Seeking Synergy Solutions

Integrating Climate and SDG Knowledge and Data for Action

For further information, please contact:
Website: sdgs.un.org/climate-sdgs-synergies
Email: climate-sdgs-synergies@un.org

Design concept and production by
Camilo Salomon @ www.cjsalomon.com

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Authors and Acknowledgements

Report Authors

Thematic Co-leads

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Luis Gomez Echeverri (Colombia)
Emeritus Research Scholar, International Institute for Applied Systems Analysis (IIASA)
Luis Gomez-Echeverri is an emeritus research scholar at the International Institute for Applied Systems Analysis (IIASA). His research interests are in the areas concerned with climate and development linkages, implementation of the Paris Agreement and Development Agenda 2030, governance and institutions, climate change, finance, and development cooperation.

Mercedes Bustamante (Chile)
Professor, University of Brasilia
Mercedes Bustamante is an ecologist and currently a full professor at the University of Brasilia recognized for her contributions to the ecological knowledge of threatened tropical ecosystems and their interactions with human-induced changes.

Ma Jun (China)
Director, Institute of Public and Environmental Affairs (IPE)
Ma Jun is the director of the Beijing-based NGO, the Institute of Public and Environmental Affairs (IPE), and a well-known and respected leader in China's environmental community. In 2006 and 2007, he launched the unique China air and water pollution online databases, for the first time providing public access to key pollution data.

Thematic Co-authors

Nazifa Rafa (University of Cambridge)
Elena Rovenskaya (International Institute for Advanced Systems Analysis)
Junichi Fujino (Institute for Global Environmental Strategies)
Eric Zusman (Institute for Global Environmental Strategies)
Felix Creutzig (Technical University of Berlin)
Tolullah Oni (University of Cambridge and UrbanBetter)

Support and Review

Geoff Clarke (Senior Science Writer and Editor)
Souran Chatterjee (Research and Analysis)

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Partners Behind the Thematic Report

International Institute for Applied Systems Analysis (IIASA) is an international research institute that advances systems analysis and applies its research methods to identify policy solutions to reduce human footprints, enhance the resilience of natural and socioeconomic systems, and help achieve the Sustainable Development Goals. https://iiasa.ac.at

University of Brasilia was created in 1962 following the joint vision of the anthropologist Darcy Ribeiro and the educator Anísio Teixeira. Its goals and mission are to be a reference in teaching, research and community projects, contributing to global knowledge in an interconnected world. https://international.unb.br

Institute of Public and Environmental Affairs (IPE) is a non-profit environmental research organization registered and based in Beijing, China. Since its establishment in June 2006, IPE has dedicated itself to collecting, collating and analyzing government and corporate environmental information to build a database of environmental information. https://wwwen.ipe.org.cn

Contributing Experts

The report's depth is indebted to the excellent inputs provided by eminent global experts through online consultations. We acknowledge the significant contributions from:

Cameron Allen (Monash Sustainable Development Institute, Monash University)
Ranjula Bali Swain (Stockholm School of Economics)
Arunabha Ghosh (Council on Energy, Environment and Water)
Upalat Korwatanasakul (United Natioons University)
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Matías Mastrán (Inter-American Institute for Global Change Research)
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Key Messages

- Integrating climate action with sustainable development policies can accelerate progress, enhance resource efficiency, and facilitate coherent policymaking, but this requires overcoming significant gaps between scientific evidence and policy implementation (knowledge-action gap).

- Fragmentation in institutional structures, climate finance, and sectoral knowledge hampers the integration of climate action and sustainable development goals (SDGs); overcoming this requires enhancing the accessibility and relevance of knowledge and data for policymakers to support effective and synergistic decision-making.

- Knowledge and data (K&D) play a crucial role in guiding practitioners to adopt synergistic approaches to climate and sustainable development actions by offering clarity on synergies, helping navigate policy landscapes, providing localized and contextualized strategies, facilitating knowledge sharing, demonstrating interactions between policies, engaging stakeholders, and translating national commitments to local actions, especially in cities.

- Knowledge and data (K&D) are needed to clarify economic benefits, reflect risks, reinforce policy coherence, and make the business case for adaptation investments to unlock financial gains and promote collaborative frameworks for public and private institutions.

- Despite the potential benefits, policy-level implementation of synergies between climate action and sustainable development goals is hindered by siloed approaches and insufficient consideration of co-benefits and trade-offs, necessitating the resolution of knowledge barriers such as lack of research, practical methods, understanding of distributional impacts, and skilled practitioners to effectively identify and implement not only the cross-sectoral opportunities but also the costs of pursuing them.

- The recommendations focus on establishing a global platform for knowledge and data to facilitate synergies between climate and sustainable development actions by: integrating vulnerability, justice, and inclusionary data; improving tools and approaches for policy relevance, including the utilization of AI; assessing investment risks and returns; building local capacity for contextualized synergies; promoting ambitious NDCs and policies cognizant of synergies; and integrating climate considerations into international forums and assessments, thereby enhancing the understanding and implementation of climate and sustainable development synergies.

Executive Summary

The pursuit of climate action and the Sustainable Development Goals (SDGs) presents a unique opportunity to foster synergies and drive transformative change towards a sustainable and resilient future. However, significant knowledge and data (K&D) gaps exist that hinder the effective integration of climate action with the SDGs. This executive summary provides an overview of the main findings, challenges, and recommendations presented in this report.

The report highlights a noticeable scarcity of comprehensive research, quality data, and overarching indicators that evaluate trade-offs between various policy goals or assess the synergies between climate action and the SDGs across specific sectors and levels, namely across adaptation, resilience measures, biodiversity protection, nature-based solutions, and loss and damage. However, it has become increasingly clear that the low uptake in synergistic efforts is not a result of the absence or availability of quality data or tools, but rather due to the fragmented nature and general inaccessibility of much of the evidence that confound policymakers and practitioners. Moreover, the lack of standardization and limited accessibility across existing tools, and meta-analyses of insights to the broad community of potential users hinder the effective mapping and anticipation of synergistic effects. Current approaches often overlook the distributional impacts of climate action, leading to inequitable outcomes and challenges in creating inclusive strategies. Additionally, the lower emphasis on multidisciplinary and systems approaches across scientific and policy sectors highlights the need for capacity building and strengthening the science-policy interface, particularly in developing countries.

To address these challenges, the report recommends the establishment of a global platform that serves as a repository of knowledge, resources, case studies, and best practices on synergies between climate action and the SDGs. This platform should embrace traditional and indigenous knowledge and involve stakeholders in knowledge co-creation and localization using the wide variety of digital technologies that can be employed for gathering and synthesizing data. It should also seek to provide a framework for better analysis and understanding of synergies and tradeoffs to ensure that this is adding value in facilitating synergistic approaches.

Furthermore, there is a need to frame K&D in a manner that considers vulnerability, justice, and inclusion to promote sustainable well-being for all. Utilizing citizen science, natural language processing (NLP)/ text mining/analysis, and composite indices can help gather and represent data on social, economic, and environmental dimensions and address distributional impacts effectively. Moreover, co-creating AI systems with human input ensures they are less biased, more accountable, and better suited to addressing complex global challenges like climate change, and ultimately contribute to a more sustainable and equitable world.

