets through a blended finance fund
Shifting behaviors	**Food Action Alliance** serves as a platform to mobilize and coordinate key actors, with the goal of transforming the food system through behavior change, policy, and investments
Sharing knowledge	**IDH Farmfit** supports investment in smallholder farming across Africa, Asia, and Latin America through business analytics and intelligence services to maximize the impact of investments and an associated fund to derisk smallholder investments

Many 4P models have already started to demonstrate initial success in meeting their objectives. For example, &Green is an investment fund that supports deforestation-free commodity production in tropical forest regions. Primary financial contributors—through grants, redeemable grants, and loans—include FMO; the Ford Foundation; the Global Environment Facility; Norway's International Climate and Forest Initiative; the UK government's Department for Business, Energy, and Industrial Strategy;[11] and Unilever. As of 2022, &Green's investments protected 3.6 million hectares of forests, avoiding or sequestering 6.6 megatons of carbon dioxide equivalent (CO_2e). The fund also has directly supported 54,000 farmers in efforts to ensure more sustainable production of commodities.

4P models use varying strategies to achieve their objectives

Depending on their objectives, these partnerships typically form around at least three strategies that reflect distinct theories of change and associated actions. The strategies—financial transactions and funds, sectoral initiatives, and wide-ranging platforms—are not mutually exclusive. Rather, they broadly represent the impetus behind partnership formation and the approach that each 4P model takes for impact.

[11] In 2023, this department was split to form the Department for Business and Trade (DBT), the Department for Energy Security and Net Zero (DESNZ), and the Department for Science, Innovation and Technology (DSIT). Responsibility for national security and investment policy has gone to the Cabinet Office. &Green 2022 Annual Report, July 25, 2023.

Existing 4P models: Approaches and focus areas

Among the more than 50 4P models reviewed, we saw a diversity in approach and topical focus. Given that the focus of our analysis was on climate and nature 4P models, we analyzed mainly 4P models that focused on these areas while acknowledging that many exist outside of the climate and nature space. In 58 percent of the cases, the organization articulated climate change mitigation as the principal objective of the 4P. In the balance of the 4P models, the principal focus was on other topics that contribute to climate change mitigation, such as mobility, renewable energy generation, and agriculture.

Most 4P models are focused on emerging economies (87 percent) and on regions rather than specific countries (65 percent). Moreover, 81 percent of existing 4P models included two of the six impact levers listed in Exhibit 6: unlocking investment, creating markets, or both. Nonetheless, more than one in five 4P models target policy barriers or share knowledge, levers that are critical for market scaling.

Notably, only 4 percent of 4P models aim to enable next-generation technologies, such as direct air capture. Early-stage technologies appear to be less conducive to 4P models, perhaps because the lack of near-term results may not justify the time and effort required to set up a 4P model. Despite the strengths of 4P models, decision makers should keep in mind that such models are not a universally effective mechanism to

Financial transactions and funds

First, collaborations across all three sectors focus on either specific transactions or the creation of investment funds. For example, Seychelles Conservation and Climate Adaptation Trust (SeyCCAT) is a 4P model comprising 19 partners across the public (for example, Government of Seychelles), private (for example, Standard Chartered), and philanthropic (for example, Blue Nature Alliance) sectors to invest in ocean stakeholders to generate new learning, bold action, and sustainable blue prosperity in Seychelles. Stakeholders here usually convene to tackle a specific financing or transactional gap, but in pursuing innovative approaches, they can establish a road map for deals to be scaled elsewhere (see sidebar “Additional examples of 4P models”).

Sectoral initiatives

Other sectoral initiatives focus on directing resources and expertise toward multiple interventions within a specific solution focus area to influence a market. Stakeholders in these types of partnerships often form secretariats to mobilize funding, coordinate interventions, improve enabling environments, and create new knowledge around their goal.

Power Africa, one of the oldest 4P models we reviewed (founded in 2013), is a US-government-led partnership that aims to increase energy access across sub-Saharan Africa, advancing low-carbon economic growth. According to its website, it aims to add 60 million new electricity connections and 30,000 megawatts of new and clean generation capacity. The partnership has supported 37.5 million new connections and has closed on 14,000 megawatts of projects. In 2022 alone, it mobilized $234 million in investment and advisory support, avoiding 7.7 megatons of CO_2. Power Africa works at the sectoral level across all of sub-Saharan Africa, working with governments to support policy change, working with investors to unlock capital, and having a broad range of tools and knowledge documents that all partners in the sector can use.

Wide-ranging platforms

The third strategy involves wide-ranging and often global platforms focused on coordinating large-scale commitments and behavior changes through catalytic actions, particularly across extensive private-sector membership. These platforms typically form in order to achieve a specific time-bound goal. For example, the Getting to Zero Coalition

Additional examples of 4P models

The following models are collaborations focused on specific transactions or fund creation:

— Enduring Earth, a collaboration by The Nature Conservancy, the Pew Charitable Trusts, WWF, and ZOMALAB, provides long-term investment in conservation through Project Finance for Permanence (PFP) initiatives, with the aim to protect at least 600 million hectares by 2030 while upholding the rights of communities and creating sustainable economic growth.[1] This PFP model is an innovative approach that supports longer-term financing, overcoming a key challenge of traditional conservation financing. To date, the partner organizations in Enduring Earth have conserved 120 million hectares across six countries.

— Eco.business Fund, initiated by Conservation International, Finance in Motion, and KFW, supports sustainable practices for both climate mitigation and adaptation across agriculture and agri-processing, fishery and aquaculture, forestry, and sustainable tourism. The fund provides direct investments, financing to intermediaries, and technical assistance across Latin American, the Caribbean, and sub-Saharan Africa. As of December 2022, the fund's investments contributed to 6.3 megatons of CO_2 sequestered and 1.1 mega-hectares of farmland transitioned to sustainable management.[2]

The following sectoral initiatives focus on targeting resources and expertise to influence a market:

— Clean Cooling Collaborative is an initiative of ClimateWorks Foundation to increase access to sustainable cooling for all. The Clean Cooling Collaborative supports enabling environments, financing, and expanding technology access for cooling globally. In its first phase, from 2017 to 2021 (as the Kigali Cooling Efficiency Program), the initiative's partners committed to reductions of 2.4 gigatons of CO_2 by 2050, with additional avoided emissions from cooling policies and plans.[3]

— Global Energy Alliance for People and Planet (GEAPP) focuses on the three major targets—carbon reduction, expanded energy access, and job creation—in the energy sector, through developing scalable solutions that can be rapidly deployed across emerging markets, incorporating financing, technical assistance, and supporting favorable enabling environments. GEAPP's core capital contribution of $1.5 billion came from the Bezos Earth Fund, IKEA Foundation, and Rockefeller Foundation. At its launch in Glasgow at COP26, GEAPP had secured public- and private-sector commitments of more than $10 billion.[4] Besides being a 4P model, GEAPP is an actor in other 4P models.

Wide-ranging platforms focus on coordinating large-scale commitments and behavior changes, as in the following examples:

— The First Movers Coalition (FMC) hosted by the World Economic Forum and founded in 2021, has seen early successes in its aims to reduce one-third of the world's emissions through hard-to-abate sectors that include commercial transport, chemicals, and steel. The 85 members, as of the time of writing this report, have made $12 billion in purchase commitments across their relevant sectors to advance green technologies. Government partners and implementation support from Breakthrough Energy also are involved in the effort. FMC's structure allows for continuous onboarding of new partners, with five new private-sector partners joining in 2023 to date.[5]

— Mangrove Breakthrough—a call for action by the Global Mangrove Alliance with UN Climate Change High-Level Champions—unites stakeholders under the shared goal of securing 15 mega-hectares of mangroves by 2030, led by a core set of guiding principles. The alliance has, as of the time of writing this report, 31 signatories, some of whom represent larger groups of partners, who commit to the broader conservation action and potentially provide additional funding.[6]

[1] Enduring Earth website, accessed September 11, 2023.
[2] *Impact report 2022: Conserving biodiversity,* eco.business Fund, July 6, 2023.
[3] *Scaling up clean cooling for all: Kigali Cooling Efficiency Program impact report (2017–2021),* Clean Cooling Collaborative, August 2021.
[4] "Global Energy Alliance for People and Planet (GEAPP)," Rockefeller Foundation, not dated.
[5] "Drax joins World Economic Forum's First Movers Coalition," Drax, August 29, 2023. A full list can be found on First Movers Coalition's website.
[6] "The Mangrove Breakthrough: A call to action," Global Mangrove Alliance, not dated.

aims to decarbonize the global shipping sector by 2050, with an intermediate goal of commercially viable zero-emissions vessels and fuels in operation by 2030. The coalition has more than 200 members, of which more than 160 are from the private sector.[12] Partners in these kinds of platforms may have varying participation levels, but in banding together, they seek to use a diverse set of actions toward a bold global ambition.

Setting up 4P models involves multiple choices

A 4P model has multiple setup choices to make, including operating model, governance model, and minimum partner contributions. Existing 4P models have found a variety of ways to organize themselves; examples include dedicated secretariats, such as Initiative 20x20 and Tropical Forest Alliance, and specific financial transactions, such as the Seychelles Conservation and Climate Adaptation Trust and a debt-for-nature swap in Gabon.[13]

The most common initiators of 4P models are philanthropies; 50 percent of existing 4P models were convened by philanthropies and associated implementing actors.[14] Private actors are most likely to convene transaction-focused 4P models, although these have been convened by all three sectors.

Criteria to consider

There is no single right way to structure a 4P model, but interviews with 4P models have highlighted some operational commonalities among successful 4P models:

— **Flexibility.** The 4P model structure should not be rigid. Partners need flexibility to act independently as necessary and have multiple ways of engaging with the partnership (for example, through a core leadership group and working groups). This flexibility can support the durability of 4P models when priorities of governments or other organizations change.

— **Ongoing engagement.** Members' engagement needs to continue—and, in fact, increase—even after goal setting, because this engagement drives real impact and supports the longevity of these partnerships. Members' engagement in a partnership also helps organizations separate themselves from internal politics.

— **Well-defined roles.** The roles for each of the three sectors must be well defined, with the convening organization offering clarity on its role.

— **Clear objectives and governance practices.** Perhaps most importantly, setting clear objectives and governance from the outset is critical to ongoing success. For example, the Nature-Based Solutions (NBS) Investment Platform, an initiative led by Capital for Climate, aims to scale up NBS enterprises and investments in Brazil across high-priority areas and associated supporting infrastructure, such as carbon markets.[15] This partnership formed a leadership group after spending extensive time thinking about governance and the value proposition of each member. Interviews with other 4P models have confirmed the value of this clear alignment of scope up front to ensure impact.

Choosing partners

By their very design, 4P models require multiple actors to come together simultaneously with aligned interests and willingness to roll up their sleeves to act. Choosing the right partners increases chances of success.

For 4P models working across countries, the key is to balance broad (for example, multinational) and specific (for example, regional and local) partners. Large organizations can provide capabilities and scale, which are important to drive impact.

[12] "Getting to Zero Coalition," Global Maritime Forum, not dated.
[13] Organizations' websites; "The Nature Conservancy announces debt conversion for ocean conservation in Gabon, first ever in Mainland Africa," The Nature Conservancy, news release, August 14, 2023.
[14] 55 percent of 4P models convened by implementing actors receive the majority of their funding from philanthropies.
[15] Capital for Climate website, accessed August 30, 2023.

Local organizations can provide specific on-the-ground knowledge. Public-sector partners will need to be committed to the goals of the 4P model and the changes it may bring.

Planning for the long term

Some 4P models have taken years to get off the ground or have found it hard to maintain both funding and action momentum over the many years often required to both seed and see the fruits of 4P model action. A key difficulty is that 4P models often entail large transaction costs, in three ways. First, effective management of initiatives generally requires some formalization of structure, such as a secretariat, that requires funding, usually from philanthropic stakeholders. Second, efforts to recruit, coordinate, and align with organizations across these partnerships are time-consuming. Third, each new organization brought into the model not only increases the potential for impact but also brings new challenges by introducing a new culture to the initiative, along with a new set of objectives, motivations, and decision points that must be accounted for in the management of a 4P model.

These costs are not unexpected or unjustified for a consequential undertaking, but the undertaking needs to be commensurate with them (see sidebar "Prepare a long runway to impact").

Prepare a long runway to impact

Given the high costs associated with 4P models and the length of time required to get them off the ground, partners should prepare a long runway to impact by minimizing costs and maintaining partner engagement. The 4P models that have demonstrated long-term stability and sustenance have benefited from an agile funding and development model that continually realigns across the interests of each actor.

An example is the Food and Land Use Coalition (FOLU), which focuses on developing sustainable food and land systems through country-specific platforms. According to the FOLU website, its model reduces the costs of stakeholder management by calibrating each member's contributions to their level of interest and maintains engagement among the stakeholder group through an ability to change relative focus if member organizations have new directions they want to try.

Other 4P models will have other methods for successful stakeholder management and engagement. But in any case, 4P models should minimize transaction costs by maintaining clear roles and responsibilities for their members.

Moreover, 4P models need to strike a balance between being focused broadly enough for significant impact but narrowly enough to ensure effective implementation. A 4P model with an overly broad scope may have difficultly pushing forward effective solutions. Conversely, a 4P model that is too limited in impact may lose the interest of its participants.

Chapter 2

A framework for identifying focus areas suited to 4P models

As interest in launching new partnerships grows, a systematic approach to identifying where and how 4P models can achieve success can be of use. This chapter outlines a framework intended to help direct time, energy, and resources toward focus areas that are well suited to 4P models. The same framework can also help decision makers assess and strengthen ideas that emerge organically.

The framework considers eight criteria that collectively evaluate the materiality, suitability, and feasibility of 4P model concepts (Exhibit 7). Materiality and suitability are assessed at the level of the focus area of a potential partnership, whereas feasibility is evaluated in the context of a particular partnership concept.

The structure and criteria of the framework are intended to be timeless, but the application of the framework is time-bound. New data will become available, and technologies and solutions will evolve in unexpected ways. Accordingly, the analysis must be revisited as time progresses, and new stakeholders may want to seek guidance on where 4P models could drive climate and nature action.

Exhibit 7

Our framework uses the criteria of materiality, suitability, and feasibility to evaluate public–private–philanthropic partnership models.

Evaluation framework

Materiality
Identifying industry and geographic hot spots with the highest return on the action, with meaningful co-benefits for resiliency, livelihoods, and well-being

Suitability
Determining solution focus areas that are in proximity to a positive tipping point, with impact potential, scalability, and additionality

Feasibility
Confirming the proposed model has a motivated anchor stakeholder, is appropriately scoped, and has alignment of expectations

Materiality: Identifying areas with substantial returns on action and with co-benefits

Prioritizing materiality ensures that any 4P models are directed toward the highest potential impact for people and the planet. Identifying this level of impact is important, given the high transaction costs (in terms of time, energy, and financial and human resources) required to form and run these partnerships.

Our analysis of current 4P models suggests that a definition of materiality in this context includes two critical dimensions: returns and co-benefits.

High return on action

The first dimension is identifying focus areas with the highest return on the actions taken. In our analysis, we measured the return based on the magnitude of impact (for example, where the highest greenhouse gas emissions are and will be in the future, where the greatest land cover loss has taken place) and the capacity of local stakeholders to address this impact. Returns can take the form of mitigation potential, avoided land cover loss, economic benefit, and other measures. High-return 4P models could focus on countries and systems where climate and nature challenges are significant and communities affected have constrained capacity to address them.

These dimensions are already visible in existing 4P models. Based on our analysis of more than 50 climate and nature 4P models, 87 percent of them include emerging economies in their focus regions. More than 95 percent focus on rolling out established technologies rather than on upstream innovation. These partnerships overwhelmingly seek to address challenges by unlocking investment (71 percent) and/or supporting the creation of new markets (31 percent), which indicates capacity needs.[16]

Delivery of co-benefits

The second dimension is noting where 4P models could potentially generate meaningful co-benefits for resilience, livelihoods, and well-being. For climate mitigation, our analysis assessed co-benefits including whether climate mitigation action in the relevant sector (for example, power, transport) enables mitigation action for other sectors and whether it enables adaptation measures such as improving soil properties of agroecosystems. Other co-benefits can include providing support for natural capital (for example, water, freshwater, oceans, forests, and biodiversity), enhancing economic development or livelihood benefits (including job creation, innovation, business cost reduction, and economic growth), or providing social-development benefits for health, well-being, and equity.

Focus areas that contribute these types of co-benefits could give rise to broader coalitions of stakeholders and greater receptivity by local communities. They also have the potential to better leverage or expand existing efforts that aim to address present economic development, infrastructure, or health efforts. For example, 40 percent of existing 4P models reviewed reference socioeconomic co-benefits in their mission statements, reflecting the growing interest of all three sectors in finding solutions that address both people and the planet.

Suitability: Identifying focus areas where a 4P model is most likely to have impact

Suitability means resources invested in developing and scaling partnerships are well matched to the strengths of a 4P model. Two major dimensions are critical here: first, proximity to positive adoption tipping points and, second, potential for success through impact relative to resource needs, scalability, and additionality.

The first dimension of suitability involves identifying the sweet spot between early adoption and positive tipping points in scale where public, private, and philanthropic interests align. In general, 4P models are well suited to supporting proven technologies and solutions near these critical tipping points—after public funding or venture capital are sought but before other capital markets are willing to fund at-scale technologies and solutions. By focusing on areas approaching (but not too close to) tipping points, 4P models can enhance their impact while maximizing their time and financial commitments.

For the second dimension of potential for success, our analysis examines a 4P model's impact potential, its scalability, and additionality. *Impact potential* is greatest when 4P models focus on areas that will benefit from immediate action and where sequential progress is critical, the model has a clear impact per dollar invested, and the model provides socioeconomic co-benefits. *Scalability* assesses whether individual initiatives can scale up and whether they can be replicated across multiple sectors, systems, or regions. For example, about 45 percent of existing 4P models have a global focus, and an additional 25 percent have a multinational focus. A geographically broad focus enables partners to spread successful models and learnings from one geographic context to others while ensuring sufficient adjustments to new contexts. Finally, *additionality* means 4P models are additive—that is, they provide impact that other partners are unable to do on their own.

[16] These components add up to more than 100 percent because some existing 4P models tackle both challenges.

Feasibility: Assessing if the right partners, structure, and alignment are in place to drive the initiative in a specific sector and country context

Feasibility means 4P models are established in areas where all partners are motivated to drive the issue and are set up for success. Here, three factors can help determine whether a specific 4P model has the right buy-in, scope, and potential scale to justify the time and resources required to stand it up:

1. an anchor stakeholder that is motivated to drive the partnership

2. rightsizing the capital, governance, and resources each sector brings

3. aligned expectations on objectives, strategy, and foundational questions such as risk/return and participation

These factors are meant to serve as a qualitative guide to help stakeholders develop 4P models with the greatest potential to succeed. They can facilitate alignment on potential strategy, operating model, and governance structure.

Identifying an anchor stakeholder

Based on our review of 4P models, at least one motivated actor is necessary to put 4P models together and ensure their longevity. In addition to dedicating time and resources to the partnership, the anchor must have a deep, multiyear commitment and be willing to experiment with approaches and models beyond what this stakeholder has historically attempted alone.

In the initial formation of a 4P model, anchors can come from any sector, although philanthropy is most frequently the initial catalyst. As a 4P model starts to come together, anchors from each of the three sectors are likely important to ensure collective action. This requires each core partner to make some clear minimum commitment of what they will bring to the partnership, whether financial, technical, or other.

Rightsizing the partnership

Some rightsizing assessment is required for each 4P model to ensure it can deliver real change to the focus area in question in a specific region. Partnerships need to balance the ambition to drive systemic change with a recognition that too large a scope could dilute the partnership's ability to deliver on its ambitions. As an example, simultaneously transforming passenger transportation and electricity generation ecosystems in pursuit of emission-free transportation is likely too much to expect one partnership to accomplish all at once.

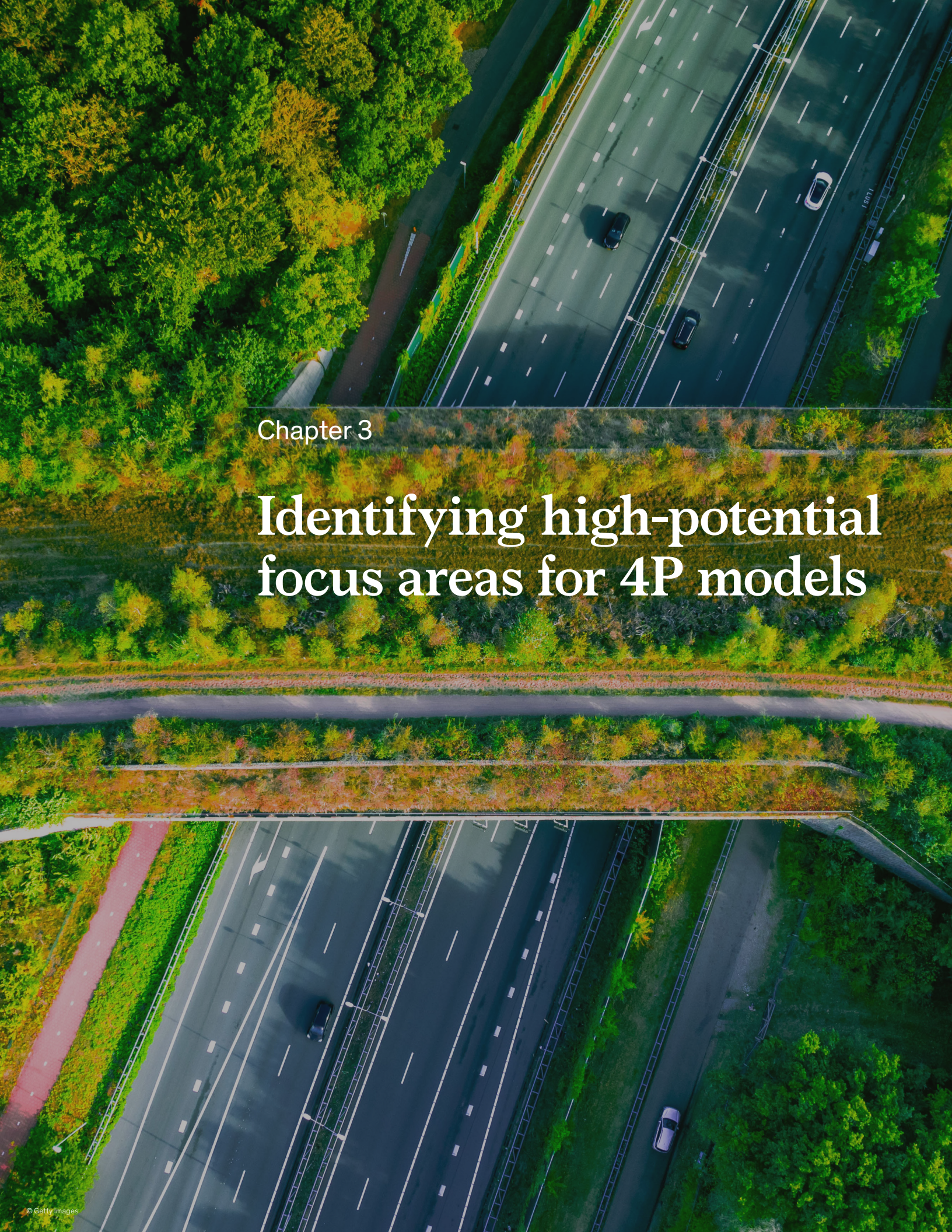
When defining the scope, organizations should take into account each partner's unique strengths and available resources. The requirements of, for example, financing a time-bound conservation transaction can differ significantly from those needed for transforming the road transportation sector across several countries. Partners can leverage their existing expertise to ensure that the resources proposed match the 4P model's planned structure and scale.

This rightsizing will inform strategic choices of the partnership. For example, setting up a secretariat or even an independent organization requires dedicated staff, time, and additional funding. A smaller, targeted 4P model may not require an independent secretariat, but a larger one likely will. Stakeholders must therefore assess whether the scale of the partnership will fundamentally require the dedicated commitment of a secretariat, which has further implications for the governance of the 4P model. Similarly, capital commitments are commonly but not necessarily required of each partner. If a partner is providing, say, technical expertise in lieu of capital commitments, partners must assess if the remaining entities can provide enough capital to support the broader 4P model goals.

Aligning expectations among the partners

The public, private, and philanthropic sectors typically operate with different timelines, risk tolerance, and expectations of returns (whether financial or social). A successful 4P model requires each partner to be satisfied with the overarching objectives of the partnership, the strategy, associated actions to achieve these objectives, and the implications of doing so. More specifically, each 4P participant should be as clear as possible about the risk, return, and timeline to impact associated with its strategic direction and associated actions. While the philanthropic and public sectors are often thought of as more risk-tolerant and patient than the private sector, these actors may not always have the financial ability and liquidity required to absorb relevant risks.

All the partners should align on the unified vision across these dimensions for the 4P model. Without this alignment, the individuals within the 4P risk spending too much time trying to make all the participants happy, rather than focusing on delivering against the unified objective. But when alignment is strong and enduring, a 4P model can often drive change beyond what individual organizations and sectors are able to achieve.



Chapter 3

Identifying high-potential focus areas for 4P models

Using the framework laid out in Chapter 2, this chapter applies the materiality and suitability criteria to highlight global solution focus areas for potential new partnerships across climate mitigation and nature. First, the analysis considers 29 hot spots at the intersection of industry sectors and country archetypes for climate and nature challenges. Within these 29 hot spots, we identify 134 climate and nature solution focus areas across four planetary boundaries (greenhouse gas emissions, freshwater consumption, forest loss, and biodiversity loss) at a global level and prioritize 31 that are well suited for 4P models. (For details of our methodology and selection process, see sidebar "Our methodology for identifying focus areas" and Appendix A).

The scope of this chapter includes the filtering of solution focus areas for proximity to tipping points, impact potential, scalability, and additionality. It excludes discussion of feasibility criteria because these are relevant and applicable only at the level of individual 4P models. Also, where the chapter does not highlight a solution focus area for a 4P model, the absence of examples does not mean 4P models in such areas cannot be successful or do not already exist.

Results of our analysis for materiality

For our materiality analysis, the first step was to identify the regional and sectoral hot spots in which 4P models could have the most impact for each of the planetary boundaries examined. This analysis was done up front to help narrow down sectors, geographies, and country archetypes (for example, based on income and economic makeup) in which a material shift in emissions would be highly beneficial for people and planet.

The following analysis highlights the unique role of the energy and agricultural sectors as central to tackling both climate and nature challenges. The power sector not only has high emissions but also affects all other sectors of the

Our methodology for identifying focus areas

Our analysis selected themes based on planetary boundaries and identified hot spots where the intersection of country archetypes and industries presented high opportunities.

Planetary boundaries

To identify a broader set of themes to focus on, we build on the concept of planetary boundaries (Exhibit A), which was introduced in 2009 and most recently updated in 2023. Our analysis used the 2015 update.[1] The Planetary Boundaries framework tracks the ability of the planet's resources at a given point to sustain the economy and support human development.[2] As shown in the exhibit, four boundaries had been crossed in 2015, indicating that biodiversity loss, forest cover loss, freshwater consumption, and climate change had progressed beyond these measures of sustainability.

We focus on the four planetary boundaries outside planetary boundaries: climate change (mitigation only), biodiversity loss, forest cover loss, and freshwater consumption. Of the remaining themes, ozone depletion was excluded as it is currently within safe boundaries with good global progress being made. Aerosol pollution, chemical and plastic pollution, and nutrient pollution were excluded because of limited data availability.[3]

Hot spots

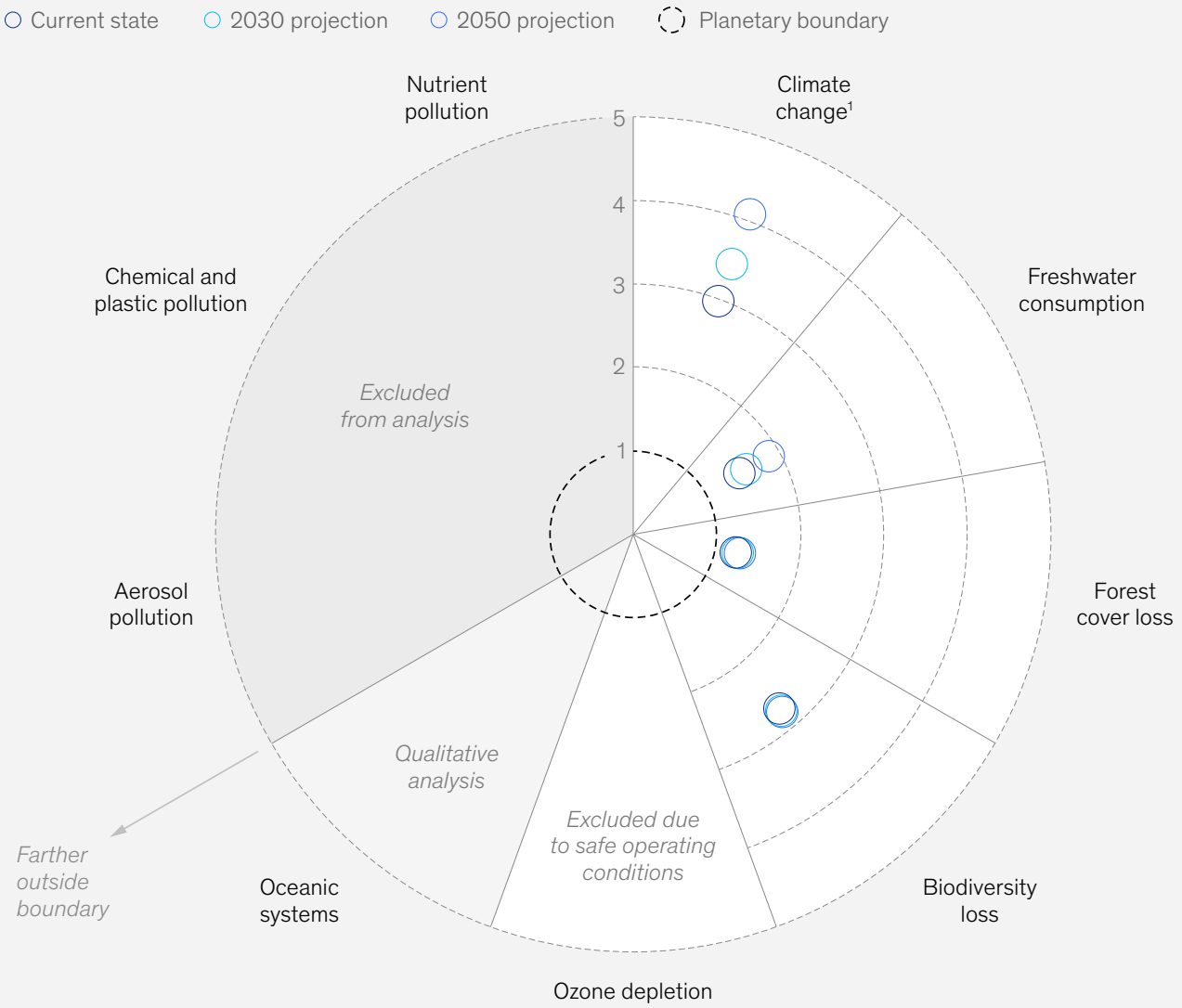
Across all countries, six sectors, and critical nature areas, we prioritized 29 hot spots covering key sectoral and regional combinations that demonstrated materiality (16 hot spots linked to climate change mitigation, and 13 hot spots linked to nature). We then drew on a wide range of literature and expert interviews to

[1] Our analysis was based on the 2015 update to the planetary boundaries and not updated to reflect the September 2023 update, which was published during the production process of our report. The later analysis found that a total of six planetary boundaries have been crossed. For more details on the 2023 update to the planetary boundaries, see Katherine Richardson et al., "Earth beyond six of nine planetary boundaries," *Science Advances,* September 2023, Volume 9, Issue 37.
[2] Johan Rockström et al., "A safe operating space for humanity," *Nature,* September 2009, Volume 461; Will Steffen et al., "Planetary boundaries: Guiding human development on a changing planet," *Science,* January 2015, Volume 347, Number 6223; Richardson et al., "Earth beyond six of nine planetary boundaries," September 2023.
[3] For further details on planetary boundaries, see Steffen et al., "Planetary boundaries," January 2015; Richardson et al., "Earth beyond six of nine planetary boundaries," September 2023; and "Nature in the balance," McKinsey, 2022.

Exhibit A

Our analysis builds on four of the nine planetary boundaries in depth.

Current and projected status against planetary boundaries, multiples beyond planetary boundary



[1]Mitigation evaluated quantitatively; adaptation evaluated qualitatively.
Source: Elena M. Bennett et al., "Planetary boundaries: Guiding human development on a changing planet," *Science,* Jan 2015, Volume 347, Issue 6223; *Nature in the Balance: What companies can do to restore natural capital*, McKinsey, Dec 2022

identify 134 solution focus areas that could be ready for climate and nature action within the hot spots identified.

To prioritize global solution focus areas that may be well suited for 4P model concepts, we applied the suitability criteria described in Chapter 2 to arrive at 31 areas where 4P models can be particularly effective. Of these 31 focus areas, we selected six to further illustrate the issues that need to be addressed and the opportunities a 4P model in a specific country context can bring—the country context ultimately being the level at which the feasibility of 4P models should be assessed. Among these six deep dives, we include two that qualitatively explore oceanic systems and climate adaptation. These six deep dives look at specific geographies, account for existing stakeholders and initiatives trying to solve these climate and nature problems, and attempt to understand whether and how 4P models can unlock climate and nature progress.

For further detail on this methodology, see the descriptions later in this chapter and in Appendix A.

economy that utilize the energy it produces. For its part, the agricultural sector plays a dual role in both climate and nature transitions, given its extensive use of natural resources. Decisions around land use—particularly as food systems develop to feed a growing global population—will have an outsize impact on the global net-zero trajectory and any nature transitions.

Identifying critical climate mitigation hot spots

In the case of climate mitigation, we defined six country archetypes across six major economic sectors based on current emissions, future emissions, and response capacity in relevant geographies. Such an archetyping and segmentation enables a recognition of the fundamental differences that exist between various countries without going all the way to country-level analysis. The six country archetypes are agriculture-based economies, forestry-intensive economies, emissions-intensive producers, fossil fuel resource producers, downstream-emissions manufacturers, and service-based economies. (For more details on our methodology for classifying country archetypes, see Appendix A.) For each country archetype, our analysis looked at potential opportunities by sectors: power, transport, agriculture and forestry, industry, buildings, and removals.

High-opportunity sectors. The resulting analysis shows opportunities highly concentrated in specific sectors (Exhibit 8). Power, agriculture, and transport stood out as top priorities for decarbonization, given the greenhouse gas emissions they generate—about 50 percent of the global total.

Not all areas with momentum from stakeholders today are prioritized in our framework. For example, shipping and aviation do not emerge as hot spots despite attracting significant interest in recent years from initiatives such as the Mission Possible Partnership. These two sectors, accounting for 4 percent of global emissions, are dropped at the global level due to their relatively low emissions, which are likely to increase only marginally in emerging economies while decreasing in advanced economies.[17] Nevertheless, 4P models in these sectors can be highly impactful so long as materiality and suitability are in line with objectives established at the sector and/or country level.

Opportunities by country archetypes. The potential of 4P models to help decarbonize is significant in countries categorized as emissions-intensive producers. Emissions for these countries are expected to grow in the near-to midterm as they industrialize quickly. However, these countries currently have limited capacity and incentive to industrialize in a more sustainable way. For example, Indonesia's power sector emissions are expected to peak only in the mid-2020s under a 1.5°C pathway and even later in the mid-2030s for other decarbonization scenarios.[18] Today, power, road transportation, and the production of cement, iron, and steel are the biggest drivers of emissions within Indonesia and other emissions-intensive producer countries.

The other country archetypes that hold significant potential for 4P models addressing climate mitigation are the agriculture- and forestry-intensive economies, where agriculture or forestry accounts for a significant share of GDP and local employment. In Kenya, agriculture—which accounts for 33 percent of the country's GDP and employs more than 40 percent of the total population—represents the largest source of emissions (70 percent), with additional opportunity to sequester carbon through agroforestry systems.[19] Decarbonizing such sectors is a tricky exercise that requires balancing the needs of local livelihoods with the global benefits of mitigating climate change. While their emission profiles are generally lower than those of the other country archetypes, agriculture- and forestry-based economies on average have lower response capacity and are expected to see a rise in emissions across the board. Further, sustainably managed forestry can provide carbon sinks and significant job creators. Hence, changing the

[17] Global emissions by sector in 2022: transport, 8.0 gigatons of CO_2 (1.7 gigatons of CO_2 for shipping and aviation); power, 14.6 gigatons of CO_2; total, 36.8 gigatons of CO_2. See "Transport," in *CO_2 Emissions in 2022,* International Energy Agency, March 2023; Davide D'Ambrosio and Max Schoenfisch, "Electricity," International Energy Agency, July 11, 2023; Elizabeth Connelly, "International Shipping," International Energy Agency, July 11, 2023; and Hyeji Kim and Jacob Teter, "Aviation," International Energy Agency, July 11, 2023.

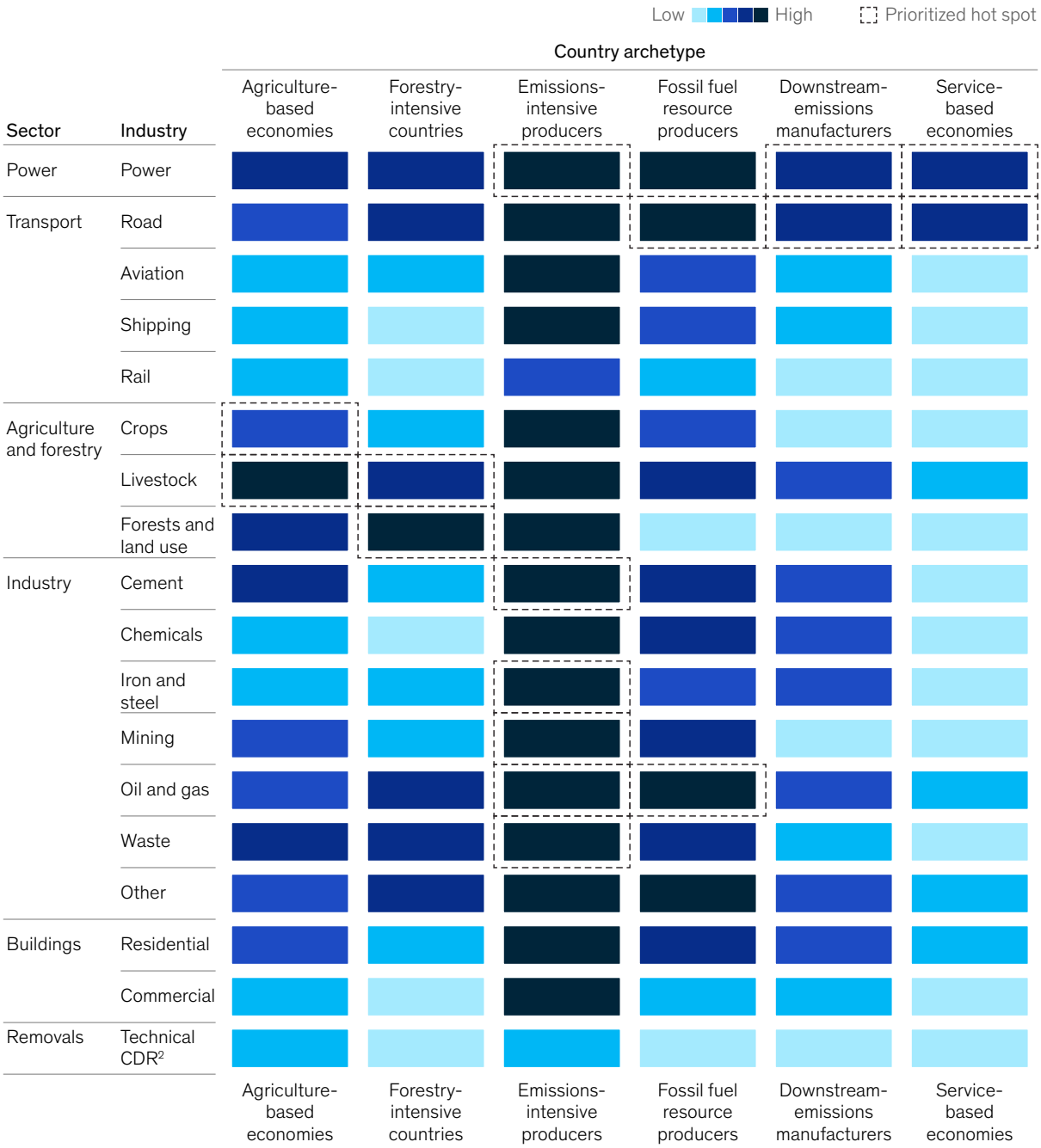
[18] "Scaling up climate action in Indonesia," Climate Action Tracker, November 25, 2019.

[19] "Kenya: Agriculture, food and water security," US Agency for International Development, May 26, 2023; Tom Volenzo Elijah, Rachel Makungo, and Georges-Ivo Ekosse, "Effective mainstreaming of agricultural emissions into climate action agenda: The case of institutions and smallholder dairy production systems, Western Kenya," *Atmosphere,* November 2021, Volume 12, Issue 1507.

Exhibit 8

High-impact sectors for climate mitigation are likely to differ by country archetypes.

Opportunity level for climate solutionsby country archetype and industry[1]



[1]Economic sectors have been prioritized according to the degree of challenge, to ensure a distribution across country archetypes, and according to momentum and excitement based on multiple interviews with experts and stakeholders acting within these sectors.
[2]CO_2 removal.

trajectory will require holistic and inclusive 4P model interventions that protect livelihoods and ensure more equitable outcomes while lowering emissions.

Such interventions, if designed well, could have positive second-order outcomes. For example, solutions to increase agricultural efficiency will improve yields and food security, reduce crop losses, increase job opportunities and income for locals, and curb emissions. Many of the countries in these agriculture- and forestry-intensive economy archetypes have a large share of smallholder farmers who could realize significant livelihood improvements from climate-focused interventions. In Ethiopia, for example, smallholder farms account for more than 90 percent of cultivated area and agricultural output, making their inclusion critical in decarbonizing the sector equitably.[20]

In our analysis, the role of a 4P model for some country archetypes—namely, fossil fuel resource producers, downstream-emissions manufacturers, and service-based economies—is not of major emphasis because of their existing capacity to respond. Many of the countries in these archetypes have mature institutional capacity and resources to allocate to climate change mitigation.

However, there are likely instances where the 4P model can be effective and impactful at a sub-national or local level, especially considering the place-based interests and connections of many large foundations and family offices. For example, the Bezos Earth Fund and the Southeast Asian Community Alliance are funding community-driven planning to avoid gentrification around Los Angeles's Taylor Yard urban greenspace project.[21] Philanthropic actors have also been involved in sectors with huge mitigation potential in these countries. For example, ClimateWorks Foundation leads the Drive Electric Campaign, a philanthropy-led 4P model supporting 100 percent electrification of road transportation by 2050 globally but with focus areas across the United States and the European Union.

Identifying critical nature hot spots

Our analysis also prioritized 13 nature hot spots, with eight experiencing deforestation and biodiversity loss (Exhibit 9); five are freshwater hot spots. These eight present an opportunity for holistic solutions to address both challenges simultaneously. In some geographies, we found ecosystems that are at risk of either deforestation or biodiversity loss but not both. For example, the Amazon is seeing the most significant deforestation globally, losing at least 5,110 square miles in 2021, but due to its size, it is not experiencing the same rates of biodiversity loss as countries like Malaysia and Indonesia.[22] However, some of the high-impact interventions identified—such as expanding markets for biodiversity or nature-based carbon credits—could be implemented in the Amazon or other areas facing only one of the challenges. In addition, although we lacked sufficient data for a robust assessment of oceans and the cryosphere, both are critical ecosystems in emissions reduction.

The main drivers of biodiversity and forest loss in most of our prioritized areas are deforestation for crop production, livestock rearing, and to provide fuel for cooking (Exhibit 10). Globally, agriculture affects more than 85 percent of the 28,000 species at risk of extinction, and since 1990, about 420 million hectares of forest have been lost through conversion to other land uses, with agriculture being the main driver.[23] More land is needed to grow food for increasing populations and to support agrarian economic growth, especially in regions with low levels of investment in enhancing agricultural productivity. There is an opportunity to address these needs in a nature-positive way that goes beyond reducing environmental impacts but also restores and enhances natural capital. For example, more resource-efficient crop rotation practices could increase yields using recycled water and lower amounts of resources, including fertilizer, which in turn boosts nutrient recycling and alleviates pressure on already-depleted water sources.[24]

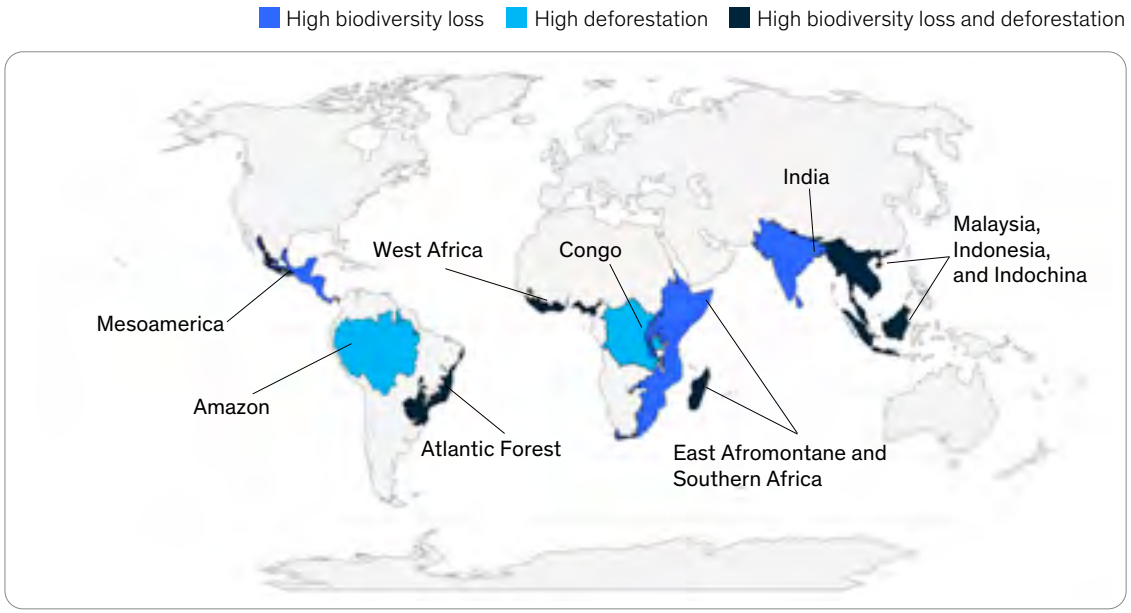
For discussion of our analysis around freshwater consumption and additional hot spots, see Appendix A.

[20] Fantu Nisrane Bachewe and Alemayehu Seyoum Taffesse, "Supply response of smallholder households in Ethiopia," International Food Policy Research Institute, 2018.
[21] "Accelerating equitable community development strategies and urban greening at Taylor Yard," Bezos Earth Fund, not dated.
[22] "It's not just coal and oil: Forests are key to climate," *National Geographic,* November 24, 2015.
[23] "Five drivers of the nature crisis," UN Environment Programme, September 5, 2023.
[24] Elizabeth Hodson de Jaramillo et al., "Boost nature-positive production," in *Science and Innovations for Food Systems Transformation,* ed. J. von Braun, K. Afsana, L. O. Fresco, and M. H. A. Hassan, Springer International, 2023.

Exhibit 9

Prioritized natural areas for forest and biodiversity loss include Central and Latin America, sub-Saharan Africa, and South and Southeast Asia.

Biodiversity loss and deforestation by region

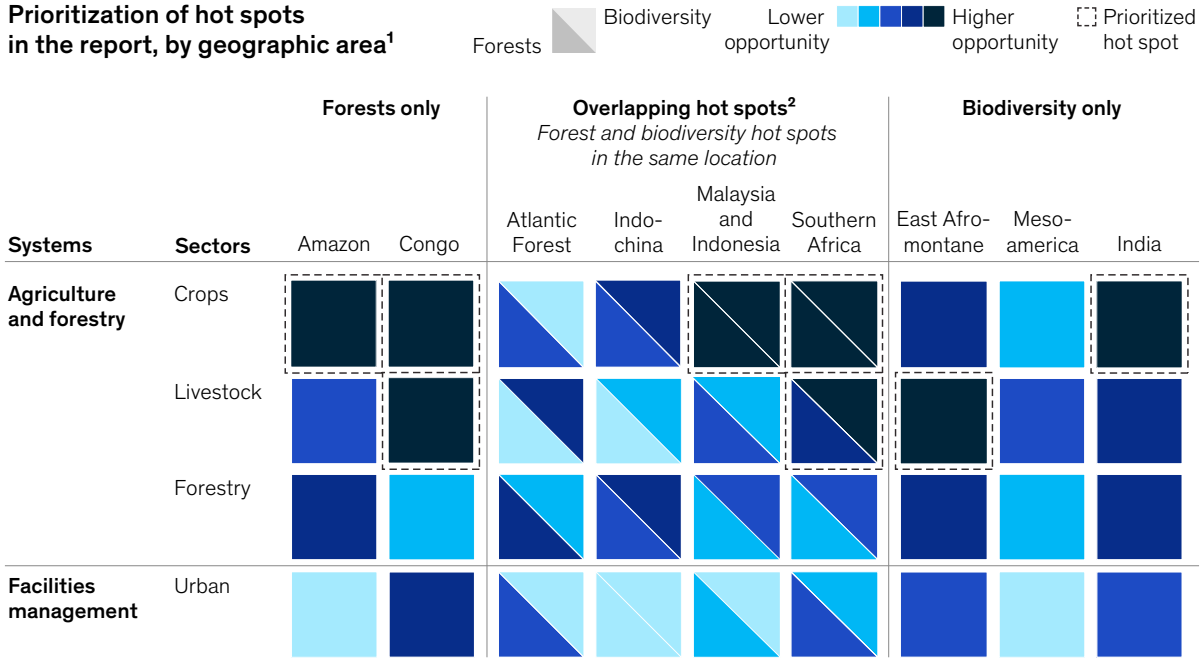


Source: Louise Mair et al. (2021); Curtis et al. (2018)

Exhibit 10

Crops and livestock are the main sources of forest and biodiversity loss.

Prioritization of hot spots in the report, by geographic area[1]



[1]Excludes West Africa, given relatively small size of region.
[2]Although the forest and biodiversity hot spots are in the same general geographic area, their locations are not perfectly identical. The forestry data set includes only forested locations in a region, while the biodiversity data set includes the entire geographic area of a region.
Source: Curtis et al. (2018); Mair et al. (2021); Allan et al. (2022); Jung et al. (2021); Strassburg et al. (2020)

Analysis for suitability

Through our materiality assessment, we identified 134 potential solution focus areas that seem likely to deliver high returns and co-benefits (for the full list, see Appendix A). For these, we assessed suitability, first in terms of proximity to a tipping point, then impact per dollar invested, then scalability (including individual scaling and replicability), and last, additionality.

Identifying solution focus areas close to critical tipping points

To identify solution areas most likely to shift into a positive tipping point (the point at which a solution begins to precipitate positive feedback loops, virtuous cycles, or the mainstreaming of new approaches), we worked with experts and used relative measures of technological maturity such as the International Energy Agency's Technological Readiness Index.[25] The potential proximity to a positive tipping point is a critical consideration, as it indicates potential alignment across the actors within 4P models. Of the 134 potential solution focus areas assessed, 122 (more than 90 percent) demonstrated the potential to approach positive tipping points within a reasonable period. Exhibits 11 and 12 illustrate mitigation solution and nature solution focus areas that are close to tipping points.

Our research identified three broad categories of positive market tipping points:

1. *Technologies and solutions that are proven but not yet commercial.* The 4P models in this category are prioritized. An example is promoting the use of alternative building materials to reduce demand for cement. Cement is a critical binder widely used in the built environment—in buildings, water structures like reservoirs and canals, human-made dams, roads, bridges, and in a lot of other infrastructure. The production of cement accounts for nearly 7 percent of global CO_2 emissions, and the sector is currently not on track to reach net zero by 2050.[26] Emissions from the sector have been relatively steady over the past five years, with a 1 percent increase in 2022. To achieve net zero, they should be declining by an average 4 percent a year.[27] The sector is struggling to reduce its emissions while coping with growing demand around the globe, especially in emerging economies where infrastructure needs are growing. There is an opportunity to reduce this demand by using alternative cementitious materials such as silica fume. These and other alternatives (some proven) are yet to be deployed at scale in most regions, and 4P models have the potential to help commercialize and scale such solutions by diversifying financing pools to derisk investments while liaising with market players and policy makers to accelerate the maturity of such solutions.

2. *Technologies and solutions that are commercially viable in developed markets but not in developing and emerging markets*. In the second category, also prioritized for 4P models, some mature technologies that would have been considered beyond a tipping point in developed economies are bogged down by market conditions in developing economies where they are not yet at scale, typically for issues related to the regulatory environment. An example is deployment of utility-scale solar. In Tanzania, solar is by far the largest renewable energy resource the country can tap into, but there is limited development of such projects. One explanation is that investment is hampered by continued challenges with tariffs that do not fully reflect the cost of generation and the creditworthiness of off-takers.[28] Also, local utilities have tended to show a low commitment to solar offtake minimum requirements, and Tanzanian financial institutions tend to prefer shorter lending terms, which is challenging for large-scale solar projects that are capital-intensive and tend to have longer lifetimes. Despite such challenges, solutions emerging across sub-Saharan Africa may in the future provide a blueprint for Tanzania. These include the Mega Solar Initiative, a collaboration between Power Africa, the governments of Botswana and Namibia, the African Development Bank, the African Union Development Agency, the International Bank for Reconstruction and Development, and the International Finance Corporation to develop two to five gigawatts of solar across the two countries.[29] Within such

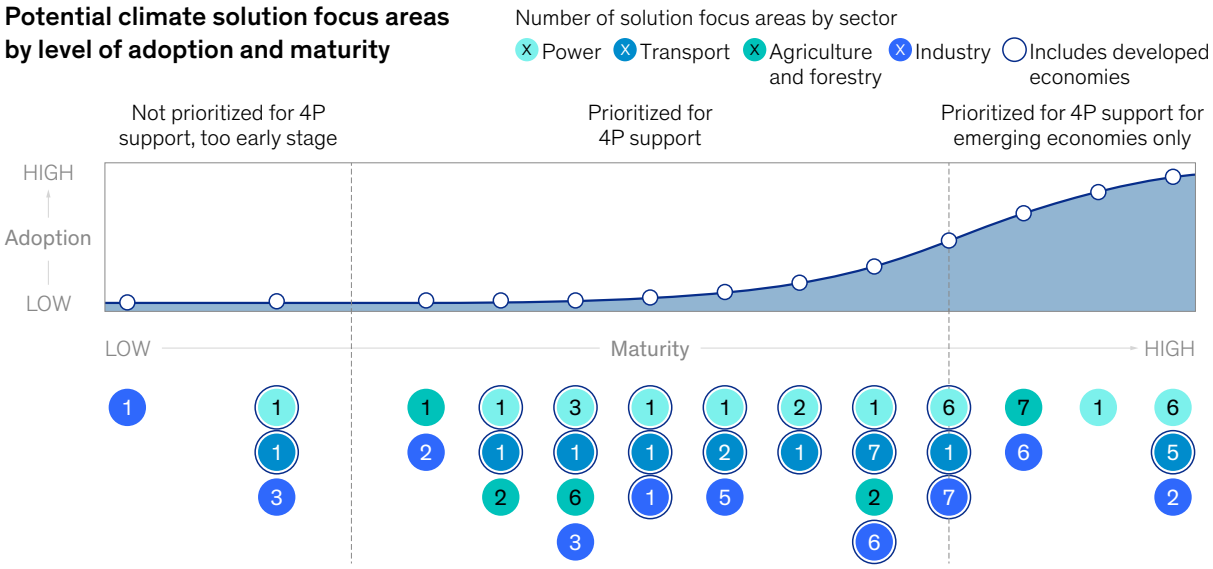
[25] ETP clean energy technology guide," International Energy Agency, July 2023.
[26] In 2022, 4,158 million tons were produced at 0.58 tons of CO_2 per ton of cement; global emissions were 36.8 gigatons. Cement data from Ana Morgado and Paul Hugues, "Cement," International Energy Agency, July 11, 2023. Total emissions from CO_2 Emissions in 2022, International Energy Agency, March 2023.
[27] Morgado and Hugues, "Cement," July 11, 2023.
[28] Ahmed Aly et al., "Barriers to large-scale solar power in Tanzania," *Energy for Sustainable Development,* February 2019, Volume 48, Number 58.
[29] "Power Africa mega solar initiative," US Agency for International Development, September 2022.

efforts, philanthropy could provide catalytic capital to circumvent some of the local limitations on financing or help coordinate efforts to scale across countries.