The report emphasizes the development and prioritization of dynamic, accessible, usable, transferable, and transparent methods and tools that combine quantitative and qualitative analyses to assess interactions between climate and SDG policies effectively. Addressing the need for evidence on the economic need and benefits of integrated climate and SDG action is crucial. Revealing incentives for public and private investors by bridging knowledge gaps in the value of SDGs and associated co-benefits can enhance understanding of investment risks and returns.

Moreover, adopting multidisciplinary and systems approaches and engaging multi-stakeholder groups to contextualize synergies at the local level is essential. Building analytical capabilities and promoting knowledge co-production can identify investment opportunities in support of synergies between the 2030 Agenda and the Paris Agreement. Integrating synergistic action into the reporting requirements for Nationally Determined Contributions (NDCs) can also help scale up ambition and implementation. Utilizing political processes and international platforms like the High-Level Political Forum (HLPF) and the Intergovernmental Panel on Climate Change (IPCC) reports to spearhead efforts towards climate and sustainable development synergies is recommended.

By fostering collaboration, promoting inclusivity, and enhancing the availability and accessibility of relevant K&D, we can unlock the full potential of synergistic approaches to build a more sustainable, resilient, and equitable future for all.

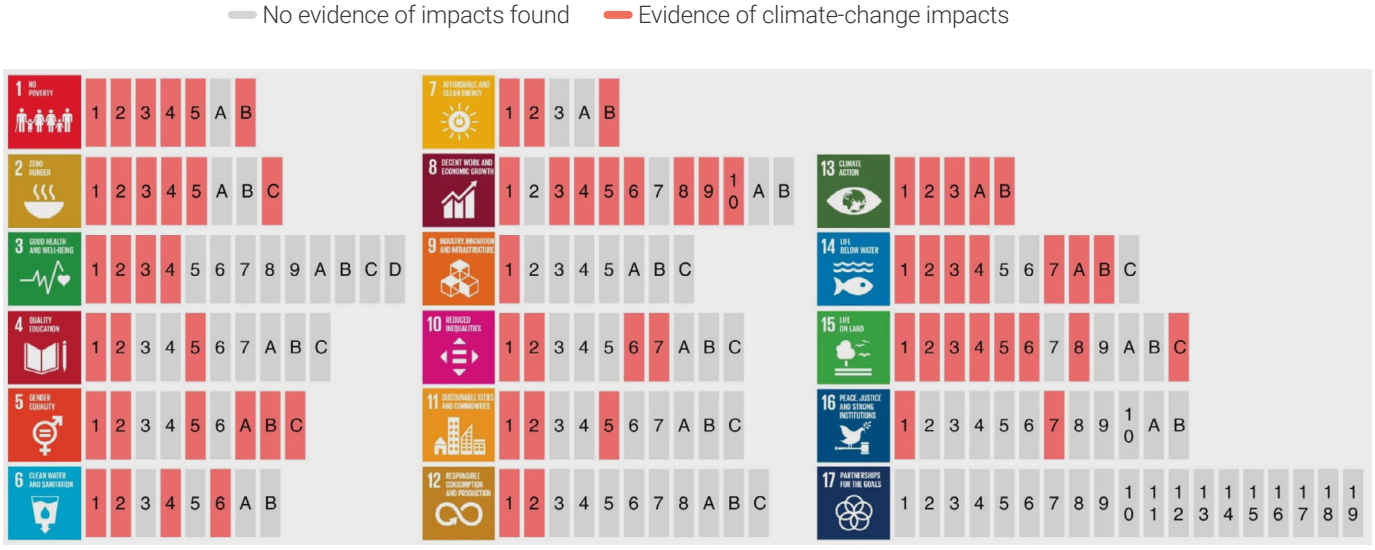
Introduction

> "Climate action is the 21st century's greatest opportunity to drive forward all the Sustainable Development Goals."
>
> – António Guterres, Secretary-General of The United Nations

The global commitment to combat climate change is increasing but still falls well short of the Paris Agreement's objectives. With its wide-ranging and unprecedented effects on social, economic, political, and environmental facets, climate change is regarded as one of the biggest threats to sustainable development (Figure 1). Addressing developmental goals and climate change requires integrated, synergistic policies. Combining climate and sustainable development actions that maximize co-benefits and mitigate trade-offs can accomplish win-win results toward achieving both agendas.

Public participation and coordination across sectors and policymakers are crucial. Resources should be used effectively, and climate action must be commercially viable and socially acceptable. Therefore, aiming for synergistic actions for climate and sustainable development benefits societies and a wide range of stakeholders such as policymakers, investors, business owners, service providers, and consumers.

FIGURE 1. Impacts of climate change on the achievement of the SDG targets. Each rectangle to the right of the relevant SDG represents a Target. Targets highlighted in red denote the presence of published evidence of impacts. The absence of highlighting indicates the absence of identified evidence, although it does not necessarily mean the absence of an impact.



Source: Fuso Nerini *et al.*, 2019.

The first global report on synergies for climate and sustainable development actions, *"Synergy Solutions for a World in Crisis: Tackling Climate and SDG Action Together"* highlighted several reasons for pursuing synergies including:

- **Accelerating Progress and Increasing Equity by Addressing Interconnected Challenges.** The achievement of the goals and targets under the Paris Agreement and the 2030 Agenda are currently both off track, highlighting the urgency in the need for a course correction and a shift in focus from individual policies to system-wide changes. Synergistic approaches, which focus on transformative changes, are critical for accelerating progress on both goals. Incremental efforts do not address the root causes of climate change and sustainable development. Building resilience in communities, ecosystems, and economies is linked to addressing climate change. Synergistic approaches can strengthen resilience by integrating climate adaptation, mitigation, and sustainable development efforts, enhancing societies' ability to adapt to climate change impacts while advancing broader development goals.

- **Enhancing Resource Efficiency and Return on Investment.** Synergies enable the optimization of resource use by identifying opportunities to address multiple objectives with the same investments or interventions, thereby enhancing resource efficiency, resulting in more sustainable outcomes. Thus, synergistic approaches have the potential to reduce investment costs by leveraging shared resources, expertise, and infrastructure across multiple goals. By identifying areas where actions to address climate change can also contribute to achieving the SDGs and vice versa, resources can be allocated more efficiently, leading to cost savings.

- **Facilitating Coherent Policy Making and Integration.** Evidence links climate action to 80 percent of 2030 Agenda targets (Fuso Nerini *et al.,* 2019), providing opportunities for impactful policies. Adopting a synergistic approach provides a structured way of understanding complex information and organizing it in ways that support informed decision-making, implementation, monitoring, and learning. This helps stakeholders across public, private, and civil society sectors to make better choices in advancing sustainable development and climate action. Synergies promote policy integration, prioritization, and innovation in an interconnected world. By identifying areas where climate action and SDGs intersect, policymakers can develop more coherent and integrated approaches to address both sets of goals effectively and anticipate and overcome any trade-offs that may emerge from the interactions.