3. *Technologies and solutions very early in their development and adoption.* In this category, technologies and solutions are at too early a stage to be considered close to a positive tipping point, so the solution areas for 4P models are not priorities. Examples include e-fuels for light-duty internal combustion engine (ICE) vehicles. E-fuels—for example, e-methanol—are lower-emission synthetic drop-in[30] fuels that can be used in ICE vehicles without any modifications to conventional engines. Exploration of e-fuels is relatively nascent, their current and future regulation is unclear, and their life cycle impacts are yet to be determined. An opportunity for financing does exist; for example, philanthropies could provide grants for research and development or derisk e-fuel investments, and the private sector could provide venture capital. However, the regulation and continued use of e-fuels in the future are uncertain. The significant resources and time required to set up a 4P model may be better suited to a technology that has been proven and offers more clarity on its market outlook.

Exhibit 11

More than 90 percent of climate solution focus areas that were analyzed are close to positive tipping points.



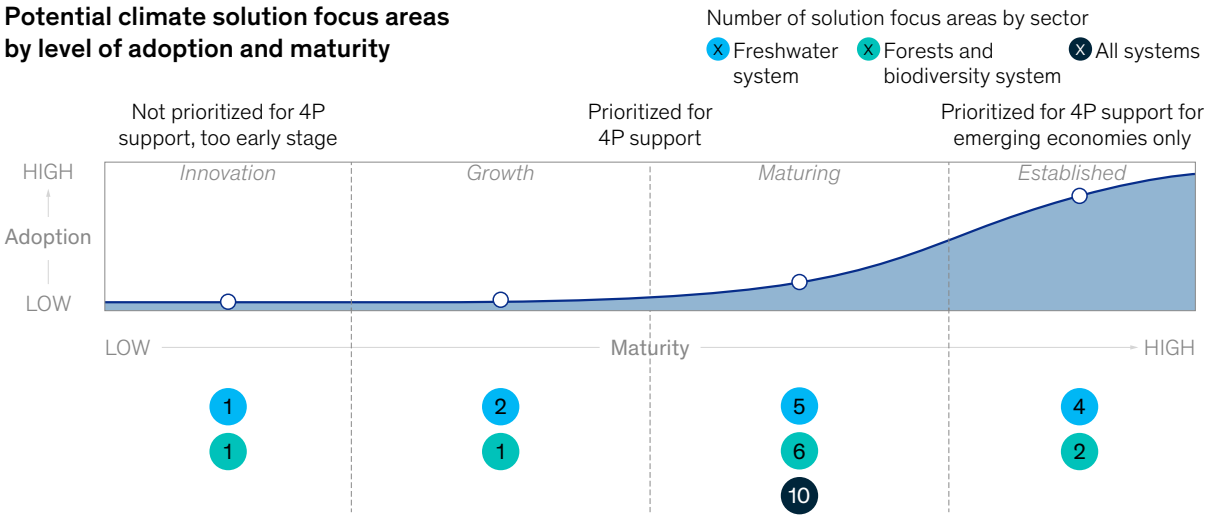
Note: "Positive tipping point" is defined as the point at which a solution begins to precipitate positive feedback loops, virtuous cycles, or the mainstreaming of new approaches.
Source: IEA Technology Readiness Level

We see a similar distribution of solution focus areas across nature hot spots. Most of the potential focus areas are considered approaching a positive tipping point, driven by well-proven technologies (Exhibit 12). Out of 32 solutions assessed, only two—desalination practices and cell-based alternatives to animal protein—were considered too immature for 4P model intervention. While many solutions are considered close to positive tipping points within nature hot spots, they remain at various stages of maturity, and different approaches to implementation will be needed. For example, precision agriculture is important for pollution reduction, but the approach is relatively immature in some

[30] Fuels that are chemically identical to and interchangeable with the petroleum-derived fuels for which they are substituting.

Exhibit 12

More than 90 percent of nature solution focus areas that were analyzed are close to positive tipping points.



Note: "Positive tipping point" is defined as the point at which a solution begins to precipitate positive feedback loops, virtuous cycles, or the mainstreaming of new approaches. Solution focus areas were ranked by category, so maturity can only be compared between categories.
Source: IEA Technology Readiness Level

markets. In Thailand, the government and local farmers are in the early stages of implementing the country's 4.0 Strategy, which includes a variety of precision agriculture solutions.[31]

Prioritizing solution focus areas within climate mitigation

Globally, within climate mitigation, we identified 18 priority focus areas that are well suited to 4P model intervention (Exhibit 13a). These included, for example, phasing out coal-based electricity generation and increasing the adoption of passenger and commercial light-duty EVs. Those two examples are commonly known high-impact levers tackling large volumes of emissions and enabling decarbonization in other sectors. However, there were some less obvious focus areas, such as improving animal health. And other seemingly obvious levers—like electrification of farm machinery or switching it to alternative fuels—were deprioritized because they were either too early-stage in development or not well suited to 4P model intervention. The following examples illustrate the nuance in our findings. As previously noted, the largest emission reduction opportunities globally involve decarbonizing the power, industry, and transportation sectors. However, within these three sectors, the solution focus areas that would be most suitable for 4P models vary by country archetype. Among emissions-intensive producers, the majority of which are emerging economies, priority opportunities include phasing out coal-based electricity generation and increasing the use of electric arc furnaces (EAF) in steel production. These nations are currently urbanizing and growing their local sectors—trends that increase energy consumption, largely from fossil fuels, due to existing infrastructure and readily available cheap fuel sources like coal. Further, there is already a demand-side pull for these solutions, which could enable rapid scaling.

In some regions, 4P models are already focusing on these areas. For example, a Just Energy Transition Partnership (JETP) is working on phasing out coal power plants in India, Indonesia, South Africa, and Vietnam, while the Southeast Asia Clean Energy Facility (SEACEF) is deploying large-scale wind and solar in the region, creating models for future 4P models to emulate and improve upon. Recognizing the challenge with historical incentive structures that continue to promote conventional fossil-fuel-based power generation, SEACEF convenes clean-energy pioneers, governments, philanthropists, development financial institutions, NGOs, and other local stakeholders to unlock policy enablers and

[31] "Farmnovation technologies in the field," *Thailand Investment Review,* January 2020, Volume 30.

Exhibit 13a

About 25 percent of material solution focus areas close to positive tipping points appear suitable for public–private–philanthropic partnerships.

Number of solution focus areas

- Agriculture-based economies
- Fossil fuel resource producers
- Forestry-intensive countries
- Downstream-emissions manufacturers
- Emissions-intensive producers
- Service-based economies
- Solution focus area progresses to next filter
- Selected for prioritization

	Solution focus area categories (number of solution focus areas per category)	At tipping point	With impact potential[1]	With scalability	With additionality	Suitable for 4P models	Potential solution focus areas for 4P models
Power	Fossil fuel decarbonization (5)	5	3	2	1	1	• Phase out unabated coal electricity generation
	Solar (3)	3	2	2	2	2	• Increase utility-scale solar capacity • Increase distributed solar capacity
	Wind (2)	2	2	2	2	2	• Increase onshore wind capacity • Increase offshore wind capacity
	Other low-carbon power (7)	6					
	Enabling technologies and infrastructure (6)	6	2	2	1	1	• Increase number of microgrids and overall microgrid capacity
	Demand measures (1)	1	1				
Transport	Vehicle switching (7)	7	4	3	2	2	• Increase adoption of passenger and commercial light-duty EVs • Increase adoption of medium- and heavy-duty commercial EVs
	Fuel switching and efficiency (4)	3	2	2			
	Enabling infrastructure and systems (4)	2	1	1	1	1	• Expand EV charging infrastructure
	Mode shift and demand measures (4)	2					
Agriculture and forestry	Livestock (4)	2	2	2	2	2	• Increase onshore wind capacity • Increase offshore wind capacity
	Crops (9)[2]	9	2	2	2	2	• Increase seed efficiency • Increase irrigation efficiency
	Forest management (6)[3]	6	6	2	2	2	• Improve forest management • Prevent forest fires
	Demand measures (4)	4	2	1	1	1	• Reduce food waste and loss

Continued on next page

Exhibit 13a continued

Number of solution focus areas

Agriculture-based economies
Forestry-intensive countries
Emissions-intensive producers
Solution focus area progresses to next filter
Fossil fuel resource producers
Downstream-emissions manufacturers
Service-based economies
Selected for prioritization

	Solution focus area categories (number of solution focus areas per category)	At tipping point	With impact potential[1]	With scala-bility	With addition-ality	Suitable for 4P models	Potential solution focus areas for 4P models
Industry	Cement (9)	8	1	1	1	1	• Reduce cement demand through use of alternative building materials
	Iron and steel (6)	5	1	1	1	1	• Electric arc furnace (EAF) usage in steel production
	Oil and gas (5)	5	1	1	1	1	• Increase leak detection and repair to reduce fugitive emissions
	Waste (11)	9					
	Mining (5)	5	1	1			

[1]Including urgency, unit impact, and socioeconomic co-benefits.
[2]Potential solution focus areas for 4P models excludes Forestry-intensive countries.
[3]Potential solution focus areas for 4P models excludes Agriculture-based economies.

attract investment for early-stage clean-energy projects in the region.[32] While 4P models are not yet working on levers like increasing EAF-based steel production, there is high potential for multistakeholder solutions. For EAF to be impactful, the private sector and governments would need to collaborate to ensure electricity grids are becoming cleaner. Philanthropies could potentially help unlock the market by offering grants to offset part of the costs from the early retirement of coal plants.

In service-based economies such as Singapore and the United States, the most impactful focus areas are the development of enabling technologies and infrastructure for the power and transportation sectors. For example, in the United States, increasing the number of microgrids to connect distributed solar and wind energy could enhance grid resilience and reliability while lowering electricity costs for consumers, thereby incentivizing more renewable energy deployment. Similarly, expanding EV charging infrastructure could alleviate range anxiety and increase ease of charging, which are some of the main hurdles to EV adoption in the United States.

Across all archetypes, some less obvious focus areas emerged as priorities, and our research suggested others that might have appeared more obvious but should be deprioritized. Among the less obvious areas was improving animal health. Livestock production is one of the key drivers of emissions: globally it emits nearly 15 percent of the global total.[33] Yet farmers, especially smallholder farmers, have limited resources to increase productivity via key levers like upgrading farm infrastructure, increasing access to veterinary care, or increasing quality of feed/grazing land. Moreover, smallholder farmers often have limited access to financing from banks and have low resilience to losses, making it necessary to engage multiple stakeholders, including philanthropies, which 4P models can facilitate.

[32] Southeast Asia Clean Energy Facility website, accessed September 7, 2023.
[33] P. J. Gerber et al., "Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities," UN Food and Agriculture Organization, 2013.

More anticipated opportunities we deprioritized include phasing out ICE passenger and light-duty commercial vehicles. While this is a critical high-impact lever for reducing global emissions, it does not lend itself well to 4P models, as positive tipping points may in fact be too close to attract philanthropic interest at scale. However, 4P models may be well placed to focus on other aspects of mobility such as accelerating the development of EV charging infrastructure and EV adoption (see "Increasing equitable access to electrified transportation in the United States" in Chapter 4).

Prioritizing solution focus areas within nature

Within nature hot spots, we identified 13 focus areas that 4P models could tackle, thereby potentially achieving significant emissions reductions or carbon removals, agnostic of country archetypes (Exhibit 13b). Our analysis of nature focus areas highlighted anticipated levers like scaling markets for carbon or other similar credits. There were

Exhibit 13b

About 25 percent of material solution focus areas close to positive tipping points appear suitable for public–private–philanthropic partnerships.

Number of solution focus areas

Solution focus area progresses to next filter

Selected for prioritization

	Solution focus area categories (number of solution focus areas per category)	At tipping point	With impact potential[1]	With scala-bility	With addition-ality	Suitable for 4P models	Potential solution focus areas for 4P models
Agri-culture and forestry	Land protection or restoration (4)	4	3	3	3	3	• Improve management and effectiveness of protected areas and other effective area-based conservation measures (OECMs) • Expand protected areas/OECMs • Restore degraded land
	Ecosystem protection from outside threats (2)	2	2	1	1	1	• Expand invasive-species control
	Irrigation efficiency (3)	3	3	3	2	2	• Expand drip irrigation • Expand other water conservation agricultural practices (eg, reservoir covers)
	Land use efficiency (7)	6	4	2	2	2	• Increase agroforestry (crops) • Expand advanced seed technology
	Pollution reduction (6)	6	2	3	3	3	• Reduce crop fertilizer use (due to overuse) • Increase usage of nitrogen inhibitors • Expand regenerative agriculture (eg, cover crops, crop rotation, no-till)
	Credit markets (1)	1	1	1	1	1	• Expand credit markets
Water supply	Credit markets (1)	8	4	1	1	1	• Expand rainwater harvesting (utility and distributed)

[1]Including urgency, unit impact, and socioeconomic co-benefits.

also a few unpredictable high-potential priorities, such as improving irrigation and agricultural water management for rice cultivation.

One lever that is especially suited for 4P models is the expansion of biodiversity, forest, and nature-based carbon credit markets. This requires a multistakeholder effort to stimulate and demonstrate demand for such credits while paving the way for the generation of these credits through robust verification and measurement policies and standards, as well as sufficient financing for projects. Such solutions are especially critical in regions with high forest cover, mangrove cover, or biodiversity. Since demand for such credits would be coming from multiple sectors, 4P models could play the role of aggregators, creating and scaling critical markets.

An example with clear benefits for water usage is improving the efficiency of irrigation and agricultural water management in rice cultivation. Rice production generates 1.2 percent of global CO_2e emissions, primarily a result of methane production from the management of rice paddies; rice contributes about 12 percent of global methane production.[34] When rice paddies remain submerged, bacteria in the soil produce methane. However, when flooded water washes away, it carries the pesticides applied to the rice, exacerbating environmental damage. This is a critical challenge to address in some nations, such as Thailand, where about 70 percent of rice paddies are rainfed.[35] To tackle this focus area, 4P models can combine public policies to incentivize the uptake of alternative approaches, philanthropic grants to help farmers upgrade their systems, and private-sector development of relevant maintenance services.

When we soften or adjust our criteria for identifying focus areas fit for 4P models, we uncover additional opportunities that may be relevant regionally, across archetypes, or for specific strategic interests. Here are a few examples:

— Our analysis deprioritized shipping decarbonization because it has a relatively low impact per dollar invested: the sector's emissions, which make up 2 percent of global emissions, are significantly lower than those of road-based transportation. But shipping decarbonization is approaching a positive tipping point, is highly scalable, and has co-benefits for ocean pollution. If our criteria had included private-sector momentum, shipping would have been deemed a higher priority, as we currently see actors, such as the Cargo Owners for Zero Emission Vessels and Getting to Zero Coalition, mobilizing efforts. These efforts are scalable.

— Increasing waste-to-energy generation was deprioritized because it has a relatively lower impact per dollar invested than other levers and the infrastructure required is capital intensive. However, in island or archipelagic countries where population density is high and land is limited (for example, Indonesia), the cost could be judicious because waste management and energy supply are challenges, and waste-to-energy could solve the two challenges simultaneously. In such places, 4P models could play a critical role in unlocking capital directed to a more industrial ecology approach to waste and energy.

— Our assessment showed that scaling the uptake of healthy and more sustainable diets would be difficult for 4P models, because influencing individual consumer behavior is challenging. However, demonstrating the viability of such diets in settings where fewer decision makers can influence the diet for large groups of people—for example, in corporate, school, or college cafeterias—could make such solutions more scalable. In fact, such opportunities would be well suited to 4P models, which could deliver both human health and sustainability objectives.

31 focus areas—or more?

Our analysis prioritizes 31 focus areas (Exhibit 14). However, 4P models may well be effective mechanisms outside these focus areas, particularly when considered at regional and national levels and within specific sectors and

[34] "World greenhouse gas emissions 2019," World Resources Institute, June 23, 2022; Julia Kurnik and Katherine Devine, "Innovation in reducing methane emissions from the food sector: Side of rice, hold the methane," WWF, April 12, 2022.
[35] Rattanawan Mungkung et al., "Measuring sustainability performance of rice cultivation in Thailand using Sustainable Rice Platform indicators," *International Journal of Agricultural Sustainability,* August 2022, Volume 20, Number 7.

subsectors. Therefore, the analysis results should not preclude 4P models in other areas if materiality, suitability, and feasibility are established.

Even just the 31 focus areas suggested as priorities could have a substantial impact. The prioritized solution focus areas are associated with 30 percent of global emissions and 30 percent of total land area. Effective action by 4P models could have significant benefit for people and planet.

Exhibit 14

Application of our methodology highlighted 31 promising solution areas across climate and nature.

	Sector	Solution focus area categories	Potential solution focus areas for 4P models
Climate mitigation	Power	Fossil fuel decarbonization	• Phase out unabated coal electricity generation
		Solar	• Increase utility-scale solar capacity • Increase distributed solar capacity
		Wind	• Increase onshore wind capacity • Increase offshore wind capacity
		Enabling technologies and infrastructure	• Increase number of microgrids and overall microgrid capacity
	Transport	Vehicle switching	• Increase adoption of passenger and commercial light-duty electric vehicles (EVs) • Increase adoption of medium- and heavy-duty commercial EVs
		Enabling infrastructure and systems	• Expand EV charging infrastructure
	Agriculture and forestry	Livestock	• Improve animal health
		Crops	• Increase seed efficiency • Increase irrigation efficiency
		Forest management	• Improve forest management • Prevent forest fires
	Industry	Demand measures	• Reduce food waste and loss
		Cement	• Reduce demand for cement through use of alternative building materials
		Iron and steel	• Increase usage of electric arc furnaces (EAFs) and recycled scrap in steel production
Nature	Agriculture and forestry	Oil and gas	• Increase leak detection and repair to reduce fugitive emissions
		Land protection or restoration	• Improve management and effectiveness of protected areas and other effective area-based conservation measures (OECMs) • Expand protected areas/OECMs • Restore degraded land
		Ecosystem protection from outside threats	• Expand invasive-species control
		Irrigation efficiency	• Expand drip irrigation • Expand other water conservation agricultural practices (eg, reservoir covers)
		Land use efficiency	• Increase agroforestry (crops)
		Pollution reduction	• Expand advanced seed technology • Reduce use of crop fertilizers (due to overuse) • Increase usage of nitrogen inhibitors • Expand regenerative agriculture (eg, cover crops, crop rotation, no-till)
	Water supply	Credit markets	• Expand credit markets
		Freshwater conservation	• Expand rainwater harvesting (utility and distributed)

Chapter 4

Six deep dives into solutions for climate and nature

This chapter looks in greater detail at six focus areas for 4P models, based on our analysis of potential priorities according to the framework we described in Chapter 2. This set of examples aims at illustrating the opportunities and challenges that three-way collaborations can encounter.

Improving pasture and animal health in Brazil

The most emissions-intensive food product is beef, associated with 2.1 gigatons of CO_2e globally—about 4 percent of total global emissions and 13 percent of global emissions from agri-food systems).[36] Demand for beef is projected to grow over the next decade, with 3 percent growth in global meat exports.[37] Beef production in Brazil has the highest emissions intensity of the top ten largest producers, at 40 kilograms of CO_2e in emissions for each kilogram of beef produced.[38] That is nearly 40 percent higher than the global weighted average emissions intensity for beef.[39] This high emissions intensity, coupled with the large size of the Brazilian cattle herd, presents a significant opportunity for emissions reduction. Three-way partnerships between state actors, the private sector, and philanthropies could potentially play a role in making Brazilian beef more sustainable through financing, technical assistance, and monitoring programs, among other solutions.

Current situation

The decentralized and extensive grazing systems that cover more than 85 percent of Brazil's beef production are a major factor underlying the relatively high emissions intensity (Exhibit 15).[40] Some 43 percent of the cattle herd is found in the nine states through which the Amazon flows, and cattle ranching is the single largest cause of Amazonian deforestation.[41]

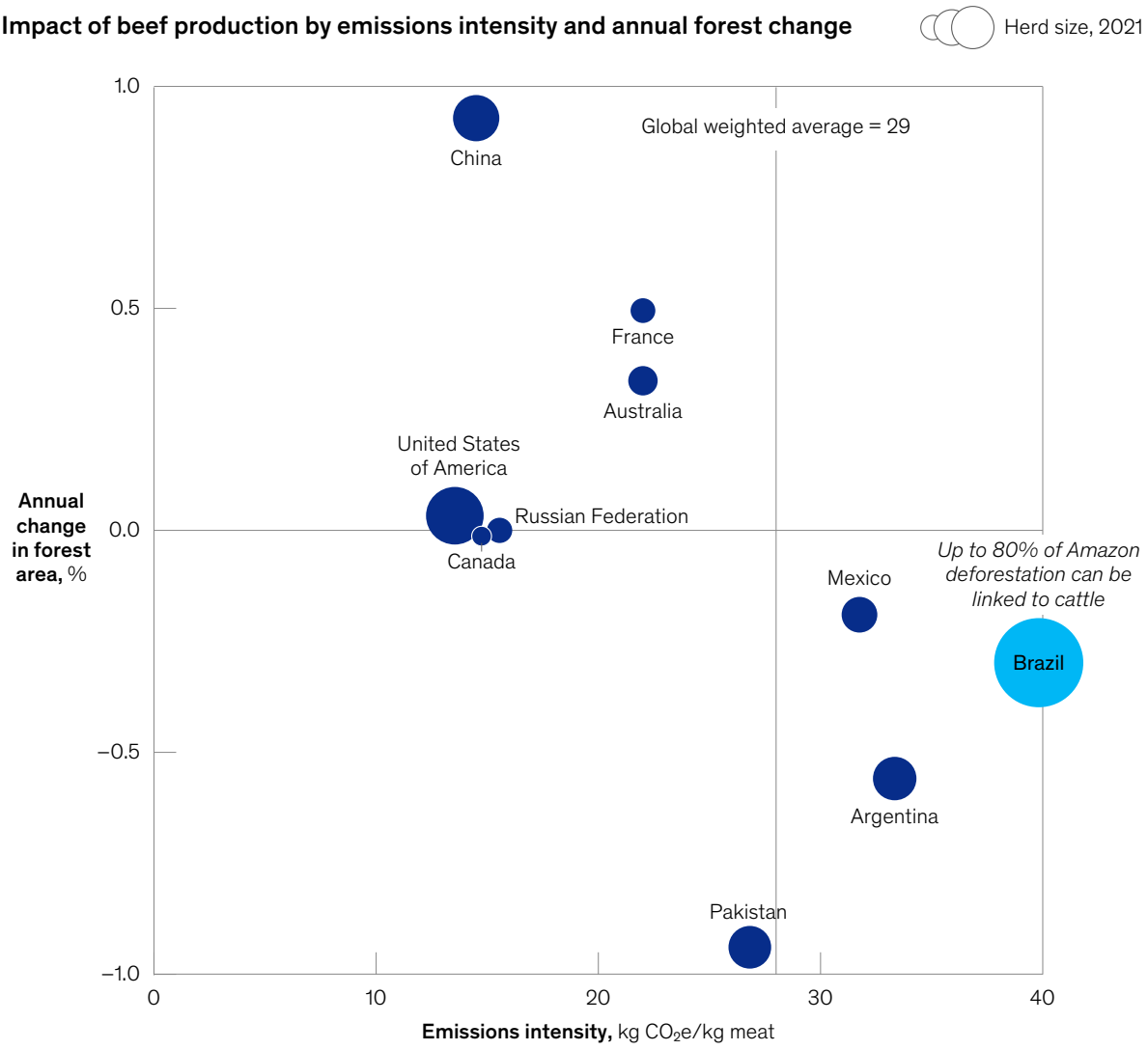
Pasture and animal health are important levers to reduce both beef emissions and deforestation. Among other benefits, improvements to pasture health imply a reduction of land use change emissions from avoided deforestation. Pilot projects restoring degraded pasture and implementing integrated livestock crop systems (which also improve animal health) have shown a reduction of 50 percent of CO_2e per hectare.[42] While demand shifts are a key and commonly discussed lever, reducing beef consumption requires fundamental shifts in consumer behavior, which may take longer to materialize. In the meantime and in parallel, pasture and animal heath can already help reduce emissions, besides providing other co-benefits.[43]

[36] Excluding emissions from associated land use change. For more details, see *Greenhouse gas emissions from agrifood systems: Global, regional and country trends, 2000–2020*, FAOSTAT Analytical Brief 50, UN Food and Agriculture Organization, November 2022.
[37] *OECD-FAO Agricultural Outlook 2023–2032*, OECD Publishing, July 6, 2023.
[38] Excluding emissions from associated land use change. For more details, see FAOSTAT, "Emission intensities," accessed September 5, 2023.
[39] Ibid.
[40] Agnieszka E. Latawiec et al., "Improving land management in Brazil: A perspective from producers," *Agriculture, Ecosystems & Environment,* March 2017, Volume 240.
[41] Cattle ranching drives deforestation through expansion of cleared pastureland; estimates of deforestation from cattle range from 50 to 80 percent, with most estimates in the range of 70 to 80 percent. For details, see Marin Elisabeth Skidmore et al., "Cattle ranchers and deforestation in the Brazilian Amazon: Production, location, and policies," *Global Environmental Change,* May 2021, Volume 68, Article 102280; Thales A. P. West et al., "Protected areas still used to produce Brazil's cattle," *Conservation Letters* (Society for Conservation Biology), October 2022, Volume 15, Number 6; PPM: Municipal livestock production, Instituto Brasileiro de Geografia e Estatística (IBGE), 2021.
[42] Estimate is based on a 2012 pilot in Mato Grosso led by the Instituto Centra da Vida (Novo Campo program). However, exact interventions applied will affect mitigation potential. Larger intensification projects are less profitable on smaller pastures: for example, the Novo Campo program only saw profitability for pasture greater than 385 hectares, while pastures of less than 200 hectares house about 45 percent of cattle in Brazil. Research from Embrapa shows mitigation potential of 5.51 tons of CO_2e per hectare for recovery of degraded pasture and 6.24 tons of CO_2e per hectare for implementation of integrated livestock crop systems (ILCS). Achieving Brazil's goals of 15 mega-hectares of pasture recovery with four mega-hectares of ILCS could lead to a reduction of up to 126 megatons of CO_2e (about 25 percent of total beef emissions). "Estabelecimentos censo agro 2017," Ibge, 2017; Celso Vainer Manzatto et al., "Mitigação das emissões de Gases de Efeitos Estufa pela adoção das tecnologias do Plano ABC: Estimativas parciais," Embrapa, June 2020; *Good livestock production practices reduce GHG emissions and increase meat production in the Amazon,* Imaflora, 2021; Erasmus K. H. J. Zu Ermgassen et al., "Results from on-the-ground efforts to promote sustainable cattle ranching in the Brazilian Amazon," *Sustainability,* April 2018, Volume 10, Issue 4; Meghan Bogaerts et al., "Climate change mitigation through intensified pasture management: Estimating greenhouse gas emissions on cattle farms in the Brazilian Amazon," *Journal of Cleaner Production,* September 2017, Volume 162.
[43] Other levers beyond the scope of our animal health and deforestation focus include additives and other methods to reduce emissions from enteric fermentation.

Exhibit 15

Brazil, one of the ten largest beef producers, is the leading source of cattle emissions globally and faces continued deforestation.

Impact of beef production by emissions intensity and annual forest change



Source: FAOSTAT

This potential reduction in cattle-ranching-related emissions is driven by a reduction of emissions intensity.[44] More than 55 percent of pastures in Brazil are on degraded deforested land, which supports a lower volume of cattle per hectare because of limited nutrients.[45] As pasture is restored, it could potentially support a higher stocking rate of cattle and reduce land requirements. This also increases the soil's carbon sequestration capacity.

Disease is another factor that contributes to beef's high emissions intensity. The global endemic disease burden can reduce livestock productivity up to 20 percent annually.[46] Parasites in Brazil represent $14 billion in cattle losses,

[44] Improvements to pasture health also imply a reduction of land use change emissions, which are excluded from emissions intensity calculations.
[45] Rafael Feltran-Barbieri and José Gustavo Féres, "Degraded pastures in Brazil: Improving livestock production and forest restoration," *Royal Society Open Science*, July 2021, Volume 8, Number 7.
[46] Brazil-specific data is unavailable, but tropical climates like those in Brazil typically have higher disease burdens on livestock than nontropical regions. More conservative estimates show up to 5 percent of the herd may die annually (not including declines in yield from nonfatal conditions). Franciéli A. Molossi et al., "Causes of death in beef cattle in southern Brazil," *Journal of Veterinary Diagnostic Investigation,* April 9, 2021, Volume 33, Number 4; World Organization for Animal Health.

with an associated 3.2 megatons of lost beef production from the largest parasite alone, which represent emissions of about 129 megatons of CO_2e.[47] For both pasture and animal health, improvements to nutrition and health can allow cattle to reach slaughter weight faster, reducing direct emissions associated with longer life spans and associated resource usage.

These levers are economically and technically feasible to implement. The Brazilian Agricultural Research Corporation (Embrapa) reviewed integrated crop livestock systems, which lead to both pasture and animal health improvements, and estimated potential net present value of $25 per hectare per year, with a profit increase of 35 cents per dollar invested.[48] Brazil has enough existing land developed to sustain agricultural production through at least 2040.[49]

Although the challenges around pasture and animal health are known, cattle ranchers have limited capacity to address them today because of limited access to financing, lack of technical knowledge, and push factors, among other limitations, particularly among upstream smallholders in the value chain.

— *Limited access to financing.* Although implementing these methods can be economical today, they require an upfront investment with a six-year payback period.[50] Ranchers lack the upfront capital to invest, with available financing for smallholders across Brazil's 2.5 million cattle ranchers limited, given current high rates of indebtedness and increasing interest rates.[51] Even though some programs target sustainable agriculture, they have less favorable interest rates than other nontargeted credit lines.[52] This is exacerbated by rancher concerns over the financial risks of unfamiliar practices.

— *Lack of technical knowledge.* Surveys of producers have shown that ranchers are unaware of alternative production methods or lack the technical knowledge to implement them. There is also resistance to change and a lack of awareness of the benefits of sustainable practices.[53] This lack of technical knowledge has also limited private-sector interest in providing more capital for pasture and animal health improvement initiatives.

— *Limited push factors.* Lack of enforcement of conservation policies, limited tracking and verification methods for indirect suppliers, low cost of land, and the ease of falsifying documents have created perverse incentives to continue deforestation. For example, ease of land grabbing means that an increase in pasture land is not necessarily linked to an increase in meat demand.[54] This pushes down land prices and, in many cases, means that the cost to deforest land can be less than the cost to reform existing land (not including productivity gains).[55]

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[47] Assumes emissions intensity of 40 kilograms of CO_2e per kilogram of meat (FAOSTAT 2020) multiplied by 3.2 megatons of "lost" meat. Note that gastrointestinal parasites reduce productivity of cattle up to 20 percent (Embrapa), which does not necessarily translate to a linear change in emissions intensity per head of cattle. "Parasitas bovinos podem causar perdas potenciais de até US$ 14 bilhões anuais à pecuária brasileira," Boehringer Ingelheim, July 11, 2022; Laerte Grisi et al., "Reassessment of the potential economic impact of cattle parasites in Brazil," *Revista Brasileira de Parasitologia Veterinária,* June 2014, Volume 23.

[48] Values calculated in 2019. Net present value (NPV) in this case corresponds to the annual return on investment from a given project. It was calculated to be 124 Brazilian reais per hectare and converted to US dollars assuming 1 BRL = 0.2 USD. M. de A. Pereira, *Avaliação econômica de sistemas de Integração Lavoura-Pecuária-Floresta: As experiências da Embrapa,* Embrapa, November 2019.

[49] Bernardo B. N. Strassburg et al., "When enough should be enough: Improving the use of current agricultural lands could meet production demands and spare natural habitats in Brazil," *Global Environmental Change,* September 2014, Volume 28.

[50] Based on Pereira, *Avaliação econômica de sistemas de Integração Lavoura-Pecuária-Floresta,* November 2019. A review of other pilots shows variability in payback period. The Novo Campo program, for example, showed a payback period of 1.5 to four years. For small pastures that require lower-cost levers, payback period can increase; a silvopastoral pilot had a four- to six-year payback period). Implementation of high-tech animal health solutions on their own can be NPV negative or positive, depending on the exact technology adopted. Zu Ermgassen et al., "Results from on-the-ground efforts to promote sustainable cattle ranching in the Brazilian Amazon," April 2018; Paulo Barreto, *Policies to develop cattle ranching in the Amazon without deforestation,* Amazônia, August 2021.

[51] Constanza Valdez, "Brazil's momentum as a global agricultural supplier faces headwinds," US Department of Agriculture, September 27, 2022; Marin Elisabeth Skidmore, "Outsourcing the dry season: Cattle ranchers' responses to weather shocks in the Brazilian Amazon," *American Journal of Agricultural Economics*, July 2022, Volume 105, Number 2.

[52] Zu Ermgassen et al., "Results from on-the-ground efforts to promote sustainable cattle ranching in the Brazilian Amazon," April 2018.

[53] Ibid.

[54] Francisco Luis Lima Filho, Arthur Bragança, and Juliano Assunção, "The economics of cattle ranching in the Amazon: Land grabbing or pushing the agricultural frontier?," Climate Policy Initiative, October 5, 2021.

[55] Ibid.; Barreto, *Policies to develop cattle ranching in the Amazon without deforestation,* August 2021.

Opportunities for action by public, private, and philanthropy partnerships

Based on our analysis, 4P models can leverage the existing momentum across sectors to support sustainable cattle ranching in Brazil. The Brazilian national government has made clear commitments to sustainable cattle ranching, including national health strategies and policy commitments to cover degraded pasture, reduce deforestation, and support low-carbon agriculture.[56] Similarly, the private sector has made commitments to sustainable cattle ranching: major meat suppliers (for example, JBS, Marfrig, Minerva) are targeting deforestation-free supply chains, and animal-health players (for example, Zoetis) are supporting lower-emission beef through market action and product availability.[57] Multiple philanthropic partnerships have emerged to support sustainable cattle ranching. Their objectives include increasing tracing of cattle through the supply chain, expanding financing options for ranchers, and facilitating investments in sustainable beef.[58]

A robust 4P model would be able to support pasture and animal health through financing, technical assistance, and monitoring. Following are potential solutions to overcome the issues smallholder ranchers face:

— *Financing the transition to sustainable practices.* Programs to offset the upfront investments required to restore pasture could help derisk the transition. These programs could be designed to reach smallholders and could mimic existing 4P model structures such as the Family Forest Carbon Program (FFCP), which developed a "green bond" to reach smallholders.[59]

— *Developing incentives for sustainable beef.* Development of a market for sustainable beef (for example, through price premiums and increased access to higher-price markets), or results-based financing conditional on farmers achieving specified sustainability-related targets, could increase rancher profits. These incentive programs could also encourage ranchers with extensive deforestation history to bring ranches back into compliance with the Brazil Forest Code through reforestation efforts.

— *Developing technical assistance programs.* Well-designed programs to educate farmers on the benefits of sustainable practices, new technologies (such as geotrackers, virtual fencing, and genetic improvements that streamline making herd management sustainable) and how to implement them can overcome the knowledge gap. Beyond education, programs can support farmers in implementing sustainable practices, maintaining pastures, and building capacity in the long term. Program structures can also mimic existing 4P model structures, such as IDH Farmfit Business Support.[60]

— *Connecting stakeholders.* Expanding collaborations among private-sector stakeholders (such as the Nature-Based Solutions Investment Platform) can increase the availability of funding and success of programs through

[56] Animal health strategy includes planning to eradicate foot-and-mouth disease; the World Organization for Animal Health announced that Brazil was free of foot-and-mouth disease with vaccination in 2018. Policy commitments include Brazil's Nationally Determined Contribution, Action Plan for Deforestation Prevention and Control in the Legal Amazon (PPCDAm), Plan for Low Carbon Emission in Agriculture (ABC plan), Plan for Adaptation and Low Carbon Emission in Agriculture (ABC+ plan). Brazil also has conservation laws that require 80 percent of rain forest land to be conserved. These policies and commitments have achieved various degrees of success.

[57] JBS aims to achieve zero deforestation across its global supply chain by 2035. Minerva has committed to eliminate deforestation in its supply chain across South America by 2030. Marfrig aims to have 100 percent of its supply chain free of deforestation/conversion by 2025 in the Amazon biome and by 2030 in the Cerrado biome. Based on a shared commitment to sustainable ruminant livestock farming, the partners to the Pastoral Greenhouse Gas Research Consortium (PGgRC), New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC), and Zoetis are collaborating to explore research mechanisms that may inhibit methane emissions from cattle, deer and sheep and reduce greenhouse gas emissions. "JBS makes global commitment to achieve net-zero greenhouse gas emissions by 2040," JBS, March 23, 2021; "Minerva Foods' commitment to sustainability," Minerva Foods, April 2021; "Marfrig's production chain to be free of deforestation within ten years," IDH, July 29, 2020; "Zoetis announces research collaboration to explore potential solutions to inhibit methane emissions from ruminant livestock," Zoetis, December 20, 2022.

[58] Partnerships include Sustainable Production of Calves Program (IDH and the Carrefour Foundation), Tropical Forest Alliance (WEF), Innovative Finance for the Amazon, Cerrado and Chaco (UNEP, The Nature Conservancy, and the Tropical Forest Alliance), and Nature-Based Solutions Investment Platform (Capital for Climate).

[59] Family Forest Carbon Program is a 4P model created by The Nature Conservancy and American Forest Foundation to support smallholder American forest owners in accessing carbon markets. It issued a $10 million bond in 2022 to pool smallholder risk for investors more effectively. See Glynnis Breen, "First-of-its-kind $10M green bond issued to finance family forest carbon program to fight climate change," American Forest Foundation, July 18, 2022.

[60] IDH Farmfit seeks to increase investment in smallholder farming, with a focus on various key crops across the developing world. Farmfit Business Support is funded by the Bill & Melinda Gates Foundation and UK Aid and provides analytics and technical assistance to farmers, coupled with blended finance. For details, see "Farmfit Business Support," IDH, not dated.

increased trust across partners. Moreover, collaboration could enhance the impact of programs. For example, technical assistance programs can reassure investors of the effective use of funding, further increasing funding availability.

— *Expanding monitoring and verification programs.* Robust satellite technology exists to enable monitoring of deforestation and pasture quality. Although pilots have been implemented across Brazil (for example, the Sustainable Production of Calves, Beef on Track), they have not yet reached scale.[61] Available and affordable monitoring and verification of indirect suppliers could add transparency to the value chain. This monitoring supports other solutions to ensure there is no leakage throughout the value chain. For example, profitability improvements from intensified pasture should avoid encouraging an expansion of cattle ranching.

There is significant opportunity to reduce emissions and transform the Brazilian beef industry in the near term. These efforts could reduce the emissions intensity of beef while we work toward other decarbonization levers such as changing individuals' consumption habits. Although many organizations target these large-scale diet shifts, they do not have to be mutually exclusive with what is achievable today.

Scaling mangrove restoration in Indonesia

Our analysis identified improving the management of protected areas, restoring degraded land, and expanding carbon credit markets as nature-focus areas well suited for 4P models. Mangroves offer an opportunity to explore what this could look like in practice. They are a critical asset for climate, nature, and human communities at a local and global scale. The soils of mangrove forests store more than 6.4 billion tons of carbon globally.[62] Per hectare, they store up to ten times more carbon than land-based forests.[63] They also provide a wide range of ecosystem services: habitat for thousands of species, flood and storm protection for coastal communities, and food and income to local communities. To help protect these precious resources, 4P models could build and scale efforts that restore and protect mangroves while simultaneously supporting the communities that depend on them.

Current situation

Indonesia hosts the largest mangrove area globally—about 25 percent of global mangrove coverage—but has experienced some of the greatest loss by area: over 6 percent since 1996, representing approximately 174 thousand hectares (Exhibit 16).[64] It therefore offers an opportunity to explore the challenges around the much-needed protection and restoration of mangroves. In Indonesia, avoiding the current rate of mangrove destruction (about 0.0074 mega-hectares per year) could reduce annual emissions by about six million tons, equal to about 1 percent of the country's emissions.[65] Further, restoring mangroves in each 0.1 mega-hectare of degraded area over the next five years could result in ten million tons of CO_2 sequestration potential by 2030. Successful mangrove restoration could also improve fishery health and fishery-based economies among coastal communities; by alleviating poverty and hunger, this could improve the well-being of 74 million Indonesians—about one-quarter of the population.

Indonesia's mangroves are protected under the 1990 Presidential Decree on the Management of Protected Areas. In 2020, the nation committed to restoring 0.6 mega-hectares of lost mangroves by 2024, the most ambitious mangrove rehabilitation target globally.[66]

[61] "Sustainable Production of Calves Program implements pasture intensification units in the Juruena Valley," IDH, July 23, 2021; Imaflora, "Beef on track," not dated.
[62] Jonathan Sanderman et al., "A global map of mangrove forest soil carbon at 30 m spatial resolution," *Environmental Research Letters,* April 2018, Volume 13, Number 5; "New study reveals that mangrove soils hold 6.4 billion tons of carbon globally," Oceanwealth, 2018.
[63] "Share the facts about mangroves," Conservation International, not dated.
[64] World Bank Blogs, "Indonesia's green belt: Protecting and restoring the country's mangroves," blog entry by André Rodrigues de Aquino, August 2, 2022; Global Mangrove Watch website, accessed July 11, 2023.
[65] Sigit D. Sasmito et al., "Challenges and opportunities for achieving Sustainable Development Goals through restoration of Indonesia's mangroves," *Nature Ecology & Evolution,* January 2023, Volume 7.
[66] Global Mangrove Watch website, accessed July 11, 2023; Sasmito et al., "Challenges and opportunities for achieving Sustainable Development Goals through restoration of Indonesia's mangroves," January 2023.

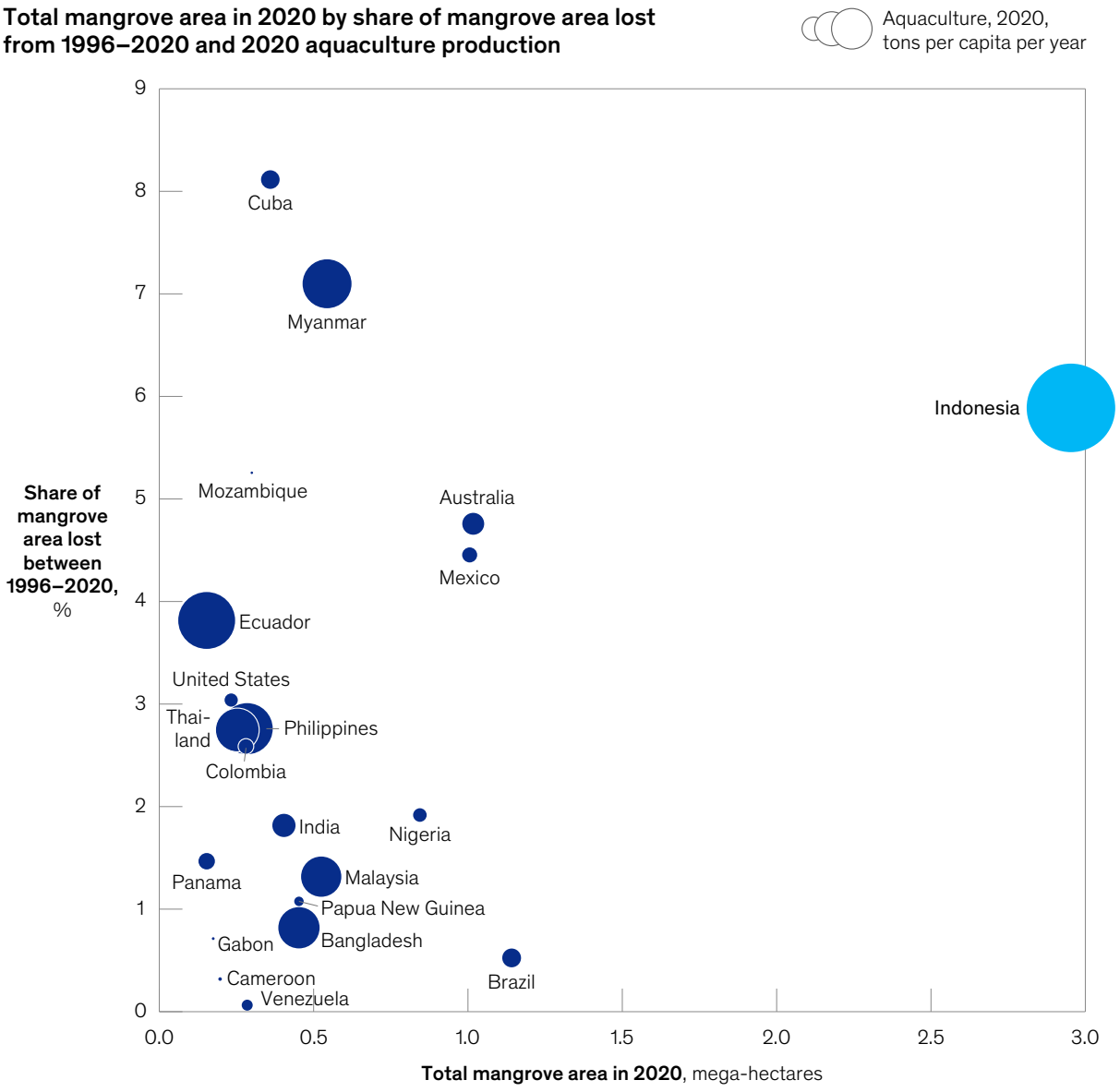
If successful, the restoration of mangroves in 0.6 mega-hectares of degraded areas could potentially sequester 60 million tons of CO_2 (about 10 percent of the country's current emissions) by 2030. Between 2017 and 2020, the area successfully rehabilitated by Indonesia was about 5,300 hectares per year, suggesting the nation would have to significantly ramp up its efforts to meet its ambitious goals.[67]

[67] Sasmito et al., "Challenges and opportunities for achieving Sustainable Development Goals through restoration of Indonesia's mangroves," January 2023.

Exhibit 16

Indonesia has the most extensive mangrove coverage globally and the largest opportunity for restoring degraded areas.

Total mangrove area in 2020 by share of mangrove area lost from 1996–2020 and 2020 aquaculture production



Source: Global Mangrove Watch

However, protecting the remaining mangroves and restoring damaged zones in Indonesia presents three main challenges:

1. *Growing local pressure to clear more mangroves for aquaculture.* Aquaculture, specifically, shrimp pond expansion, is associated with more than 50 percent of mangrove loss in Indonesia.[68] Following the depletion of alternative fishing grounds, human-made ponds have become an important food and income source for the growing population. Further, there is limited monitoring and enforcement of protected areas, and in some areas, aquaculture is encroaching on mangroves. In 2021, Indonesia was the second-largest aquaculture producer by volume globally (total inland and marine, including fish, mollusks, crustaceans, and aquatic plants).[69] In 2022, the country announced a goal to increase total annual shrimp production to two million tons per year—more than double—by 2024.[70] Unless existing pond yields increase, Indonesia may need to clear even more mangroves to meet this target and feed its growing population and aquaculture economy.

2. *Limited opportunities to generate revenue from, and hence funding for, mangrove restoration efforts.* Currently, there are limited opportunities for Indonesia to generate income from the restoration of mangroves, as current ecosystem services are not accounted for. The country recently joined the Blue Carbon Action Partnership to scale up revenues from blue carbon credits from mangrove restoration.[71] Indonesia's Peatlands and Mangrove Restoration Agency (BGRM) which is responsible for coordinating restoration efforts across NGOs and government partners has an annual budget of $100 million for mangrove restoration, which is insufficient by itself.[72] Mangrove restoration costs, on average, $1,640 to $3,900 per hectare in Indonesia, which would cover, at best, 60,000 hectares a year, a mere tenth of the country's stated four-year target.[73] Indonesia has not yet reported on progress toward its ambitious mangrove restoration goals.

3. *Relatively immature and fragmented mangrove restoration techniques.* Globally and in Indonesia, mangrove restoration efforts have been implemented at a small scale (ten to 400 hectares) and have seen low success rates. Reasons given include suboptimal practices, including poor site or species selection; limited focus on restoring conducive hydrological conditions; and projects conducted in isolation without a coordinated regional approach. In Indonesia, restoration efforts sometimes emphasize planting seedlings over restoring conditions that enable mangrove growth, such as soil content and hydrology, which can be more effective. Further, more than half of 61 rehabilitation studies observed in Indonesia were not monitored over time, limiting opportunities to gather lessons learned across efforts.[74]

Opportunities for action by public, private, and philanthropy partnerships

Mangrove protection and restoration will likely continue to face challenges from the short-term subsistence and economic needs driving their degradation. Positive system-level outcomes are more likely when nature conservation and restoration have strong legislative support or are at parity with or more profitable than the activities that degrade them. That gap could be closed by 4P models delivering several potential solutions:

Designing sustainable shrimp-pond-management programs to mitigate pressure to clear more mangroves for pond expansion. Ways in which 4P models could contribute to holistic, sustainable, pond-management programs aimed at improving shrimp yields include managing pond waste to minimize water pollution, restoring mangroves in portions

[68] "Conversion-free farmed shrimp," WWF Seafood Sustainability, not dated; Muhammad Ilman, Iwan Wibisono, and Nyoman Suryadiputra, *State of the art information on mangrove ecosystems in Indonesia,* Wetlands International, January 2011.
[69] "Aquaculture production," World Bank, accessed July 11, 2023.
[70] Toan Dao, "Indonesia standing firm on increasingly unlikely 2 million MT shrimp-production target," SeafoodSource, February 23, 2023.
[71] For details, see "New initiative to help government and business navigate untapped 'blue carbon' and restore coastal ecosystems," World Economic Forum, March 2, 2023.
[72] Sigit D. Sasmito et al., "Challenges and opportunities for achieving Sustainable Development Goals through restoration of Indonesia's mangroves," *Nature Ecology & Evolution,* January 2023, Volume 7.
[73] World Bank Blogs, "Indonesia's green belt," August 2, 2022.
[74] "Challenges and opportunities," January 2023.

of the ponds, and identifying unproductive aquaculture ponds that are well suited to mangrove restoration. Further, 4P models could emphasize the need for enforcement efforts to protect mangroves. Collectively, these efforts could alleviate pressure to clear more mangroves for pond expansion while increasing aquaculture revenues for locals. Further, sustainably raised shrimp could fetch premium prices via emerging certification programs for sustainable sourcing. Studies point to a global average price premium of close to 17 percent for sustainable seafood.[75]

Unifying existing mangrove protection and restoration efforts to enhance their effectiveness. Despite multiple mangrove restoration efforts led by different stakeholders, there is room for more progress in restoring Indonesia's mangroves. One way 4P models could help would be to facilitate the unification of existing isolated projects toward a shared goal. With a more systemic lens, they can mobilize resources to support those projects and lead an effort to raise the collective ambition of restoration efforts. Also, 4P models could help coordinate knowledge sharing and monitoring across mangrove restoration efforts. Emerging partnerships involved in similar initiatives include the Mangrove Breakthrough, which is working to catalyze the financial support needed to scale proven solutions and move toward a more unified global vision for mangrove restoration, which 4P models could build on.[76]

Helping build value chains for income-generating mangrove protection and restoration efforts. To alleviate pressure from economy-driven mangrove destruction, 4P models could help scale emerging markets for conservation-based initiatives such as the following:

— *Mangrove restoration blue carbon credits.* To help scale up the emerging carbon credit value chain, 4P models could generate and sell blue carbon credits from mangrove restoration and protection efforts (for example, credits from the absorption of carbon in coastal and oceanic ecosystems). Individual projects could be bundled into larger portfolios to blend the quality and hence the price of the credits generated, and 4P models could help build coalitions that make advance commitments to purchase such credits. Indonesia has started considering blue carbon projects. In January 2023, the Indonesian government signed a partnership with the World Economic Forum to scale the nation's blue carbon efforts and address the growing demand for blue carbon credits. This provides yet another foundation for 4P models to build upon.[77]

— *Payments for ecosystem services.* Another possibility would be for 4P models to help design programs to facilitate payments for mangrove-related ecosystem services. They could assess willingness to pay among ecosystem service beneficiaries with an equity lens. They could also lead efforts for the fair valuation of ecosystem services and inform structures to ensure equitable distribution of payments to the local communities responsible for avoided deforestation or restoration of mangroves. For example, such programs could have coastal businesses pay for flood and storm protection or require diving tourists to pay fees for water filtration.

— *Ecotourism.* In the realm of tourism, 4P models could help identify a few flagship zones and design ecotourism initiatives that create local jobs and generate income to finance restoration efforts. Designing such programs would require that 4P models heavily engage local communities, mangrove experts, and the government to ensure a balance between nature and economic goals. Mangroves are unique ecosystems and could provide additional value as carefully managed tourism assets while undergoing restoration.

Mangrove protection and restoration benefit climate, nature, and human communities. The Indonesian government and other public, private, and philanthropic actors and joint partnerships have invested resources into mangrove restoration projects. However, ample opportunity remains for multi-stakeholder structures like 4P models to enhance the protection of this precious resource and restore degraded areas while ensuring the security of local livelihoods.

[75] Shanshan Li and Zein Kallas, "Meta-analysis of consumers' willingness to pay for sustainable food products," *Appetite,* August 2021, Volume 163, Article 105239.
[76] For more, see "The mangrove breakthrough," Global Mangrove Alliance.
[77] "World Economic Forum signs partnership with Indonesia on blue carbon to support national climate goals," World Economic Forum, January 19, 2023.

Increasing equitable access to electrified transportation in the United States

Road transport represents 12 percent of global emissions (6.1 gigatons of CO_2e).[78] Decarbonizing road transport is a critical lever for global decarbonization efforts, particularly in developed economies with high vehicle ownership. The United States has the highest road transport emissions per capita (4.4 tons of CO_2e per person) and below-average electric vehicle (EV) adoption rates among high-income countries (9 percent versus 22 percent average across European Union countries).[79] At the same time, access to alternative transit options is low, with only 5 percent of US workers commuting on public transit, even though buses can reduce emissions per passenger mile by up to 70 percent (Exhibit 17).[80] This presents an opportunity for 4P models to build on the momentum of existing partnerships working to increase electrified transit adoption.

Current situation

Although the United States may be approaching a positive tipping point in EV adoption, low-income households[81] are experiencing higher barriers to access, despite benefits from adoption. Purchases of passenger EVs have increased 29 percent per annum since 2018 and accounted for 8 percent of new-car sales in 2022.[82] However, in 2022, only 24 percent of the nation's public chargers were in disadvantaged communities, which have 33 percent of the population (Exhibit 18).[83] Differences in access to charging infrastructure are more acute in practice than public infrastructure reveals, as 80 percent of EV charging is completed at home, which is not a feasible choice for most disadvantaged communities.[84] At the same time, the Department of Transportation has found that urban disadvantaged communities have 39 percent higher travel barrier scores than other communities.[85] Disadvantaged communities experience worse air quality from vehicles (29 percent higher exposure to diesel particulates than other communities in urban America) and would receive the greatest health benefits from EV adoption across both passenger vehicles and public transit.[86]

Transitioning to electrified transit can eliminate all tailpipe emissions from fuel combustion (86 percent of lifetime emissions), which translates to 55 percent lower emissions for new passenger EVs than for combustion engine vehicles.[87] Increasing alternative options may also encourage a larger switch from private vehicles to public transit, further reducing emissions, particularly in urban areas. At the same time, the United States is pushing toward transit system decarbonization with the passage of new bills like the Inflation Reduction Act.