The first report also offered recommendations to accelerate synergistic action on climate and sustainable development, which include: enhancing collective resilience; strengthening the science-policy-society interface; promoting institutional capacity building; ensuring policy coherence; developing a framework for action; ensuring a just transition; addressing investment gaps; utilizing Conference of Parties (COPs) in the United Nations Framework Convention on Climate Change (UNFCCC) and other relevant political processes such as the High-Level Political Forum (HLPF); prioritizing synergies in UN and financial institutions; and focusing on cities.

However, the low uptake of synergistic actions by policymakers remains a perplexing challenge – demonstrated by the fact that very few, if any, of the major climate and SDG policy instruments and commitments, such as Nationally Determined Contributions (NDCs), Long-Term Low-Emissions Development Strategies (LT-LEDS), National Adaptation Plans (NAPs), and Voluntary National Reviews (VNRs) – expressly address the other. It is obvious that a variety of obstacles exist that impede the broad creation and use of policies that concurrently address development and climate agendas.

One of the major obstacles contributing to the generally low adoption of a synergistic strategy to address the 2030 Agenda and Paris Agreement is the substantial gap between applied policy action and scientific evidence. The fragmented nature of relevant knowledge and data (K&D) widens the gap between scientific evidence and policy action. For practitioners, this translates into inadequate access to comprehensive knowledge and insufficient data-driven decision-making processes.

This Report underscores the key role of K&D in advancing sustainable development and climate synergies by highlighting its important role in facilitating synergistic policymaking, identifying some of the key K&D gaps that have been hindering climate and developmental action, and recommending how K&D can support the operationalization of a synergistic approach. It does so by building upon the first report, *"Synergy Solutions for a World in Crisis: Tackling Climate and SDG Action Together"*, together with extensive online consultations with eminent international experts to develop action-oriented recommendations.

What Knowledge and Data Can Do for Policymakers and Practitioners

One of the several impediments to pursuing synergies of climate and sustainable development actions is fragmentation at all levels – the fragmentation of institutional landscapes, both subnational, national, and international, due to their operation in siloes; the fragmentation of climate finance and its governance; and finally, the fragmentation of K&D due to the proliferation of different tools and methods often of little relevance to the policy context. A comprehensive and integrated understanding of the social-environmental systems reflected in the SDGs is severely hampered by this fragmentation. It is also precisely this fragmentation that underlines the need for enhancing K&D for synergistic action. This is in addition to other challenges such as the capture of institutional processes by vested interests, the high cost of cross-silo integration, and the frequently limited capacity to address synergies.

The imperativeness of visibility, accessibility, and relevance to policy of the knowledge base on climate and SDG synergies, including the potential for trade-offs, is being recognized more than ever. With government officials and policymakers often handling multiple multi-faceted challenges at once, K&D generation efforts to advance synergies need to strike the balance between causing information fatigue and offering necessary and usable resources, relevant evidence, and associated tools. At the outset, K&D has numerous contributions to make in helping guide practitioners to employ a synergistic approach. This can include, but is not limited to:

- Helping policymakers and practitioners navigate the policy landscape by (i) anticipating and addressing political constraints that emerge from vested interests, financial and institutional power dynamics, and barriers to regional and global partnerships for implementation, (ii) facilitating the development of institutional arrangements for synergistic action by creating visionary maps of the roles and responsibilities of national governance structures and stakeholders in policy processes, (iii) resolving incoherence by offering insights on potential policy interactions *ex-ante*, their distributional and equity outcomes, and approaches to 'correct' policies to be more coherent and mutually supportive, and (iv) offering frameworks, tools, and other resources to policymakers and practitioners to enable synergistic action.

- Providing tailored approaches for pursuing synergies through localization and contextualization at different levels within and between countries, particularly by exposing policymakers to sustainable pathways and synergies through various entry points, such as mobility, food, and ecosystems, to inform policy decisions and promote multi-stakeholder collaboration and transparency in communication and decision-making. Because of the differences in national priorities, national income, political leadership, ideology, and economic, institutional, environmental, and social structures and conditions, the climate and SDG interactions that will be of interest to different countries will also be different, as will the nature of interactions themselves. Some nations, particularly countries of the Global South, may find it more fruitful to use SDGs, particularly those related to poverty alleviation, access to services, electricity access, food security, and building out basic

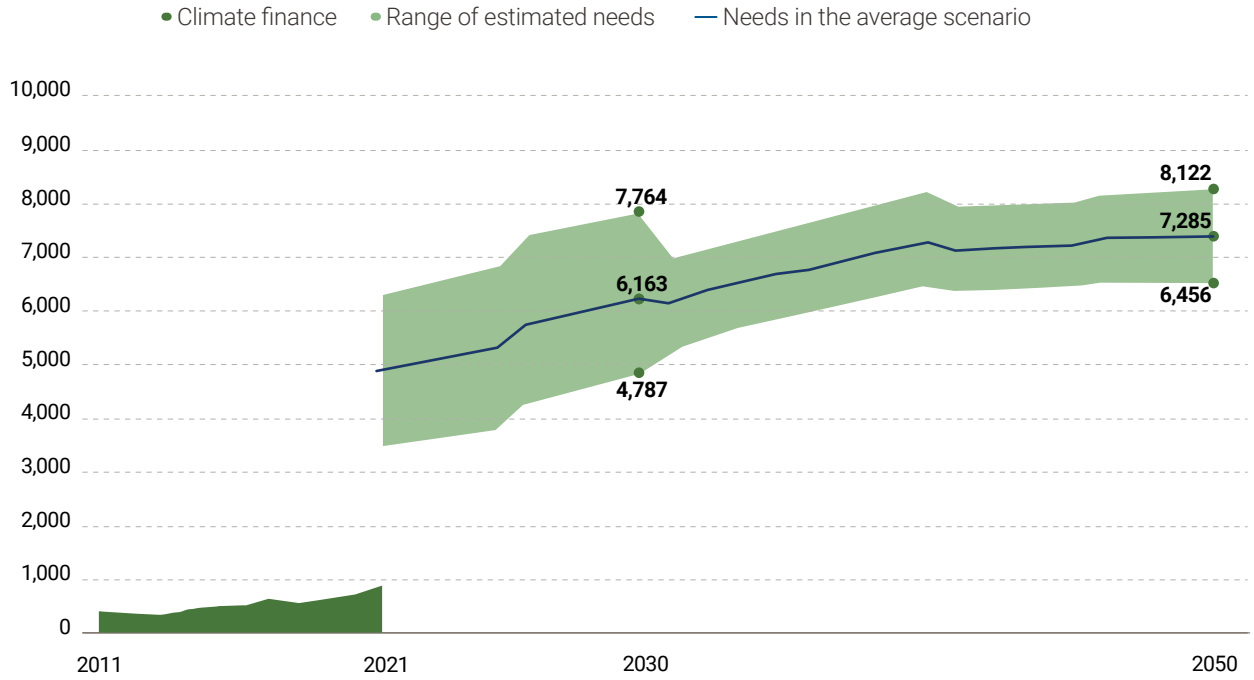
infrastructure, as an entry point for utilizing synergies with climate action. For example, emerging countries like China focus more on creating synergies between climate mitigation and air pollution reduction, nature conservation, and high-quality growth. Conversely, several countries of the Global North may wish to focus on other SDGs, such as social exclusion and equity, reducing the cost of living, and lowering health care costs. Through localization and contextualization of K&D, the current prevalent top-down model of science and knowledge generation can be replaced by one where local knowledge, practices, and priorities are used in the co-design of policies (ISC, 2023).

- Providing guidance and creating opportunities for knowledge sharing on some of the universally prioritized goals, such as economic growth, job creation, social stability, investment, and climate mitigation and adaptation commitments under the Paris Agreement, and recent the COP28.
- Demonstrating both negative and positive interactions, that is, co-benefits and trade-offs, to better understand their dynamics to ensure policy coherence and minimize the discrepancy between developmental policies and climate action. Some areas of interest include the intersection between climate, security, and development issues, as well as the potential proximity of social and Earth systems' tipping points with planetary boundaries, to encourage policymakers to employ integrated approaches when tackling these.
- Engaging different sectors, ministries, and other stakeholders in climate action to identify priority elements within NDC implementation plans using analytical products such as refinement of key performance indicators (KPI), costing, prioritization, and stocktaking for assessing progress, and making the case for climate action.
- Translating national commitments across climate action and SDGs to local levels, such as cities, which are hubs of innovation, technology, resources, and efforts for improving well-being and quality of life, as well as an assemblage of a diverse range of actors. Cities are one of the fastest-growing areas in the world, hosting some 55% of the world's population currently which is expected to rise to 68% by 2050 (UNDESA, 2018). Cities also account for over 70% of the global greenhouse gas emissions (Dasgupta *et al.,* 2022). As a first step toward reducing these emissions, K&D has an important role to play in identifying the diverse sources of these emissions, along with ways to accurately measure and monitor them. Moreover, conflicts between planning, governance, and expansion authorities need to be addressed through transformative systems that integrate climate and developmental perspectives across sectors/levels and different stakeholders. K&D can help bring forth lessons learned from real studies and change agents on the ground to help navigate the challenges of power dynamics and cultural constraints and foster collaboration.

In its current state, the international financial architecture has numerous limitations that make it unable to support climate and sustainable development synergies. These include: (i) the failure to procure adequate amounts of investments in both SDGs (USD 4.3 trillion financing gap per year between 2020 and 2025 (OECD, 2022)) and climate action (Figure 2); (ii) the failure to support countries of the Global South, which often lack the finances to invest in climate transition and sustainable development actions; and (iii) the failure of investment materializing for the most at-need sectors, such as climate resilient food, health, housing and infrastructure, and adaptation. Therefore, K&D has an important role to play in unveiling the financial gains and mitigating perceptions of risks in investment for synergies. These include but are not limited to:

- Enhancing our understanding of the economic need to pursue synergies, particularly by elucidating the often-ambiguous relationship between climate and development finance. It can also foster investments in a low carbon economy and climate finance by demonstrating the importance of SDGs and the associated benefits of different green investments, especially for the private sector. It can further advance biodiversity investments, which are currently affected by limited data availability. Finally, K&D can highlight the **cost of inaction** in addressing synergies, thereby accelerating progress in the two agendas.
- Accurately reflecting the physical climate and transition risks into investment decision-making, such as for green infrastructure investments, which are often ridden with innovation risks. K&D can also uncover incentives for investors to prioritize a synergistic approach, and facilitate mechanisms of co-financing therefore, engendering a collaborative framework for public and private institutions and communities.
- Reinforcing policy coherence, by elucidating concepts and resolving inconsistencies, such as those regarding green taxonomies, which currently often lack alignment and therefore fail to foster synergies between climate and SDGs.
- Making the business case for adaptation and the return on investment of specific adaptation investments, by offering better-quantified assessments of trade-offs, matching priorities with suitable pools of capital, and a narrative framing that centers on poverty reduction and human development.

FIGURE 2. Global tracked climate finance and estimated annual climate finance needs through 2050 (USD million).

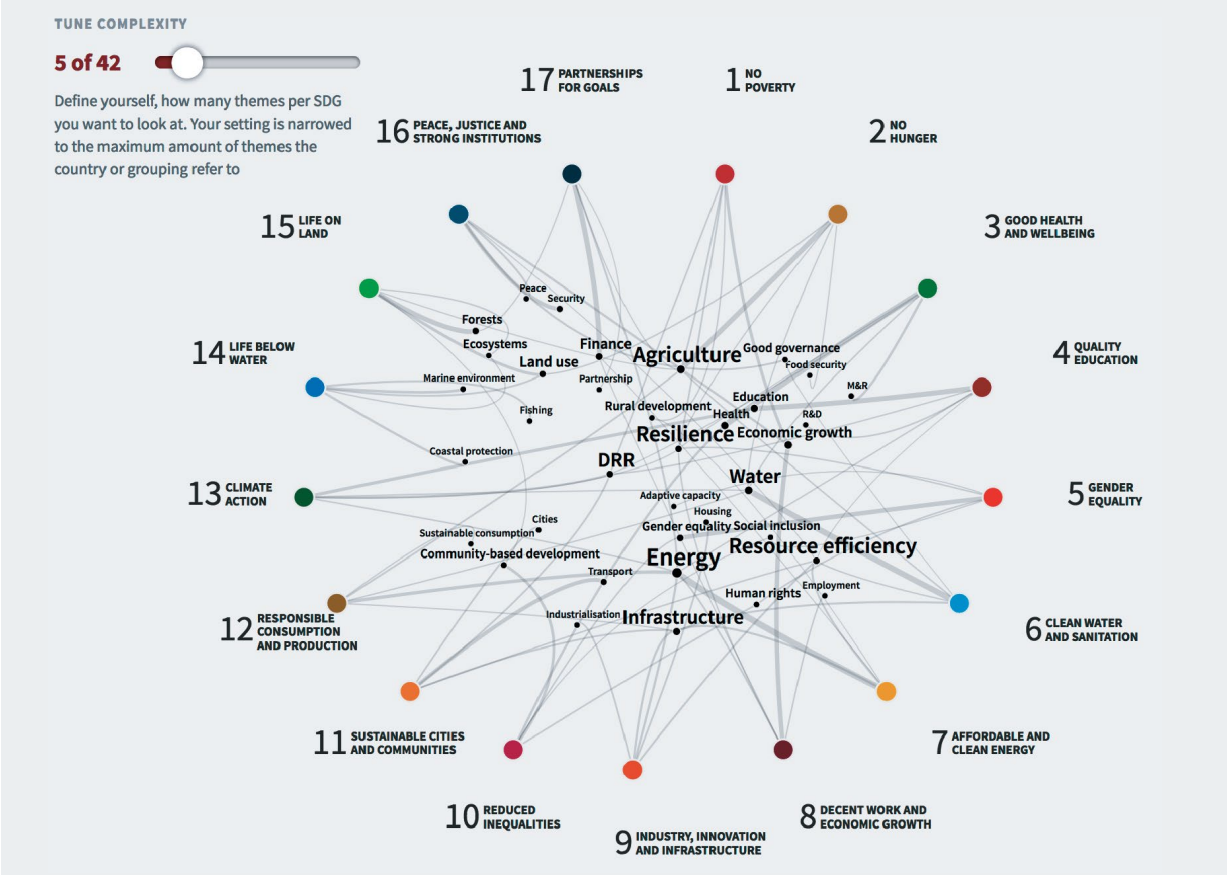


Source: Solomon *et al.*, 2023.