However, improving infrastructure access to increase electrified transport in disadvantaged communities faces three direct challenges:[88]

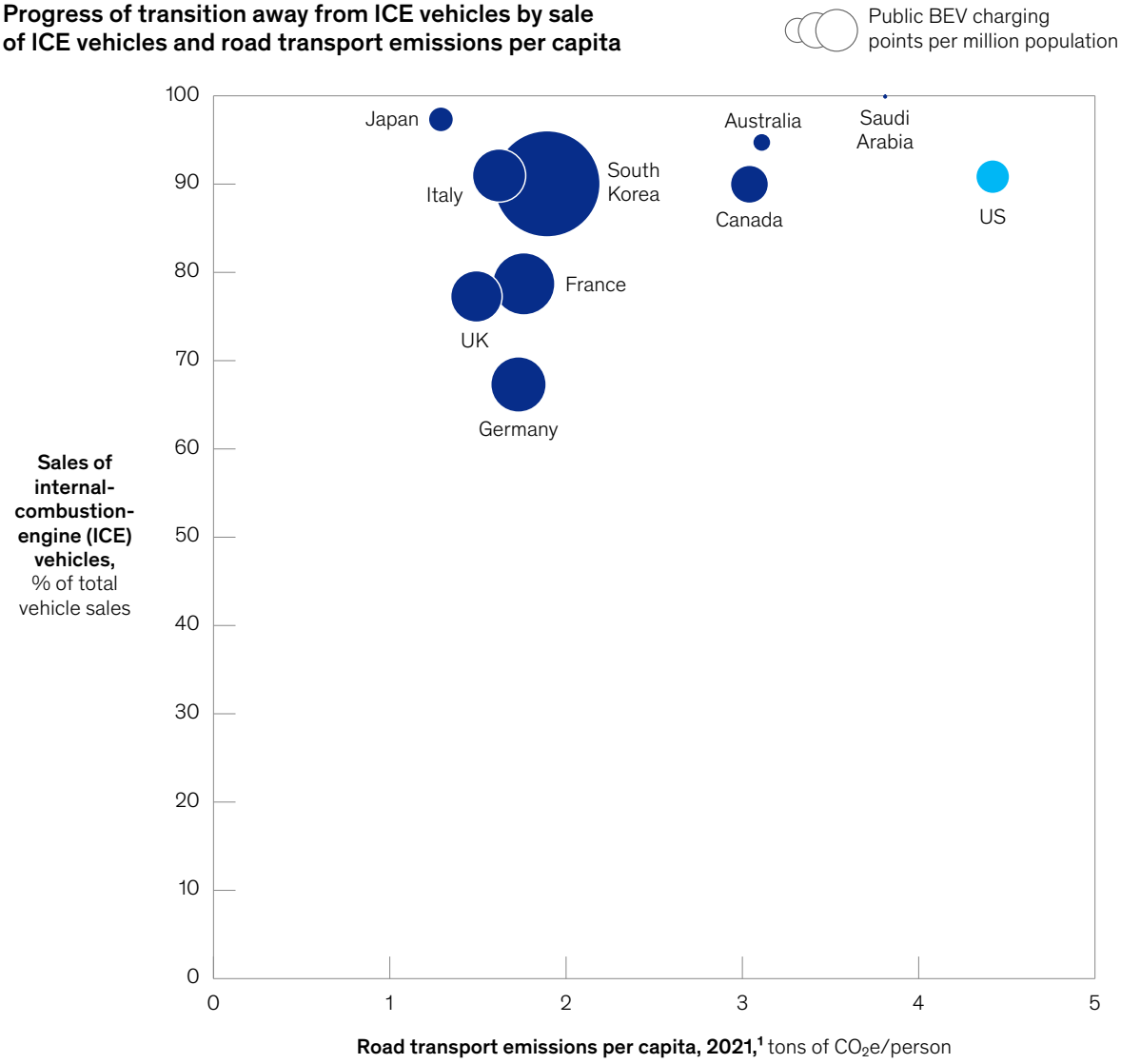
1. *Lack of publicly owned charging infrastructure.* To meet demand projections, public passenger charging infrastructure may need to grow more than 30 percent per annum from 2022-30. To date, the private sector has been deterred by underutilization of existing chargers, particularly in disadvantaged communities. Public-transit

[78] EMIT.
[79] Statistics throughout this deep dive refer to battery EVs and plug-in hybrid EVs unless otherwise noted. Greenhouse gas inventory data from "Greenhouse gas inventory data—detailed data by party," UN Framework Convention on Climate Change (UNFCCC), not dated; *CO_2 emissions from fuel combustion,* International Energy Agency, 2020 (Korea and Saudi Arabia only); World Bank; IHS Markit.
[80] "New census report shows public transportation commuters concentrated in large metro areas of the United States," US Census Bureau, news release, April 1, 2021; Siqi Zheng and Aaron Krol, "Public transportation," MIT Climate Portal, February 21, 2023.
[81] Defined as disadvantaged by the Justice40 Initiative. For details, see "Justice40: A whole-of-government initiative," White House, not dated.
[82] For details, see "Global EV data explorer," International Energy Agency.
[83] Total level 2 and DC fast charger. For details, see "Alternative fueling station locator," US Department of Energy, Alternative Fuels Data Center, not dated; "Explore the map," Climate and Economic Justice Screening Tool, Council on Environmental Quality, not dated.
[84] Michael Blonsky, Prateek Munanka, and Sivasathya Balamurugan, *Incorporating residential smart electric vehicle charging in home energy management systems,* IEEE Green Technologies Conference, online, April 7–9, 2021.
[85] Measure used in Justice40 initiative and defined as average of relative cost and time spent on transportation. For more information, see "Explore the map," Climate and Economic Justice Screening Tool.
[86] Represents the primary measure of air quality from transport used in the Biden administration's Justice40 Initiative. Although some high-income urban areas also face air quality challenges, socioeconomic status is tied to worse health outcomes from poor air quality. For more information, see "Explore the map," Climate and Economic Justice Screening Tool.
[87] This number can vary depending on source of electricity, vehicle model, and operational conditions. *Insights into future mobility,* MIT Energy Initiative, November 2019; "Comparative life-cycle greenhouse gas emissions of a mid-size BEV and ICE vehicle," International Energy Agency, May 2021.
[88] Other equity-specific EV challenges include high upfront vehicle prices, but this challenge is not necessarily the right fit for 4P models' limited resources, given the direction of the market today. Supporting manufacturing scale-up has additional relevant socioeconomic considerations (for example, relationship between manufacturing and vehicle price), but this was not prioritized in the analytical framework.

Exhibit 17

The United States accounts for a large share of transport emissions and lags in EV uptake among transport emitters in major developed economies.

Progress of transition away from ICE vehicles by sale of ICE vehicles and road transport emissions per capita



[1]Except 2018 for South Korea and Saudi Arabia, 2020 for Australia (latest available data).
Source: IEA; IHS Markit, UNFCCC; World Bank; McKinsey Center for Future Mobility

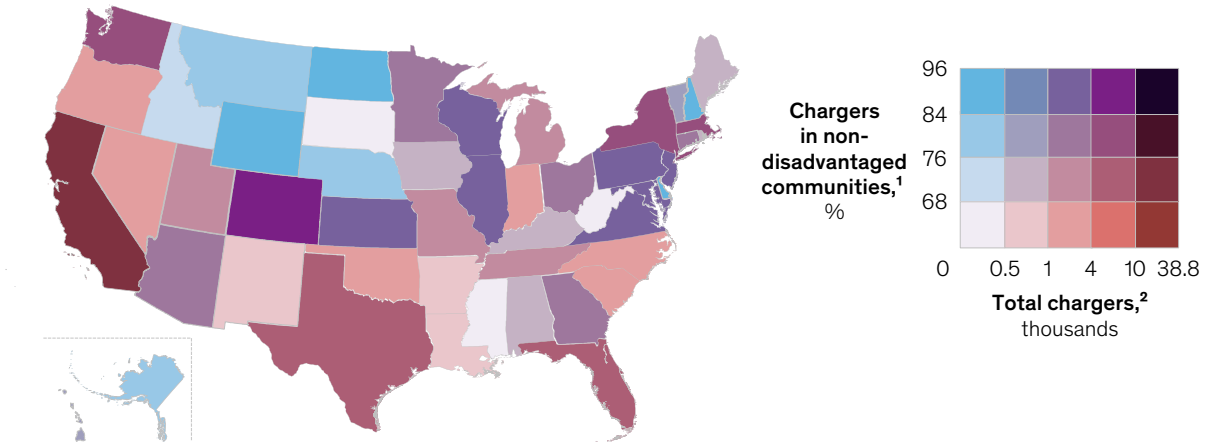
agencies also require significant growth in charging infrastructure to support fleets, given the limited number of chargers today.[89]

[89]Based on current projections, including vehicle demand, charger technology distribution, utilization, and other key inputs. Changes to assumptions could have significant impact on projects. For details on charging infrastructure projections, see Peter Fröde, Morgan Lee, and Shivika Sahdev, "Can public EV fast-charging stations be profitable in the United States?," McKinsey, October 5, 2023.

Exhibit 18

In the United States, the distribution of charging infrastructure favors more affluent communities.

Distribution of chargers



[1]Calculated based on whether the station location falls within a non-disadvantaged census tract, as defined by the Justice40 Initiative.
[2]Level 2 and DC fast chargers only; calculated as the number of charging points, not charging stations.
Source: US Department of Energy (Alternative Fuels Data Center), Climate and Economic Justice Screening Tool, Federal Communication Commission - Area API

2. *Lower rates of vehicle ownership.* Many households in disadvantaged communities do not own vehicles, and 72 percent of households that do not own vehicles have an income of less than $50,000 annually.[90] At the same time, low-income households have a disproportionate share of used-vehicle purchases: 66 percent of households with incomes less than $40,000 buy used vehicles, compared with 41 percent of households with incomes greater than $100,000.[91] Until the market for used EVs reaches scale, low-income households will face additional barriers to access. Alternative forms of electric transit are needed to support households without access to newprivate vehicles.

3. *Operational complexity of alternative forms of transit.* Alternative forms of transportation, including public transit, e-bikes, e-scooters, and other micromobility options, are more complex to scale due to the nature of fleet planning. For public transit, operating both electric and diesel infrastructure concurrently creates challenges. Public transit is also logistically complex, as it covers large areas and is influenced by multiple layers of government; for example, many transit systems receive federal, state, and local funding. For micromobility, there is a limited set of successful pilots, creating concerns about fleet management and maintenance.

Federal and state-level policies are increasing the availability of charging infrastructure, particularly in California. New federal tax credits and grants have emerged to support public charging infrastructure.[92] California has gone further by mandating new EV sales, funding research that identifies barriers to adoption among low-income communities, and providing additional credits for EVs and public charging infrastructure.[93] Other states, including Massachusetts, New York, and Oregon, have followed California's lead and have developed their own EV policies.

[90]US Census Bureau, American Community Survey, 2021 (five-year estimates accessed through IPUMS).
[91]*Report on the economic well-being of US households in 2015,* Board of Governors of the Federal Reserve System, May 2016.
[92]Federal policies for passenger vehicles and buses include the Inflation Reduction Act and Infrastructure Investment and Jobs Act (National Electric Vehicle Infrastructure Program).
[93]California policies include the Clean Energy and Pollution Reduction Act (SB 350), Electric Vehicle Charging Infrastructure Assessment (AB 2127), and the California Electric Vehicle Infrastructure Project.

Specific bus policies have also emerged to support acquisition of buses and building of infrastructure for public-transit agencies and schools.

Opportunities for action by public, private, and philanthropy partnerships

The private and philanthropic sectors have made significant efforts toward increasing adoption of electrified transit. Major OEMs have been developing and expanding charging networks. Philanthropy also has been active, forming policy-focused transportation electrification 4P models, creating community-based rural ride-sharing programs, and supporting adoption of electric school buses.[94]

Given the current status of electrified transit in the United States and the early successes of 4P models in California, new entrants are likely to add value by supporting existing initiatives or targeted policy solutions to enable public infrastructure development. This will be particularly relevant in urban areas, which can maximize the impact of limited 4P model resources. Existing initiatives are already seeing progress. For example, the Drive Electric Campaign helped to advocate for California's Advanced Clean Trucks rule, which requires truck makers to sell an increasing percentage of zero-emission trucks from 2024-30, and has been replicated in other states, including New York, Oregon, and Washington.[95]

There are several ways in which 4P models can continue to build on the momentum of existing partnerships:

— *Evaluating and sharing best practices and policies for urban transport systems.* Partners within a 4P model can work together to identify effective solutions in public infrastructure development to support urban transport, including private and public vehicles. Philanthropy could be helpful in coordinating across actors that influence public transit and the associated infrastructure and could bring the government into the dialogue. As the philanthropic, private, and public sectors prioritize solutions, they can advocate for laws at the federal level. A first step toward learning from ongoing initiatives and assessing what could be further scaled could be to evaluate the effectiveness of California policies, such as additional funding for public chargers in disadvantaged communities.[96]

— *Piloting alternative modes of transit.* Proof-of-concept pilots funded by the philanthropic or public sectors for electrified public transit and micromobility can expand access to and scale zero-emission transit to all populations, regardless of vehicle ownership. Assistance programs can also support cities in setting up or scaling alternative transport options. Expanding the work of existing 4P models—for example, bringing the community-based ridesharing program developed by Green Raiteros to urban areas—can further enhance impact.

— *Derisking the development of publicly accessible infrastructure in disadvantaged communities.* Charging infrastructure includes both public-transit infrastructure and public-passenger charging stations. For passenger vehicles, lack of a clear business case has prevented private-sector infrastructure investments in disadvantaged communities,[97] which can be addressed through concessionary capital or other incentives until the market is at scale. For example, pilots for longer-duration, lower-interest-rate loans to install chargers in relevant communities could allow time for adoption of EVs while removing customer concerns about available charging infrastructure. For alternative modes of transit, additional financing options for cities can speed up the transition to electrified transit. Funding can complement existing programs. For example, the California Electric Vehicle Infrastructure

[94] The Drive Electric Campaign (ClimateWorks Foundation) aims to support 100 percent vehicle electrification globally by 2040. Green Raiteros is a community-based rural ridesharing program in California launched by the California Endowment. the California Public Utilities Commission (CPUC), EVgo, the LEAP Institute, and the Schmidt Family Foundation. The Bezos Earth Fund has programs focused on electric trucks and buses.

[95] For details, see Hieu Le, "Clean truck corridors, coast to coast," Drive Electric Campaign, December 2, 2021; Anthony Eggert, "How electric freight is picking up speed around the world," Climateworks Foundation, March 3, 2022.

[96] "California Energy Commission launches $38 million project for EV charging in low-income and disadvantaged communities," California Energy Commission, September 12, 2023.

[97] Disadvantaged communities as defined by the Justice40 Initiative.

Project aims to increase public EV infrastructure but has been oversubscribed, with only a third of requests for grants fulfilled.[98]

— *Creating consumer advocacy and engagement programs.* Cost, environmental, and operational misconceptions still limit the uptake of passenger and bus electric vehicles; a recent survey showed half of consumers were unaware of available federal tax incentives.[99] Programs to overcome EV myths and misconceptions can be coupled with engagement programs to support consumers and cities in confirming eligibility and applying for the available state and federal incentives. These types of programs could, for example, build upon WRI's Electric School Bus Initiative, which provides school districts with technical assistance in transitioning to electric buses.[100]

Although significant advancements have been made in increasing infrastructure for electrified transit, 4P models can help ensure that uptake is completed equitably throughout the United States. Only through these kinds of efforts of growing transit systems in disadvantaged communities can the United States achieve full transportation electrification.

Reducing reliance on coal in the Philippines

Decarbonizing the power sector, which accounts for nearly 25 percent of global CO_2 emissions, is essential for bringing the world as close as possible to a 1.5°C pathway.[101] Phasing out coal is only one of multiple solutions, but it presents an opportunity for faster, higher-impact CO_2 reductions, given that it is the most carbon-intensive fuel and accounts for the majority of global power emissions.[102]

Phasing out coal can involve socioeconomic risks, depending on country, and it can heighten inequities in energy access and raise questions about who should pay for the transition. In many places, coal remains the most economical, reliable, and widely available fuel source. We focus in this section on the opportunity for 4P models to help reduce reliance on coal in the Philippines, one of many countries that are highly dependent on coal.

Current situation

In general, regions with high dependence on coal have the greatest opportunity for emissions reductions. Further, areas with low energy security and equity need support to ensure a just transition that protects local livelihoods and businesses from energy disruptions and energy poverty. Countries like India, Indonesia, South Africa, and Vietnam are working to implement multi-stakeholder partnerships to transition from coal to cleaner energy in an orderly and equitable manner.

The Philippines is grappling with the same challenges and starting to transition to a cleaner grid (Exhibit 19). The country has set targets to increase the share of renewables in the energy mix to 35 percent and 50 percent by 2030 and 2040, respectively. In 2020, the government introduced a moratorium on greenfield coal-fired power

[98] Noel Crisostomo et al., "Assembly Bill 2127 electric vehicle charging infrastructure assessment: Analyzing charging needs to support zero-emission vehicles in 2030—revised staff report," California Energy Commission, May 2021.
[99] Jeff S. Bartlett, "More Americans would buy an electric vehicle, and some consumers would use low-carbon fuels, survey shows," *Consumer Reports,* July 7, 2022.
[100] For details, see "Electric School Bus Initiative," World Resources Institute, not dated.
[101] Energy-related CO_2 emissions grew by 0.9 percent to over 36.8 gigatons in 2022. The largest absolute sectoral increase in emissions was from electricity and heat generation, reaching an all-time high of 14.6 gigatons. For details, see *CO_2 emissions in 2022,* International Energy Agency, March 2023.
[102] Coal emits 865 grams of CO_2e per kilowatt-hour (kWh), whereas the average carbon intensity of electricity generated today is 475 grams of CO_2e per kWh. See "Average CO_2 intensity of power generation from coal power plants, 2000–2020," International Energy Agency, June 29, 2020; "Emissions," in *Global energy and CO_2 status report 2019*, International Energy Agency, March 2019; IEA, *Coal in net zero transitions,* November 2022.

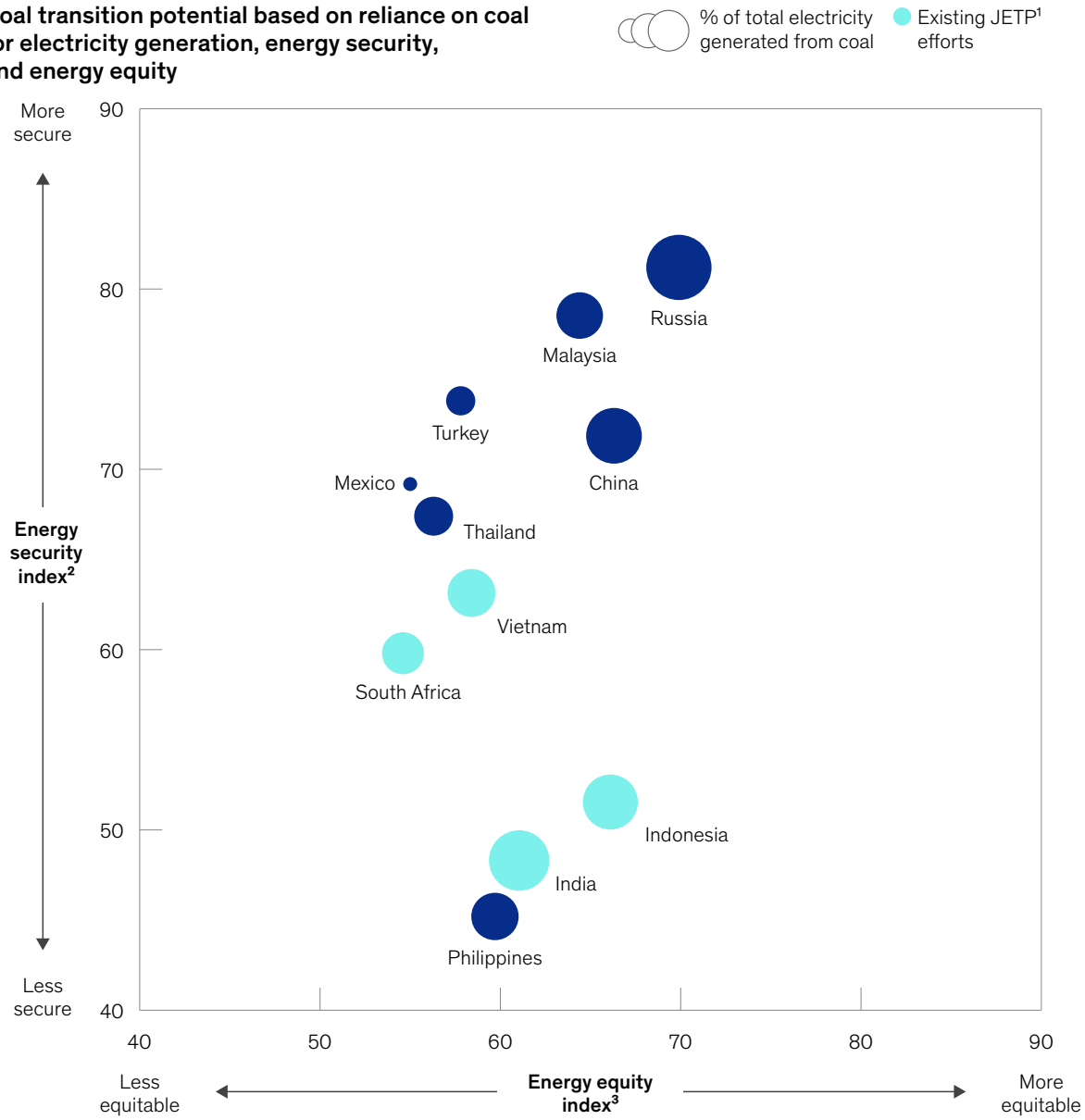
plants.[103] To help accelerate this process, 4P models can test a streamlined Just Energy Transition Partnership (JETP) agreement with the Philippines.[104]

[103] *2020–2040 Philippine Energy Plan: Towards a sustainable and clean energy future,* Philippine Department of Energy, June 2023.
[104] A common obstacle in past JETPs has been a long setup process. Funders await proposals for concrete power projects before committing funding, while recipient governments seek firm commitments before initiating evaluations for such projects. Improving this process can accelerate funding.

Exhibit 19

The Philippines is the only coal-reliant country with energy security and equity challenges that lacks a planned Just Energy Transition Partnership.

Coal transition potential based on reliance on coal for electricity generation, energy security, and energy equity



[1] Just Energy Transition Partnership.
[2] Index of import independence, diversity of electricity generation, and energy storage.
[3] Index of access to electricity, electricity prices, and gasoline and diesel prices.
Source: World Energy Trilemma Index

In the Philippines, coal contributes nearly 58 percent of the energy mix.[105] The country imports 75 percent of its coal (mostly from Indonesia), exposing its current power supply to volatility in commodity prices and exchange rates.[106] To meet future demand in the Philippines, electricity supply from coal is expected to increase by 6 percent annually, while renewables are projected to increase by only 1.5 percent annually.[107] Further, although at least 95 percent of the Filipino population has access to electricity, supply is intermittent; in 2021, power outages cost the country 107.5 million consumer hours.[108] Filipino households also have the second-highest electricity costs in Southeast Asia; they pay $0.177 per kWh (at the time this report was written), compared with $0.095 in Indonesia and $0.079 in Vietnam.[109] Further, Filipino consumers are vulnerable to energy price shocks due to automatic fuel pass-through allowances for power producers.[110]

The Philippines is facing four main challenges to phasing out coal:

1. *Lack of an economically viable baseload replacement for coal to ensure security of supply in the short to medium term.* The Philippines currently has no financially viable lower-carbon alternatives for baseload coal generation. The country's only gas field is set to run dry within the next four years, and the nation is gearing up for higher costs from importing liquefied natural gas (LNG).[111] Other alternatives, such as hydro- and nuclear power, would require significant investments, as there is currently limited to no capacity locally.

2. *Efforts to promote renewables development have not yet gained momentum.* While the Renewable Energy Act (REA) was enacted in 2008, the rollout of its elements could have been faster, as acknowledged by the Philippines' president.[112] For example, the Department of Energy says milestones from policy mechanisms like on-grid and off-grid Renewable Portfolio Standards were not achieved until 2017 and 2018.[113]

3. *Early retirement of coal-fired power plants will create massive costs that need to be redistributed across the sector.* Filipino power producers may face significant stranded-asset risk from the early retirement of coal power plants, depending on the target year, which may cause reluctance to transition to a lower-carbon energy mix. Our analysis of cost-optimized coal-plant retirement schedules for the Philippines showed an average plant age of about 12 years, which is 28 years less than the typical lifetime of a coal plant. If the Philippines were to phase out coal by 2035, this would result in stranded-asset risk of about $7 billion.[114]

4. *The Philippines' power network requires extensive capital, beyond typical expenses, for an orderly transition to renewables.* Due to the Philippines' archipelagic nature, historic reliance on coal, and heightened vulnerability to natural disasters like typhoons and earthquakes, the country's network is split into grid and off-grid clusters across the islands. These first need to be interconnected and linked to alternative backup power sources to

[105] For details, see "Energy resources: Coal," Philippine Department of Energy, not dated.
[106] Sara Jane Ahmed and Jose Logarta, "Carving out coal in the Philippines: Stranded coal plant assets and the energy transition," Institute for Energy Economics and Financial Analysis (IEEFA) and Institute for Climate and Sustainable Cities (ICSC), October 2017.
[107] *Phasing-out coal in the Philippine*s, Mercator Research Institute on Global Commons and Climate Change, Policy Brief, November 2021; "The political economy of a global coal phase-out" (PEGASOS), November 2021; Nils Ohlendorf, Michael Jakob, and Jan Christoph Steckel, "The political economy of coal phase-out: Exploring the actors, objectives, and contextual factors shaping policies in eight major coal countries," Energy Research & Social Science, August 2022, Volume 90, Article 102590.
[108] For details, see "Access to electricity (% of population)—Philippines," World Bank DataBank, not dated.
[109] For details, see "Philippines electricity prices," GlobalPetrolPrices.com, accessed October 2023.
[110] Sara Jane Ahmed, "Electricity in the Philippines does not need to be so expensive—or dirty," Eco-business, May 16, 2018.
[111] Enrico Dela Cruz and Emily Chow, "As gas reserves wane, Philippines faces rising costs in switch to LNG," Reuters, May 24, 2023; Huyen Trang Vu and Zhi Xin Chong, "Sluggish LNG imports expected in the Philippines and Vietnam," S&P Global Commodity Insights, July 10, 2023.
[112] Job Manahan, "Marcos Jr recognizes PH's 'slow' transition to renewable energy," ABS CBN News, August 9, 2023.
[113] *2020–2040 Philippine Energy Plan,* Philippine Department of Energy, June 2023.
[114] Assumed median decommissioning cost for coal plants based on data estimates from Daniel Raimi, *Decommissioning US power plants: Decisions, costs, and key issues,* Resources for the Future, October 2017.

enhance the grid flexibility needed for renewable integration.[115] Further, transmission and distribution lines and renewable assets will need physical reinforcement to strengthen their resilience to physical hazards.[116]

Phasing out coal is one element of an energy transition, and the Philippines will need to increase renewable capacity by 117 gigawatts and invest $133 billion in its power sector by 2050 for a power sector transition, according to estimates by McKinsey's global Energy and Materials Practice (Exhibit 20).

Opportunities for action by public, private, and philanthropy partnerships

The Philippines relies on a suite of policies, partnerships, and market-based solutions to help accelerate the transition. Their impact remains nascent.

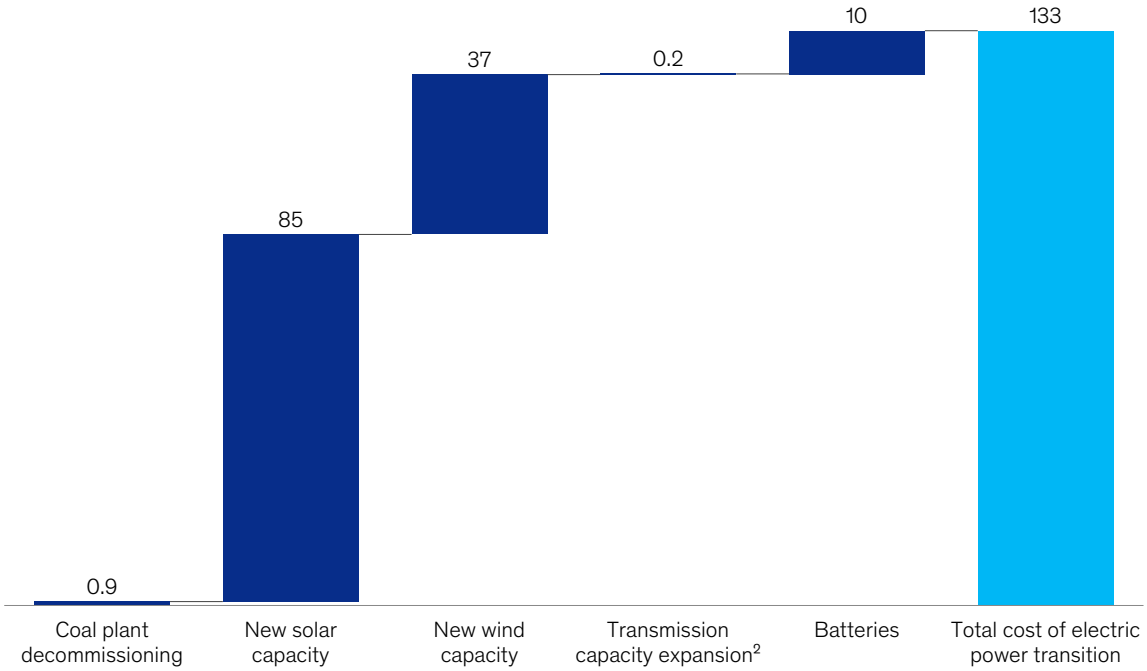
To accelerate the Philippines' energy transition, 4P models could build on the JETP model implemented in other countries to facilitate a nationwide coal phaseout. JETPs are a financing mechanism to help coal-reliant emerging economies transition to clean energy while reskilling affected workers and creating new economic opportunities for

[115]We assume a scenario in which the Philippines meets its Nationally Determined Contribution to achieve peak emissions by 2030. In addition, we assume reduction in power sector carbon emissions of at least 80 percent by 2050 compared with 2021 levels; a reduction in solar and wind capital expenditure costs of at least 35 percent by 2050 compared with 2021; a coal phaseout by 2050; and fivefold load growth between 2021 and 2050.
[116]*2020–2040 Philippine Energy Plan,* Philippine Department of Energy, June 2023.

Exhibit 20

The Philippines would need about $130 billion to transition away from coal by 2050.