Knowledge and Data Gaps in Climate and Developmental Action

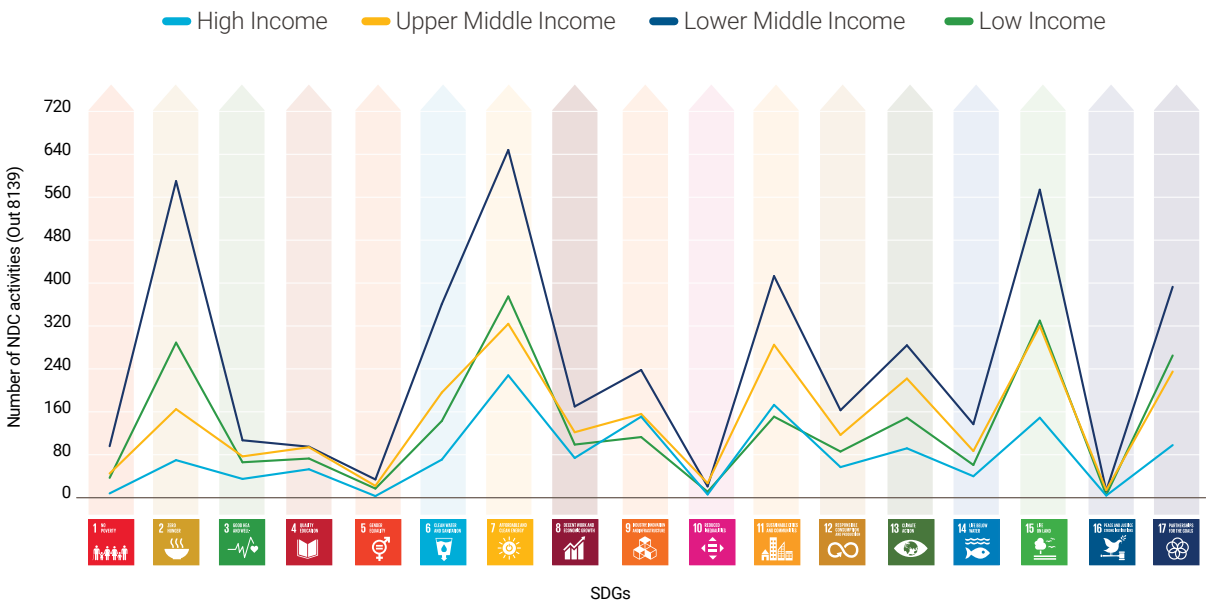
Despite the promises offered by synergies across climate and sustainable development actions, implementation at the policy level has been generally slow, as policy actions on climate change and individual SDGs tend to operate in silos, and most fail to account properly for potential co-benefits and trade-offs. For example, only about 20 of the 160+ current NDCs explicitly refer to SDGs, although, there are some prominent SDG themes, such as those related to agriculture, ecosystem conservation and restoration, energy, resilience, water, resource efficiency, infrastructure, and disaster risk reduction (see Figure 3). Moreover, the overlaps between SDGs and NDC activities are more pronounced for low-income and lower-middle-income countries than for high-income countries (Figure 4). However, there remains a dearth of climate action-SDG interlinkages in the policy sphere, especially those relating to SDGs that address health, gender, inequality, and education (Dzebo *et al.*, 2018).

FIGURE 3. Synergies between the 5 most frequently found SDG themes in NDC, obtained using the NDC-SDG Connections tool.



http://ndc-sdg.info. Source: Dzebo *et al.*, 2018.

FIGURE 4. Number of climate activities that correspond to each of the 17 SDGs across different regions.

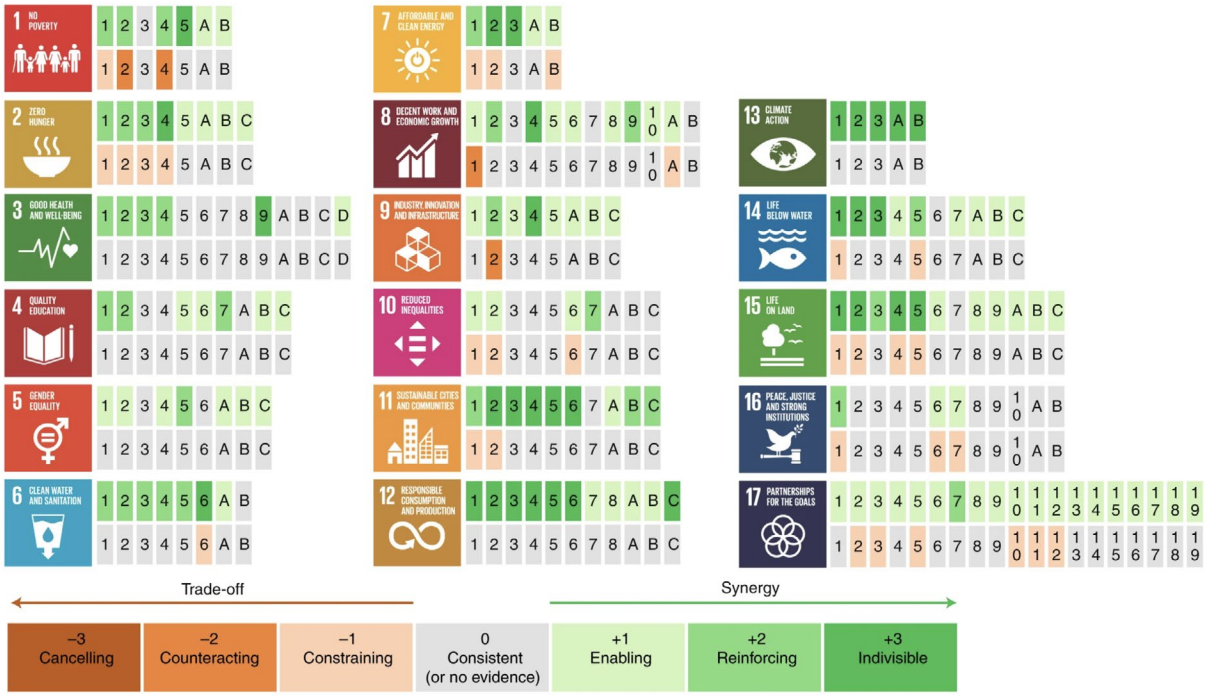


Data obtained from http://ndc-sdg.info

A fair transition to zero-emissions and climate-resilient sustainable development depends on balancing the two priorities. To operationalize synergies, numerous knowledge barriers need to be addressed:

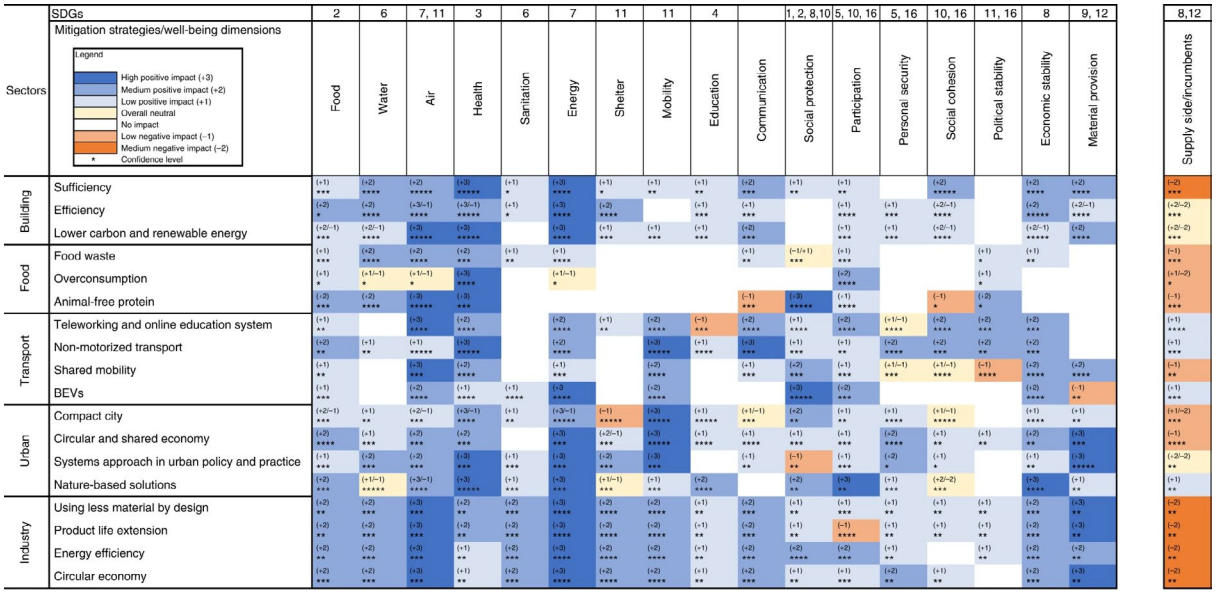
- *Lack of research, quality data, and comprehensive indicators at different levels and across all sectors.* There is a scarcity of data and indicators to assess the synergies between the two agendas at different levels, including adaptation, resilience measures, biodiversity protection, nature-based solutions, and loss and damage. Available instruments only evaluate a few co-benefits, such as reduced air pollution, improved health, and increased employment. Moreover, although there is a wealth of knowledge about co-benefits, less is known about how to manage possible trade-offs between various policy goals (Figure 5). In addition, the existing literature has focused primarily on investigating the interactions between SDGs, impacts of climate change, and climate adaptation at a broad scale, but has failed to provide a systematic understanding of the role of different sectors, which are often the focus of national governments when implementing mitigation and adaptation plans. An exception is the analysis of sectoral demand side interventions (Creutzig *et al.*, 2022a,b) that evaluated well-being-related synergies and tradeoffs, roughly corresponding to SDGs 1-11, for a variety of sectoral policy classes. It finds that most measures are synergistic and that less than 5% of measures lead to hard trade-offs (Figure 6). Nonetheless, the insular nature of interdisciplinary knowledge exchange in academic fields makes very litter difference in addressing research gaps in the relationship between climate action and the SDGs, leading to cross-sectoral spillover effects and missed opportunities for trade-offs in development policies.

FIGURE 5. Positive synergies (co-benefits) and trade-offs between climate action and the SDG targets. Each rectangle to the right of the relevant SDG represents a Target. The highlighting represents the strength of an interaction, while its absence indicates the absence of identified evidence, which may not necessarily imply the absence of an interlinkage. As illustrated above, there is still little evidence of the impacts of climate on many targets, particularly regarding trade-offs.



Source: Fuso Nerini *et al.*, 2019.

FIGURE 6. Effects of demand-side options on well-being in 19 sectors. Magnitude and direction of well-being effect.



Source: Creutzig *et al.*, 2022b

- *Insufficient practical methods and approaches for interaction mapping between climate and development actions, accessible to policymakers and other key stakeholders*, both in the literature and in practice. Part of the challenge is the proliferation of tools with different data requirements (see Tables A1 and A2 for a review of tools on synergies and co-benefits and studies that model co-benefits from different sectoral or policy focus respectively). Moreover, much of the published research is abstract and thus of limited use to policymakers who deal with problems on the ground. There is also a need for organized initiatives to assess usable knowledge. Furthermore, model-based quantification methods such as integrated assessment models have limitations due to various assumptions, estimations, and uncertainties, making them less policy-relevant for SDG and climate action synergies. In addition,the paucity of accessible tools to quantify and monetize the co-benefits of undertaking synergistic action can hinder the decision-making process.

- *Inadequate understanding of ways to address distributional impacts.* Understanding the distributional impacts of climate action is essential for creating all-encompassing strategies that are advantageous to all. However, the absence of a standardized worldwide reporting system makes it difficult to quantify co-benefits and assess synergistic programs. Top-down approaches hinder the localization of climate change challenges that require multi-stakeholder groups and processes. This requires awareness and commitment to connect regional initiatives with global objectives. To ensure a just transition, more studies on inclusive policy assessment frameworks and data that are easily accessible are required, as most indicators and research focus on averages.

- *Shortage of skilled practitioners with the necessary knowledge* to successfully identify and implement the cross-sectoral opportunities presented by a synergistic approach to climate and development. Researchers, particularly early-career ones, need to understand how decisions are made and provide the scientific justification for various policy options. To facilitate objective policymaking, policymakers need to comprehend the rationale behind different solutions. For climate and sustainable development action, multidisciplinary and systems approaches across scientific and policy sectors are necessary. Unfortunately, few universities offer postgraduate degrees, support science, or do research in transdisciplinary fields like sustainability.

Recommendations for Knowledge and Data for Advancing Synergies of Climate and Sustainable Development Actions

The following is a concise set of recommendations on future K&D for accelerated action on climate and sustainable development synergies. These recommendations are designed to address a critical question posed in this report: How can knowledge and data be enhanced to advance synergies of climate and sustainable development actions?

I. Toward a **Global Platform for Knowledge and Data on Climate and SDG Synergies**

It has become increasingly clear that the low uptake in synergistic efforts is not the result of the absence or availability of data, but rather the multiple streams of data that confound policymakers and practitioners. These include the various reporting mechanisms and platforms beyond official sources, such as research studies and community surveys, especially if they are of little policy relevance. Existing K&D platforms, even as they consolidate important evidence, do not respond to the needs for a synergistic approach. Therefore, this platform would seek to provide a framework for better analysis and understanding of synergies and tradeoffs to ensure that this is adding value in facilitating synergistic approaches.