Investment needed for the Philippines to achieve a 70% renewable grid mix by 2050,[1] $ billion



[1]Based on goals to generate 90 gigawatts from solar and 27 gigawatts from wind (onshore and offshore wind generation), supported by about 25 gigawatts of batteries, to reach a grid mix with ~70% renewables by 2050; hydro generation is included as a renewable generation resource.
[2]Transmission capacity expansion costs include only costs associated with interregional transmission.
Source: McKinsey Global Energy and Materials Practice

the impacted communities.[117] The first JETP was established in 2021 in South Africa, and such mechanisms have a long way to go. Still, their implementation in different regions offers lessons that 4P models can build on. Among the potential solutions are the following:

— *Mobilizing diverse sources of funding to support a coal phaseout.* Securing adequate amounts of appropriate funding for all the elements of a coal phaseout is challenging. There is a need for grants to subsidize the early retirement of coal plants (an expense better suited to public grants or philanthropic donations than loans), and other types of financing are needed to scale renewables. Separately, to attract more private-sector financing, the local government could offer guarantees or other insurance mechanisms to derisk such transactions.

— *Explicitly positioning coal phaseout as a legitimate brown-to-green opportunity.* Developing an updated and sustainable finance taxonomy with explicit approvals and legitimacy around coal phaseout investments could attract more lenders. In many regions, lenders are restructuring their portfolios to shift away from financing fossil fuel sectors, which may pose reputational and transition risks associated with investing in coal power plants that are not immediately being decommissioned.

— *Expand access to low-carbon electricity.* A coal phaseout needs to be paired with increasing alternative power sources for the approximately remaining 2.5 percent of Filipinos yet to obtain access to electricity.[118] Partnerships like the one between the Philippine Rural Electric Cooperatives Association, the US Agency for International Development, and the US National Renewable Energy Laboratory plan and develop transmission expansion to areas with suitable renewable energy potential.[119]

Electricity markets are technically and politically complex: power grids are interconnected, the sector is often heavily regulated, and changes in the energy mix and prices have direct impacts on businesses and households. This complexity necessitates multi-stakeholder solutions that 4P models can help unlock.

Increasing mitigation and resiliency opportunities for rice production in Thailand

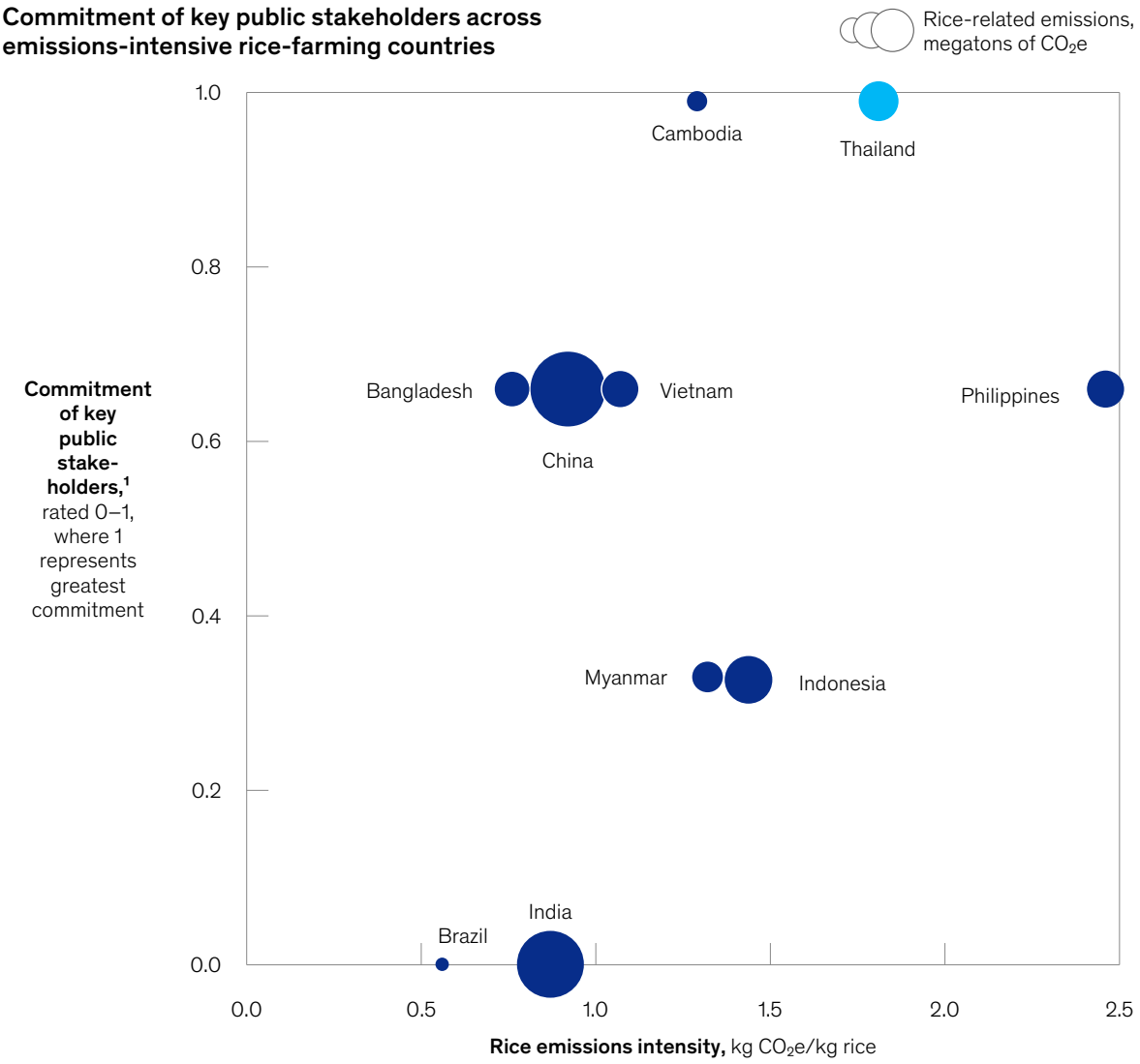
Rice is key to global food security, with 3.5 billion people consuming it daily.[120] Rice production is also a major source of global greenhouse gas emissions (approximately 600 megatons of CO_2e in 2019, or 1.2 percent of total emissions).[121] At the same time, a climate-change-driven increase in the strength and frequency of droughts and floods is already starting to reduce rice yields.[122] As the effects of climate change worsen, the food supply in emerging economies, which produce 96 percent of rice, will likely be threatened.[123]

Thailand offers a case study for exploring a transformation of the rice sector to mitigate emissions and improve food system resilience. Thailand is the sixth-largest producer and second-largest exporter of rice. However, yields are below average (70 percent lower on average per hectare than for other top rice producers), with high volumes of rain-fed rice, which can be less resilient to changing rainfall patterns (Exhibit 21).[124] The emissions intensity of rice production in Thailand—1.8 kilograms of CO_2e per kilogram of rice—is 34 percent higher on average than it is in the other major rice-producing countries.[125] The Thai government has recognized rice as a major emissions source and has signaled a commitment to change; 4P models can help accelerate these efforts.

[117] Katherine Kramer, "Just Energy Transition Partnerships: An opportunity to leapfrog from coal to clean energy," International Institute for Sustainable Development, December 7, 2022.
[118] For details, see "Access to electricity (% of population)—Philippines," World Bank DataBank, not dated.
[119] *2020–2040 Philippine Energy Plan,* Philippine Department of Energy, June 2023.
[120] Emissions are primarily methane, which has a significantly higher global warming potential than CO_2 in the near term. "How sustainable rice production plays a key role in food security," Sustainable Rice Platform, November 26, 2021.
[121] "World greenhouse gas emissions 2019," World Resources Initiative, June 23, 2022.
[122] Mélodie Trolliet and Nicolas Saint-Bris, "What does a regional adaptation plan could look like? The case of water management and sustainable agriculture in Thailand," UN Climate Change High-Level Champions, UN Framework Convention on Climate Change, August 25, 2022.
[123] Scaling private sector investment in sustainable rice: Needs and opportunities, Sustainable Rice Landscapes Initiative, November 2022.
[124] The others are Bangladesh, Brazil, Cambodia, China, India, Indonesia, Myanmar, the Philippines, and Vietnam. Some of this yield difference is driven by the nature of the Hom Mali variety that Thailand grows. Data from FAOSTAT and the Food and Agriculture Organization of the United States, accessed August 24, 2023.
[125] Ibid.

Exhibit 21

Thailand has one of the highest emissions intensity levels of the largest rice producers.



[1]Scores are based on the alignment of country strategy to sustainable rice farming, assessed using the following 3 questions: *Is the relevant government ministry a member of the UN's Sustainable Rice Platform? Is rice part of the country's stated Nationally Determined Contribution? Has the government created specific schemes to support rice farmers?*
Source: Earth Security Group; FAOSTAT; Sustainable Rice Platform; UNFCCC

Current situation

Many lower-emission practices for rice production have additional resilience and economic benefits.[126] Mitigation and resilience levers—including water management, rice straw management, pest management, and input usage—could have the greatest impact on the 3.7 million Thai smallholder rice-farming households. Benefits could include increasing resilience in the face of climate change (that is, a greater ability to withstand droughts and floods), resolving

[126] Chania Frost, Kartik Jayaram, and Gillian Pais, "What climate-smart agriculture means for smallholder farmers," McKinsey, February 28, 2023.

labor concerns among an aging population, and addressing low yields relative to those in neighboring countries.[127] For example, water management practices such as alternate wetting and drying—a water-saving technology where the rice field is alternately flooded and drained—could become a necessity in the coming years. Recently, the government asked farmers to restrict their rice crop to conserve water.[128]

Although the net economic benefit depends on the exact farmer context, pilots have shown financial benefits from lower-emission practices.[129] One public–private partnership pilot in Thailand that supported more than 19,000 smallholders showed a 20 percent increase in net income and 21 percent reduction in rice-related emissions through the implementation of Sustainable Rice Platform standards .[130] The largest driver of the income increase was increased cost efficiency, particularly through improved nutrient management. These practices can come with reduced labor costs as they increase the ability to mechanize; for example, labor costs for dry direct seeding can be 75 percent lower than the labor costs of transplanting during the relevant stage of rice growing, although seed costs may increase.[131] This benefit has become more significant in recent years as labor costs have continued to increase.[132]

Because Thai smallholders have fragile household finances, they face challenges in implementing more-sustainable practices. More than 40 percent of farming households in Thailand live below the country's poverty line, with more than 30 percent of farming households bearing the weight of unsustainable debt.[133] Rice farmers face particularly high levels of debt, which is worsened by low margins in the rice sector.[134] This level of debt and the cultural and economic realities erect at least two barriers to a transition to lower-emission practices:

— *Low capacity to absorb perceived and real risks.* Farmers have limited ability to absorb any negative outcomes from changing standard practices or from perceived risks (such as distrust of new technology) and real risks (such as a potential temporary decrease in yield as farmers learn new practices). For example, Thailand has high irrigation water usage (11.3 cubic kilometers per year) because clear water rights are lacking,[135] and it has been experiencing droughts of increasing severity. Uncertainty over the impact of new irrigation practices in the face of already-fluctuating yields prevents farmers from investing in new practices, such as laser land leveling (LLL)—a method to level land precisely and thereby improve water use efficiency, increase grain yield, and improve grain quality—especially when no successful implementation examples exist. This is exacerbated by limited ownership of farmland among smallholders.

— *Limited access to upfront financing.* Adopting lower-emission and high-resiliency practices often requires machinery or new inputs. For example, implementing LLL can save money but requires more expensive equipment.

[127] "Better rice, better life," Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), not dated; *Financing sustainable rice for a secure future innovative finance partnerships for climate mitigation and adaptation,* Earth Security Group, November 19, 2019.

[128] Astarti Widya Dharma, *Promoting global best practices and scaling of low emissions technologies by engaging the private and public sectors in the paddy rice sector,* Scoping study: Climate Smart Rice Thailand, Climate & Clean Air Coalition, June 2021; Napat Kongsawad, "Global supplies of sugar, rice at risk from looming Thai drought," Bloomberg, July 3, 2023.

[129] Half of farming households own less than 10 rai (1.6 hectares) of land, and many rice farmers rent their land. Exact economics will depend on the nature of the land. Manop Udomkerdmongkol and Nawarat Chalermpao, "Thai agricultural sector: From problems to solutions," United Nations Thailand, December 2, 2020.

[130] The project, called the Market-Oriented Smallholders Value Chain, was funded by German Federal Ministry for Economic Cooperation and Development (BMZ), Thai Rice Department, Olam Agri, and Crop Life International. Exact practices required, depending on the nature of the land and existing practices, included land management (for example, land laser leveling), water management (for example, alternate wetting and drying), nutrient management (for example, site-specific nutrient management), and pest management (for example, integrated pest management). For project details, see "Large scale sustainable rice project lifts incomes of smallholder farmers in Thailand and makes positive impact on environment," press release, Olam Group, September 6, 2022.

[131] Labor comparison between direct and nondirect seeding. Wet direct seeding already has significant adoption across the Central Plains in Thailand. Although a transition to dry direct seeding from wet direct seeding does not lead to additional labor savings, it further reduces water usage. Thai Rice NAMA fact sheet, GIZ Thailand Food and Agriculture Cluster, May 12, 2022; Ngo Duc Minh, Truong Thi Kieu Lien, Vo Thi Thao Nguyen, et al., *The current adoption of dry-direct seeding rice (DDSR) in Thailand and lessons learned for Mekong River Delta of Vietnam,* CGIAR Research Program on Climate Change, Agriculture and Food Security working paper, Number 273, 2019.

[132] Onnucha Hutasingh, "Thailand to push for fairer rice prices," *Bangkok Post,* September 4, 2022.

[133] Debt greater than farming income. For more information, see Udomkerdmongkol and Chalermpao, "Thai agricultural sector," December 2, 2020.

[134] Udomkerdmongkol and Chalermpao, "Thai agricultural sector," December 2, 2020; Kerstin Linne, Juejan Tangtermthong, and Rishika Das Roy, *Thailand low-emission rice (Thai rice): Mid-term evaluation and learning exercise (ELE) report and management response,* NAMA Facility, May 2022.

[135] Shabbir Gheewala et al., "Water footprint and impact of water consumption for food, feed, fuel crops production in Thailand," *Water,* 2014, Volume 6, Number 6.

The direct cost per hectare, including land preparation, would be $375 for LLL, versus $770 for typical irrigated farms.[136] But most Thai farmers do not have access to a tractor with sufficient horsepower for LLL.[137] During the transition phase, financing can ease cash pressure for farmers who lack the upfront capital required to invest in new practices. Although some government financing is available, farmers are often reluctant to increase their debt, particularly those who do not own their farmland.

Opportunities for action by public, private, and philanthropy partnerships

The Thai government is supportive of advancing sustainable rice production, which can serve as a foundation from which to build a 4P model. The government has made commitments to reduce rice emissions, developed support schemes for farmers, and provided research funding. The Thai government has also advanced partnerships to support sustainable rice. One of the largest sustainable-rice programs globally is the Thai Rice Nationally Appropriate Mitigation Actions (NAMA) facility, a joint program between the Thai Government and the German Corporation for International Cooperation (GIZ), which provides microcredit and technical assistance to support low-emission technologies such as LLL services, which increase rice yields by at least 10 percent and can reduce production costs, for up to 100,000 smallholders.[138] GIZ and the Thai Department of Rice are further collaborating on a proposal focused on mitigation and adaptation with the Green Climate Fund, among other projects.

By leveraging this favorable enabling environment, 4P models can develop innovative financing while supporting a growing market for sustainable rice and its by-products. To reach smallholders more effectively, any solutions must be developed in close coordination with local partners on the ground. These solutions could include the following:

— *Derisking the transition to new processes and products.* A 4P model can primarily be focused on financing and supporting technical assistance.

— *Developing new financing mechanisms to pool risk for investors.* Supporting small rice farmers directly (versus through government programs) can be challenging for organizations like development-finance institutions (DFIs) without a risk pooling mechanism,[139] so 4P models can innovate new ways to derisk investments in smallholder rice farms, led by concessionary capital. Research has suggested a "rice bond" could succeed at increasing farmer access to finance that fits their needs.[140] Other risk pooling mechanisms could include financing input or extension service providers, who can spread risk across a portfolio.[141] This aggregation of smallholders under one mechanism can extend to demand aggregation—say, for inputs. Also, 4P models can consider other adjacent mechanisms that do not increase existing debt burden, such as results-based financing of mitigation.

— *Expanding agricultural services.* Technical-assistance programs can be developed to implement new practices that expand existing public-sector programs. These programs should emphasize resilience and economic benefits and ensure farmers see success from implementing relevant practices. In addition, 4P models can support farmers in learning to manage high levels of existing debt.

— *Creating markets for by-products.* There is opportunity to develop markets for rice by-products, such as rice straw. Circular-economy approaches are beginning to emerge in Thailand. For example, a UK–Thai research collaboration piloted an anaerobic digestor to create biogas from rice straw, which can reduce emissions from

[136] The calculation assumes one baht equals $0.03 and is a conversion to hectares from the cost per rai, the standard unit to measure land in Thailand. One rai is equal to 0.16 hectares. The direct cost per rai would be $60 for LLL, versus $123 for typical irrigated farms. "Thai rice: Strengthening climate-smart rice farming," Concept Note, Green Climate Fund, June 14, 2021; Dharma, Promoting global best practices and scaling of low emissions technologies, June 2021.

[137] "Thai rice," Green Climate Fund, June 14, 2021.

[138] Facility funding was originally scheduled to end in 2023 but has been extended to mid-2024. For more information, see Thai Rice NAMA fact sheet, GIZ Thailand Food and Agriculture Cluster, May 12, 2022.

[139] *Scaling private sector investment in sustainable rice,* November 2022.

[140] Thailand is the first country in Southeast Asia to have a green bond issued to support agriculture.

[141] Applicability depends on the exact role of service providers, as many are farmers themselves. Linne et al., *Thailand low-emission rice,* Nama Facility, May 2022.

burning it (a process thatproduces more than six megatons of CO_2e annually) and create additional sources of revenue for farmers, although any sourcing of rice straw would have to fit within the constraints of rice-growing seasons.[142] To kick-start these markets, 4P models could expand pilots or offer volume guarantees. These market-building activities can complement the work of a 4P model focused on financing and technical assistance.

Existing 4P model structures can be leveraged to inspire new financing mechanisms in Thailand. For example, the Family Forest Carbon Program, set up by the American Forest Foundation and The Nature Conservancy, developed a green bond to support generation of nature-based carbon credits for smallholders.[143] Other innovative bond structures have been used across multiple types of other 4P models, including Blue Bonds in Belize and the Seychelles Conservation and Climate Adaptation Trust.[144] Although the market dynamics in Thailand differ, other 4P models have paved the way to implement innovative financing and support smallholders.

Supporting sustainable rice in Thailand has clear climate and socioeconomic benefits. For Thai rice farmers to succeed with these projects, their solutions must have a known adaptation and economic benefit. Many solutions provide improvements in air quality, food security, and climate resilience, along with emissions reductions. Importantly, joining such a 4P model presents stakeholders across the sectors with clear motivations, including higher uptake of new products for the private sector and an increase in GDP for the public sector.

Expanding clean cooling in India

There is a clear public-health need for cooling. McKinsey Global Institute's 2020 report on Climate risk and response notes that, absent an adaptation response, as heat and humidity increase, between 160 million and 200 million people in India could live in regions with a 5 percent average annual probability of experiencing a lethal heat wave by 2030.[145] Exhibit 19 highlights India's exposure to heat relative to other countries, while Exhibit 20 shows projections of growing heat waves in India. Beyond the public-health implications, the average number of daylight working hours lost to excessive heat could increase to a point where between 2.5 and 4.5 percent of GDP were at risk annually.

But if countries meet this need through air-conditioning, the related electricity demand threatens to dramatically increase emissions. Space cooling may account for 18 percent of the increase in global emissions from 2016-50.[146] Finding clean cooling solutions is therefore critical for adapting to climate change as well as mitigating it.

Current situation

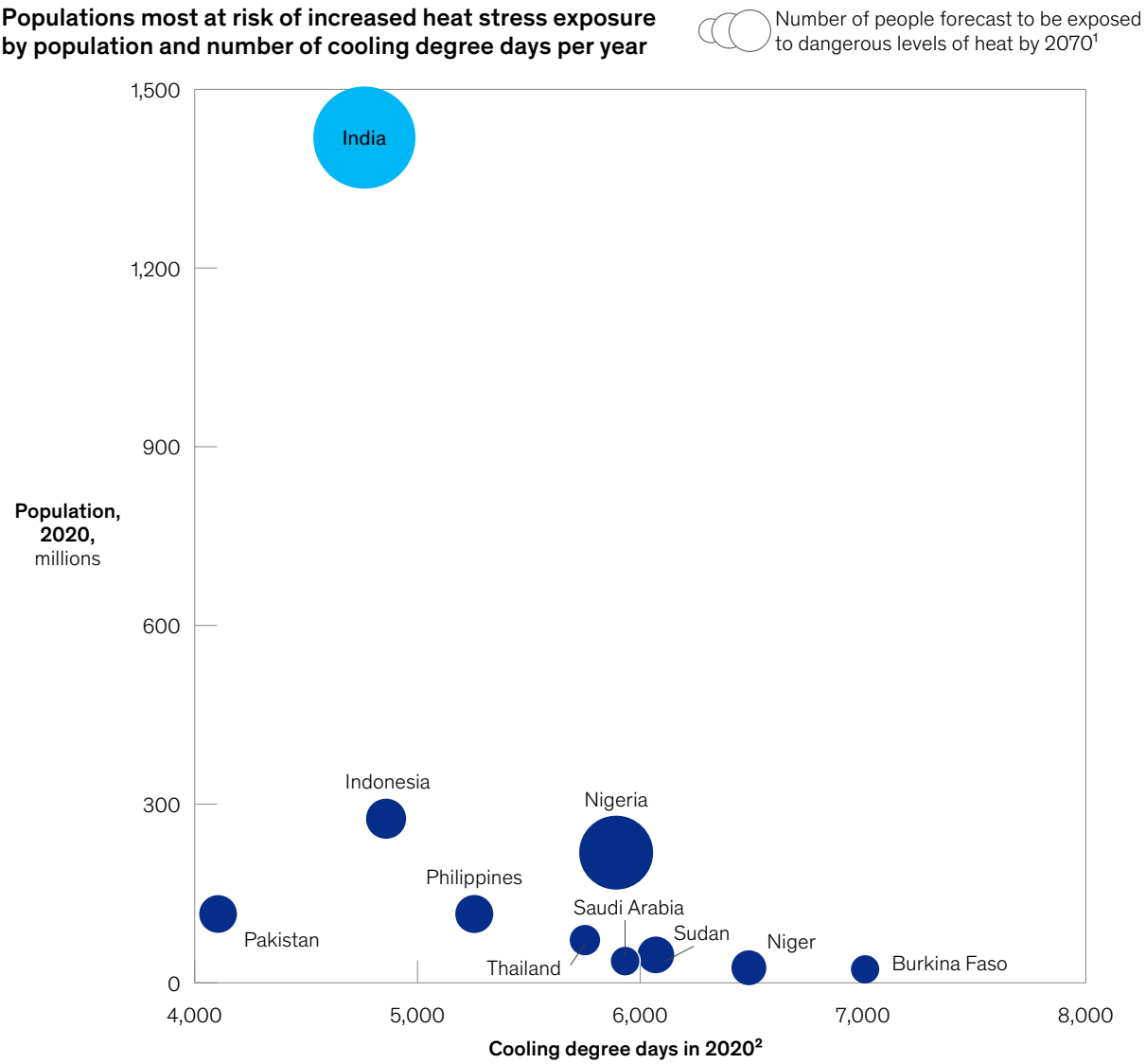
In India, cooling demand is projected to grow eightfold by 2038, which has significant implications for power demand and related emissions.[147] The demand for room air-conditioning may require adding 600 gigawatts of new power generation capacity by 2050.[148] Higher demand for air-conditioning would mean an additional 1.4 billion tons of CO_2e between now and 2030, from both electricity generation and refrigerant leakage.[149] And the required infrastructure build-out would be expensive; the capital cost just for the additional power plants would be around $600 billion.[150]

[142] Agapol Junpen et al., "Emission of air pollutants from rice residue open burning in Thailand, 2018," *Atmosphere*, August 2018, Volume 9.
[143] Breen, "First-of-its-kind $10M green bond issued," July 18, 2022.
[144] Owen, "Belize: Swapping Debt for Nature," May 4, 2022; For more information, see Seychelles Conservation and Climate Adaptation Trust website.
[145] Jonathan Woetzel et al., "Climate risk and response: Physical hazards and socioeconomic impacts," McKinsey Global Institute, January 16, 2020.
[146] IEA Baseline scenario; *The future of cooling: Opportunities for energy-efficient air conditioning,* International Energy Agency, May 15, 2018.
[147] India Cooling Action Plan, Government of India Ministry of Environment, Forest & Climate Change, Ozone Cell, March 2019.
[148] Radhika Lalit and Ankit Kalanki, "How India is solving its cooling challenge," Rocky Mountain Institute, May 16, 2019.
[149] Assuming India's current power generation mix stays constant, meaning fossil fuels account for 76 percent of total generated electricity. Jonathan Woetzel et al., "Will India get too hot to work?," McKinsey Global Institute, November 25, 2020.
[150] Assuming a capital cost of 83.4 million Indian rupees per megawatt of added power generation capacity.

Exhibit 22

India has the most people at risk among countries with the largest populations expected to experience heat waves by 2070.

Populations most at risk of increased heat stress exposure by population and number of cooling degree days per year



[1]Defined as exposure to mean annual temperatures equal to or greater than 29 degrees Celsius (84 degrees Fahrenheit). Assumes global warming by 2100 of 2.7 degrees Celsius (4.9 degrees Fahrenheit).
[2]Defined as the difference between daily average temperature and 18.3°C (65°F), summed up over a year.
Source: World Bank

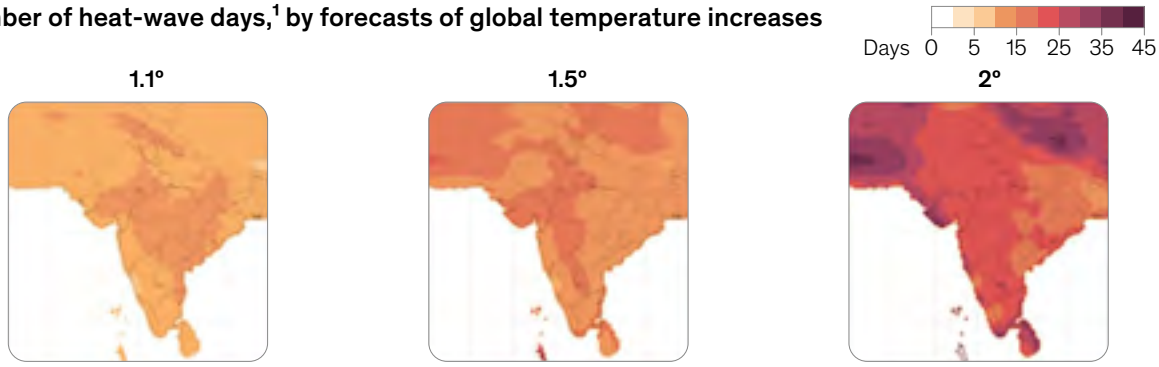
A range of solutions can protect people from heat while minimizing related emissions. For the sake of maintaining a manageable focus area for 4P models, the solutions highlighted here center on reducing the need for air-conditioning and its associated emissions impact. One set of measures can reduce the buildup of heat in buildings in the first place, and another set can reduce the energy need of air-conditioning units and the use of potent greenhouse gases in their refrigerants. These approaches have been implemented in parts of India, proving their technical feasibility. However, three practical challenges still hinder the effectiveness of these sustainable cooling approaches:

— *Stakeholders lack coordination and face misaligned incentives.* Retrofitting buildings, changing construction practices, and incorporating heat resiliency into urban planning require the coordination of a broad range of

Exhibit 23

India could experience 30 to 40 heat-wave days if the global temperature rises two degrees Celsius.

Number of heat-wave days,[1] by forecasts of global temperature increases



[1]Heat-wave days are defined as more than 3 days of temperatures higher than the local 95th percentile of temperatures, measured based on today's (1.1°C) climate; forecasts for 1.5° and 2° scenarios are shown.
Source: McKinsey Climate Analytics

government agencies (for example, Ministry of Power, Bureau of Energy Efficiency, and various construction and planning municipal departments) covering areas like appliance standards, building permits, and the cooperation of the construction sector. Efficiency retrofits often impose costs on building owners and deliver benefits to tenants, a misalignment of interests that must be overcome to scale heat adaptation measures.