There needs to be a global focal point for accessing relevant tools, resources, and global and regional best examples, practices, and case studies on synergies that serve as a repository of knowledge as well as a source of systematic knowledge creation, using the best digital tools available for this purpose. This platform would address the limitations of current top-down practices by developing local research, knowledge, and capacities for co-design and co-implementation (ISC, 2023). Knowledge co-creation with stakeholders is crucial for localizing the SDGs and climate commitments and will thus be an important feature of this platform. The proposed platform also aims to embrace traditional and indigenous knowledge, which the current wealth of K&D fails to do, and thus excludes important worldviews and lived experiences when developing policies. Stakeholders, including the public and private sectors, academics, and civil society, must be involved for a balanced representation and inclusion across gender, age, and diversity. It would help bridge gaps in data and literature, offering context-specific insights. Moreover, by consolidating evidence from the field, the ambition of this global platform is to contribute to the current debate on the reform of the global financial architecture by demonstrating the promises of synergistic approaches and encouraging investors to finance such policies by revealing the multiple co-benefits these can achieve.

The platform would be easily accessible to policymakers, practitioners, and everyone interested, structured as a hub, and overseen by a range of actors and collaborators that conduct the sensitive tasks of contributing data and undertaking quality control in the selection of data through a review process. The platform will

present data in easily readable charts, graphs, and maps, as well as visuals as much as possible to help users see, understand, and interact with the data regardless of their level of expertise. An interactive global map locating some of the best practices and case studies in the world would also be a primary feature of the platform to make the data more accessible and usable by policymakers and other stakeholders while ensuring that the data presented is comprehensive by accounting for the local context where it is generated from (see Figure A1 as an example).

II. Towards more **vulnerability, justice, and inclusionary data for assessing distributional impacts and future synergies**

There is a crucial need for framing knowledge and data in a way that includes consideration of vulnerability, justice, and inclusion to promote universal social well-being and welfare for a just transition. In the context of climate justice, there is also a need to ensure that the progress measured through development and climate actions is compared against potential losses and damages. These gaps contribute to the lack of consideration of the distributional impacts of policies and are particularly pronounced for synergies between, for example, adaptation, safeguarding biodiversity, and social welfare. Addressing these can be done, for example, by gathering data on social dimensions using citizen science, natural language processing (NLP), and text mining/literature analysis as well as using composite indices, especially for addressing the economic vulnerabilities of the countries of the Global South. Beyond the conceptual shift to recognize the importance of distributional impacts, we need robust tools to describe and, ideally, anticipate them. To describe distributional impacts, different indicators characterizing distributions can be used, such as those that focus on distribution tails, using a library of indicators, rather than one. To anticipate distributional impacts, agent-based modeling can emerge as a powerful modeling approach. Currently, it is often difficult to assess future synergies due to a lack of data and historical precedents, and such assessments often need to present their theory of change based on indirect evidence. K&D generation can also contribute to a climate resilience atlas to understand the impacts of a changing climate on physical risk, exposure, the sensitivity of local economies, and social and administrative adaptive capacity to ensure that future potential synergies come to manifest even under a changing climate.

III. Towards more **appropriate and policy-relevant tools, methods, and approaches**

As we have seen, a key K&D gap is not the lack of tools and methods at hand to assess interactions between climate and SDG policies but rather the multiplicity of them. While scenario analysis and quantitative modeling make for important tools for national sustainable development and climate action implementation plans, each tool may offer different advantages according to the kind of outputs they produce. Overall, the appropriateness of the tool or method depends on which stage of the policy phase it can effectively contribute to, and how embedded it is in policymaking to compare policy options and produce outputs that are applicable and relevant. Therefore, generally, while tools and methods need to be dynamic to project change over time as well as being transferable, accessible, and offer transparency in terms of model architecture and applications, a balance needs to be achieved between the accessibility and ease of use of tools and methods for policymakers and practitioners, and their relevant sophistication, which may affect usability.

Because we currently lack reliable and long enough data series, prioritization should be on methods and approaches that focus on specific cases, locations, and contexts to derive insights, rather than statistical methods that rely on data across the board. Methods and tools also need to have more enhanced flexibility and adaptability to the diverse contexts of the Global North and South countries to assist in the pursuit of their climate targets and 2030 Agenda.

Moreover, the focus should be on the use of methods that combine quantitative and qualitative analyses as well as knowledge co-creation, such as integrated assessment models combined with expert elicitation or qualitative literature analyses or local and indigenous knowledge, to fully understand the effects of climate and SDG interactions (Pradhan, 2023).

At the international level, nations can be incentivized to pursue synergies by developing SDG rating tools or indicators against climate interventions, or *vice versa*, to run a categorization of countries in their successful utilization of synergistic approaches, similar to the World Bank's categorization of countries according to their national economies. These indicators or tools can be used to 'graduate' countries as they move on to pursue more synergistic efforts.

IV. Towards **utilizing AI for knowledge management at the interface of climate change and SDGs**

Artificial intelligence tools can provide rapid access to knowledge, and in principle be tailored to providing knowledge on sustainability and climate action (Thulke *et al.,* 2024). However, the design of underlying data and the functioning of tools are subject to bias and errors and require quality control.

Recent research (Debnath *et al.,* 2023) explores the integration of AI with human intelligence to address climate change and support Sustainable Development Goals (SDGs). It emphasizes the critical need for designing AI systems that are less biased and more trustworthy by embedding human knowledge and perspectives into the AI development process. According to the paper, AI can contribute to a "*planetary epistemic web,*" a comprehensive knowledge network that supports climate action by integrating diverse and context-specific knowledge. By enhancing mitigation and adaptation strategies through better-informed predictions about environmental changes and focusing on social tipping points, AI can play a pivotal role in combating climate change. An attempt to organize the overall case study literature on climate change mitigation and cities according to different types of cities indicates the potential of combining big literature and big data tools (Lamb *et al.*, 2019; see also "*Leveraging Synergies between Climate and the Sustainable Development Goals in Cities: Entry Points, Sectoral Actions and Governance Enablers*"). However, the fairness of AI systems is critical – they must be built on diverse, representative pre-training datasets to avoid data injustices and biases.

Current AI systems are often trained on biased datasets, leading to unreliable and unjust outcomes. Addressing these biases is essential for effective climate action. Incorporating human feedback into AI systems, for example, through reinforcement learning, helps correct biases, improve interpretability, and align AI outputs with human values and knowledge. A less biased AI should leverage an epistemic web of interconnected knowledge domains, including social, semiotic, and semantic networks, to ensure that AI systems reflect the complex, intertwined dimensions of human knowledge.

Engaging diverse groups in the AI development process helps capture a wide range of perspectives and reduces biases. Ensuring AI systems are transparent and accountable is essential for gaining public trust and making informed decisions for climate action. Developing inclusive datasets that represent various demographics, including marginalized communities, is necessary for creating fair and effective AI systems.

Overall, co-creating AI systems with human input ensures they are less biased, more accountable, and better suited to addressing complex global challenges like climate change. This human-in-the-loop approach not only improves the trustworthiness of AI but also aligns it with the ethical and justice-oriented goals necessary for achieving SDGs and planetary health. The integration of AI and human intelligence, supported by an epistemic web, provides a robust framework for informed decision-making and effective climate action, ultimately contributing to a more sustainable and equitable world.