— *Market forces do not naturally favor highly efficient appliances.* New air-conditioning systems are gradually gaining energy efficiency but at nowhere near the pace required to counterweigh the growth in air-conditioning demand. According to a 2019 survey, air-conditioners with India's highest efficiency rating of five stars accounted for only 20 percent of owned units, while three-star air-conditioners accounted for 37 percent.[151] Further, because HVAC appliances have high upfront costs, most consumers are too price sensitive to buy the most efficient appliances, which in turn discourages manufacturers from investing in efficiency innovations.

— *Conventional refrigerants pose emissions risks even within efficient appliances.* Air conditioners use refrigerants to remove heat. In India, as in many other countries, those refrigerants are typically from one of two categories: hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs), both of which have global-warming potential (GWP) that is orders of magnitude higher than that of other greenhouse gases. For instance, one ton of the refrigerant R-410a released into the atmosphere has the same GWP as 2,088 tons of carbon dioxide.[152] In India, as of 2018, 94 percent of air-conditioning refrigerants had high GWP.[153]

Opportunities for action by public, private, and philanthropy partnerships

Numerous actors in the public, private, and philanthropic sectors are tackling aspects of the sustainable-cooling challenge. In the public sector, India was one of the first countries to set a nationwide cooling policy.[154] India also

[151] Radhika Khosla et al., "The what, why, and how of changing cooling energy consumption in India's urban households," *Environmental Research Letters,* March 2021, Volume 16, Number 4.
[152] Mohit Sharma, Vaibhav Chaturvedi, and Pallav Purohit, "Long-term carbon dioxide and hydrofluorocarbon emissions from commercial space cooling and refrigeration in India: A detailed analysis within an integrated assessment modelling framework," *Climatic Change*, August 2017, Volume 143, Numbers 3–4.
[153] GWP equal to or greater than 150, a threshold used by, for example, the California Air Resources Board. Manjeet Singh, Gurprasad Gurumurthy, and Shreya Shekhar, "Mapping the refrigerant trends in India: An assessment of room AC sector," Energy and Resources Institute, September 30, 2018.
[154] "Facilitating the implementation of the India Cooling Action Plan (ICAP) event at the 31st Meeting of the Parties (MOP) of the Montreal Protocol," Alliance for an Energy Efficient Economy, November 8, 2019; "India Cooling Action Plan," IEA, May 12, 2021. In 2019, India published the India Cooling Action Plan, which offers a 20-year perspective on how to put the demand for cooling on a more sustainable footing.

promotes more efficient air-conditioning appliances and has experience with creating demand for efficient appliances through government purchasing.[155]

In the philanthropic sector, the Clean Cooling Collaborative provides grants to support countries and companies in institutionalizing energy efficiency efforts. The Mahila Housing Trust is a pioneer in providing cool roofs for women with low incomes, and similar efforts are funded by the Rockefeller Foundation.[156] Bloomberg Philanthropies supports urban heat-adaptation efforts through the C40 Cities Climate Leadership Group. The Lemelson Foundation has been involved in incentivizing manufacturers to commercialize highly efficient residential air-conditioning systems.[157]

To bring about holistic solutions to these challenges, 4P models can expand existing work done by organizations such as the Clean Cooling Collaborative and the Rockefeller Foundation. Three areas in particular stand out as suitable priorities for 4P models:

1. *Facilitating holistic planning to address urban heat island effects.* Cities have options to reduce the urban heat island effect through passive cooling measures and decreasing the need for air-conditioning. Suitable measures can be implemented at the building level (for example, increasing the albedo of roofs or external walls and improving thermal insulation) and at the city-planning level (for example, bolstering tree coverage and green corridors to provide shade and cooling through evapotranspiration). Philanthropic organizations can provide part of the upfront funding and technical resources that such measures require. Local, state, and federal government agencies can create whole-of-government heat plans ranging from construction standards to appliance efficiency requirements and incentives. Private-sector associations can support governments in defining practical programs for companies to implement the heat plans.

2. *Accelerating the adoption of high-efficiency air-conditioning systems.* In recent years, some manufacturers have demonstrated the technical feasibility of highly efficient air-conditioners with an 80 percent reduction in climate impact from power use and refrigerants. The main challenge now is to create enough demand for these designs to stimulate mass production. This requires incentives on both the supply side, for manufacturers to start commercialization, and on the demand side, for consumers to buy these units. The public sector can play a vital role; in fact, the Indian government has experience in bolstering demand and lowering prices for energy-efficient appliances. In the area of lighting, for example, the government has guaranteed bulk purchases for energy-efficient designs and then resold them to lower-income customer segments at lower upfront cost and on-bill financing.[158] This approach could be adapted to air-conditioning in combination with other enabling factors, such as updating global appliance-testing standards to consider idiosyncrasies of high-efficiency air-conditioning and adapting energy-efficiency labels to signal to consumers the energy savings from high-efficiency units. In addition, 4P models can boost adoption of those models by coordinating financing for consumers through business models like cooling-as-a-service and on-bill financing, where private investment covers the upfront purchase cost with government loan guarantees, financed with long-term savings from lower energy bills and deferred infrastructure investments.

[155] Ankit Kalanki and Caroline Winslow, "Global Cooling Prize: A pathway to net-zero residential cooling by 2050," Rocky Mountain Institute, April 20, 2021. India's Bureau of Energy Efficiency defines the minimum energy performance standards for air conditioners and has been raising this efficiency performance requirement at nearly 3 percent every year. It has also developed a star label system to raise consumers' awareness about the efficiency of room air-conditioning systems; In 2009, India bundled four national public-sector entities into an energy services joint venture, the Energy Efficiency Services Limited (EESL), with the goal of aggregating demand for energy-efficient technologies. This joint venture launched a pilot program in 2019 in partnership with BSES, a utility in Delhi, aimed at deploying air-conditioning units with 40 percent higher efficiency at prices similar to those of midlevel-efficiency systems.

[156] Sweta Daga, "To reduce heat stress, Indore develops cool roof technology," Rockefeller Foundation, October 28, 2014.

[157] The Lemelson Foundation partnered with the Government of India, Mission Innovation, Rocky Mountain Institute, and others to launch the Global Cooling Prize, a competition in 2019–21 for air-conditioning manufacturers to develop a residential cooling system that is at least five times more efficient than baseline air-conditioning units and will be commercialized by 2025. The winners were announced in 2021. The Cooling Prize criteria and prize winners are published on the Global Cooling Prize website.

[158] *India's UJALA story: Energy efficient prosperity,* Energy Efficiency Services, 2020.

3. *Ensuring phaseout and safe disposal of refrigerants.* A third possible role of 4P models would be to create the ecosystem required to safely end the use of HFC refrigerants. In this role, 4P models can boost the momentum behind manufacturers setting targets for Scope 3 emissions, which typically constitute the vast majority of their emissions. Also, 4P models can provide funding and industry partnerships for value chains tackling the recovery and reclamation of high-GWP refrigerants, and they can pilot track-and-trace programs to clamp down on the illegal trade of these refrigerants.

In sum, it is an urgent matter to steer the booming demand for cooling in India toward sustainable approaches, yet implementing measures like holistic urban heat planning, commercializing high-efficiency air-conditioners, and phasing out HFCs is a complex undertaking. This situation offers ample opportunities for 4P models to rally stakeholders and scale up proven solutions.

Technical Appendix

Appendix A

Methodology

The objective of the analytical framework is to propose criteria for evaluating which climate and nature solutions are best suited to public–private–philanthropic partnerships (4P models). This technical appendix aims to provide methodological details that are not provided in Chapter 2 of this report. The details are arranged according to the three-part structure of the analytical framework:

1. *Materiality.* Identify hot spots with the most potential for support on climate and nature challenges, based on three criteria:

    a. magnitude of potential impact, based on the extent of the climate and nature challenge today
    b. country capacity to respond
    c. co-benefits across sectors and climate hazards

2. *Suitability.* Identify solution focus areas close to positive tipping points that the 4P model is well placed to support, based on two criteria:

    a. in hot spots identified in the materiality assessment
    b. near positive tipping points and primed for 4P model action based on impact potential, scalability, and additionality

3. *Feasibility.* Assess which of the identified focus areas can be practically implemented, based on real-world conditions and motivations meeting three criteria:

    a. an anchor stakeholder that is motivated to drive the partnership
    b. rightsizing of the partnership in terms of the capital, governance, and resources each sector brings
    c. alignment of expectations among the partners

Step 1: Materiality

The materiality analysis identifies which regions and sectors could have a disproportionate impact on climate and nature challenges with the support of actors beyond the in-country public and private sectors.

Critical climate and nature themes based on planetary boundaries

We leveraged the planetary boundaries framework to identify and build on four climate and nature themes for analysis: climate change mitigation, freshwater consumption, forest cover loss, and biodiversity loss.[159] The planetary boundaries framework is frequently used. At the highest level, it provides a segmentation of the climate and nature challenges the world faces. The framework includes nine boundaries. Of these, we have excluded ozone depletion, as it is currently within safe boundaries, and we exclude chemical and plastic pollution, nutrient pollution, and aerosol pollution due to limited data availability. We explore oceanic systems beyond ocean acidification qualitatively, using a deep dive on mangrove restoration in Indonesia. We also assess climate change adaptation through a deep dive on clean cooling in India.

[159] This paragraph draws from Steffen et al., "Planetary boundaries," January 2015; Richardson et al., "Earth beyond six of nine planetary boundaries," September 2023.

Magnitude of impact, country response capacity, and co-benefits

For each of the themes identified through the planetary boundaries, we identified geographic or sectoral hot spots that have the highest needs for solutions today and in the future, and which are in countries with only limited capacity to respond.[160]

— *Magnitude of impact today and in the future.* We assessed the most significant negative climate and nature impacts in specific geographies and the underlying sectors driving these challenges. We applied a sectoral lens to identify root causes, where the highest potential for change exists, and which specific actors could support a positive climate and nature shift.

— *Country response capacity.* Based on GDP per capita, we assessed a country's ability to deal with the identified challenges, giving priority to countries with lower response capacity. This dimension considers that climate and nature challenges are global but that some countries theoretically able to have a disproportionate positive impact on issues may lack the resources to do so. This thinking is applied to existing climate and nature 4P models assessed, of which 87 percent focus on emerging economies.

— *Co-benefits.* We identified sectors able to provide large co-benefits, which include enabling potential (for example, ability to decarbonize other sectors), climate adaptation, natural capital, economic development and livelihoods, and health, well-being, and inclusiveness. This step ensures that tackling climate-change-mitigation hot spots (for example, high-emitting sectors), if done equitably and efficiently, can result in positive co-benefits. Key sectors drive negative externalities across various environmental, social, economic, and health contexts. Therefore, decarbonizing sectors such as the power sector could create positive shifts in society.[161] Among climate and nature 4P models, 40 percent explicitly reference socioeconomic co-benefits in their mission statements, indicating a willingness to build partnerships that have positive impacts beyond the immediate sectoral focus.

The purpose of this step of the analysis is to locate the most critical needs across themes to focus the rest of the framework at the sectoral level. We took slightly different prioritization approaches for climate versus nature, because emissions mitigation is a global commons issue while nature issues are often (though not always) relatively localized. In the following discussion, the slightly different approaches are illustrated with mitigation and biodiversity examples.

Climate mitigation

For climate mitigation, we categorized countries into six archetypes (Exhibit 24). These are based on economic activity, emissions profile, and response capacity, reflecting the fact that mitigation needs and capacity to respond vary across countries.

[160] This section draws from Systems Change Lab; NGFS Scenarios Portal, Network for Greening the Financial Sector; World Development Indicators, World Bank; Aqueduct, World Resources Institute; *Terrestrial ecoregions of the world*, WWF, August 2012; "Biodiversity hotspots," Conservation International; Philip G. Curtis, Christy M. Slay, Nancy L. Harris, et al., "Classifying drivers of global forest loss," *Science*, September 14, 2018, Volume 361, Number 6407; Mair et al. Species Threat Abatement Restoration scores. Underlying agriculture, food, and land use assumptions are from multiple economic and land use scenario references.

[161] For example, a study considered the impacts of a Clean Energy Standard designed to ensure the United States reaches 80 percent clean electricity by 2030. The results were that it could improve air quality, help avoid 9,200 premature deaths from respiratory diseases in 2030, and lead to $1.13 trillion in health savings due to cleaner air between now and 2050. See "An 80×30 clean electricity standard: Carbon, costs, and health benefits," Harvard T. H. Chan School of Public Health, July 12, 2021.

Exhibit 24

We developed six country archetypes for the climate mitigation assessment.

Country archetype	Definition	Example countries[1]	
Agriculture-based economies	Agriculture is the primary source of employment and income for a large share of the population in these countries, accounting for up to about 55% of jobs and up to about 30% of GDP.	Kenya Morocco	Philippines Sri Lanka
Forestry-intensive countries	In these countries, which have generally reached the early or middle stages of industrialization, the agriculture and forestry sectors together represent significant shares of GDP (>5%), jobs (>10%), and capital stock (>5%).	Argentina Brazil	Malaysia Panama
Emissions-intensive producers	These countries derive sizable portions of their GDP—about 18% on average—from highly exposed sectors such as high-emissions manufacturing, fossil-fuel-based power, and agriculture.	Bangladesh China	India South Africa
Fossil fuel resource producers	Fossil fuel industries account for a significant portion of GDP in these countries (ranging from 3% in Australia to 39% in Kuwait) and a large share of physical capital (an average of about 15%, vs 2% in the rest of the countries).	Australia Bahrain	Canada Egypt
Downstream-emissions manufacturers	The main exposure for these middle- to high-income countries relates to the manufacturing of goods, such as automobiles and industrial machinery, that could experience falling demand in their current form because they use fossil-fuel-based energy.	Austria Germany	Japan Mexico
Services-based economies	In these economies, countries with high GDP per capita derive most of their economic output from service sectors, so their overall exposure to net-zero transition adjustments is low. However, in certain regions and sectors, exposure could be high.	Denmark Israel	Singapore United States

[1]The analysis includes 113 countries, which make up about 95% of global GDP.

We next identified sectors across these country archetypes where current or future emissions are high and where countries do not have enough resources to fully respond to the challenges. As a final step, we assessed the co-benefits of mitigation action (for example, the additional outcomes from carbon mitigation projects that benefit society more broadly) in these sectors to ensure that they have high impact potential outside of just climate mitigation.

Biodiversity and forest loss

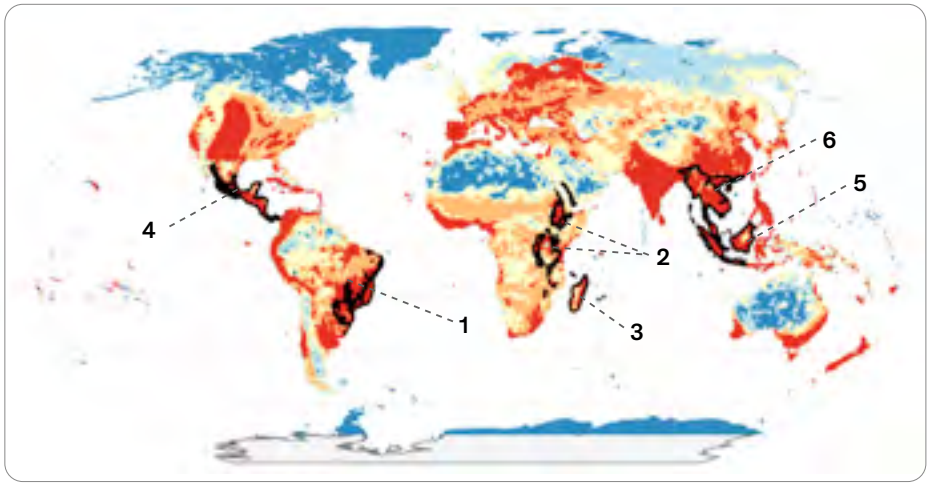
For biodiversity loss, we focused on regions with high species-risk levels. We based our assessment on the Species Threat Abatement Restoration (STAR) metric, which draws from the International Union for Conservation of Nature's (IUCN's) Red List of Threatened Species. We mapped terrestrial global biodiversity hot spots, focusing on the 20 largest hot spots outside of developed economies. Then we identified the areas with the greatest biodiversity risk, as measured by extinction risk. This process resulted in six hot spots for biodiversity loss (Exhibit 25).

A limitation of this analysis is that it does not account for future projections of biodiversity loss. The underlying biodiversity hot spot data from Conservation International has not been updated since 2016 and is potentially outdated. Nevertheless, the data set is among the most frequently updated biodiversity data sets.

Exhibit 25

Spatial analysis reveals at least six biodiversity hot spots at very high risk globally.

Spatial overview of critical nature areas[1] overlaid with species' extinction risk[2]



	1. Atlantic Forest	2. Eastern Afromontane	3. Madagascar	4. Mesoamerica	5. Sundaland	6. Indo-Burma
Example countries	Brazil Ecuador Peru	Ethiopia Kenya Uganda	Madagascar	Costa Rica Mexico Panama	Indonesia Malaysia	Cambodia Myanmar Thailand

[1]Critical nature areas are biodiversity hot spots based on Conservation International's biodiversity hot spots—defined regions around the world where biodiversity conservation is most urgent because of high levels of endemism and human threat.
[2]Species risk levels are based on the Species Threat Abatement Restoration (STAR) metric, which uses data from the IUCN Red List of Threatened Species to estimate the potential reduction in species extinction risk; data are classified into quintiles.
Source: Mair et al.

For forest loss, we mapped the current distribution of WWF Global 200 priority regions, focusing on the 20 largest tropical forest areas (excluding temperate forests). We identified forest hot spots based on drivers of deforestation, including commodities, agriculture, wildfire, and shifting approaches to agriculture and forestry. This resulted in six prioritized hot spots (Exhibit 26).

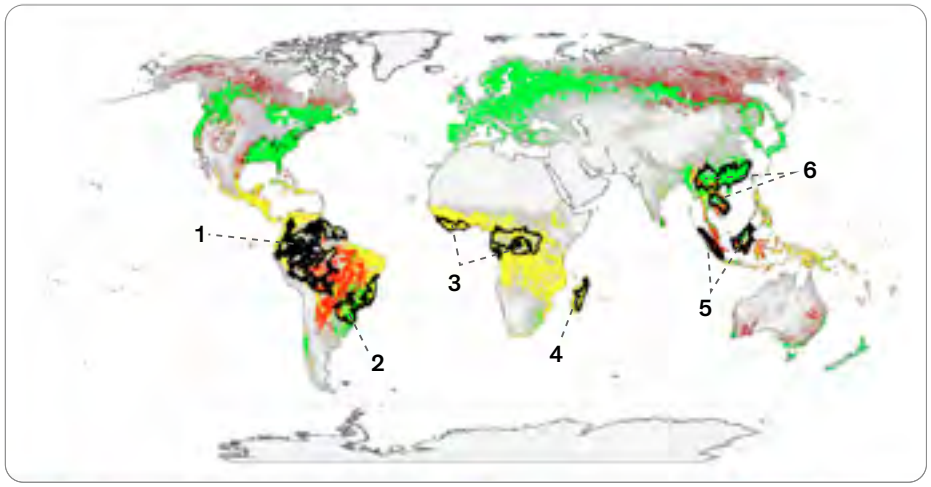
A limitation is that the analysis does not directly account for future projections of forest loss or for additional, potentially relevant environmental or social variables, such as carbon sequestration potential, biodiversity richness, or the presence of indigenous communities. Also, temperate forests are excluded (due to significantly less deforestation, less biodiversity, and less carbon sequestration potential than in tropical forest areas) but may be important for climate and biodiversity goals.

Biodiversity loss and forest cover loss are two planetary boundaries often intrinsically linked to the same ecosystem. For example, the focus areas emerging as priorities for 4P models in agriculture were nearly identical for the two themes. We therefore combined the two analyses to identify four hot spots for both biodiversity and forest loss.

Exhibit 26

Spatial analysis reveals at least six forest hot spots globally.

Spatial overview of the largest tropical forests[1] with dominant drivers of tree cover loss overlaid



	1. Amazon rainforest	2. Atlantic rainforest	3. Congo and Guinea rainforest	4. Madagascar rainforest	5. Indomalaya rainforest	6. Indochina rainforest
Example countries	Brazil Ecuador Peru	Argentina Brazil Paraguay	Democratic Republic of Congo Ghana Liberia	Madagascar	Indonesia Malaysia	Cambodia Myanmar Thailand

[1]Excluding forests not experiencing major forest loss in recent years.
Source: Curtis et al.

Freshwater consumption

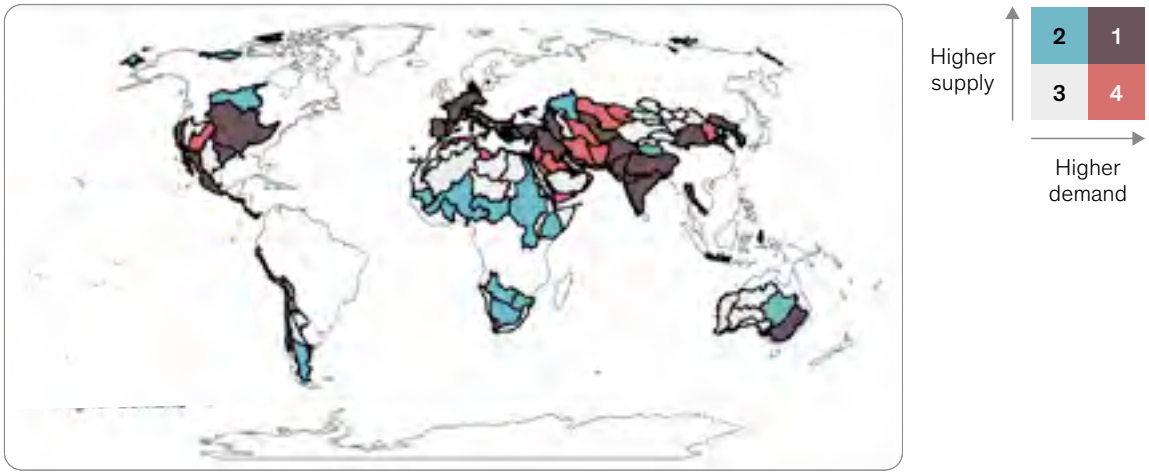
We conducted a similar process for freshwater consumption. We began by identifying freshwater hot spots around the globe, using data from WRI Aqueduct Global Maps (Exhibit 27). We identified priority river basins, based on current and future (2040) chronic water stress, including basins with high or very high current stress or very high expected future stress. Water stress measures the ratio of total water withdrawals to available renewable surface and groundwater supplies. Highly water stressed basins are defined as river basins whose average water stress levels are in the top 40 percent of the water stress data set. We categorized high-stress water basins using current water demand and water supply to assess drivers of stress (consumption and/or abstraction). Low demand means the demand is low relative to that in other highly stressed basins.

This approach has a few limitations. First, data aggregated at the level of river basins may be too coarse for local assessments of water stress. Also, the data does not account for interannual and seasonal variability in water stress. Finally, the analysis of absolute water stress does not account for differences in per capita consumption.

Exhibit 27

Freshwater hot spots were analyzed across water supply and demand of critical water basins.

Spatial overview of highly stressed water basins[1] and their relative level of demand[2] and supply



	1. Highly stressed basins with high demand and high supply	2. Stressed basins with low demand and high supply	3. Highly stressed basins with low demand and low supply	4. Highly stressed basins with high demand and low supply
Example countries	India Mexico Turkey	Ghana Nigeria South Africa	Algeria Chad Libya	Kazakhstan Libya Uzbekistan

[1]Highly water-stressed basins are defined as river basins whose average water stress levels are in the top 40% of the water stress data set; water stress measures the ratio of total water withdrawals to available renewable surface and groundwater supplies.
[2]Low demand is relative in this context to other highly stressed basins.
Source: WRI Aqueduct Global Maps 3.0

Next, we identified the primary drivers of water stress for highly stressed basins, based on an analysis of current and expected future water stress at the sectoral level. We determined that primary drivers are the food and beverage processing, agriculture, and water supply sectors (Exhibit 28).

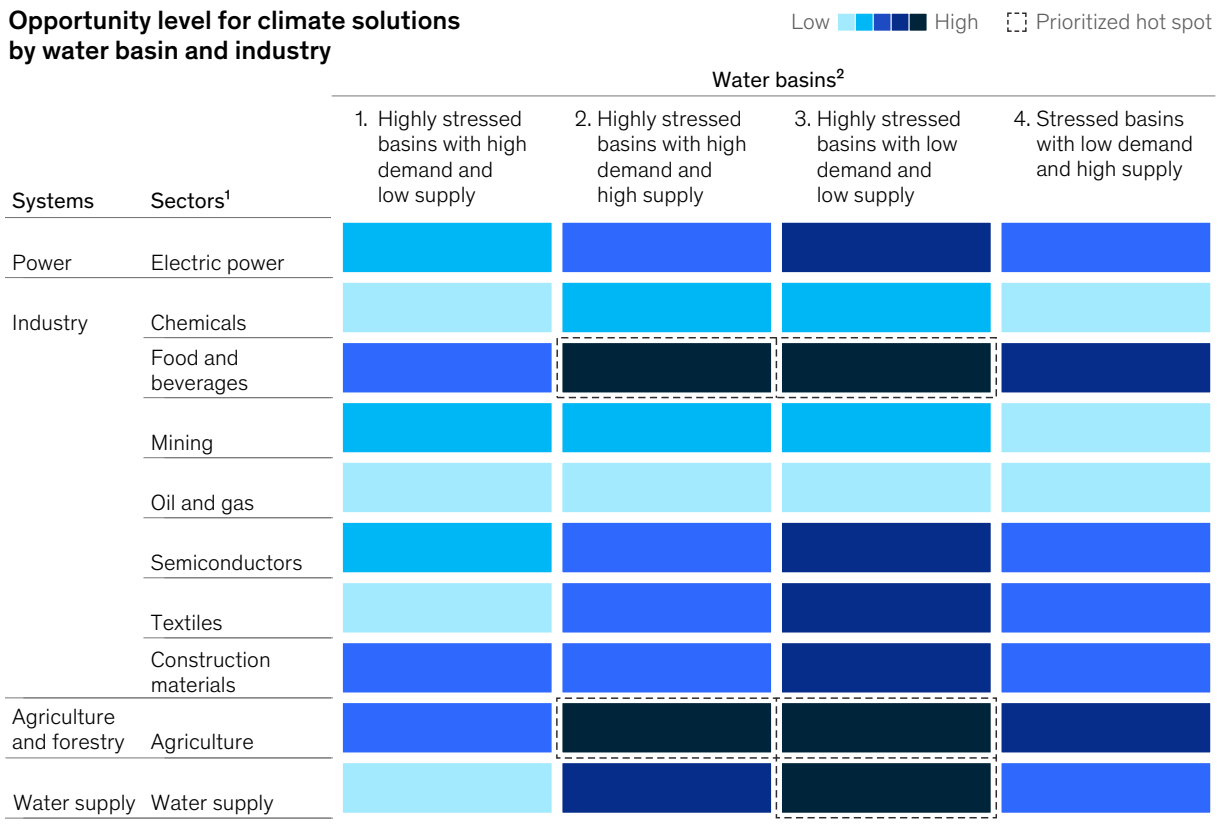
To conduct this analysis, we combined data on current and future water stress at the sectoral level and calculated the median stress levels within each hot spot. In addition, we used data on current and future water supply to assess the degree to which individual water hot spots are primarily stressed due to supply constraints or high depletion rates. To determine the response capacity within each hot spot, we used national-level statistics on GDP per capita and calculated a spatially weighted average.

To determine the overall need for 4P model support, we combined three metrics: the current level of water stress (weighted 30 percent), the future level of water stress estimated for 2040 (weighted 30 percent), and current response capacity (weighted 40 percent).

One limitation of this analysis is that the primary screening tool considers only water quantity, whereas subsequent analysis looks at levers for both water quality and quantity. Another limitation is that no water projections are available at the sectoral level, so future water stress values are based on current water stress value multiplied by the total proportional change in water stress within each hot spot. Also, the data do not differentiate between livestock and crop agriculture.

Exhibit 28

The agriculture sector and the food and beverages industry emerge as high-demand-side factors for stressed water basins.



[1]Excluding municipal water supply, which is an important sector but lacks sufficient data.
[2]All water basins evaluated are stressed. Levels of demand and supply are relative to other stressed basins.
Source: WRI Aqueduct Global Maps 3.0

Step 2: Suitability

We assessed suitability by converting hot spot results into a comprehensive list of potential focus areas. We then analyzed the full list to prioritize focus areas that we consider close to tipping points. We assessed each 4P model that is proximate to a tipping point to find those that have impact potential; these are considered suitable for the 4P model.

Step 2.1: Convert hot spot results into comprehensive list of focus areas

For selected regions/hot spots and sectors, we developed a holistic and comprehensive list of potential focus areas. The items on this longlist represent areas that have high impact-to-cost ratios for 4P models, as these focus areas have potential for significant growth.

To identify focus areas for climate mitigation, we used sources such as Systems Change Lab, the IPCC's *Climate change 2022* report, and the Rocky Mountain Institute and IKEA Foundation report *Philanthropy for climate action: Reducing global emissions through high impact interventions.* Additional research then identified gaps in the longlist.[162] Finally, we validated the longlist with multiple experts across industries.

[162] Additional sources include *The task force on philanthropic innovation in Paris agreement implementation,* European Climate Foundation, September 2019; *Climate philanthropy: A guide for action,* Climate Leadership Initiative, 2022; *Philanthropy's full force: Mission investments to catalyze climate solutions,* Redstone Strategy Group, July 2016; *Opportunities for climate philanthropy engagement in Africa,* ClimateWorks Foundation and Good Energies Foundation, February 24, 2020; and expert input.

For climate mitigation, we developed a comprehensive list of a possible 102 focus areas across 19 industries (for example, solar, crops, cement) that 4P models could consider supporting (Exhibit 29).

Exhibit 29

Longlist of climate-mitigation focus areas included in the analysis

Sector	Industry	Solution focus areas
Power	Fossil fuel decarbonization	• Phase out unabated coal electricity generation • Phase out other unabated fossil fuel electricity generation (including natural gas) • Increase coal carbon capture and storage (CCS) • Increase CCS at other fossil fuel generation facilities • Reduce methane emissions from coal, oil, and gas power through increased efficiency and leak detection and repair
	Solar	• Increase utility-scale solar capacity • Increase distributed solar capacity • Increase concentrated solar power (CSP) capacity
	Wind	• Increase onshore wind capacity • Increase offshore wind capacity
	Other low-carbon power	• Increase large-scale hydro capacity • Increase small-scale hydro capacity • Increase geothermal capacity • Increase tidal power capacity • Increase conventional nuclear capacity • Increase advanced nuclear capacity (including novel fuels, small modular reactors, fusion) • Increase bioelectricity (including bioenergy with carbon capture and sequestration [BECCS], biomass, biowaste)
	Enabling technologies and infrastructure	• Increase number of microgrids and overall microgrid capacity • Increase transmission and distribution infrastructure • Integrate local grids with each other and into the national grid • Improve grid management • Increase battery storage capacity • Increase other energy storage capacity (including mechanical and thermal storage)
	Demand measures	• Increase demand-management practices

Sector	Industry	Solution focus areas
Transport	Vehicle switching	• Phase out ICE passenger and light-duty commercial vehicles • Phase out ICE commercial medium- and heavy-duty vehicles • Phase out ICE buses (including transit, coach, and school buses) • Increase adoption of passenger and commercial light-duty EVs • Increase adoption of medium- and heavy-duty commercial EVs • Increase adoption of hydrogen-powered commercial trucks • Increase adoption of EV buses (including transit, coach, and school buses)
	Fuel switching and efficiency	• Increase use of low-emissions fuels (including biofuels) for medium- and heavy-duty ICE vehicles • Increase use of e-fuels for light-duty ICE vehicles • Improve ICE vehicle efficiency • Improve commercial-fleet operational efficiency (routing, driver training, fleet monitoring)
	Enabling infrastructure and systems	• Expand EV charging infrastructure • Expand public-transport networks and access • Enhance built environment and infrastructure to facilitate alternative transport options (including walkable cities, bike lanes, anti-gridlock zones, building codes to include charging) • Increase recycling and second-life solutions for batteries and hydrogen fuel cells
	Mode shift and demand measures	• Increase commuting on public transport • Expand carpooling, rideshares, bike shares • Shift mix of transport modes toward lower-carbon alternatives (eg, car to public transport, car to bike or walking) • Reduce transport demand and usage (eg, increased working from home, telepresence)

Sector	Industry	Solution focus areas
Agriculture and forests	Livestock	• Improve animal health • Adopt feed additives for decreased methane • Improve waste management for livestock waste (eg, anaerobic digestors/biofuel) • Increase livestock input efficiency
	Crops	• Expand regenerative farming • Expand agroforestry • Increase seed efficiency • Increase crop input efficiency • Increase irrigation efficiency • Electrify farm machinery • Adopt alternative fuels for ICE on-farm machinery • Enhance soil sequestration in agriculture (including soil management, agroforestry, biochar) • Expand biomass production for BECCS
	Forest management	• Improve forest management • Prevent forest fires • Increase conservation of forest ecosystems • Increase restoration of forest ecosystems (including afforestation) • Increase conservation of nonforest ecosystems (including peatlands, coastal wetlands)
	Demand measures	• Reduce food waste and loss • Increase uptake of healthy, sustainable diets • Increase uptake of alternative proteins • Develop reuse/circularity ecosystem for forest products

For selected regions/hot spots and sectors, we developed a holistic and comprehensive list of potential focus areas. The items on this longlist represent areas that have high impact-to-cost ratios for 4P models, as these focus areas have potential for significant growth.

To identify focus areas for climate mitigation, we used sources such as Systems Change Lab, the IPCC's *Climate change 2022* report, and the Rocky Mountain Institute and IKEA Foundation report *Philanthropy for climate action: Reducing global emissions through high-impact interventions.* Additional research then identified gaps in the longlist.[159] Finally, we validated the longlist with multiple experts across industries.

[159] Additional sources include *The task force on philanthropic innovation in Paris agreement implementation,* European Climate Foundation, September 2019; *Climate philanthropy: A guide for action,* Climate Leadership Initiative, 2022; *Philanthropy's full force: Mission investments to catalyze climate solutions,* Redstone Strategy Group, July 2016; *Opportunities for climate philanthropy engagement in Africa,* ClimateWorks Foundation and Good Energies Foundation, February 24, 2020; and expert input.

For nature, we developed an initial longlist by using nature conservation and restoration levers from the International Union for Conservation of Nature's PANORAMA platform, the Convention on Biological Diversity's 23 targets for 2030, and "Nature in the balance," a McKinsey report. We then conducted additional desk research and validated the longlist with ten nature experts to identify any gaps in the analysis.[163] Across our three systems, we developed a comprehensive list of 32 focus areas in seven solution areas (for example, pollution reduction, irrigation efficiency) that 4P models could consider supporting (Exhibit 30).

Exhibit 30

We analyzed almost 135 solution focus areas across climate and nature.

System	Solution area	Solution focus areas
Freshwater	Freshwater conservation	• Improve water system leak management • Expand groundwater extraction monitoring and regulation • Build dams and reservoirs • Replace canals with pipes in order to decrease water loss due to evaporation • Build or expand aqueduct systems • Expand rainwater harvesting (utility and distributed) • Implement water-pricing system • Increase number of reservoir covers (water utilities) • Increase desalinization practices
	Irrigation efficiency	• Expand drip irrigation • Expand other water-conservation agricultural practices (eg, reservoir covers) • Expand water-efficient manufacturing
Forests and biodiversity	Ecosystem protection from outside threats	• Expand invasive-species control • Expand monitoring and incentives to decrease illegal harvesting
	Land use efficiency	• Increase agroforestry (crops) • Expand second-generation biomass production • Increase consumption of existing plant-based protein sources • Increase consumption of cell-based alternatives to conventional proteins[1] • Expand advanced seed technology • Expand genetic selection in livestock • Expand forest gardening
	Credit markets	• Expand credit markets

[1]Also relevant for freshwater conservation.

[163] Additional sources include UNEP: Biodiversity Monitoring for REDD+; Timber Trade Federation: Sourcing sustainable timber; Yufeng He, Deepak Jaiswal, Xin-Zhong Liang, et al., "Perennial biomass crops on marginal land improve both regional climate and agricultural productivity," *GCB-Bioenergy,* May 2022; *Using water efficiently: Ideas for industry,* US Environmental Protection Agency, EPA832-F-99-081, April 2000; "The science of cultivated meat," Good Food Institute, not dated; Christopher Costello and Daniel Ovando, "Status, institutions, and prospects for global capture fisheries," *Annual Review of Environment and Resources,* October 2019, Volume 44; *Groundwater: Making the invisible visible,* UN World Water Development Report 2022, UNESCO, March 2022.

System	Solution area	Solution focus areas
All systems	Land protection or restoration	• Improve management and effectiveness of protected areas and other effective area-based conservation measures (OECMs) • Expand protected areas and OECMs • Restore degraded land • Expand measurement, reporting, and verification (MRV) technology
	Pollution reduction	• Reduce usage of crop fertilizer (due to overuse) • Add buffer zones between agricultural areas and freshwater • Expand regenerative agriculture (eg, cover crops, crop rotation, no-till) • Expand precision agriculture • Increase usage of biological pest and fungus controls • Increase usage of nitrogen inhibitors

Step 2.2: Crop longlist to prioritize focus areas close to tipping points

For each identified potential focus area, we analyzed which ones are near positive tipping points. This refers to instances where a technology, behavior, or market is at the point of maturity and where immediate and coordinated action could have a strong catalytic effect.[164] For example, the Bloomberg analysis of 19 countries' passenger-vehicle market shows that once 5 percent of new-car sales are fully electric, market adoption will rapidly scale.[165]

For technologies, behavioral shifts, and related policies or enablers, we assessed areas against a technology adoption pathway S curve over time. Technologies or behavioral shifts that fell within the growth or maturing stage of the S curve were considered to be at a positive tipping point. We screened out technologies or shifts with either of the following characteristics:

- early stage and not yet well placed for a push into mainstream adoption or uptake
- in developed economies and already past tipping points on a path toward adoption, so less likely to need the concentrated support that 4P models can provide

The boundaries applied in the S-curve analysis ensure that the 4P models' focus areas can have near-term impact and best leverage the strengths of all partners. This is consistent with the focus of the 50-plus 4P models assessed: more than 90 percent concentrate on focus areas within these parameters, while only 4 percent aim to scale focus areas in the innovation stage of the S curve.

We accounted for differing conditions between developed and emerging economies. In practice, deployment is a function of both technology maturity and market and policy conditions. This results in slower adoption in low-income and emerging countries relative to developed economies. Therefore, while solutions in the late innovation and growth phases are suited to 4P model support in all economies, nominally mature and established technologies also may benefit from 4P model support in emerging economies (Exhibit 31). For example, deploying utility-scale solar

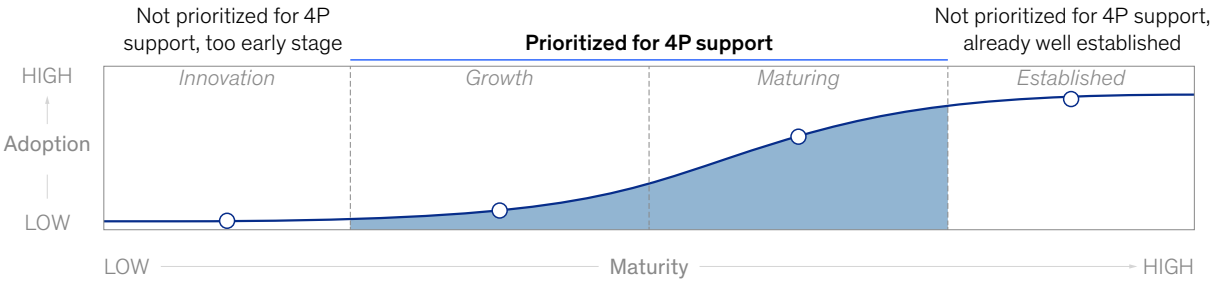
[164] Inputs for technology readiness level were "ETP clean energy technology guide," International Energy Agency (IEA), July 2023; McKinsey's Transition Finance Model IEA TRL expansion; expert input; and desk research for individual technologies not included in IEA.
[165] Tom Randall, "US crosses the electric-car tipping point for mass adoption," Bloomberg, July 9, 2022.

Exhibit 31

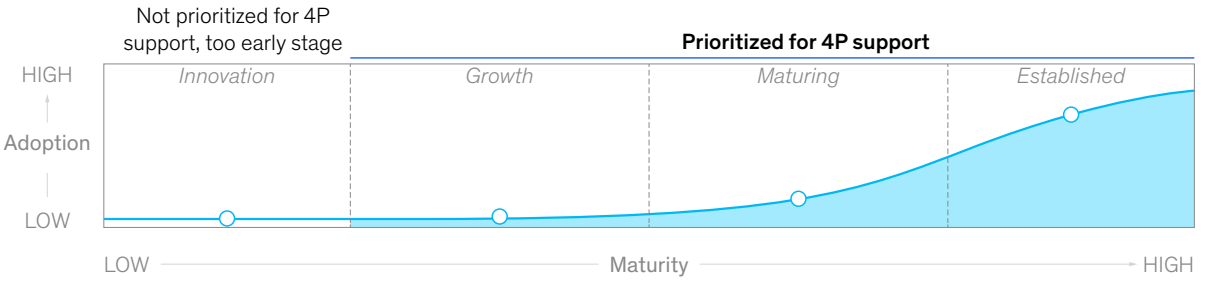
Technology development and adoption maturity levels help to identify solution focus areas close to positive tipping points.

Potential climate solution focus areas

Developed economies



Emerging economies



photovoltaics (PV) is well established in some European markets but has not yet been proven at scale in certain markets in Africa and Southeast Asia. For this reason, the screening threshold for emerging economies is slightly wider than for developed economies.

Step 2.3: Assess impact potential of each solution focus area for the 4P model

For each solution focus area, we assessed the 4P model's impact potential across four criteria: the urgency and role in unlocking sequential progress, the unit impact potential, socioeconomic co-benefits, and scalability (including individual scaling, replicability, and ability to enable improvements at a systemic level).

Assessment of urgency. Regarding urgency, focus areas were considered urgent if they satisfied either of two criteria: they play an important role in net-zero transitions or other downstream solutions, or they are highly salient in relevant geographies. To determine urgency based on these criteria, we answered the following questions for focus areas in climate mitigation:

- Does the IEA mark the potential focus area with high importance for achieving net zero?
- Is the potential focus area a primary element of the sectoral transition or essential for other downstream solutions?
- Is there high salience for the potential focus area in the relevant geography?

For the nature themes, all potential focus areas were considered urgent, given the importance of natural capital for climate mitigation and society in general.

Assessment of unit impact potential. For unit impact potential of each focus area, we estimated its impact per dollar invested and compared that with other focus areas' impact per dollar. We assessed the impact per dollar invested for all focus areas that will have a direct climate or nature impact. For example, climate-mitigation focus areas were assessed using emissions reduction per dollar invested.[166] For nature, we used cost per hectare for forest and biodiversity focus areas and cost per cubic meter of water for freshwater focus areas.[167]

Assessment of co-benefits. For co-benefits, we considered focus areas to have sufficient socioeconomic co-benefits when they have direct equity benefits for marginalized groups, economic development impacts, or health impacts. For equity co-benefits, a focus area made it to the next stage of the analysis if it received a "Yes" answer to any of the following equity co-benefits questions:

- Is there a direct equity co-benefit for a vulnerable group?
- Is there an economic development co-benefit?
- Is there a health co-benefit?

Assessment of scalability. Scalability potential of a focus area was assessed based on whether it can be easily scaled or replicated. Focus areas were judged to have enough scalability if they met any of the following conditions: unit economics and deployment approaches allow for rapid scaling; market demand is already established; the focus area is either deployable in isolation of progress on other focus areas or unlocks pathways for improvement in other focus areas by making them more effective, efficient, or cheaper; or the focus area is easily replicable across different contexts.

Each focus area was ranked low, medium, or high based on its outcome in a scorecard assessment of scaling factors, including the following criteria:

- Unit economics and deployment approaches allow for rapid scaling.
- Established demand-side pull enables rapid scaling.
- The focus area is deployable in isolation or requires other focus areas to be deployed in practice.
- The focus area unlocks pathways for other focus areas to make them more effective, efficient, or cheaper.
- The focus area is easily replicable in other contexts.

[166] Key sources include *Philanthropy for climate action: Reducing global emissions through high impact interventions,* Rocky Mountain Institute, November 2022; *Climate change 2022: Mitigation of climate change,* Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change; McKinsey Nature Analytics.

[167] Key sources include A. A. Jacobs et al., "Cover crops and no-tillage reduce crop production costs and soil loss, compensating for lack of short-term soil quality improvement in a maize and soybean production system," *Soil and Tillage Research,* April 2022, Volume 218; "Conservation's impact on the farm bottom line," Soil Health Partnership, March 2021; Sait Sarr et al., "Do conservation practices bring quick changes to key soil properties for resource-limited farmers?," *Journal of the Kentucky Academy of Science,* October 2019, Volume 80, Number 1; Project Drawdown; Larry D. Godsey, "Economic budgeting for agroforestry practices," *Agroforestry in Action* (University of Missouri Center for Agroforestry), 2010, Number AF1006; Graham Brookes, "Farm income and production impacts from the use of genetically modified (GM) crop technology 1996–2020," *GM Crops & Food,* July 2022, Volume 13, Number 1; "Reducing the price of alternative proteins," Good Food Institute, not dated; Hannah Ritchie, Pablo Rosado, and Max Roser, "Meat and dairy production," Our World in Data, 2017; A. B. Smit et al., *Cost of crop protection measures: A follow-up to the study "The future of crop protection in Europe" (2021),* European Parliamentary Research Service, September 2021; Steven W. Martin et al., "Estimating total costs and possible returns from precision farming practices," *Crop Management,* October 2005, Volume 4, Number 1; Rocky Mountain Institute; *Farm production expenditures: 2020 summary*, US Department of Agriculture, July 2021.

This step filtered out focus areas that do not offer high core impact relative to their cost and those that have low scalability.

Step 2.4: Practical evidence of 4P model suitability
For all focus areas that meet the impact-potential criteria, we looked for additional indications grounded in practical evidence or expert input. Specifically, we assessed two factors:

1. *relevant 4P model examples* providing evidence of a 4P model's ability to support in an area of focus based on a library of case studies and expert interviews

2. *4P model additionality*—expert views on where 4P models, rather than single actors or two-actor partnerships, would provide additionality to implement solutions

Step 3: Feasibility

The third and final step focused on whether there is sufficient commitment to action among partners to drive real and meaningful impact through the identified focus areas. While the analytical component supports the identification of focus areas where 4P models could have the greatest impact, the success of a 4P model depends on the partners. This report does not include the feasibility analysis because it depends on partners coming together in the real world. We can, however, list three steps we believe are helpful in assessing the feasibility of a 4P model:

1. Identify an anchor stakeholder motivated to drive the partnership.

2. Rightsize the partnership in terms of the capital, governance, and resources provided by each of the sectors.

3. Align expectations among the partners.

Appendix B

The 4P models reviewed

The following descriptions provide an overview of the climate and nature 4P model examples reviewed in our analysis. This list is comprehensive but not exhaustive. It includes a brief description of each, with language captured directly from the relevant partnerships' websites or members' press releases where relevant.

&Green. The goal of &Green is to finance the delinking of major commodity supply chains from deforestation in a way that is commercially viable and replicable. The fund focuses on the tropical forests and peatlands most in need of protection and invests in the commodity sectors most active in those valuable ecosystems: palm oil, soy, and forestry (including rubber).

African Forest Landscape Restoration Initiative (AFR100). AFR100 is a country-led effort to bring 100 million hectares of land in Africa into restoration by 2030.

Amazon Region Protected Areas for Life (ARPA). The ARPA program is the world's largest tropical-forest protection initiative. It was launched by the Brazilian government and is coordinated by Brazil's Ministry for the Environment.

Belize debt-for-nature swap. The Belize debt-for-nature swap is a $364 million debt conversion for marine conservation. At signing, it was the world's largest debt refinancing organization for ocean conservation.

Breakthrough Energy Catalyst. Breakthrough Energy Catalyst funds and invests in project companies using emerging climate technologies that reduce emissions. By investing in these opportunities, it seeks to accelerate the adoption of these technologies worldwide and reduce their Green Premiums.

Breathe Cities. Breathe Cities is a pioneering initiative to reduce air pollution, cut carbon emissions, and improve public health in cities around the world. Its projects include pilots for London and Warsaw.

Clean Cooling Collaborative. Clean Cooling Collaborative, a philanthropic initiative of ClimateWorks Foundation, is working to transform the cooling sector by reducing its greenhouse gas emissions and making efficient, climate-friendly cooling accessible to all.

Climate Finance Partnership. The Climate Finance Partnership looks to accelerate the flow of capital into climate-related investments in emerging markets.

Climate Investor One and Two (CI1 and CI2). Climate Investor One (CI1) is a blended finance facility delivering renewable energy infrastructure projects in emerging markets. Climate Investor Two (CI2) is Climate Fund Managers' (CFM) second climate-focused blended finance initiative.

Climate Justice Resilience Fund. The Climate Justice Resilience Fund (CJRF) makes grants that support women, youth, and indigenous peoples in creating and sharing their own solutions for climate resilience.

Coalition for Private Investment in Conservation (CPIC). The CPIC is a global, multi-stakeholder initiative focused on enabling conditions that support a material increase in private, return-seeking investment in conservation.

Convergence. Convergence scales sustainable climate finance by providing grant funding and dedicated acceleration services to early-stage and market-ready financial solutions.

Cool Capital Stack. The Cool Capital Stack is a global financing initiative that delivers on-the-ground impact by mobilizing the full range of capital sources to protect marginalized communities and local economies from extreme heat.

Drive Electric Campaign. The Drive Electric Campaign has a wide scope of operations on a large scale, philanthropy-powered global initiative to achieve a global tipping point by 2026, leading to the electrification of all road vehicles by 2050.

Eco.business Fund. The eco.business Fund provides dedicated financing and technical assistance to financial institutions and businesses committed to environmental practices in unique ecological landscapes in Latin America and sub-Saharan Africa.

Electric School Bus Initiative. The Electric School Bus Initiative aims to build unstoppable momentum toward an equitable transition to electric school buses by 2030, bringing health, climate, and economic benefits to children and families across the United States and normalizing electric mobility.

Enduring Earth. Enduring Earth is a collaboration that works with all agents of the environment to accelerate conservation at a global level. The partnership seeks to protect and conserve the planet's oceans, lands, and freshwater and to secure long-term financing for conservation, economic diversification, and community prosperity.

Facility for Energy Inclusion Off-Grid Energy Access Fund. The mission of the Facility for Energy Inclusion Off-Grid Energy Access Fund is to support the growth of energy access companies across Africa and develop their capacity to sustainably access capital at scale.

Family Forest Carbon Program. The Family Forest Carbon Program enables family forest owners to access climate finance from carbon markets, empowering them to help address climate change while earning income from their land.

First Movers Coalition. First Movers Coalition is an alliance of companies focused on reducing emissions in the hard-to-abate sectors, including aviation, chemicals, concrete, shipping, steel, trucking, and direct air capture, which collectively account for more than a third of the world's carbon emissions.

Florida Solar Energy Loan Fund (SELF). SELF provides microloans for residents who otherwise couldn't get financing for sustainable home improvements due to barriers such as low credit scores.

Food Action Alliance. The Food Action Alliance is a multi-stakeholder platform for scaling food systems innovation and impact, mobilizing and coordinating collective investment and action to deliver on national food systems strategies and support a transition to improved food systems.

Food and Land Use Coalition. The Food and Land Use Coalition is a global community of change makers working to accelerate the transformation of food and land use systems to unlock a net-zero, nature-positive world while also ensuring social justice and food security for all.

Food Securities Fund. The Food Securities Fund aims to lend working capital to sustainable agriculture companies in emerging and developing markets.

Friends of Ocean Action. Friends of Ocean Action is a coalition of ocean leaders who are fast-tracking solutions to pressing challenges facing the ocean.

Gabon debt-for-nature swap. The Gabon debt-for-nature swap is a transaction to refinance $500 million of Gabon's national debt and generate an expected $163 million in new funding for ocean conservation.

Getting to Zero Coalition. The Getting to Zero Coalition is an industry-led platform for collaboration that brings together leading stakeholders from across the maritime and fuels value chains with the financial sector and others committed to making commercially viable zero-emission vessels a scalable reality by 2030, aiming toward full decarbonization by 2050.

Global Battery Alliance. The Global Battery Alliance is a public–private collaboration platform founded in 2017 at the World Economic Forum to help establish a sustainable battery value chain by 2030.

Global Energy Alliance for People and Planet (GEAPP). GEAPP is a collective movement for change, working to unlock renewable energy access in emerging economies.

Green Raiteros. Green Raiteros is a community-based concept that revolutionizes mobility for rural communities.

IDH Farmfit. IDH Farmfit supports investments in smallholder farming, bridging the funding gap and establishing smallholder finance as a new asset class.

Indonesia Just Energy Transition Partnership (JETP). The Indonesia JETP will accelerate Indonesia's transition to a cleaner energy future, reducing cumulative greenhouse gas emissions.

Initiative 20x20. Initiative 20x20 is a regional partnership that aims to change the dynamics of land degradation in Latin America and the Caribbean and to advance restoration across the region.

Innovative Finance for the Amazon, Cerrado and Chaco (IFACC). IFACC serves banks, companies, and investors seeking to expand innovative finance for deforestation/conversion-free beef and soy in these regions.

Legacy Landscapes Fund. Legacy Landscapes Fund sources funding from public and private donors to protected areas with a long-term, flexible program approach. The partnership goal is to fund a global, diversified portfolio of at least 30 of the world's most relevant biodiversity hot spots by 2030.

Louisiana Environmental Impact Bond. Quantified Ventures worked with the Environmental Defense Fund (EDF) and the State of Louisiana Coastal Protection and Restoration Authority (CPRA) to develop an outcomes-based financing approach to fill capital gaps for critical coastal wetland restoration projects in the state's 2017 Coastal Master Plan.

Nature-Based Solutions (NBS) Investment Platform. The Nature-Based Solutions Investment Platform is a group of investors supporting NBS market scale-up in Brazil, supported by an investment intelligence platform.

Ocean Risk and Resilience Action Alliance (ORRAA). The ORRAA is a multisector collaboration working to incentivize greater private investments and blended finance into coastal natural capital by pioneering products that address ocean risk and build resilience in the regions that need it most.

Power Africa. Power Africa, a US-government-led partnership, convenes the collective resources of the private sector, international development organizations, and governments from around the world to increase energy access and end energy poverty in sub-Saharan Africa.

PREVENT Waste Alliance. Prevent Waste Alliance addresses waste prevention, collection, and recycling and the increased uptake of secondary resources in low- and middle-income countries.

Salesforce Blue Carbon Markets. The initiative works to develop consistent standards for assessing high-quality blue carbon credits in order to ensure that increasing investment into the growing market is directed to sustainable projects that do not neglect local communities and biodiversity.

Seychelles Conservation and Climate Adaptation Trust (SeyCCAT). SeyCCAT invests in ocean stakeholders to generate new learning, bold action, and sustainable blue prosperity in the Seychelles.

SLOCAT Partnership. SLOCAT is an international multi-stakeholder partnership powering systemic transformations and a just transition toward equitable, healthy, green, and resilient transport and mobility systems for people and the planet.

South Africa Just Energy Transition Partnership (JETP). The South Africa JETP aims to accelerate the decarbonization of South Africa's economy, with a focus on the electricity system.

Southeast Asia Clean Energy Facility (SEACEF). SEACEF is a collaboration between leading international foundations to accelerate the low-carbon transition in Southeast Asia.

Southeast Asia Energy Transition Partnership (ETP). The Southeast Asia ETP is a five-year, multidonor partnership to support sustainable energy transition in Southeast Asia in line with the Paris Agreement. Its initial focus is on Indonesia, the Philippines, and Vietnam.

Sustainable Energy for All (SEforALL). SEforALL is an international organization that works in partnership with the United Nations and leaders in government, the private sector, financial institutions, civil society, and philanthropies to drive faster action toward the achievement of Sustainable Development Goal 7 (SDG7) in line with the Paris Agreement on climate.

The Mangrove Breakthrough. The Mangrove Breakthrough is part of a set of Marrakech Partnership Adaptation and Resilience Breakthroughs, which collectively define global milestones and high-impact solutions to reduce climate risks, particularly in vulnerable communities, through adaptation action.

The Ray Highway. The Ray Highway partnership seeks to trial technology along the 18-mile stretch of Interstate 85 in Troup County, Georgia, called The Ray, with the expectation it can be implemented across the state to improve roadway safety, reduce traffic congestion, and improve organizational efficiency.

Tropical Forest Alliance. The Tropical Forest Alliance is a multi-stakeholder partnership platform initiated to support the implementation of private-sector commitments to remove deforestation from palm oil, beef, soy, and pulp/paper supply chains.

Tropical Landscapes Finance Facility. The Tropical Landscapes Finance Facility offers long-term loans in Indonesia to projects and companies that stimulate green growth and rural jobs.

Vietnam Just Energy Transition Partnership (JETP). The Vietnam JETP aims to accelerate the peaking of Vietnam's greenhouse gas emissions and its transition to clean energy.

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