V. Towards a **better assessment of investment risks and returns**

One of the greatest barriers to the uptake of synergies is the lack of evidence on the economic need to pursue integrated climate and SDG action. There is an inadequate understanding of the risks and benefits of synergistic action due to the co-existence of both co-benefits and trade-offs between climate and sustainable development actions. The relationship between climate and development finance is also not well understood. Specifically, it is unclear how much their combined efforts could reduce the financing gaps for individual SDGs and climate action, as well as whether their co-benefits will have positive or negative spillover effects that could further influence the need for investment. Therefore, future K&D will have the crucial role of revealing incentives for both public and private investors by addressing knowledge gaps in the value of SDGs and associated co-benefits of different green investments. Importantly, it will highlight how climate and SDG action may lower the need for biodiversity investment, how physical and transition risks for green investments change after incorporating co-benefits across SDGs, and how adaptation investment may affect development and welfare.

VI. Towards the **contextualization of synergies through local capacity building and collaboration**

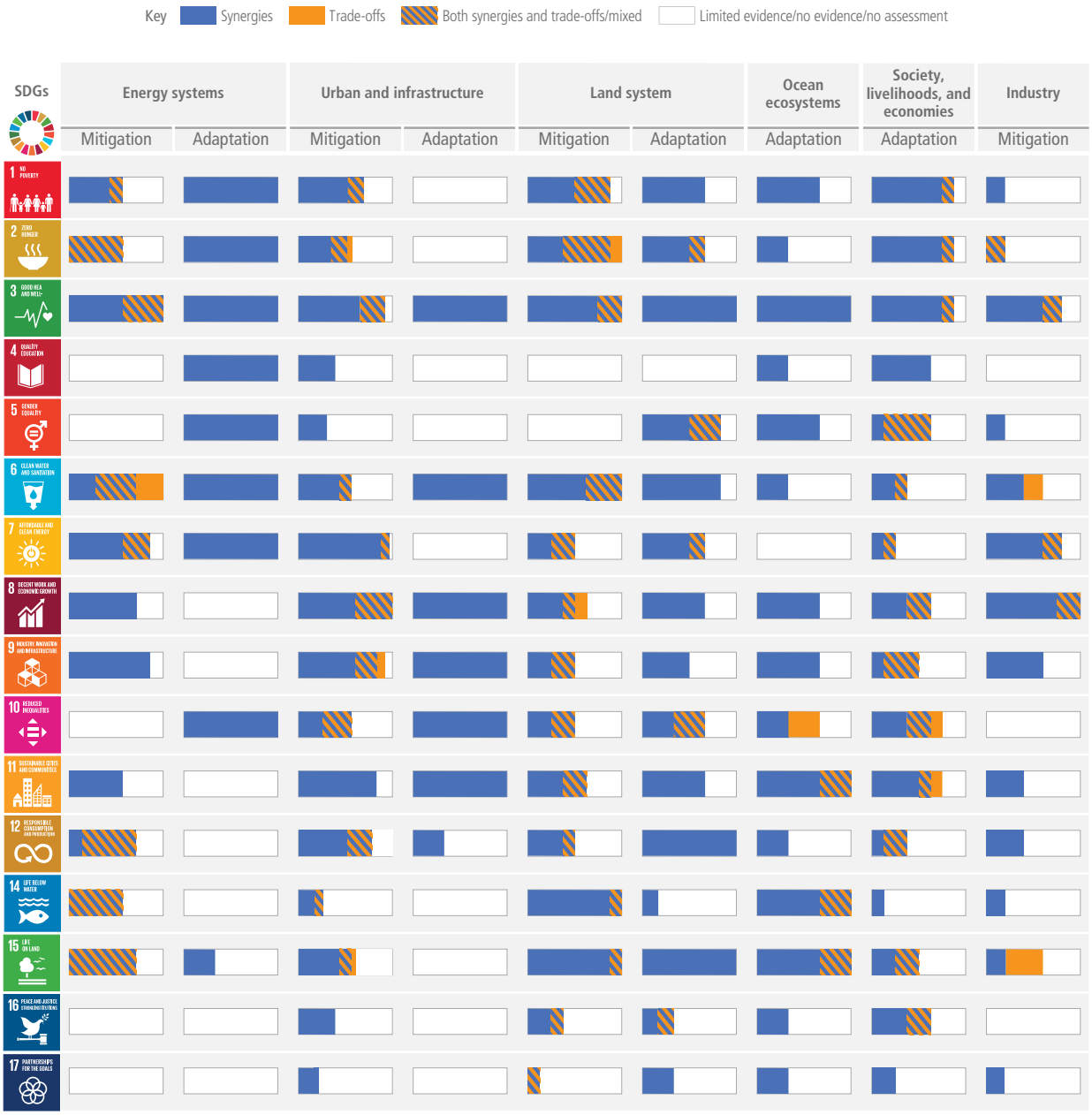
There is a globally recognized need to contextualize the progress and impacts of the 2030 Agenda and climate action at the local level. Top-down strategies that aim to implement universal methods and strategies in various nations and areas hinder the localization of climate change and development issues, which are frequently formed by local circumstances and handled by local resources. To address the localization of climate and development challenges, multidisciplinary and systems approaches, as well as multi-stakeholder groups and processes, must be adopted. These require awareness, commitment, and capacity — qualities that are not always present in many nations, especially those in the Global South. Research institutions should create incentives and support structures to encourage interdisciplinary research, breaking down traditional disciplinary barriers by offering grants, awards, and recognition for interdisciplinary work. Knowledge exchange should be fostered through platforms and networks that facilitate collaboration among diverse knowledge communities, including traditional and non-expert knowledge holders. Furthermore, international institutions involved in evidence assessment and synthesis should organize their work around specific SDGs and climate targets, leveraging the expertise of various organizations to address the crosscutting nature of SDG challenges effectively.

Future K&D needs to contribute to the bottom-up framing of development and climate targets by exploring which specific developmental actions reduce/increase emissions and improve/lower adaptive capacity, to introduce policymakers and practitioners to sustainable pathways and synergies through various entry points relevant to them and according to national priorities and local socioeconomic and political context. At the same time, local-level analytical capabilities also need to be built for normative and instrumental reasons to drive investments in the 2030 Agenda and Paris Agreement. In addition, knowledge co-production, and local perspectives, particularly at the subnational level, are also important for understanding and addressing synergies between SDGs and climate action. Indeed, greater inclusivity, social ownership, and more ambitious outcomes in climate and sustainable development action can only be achieved through greater stakeholder engagement.

VII. Towards **more ambitious NDCs, policies, and knowledge that are cognizant of synergies**

The outcome of the first Global Stocktake (GST) (UNFCCC, 2023) called upon countries to scale up their ambition and level of implementation of NDCs, center them around the synergies between the Paris Agreement and the 2030 Agenda and report back at COP 30. Indeed, as economy-wide approaches no longer necessarily improve the quality of NDCs, making synergistic action part of the reporting requirement for NDCs may be an effective way to achieve these greater levels of ambition and implementation. At the same time, the upcoming HLPF and the Summit for the Future present good opportunities to spearhead efforts toward climate and sustainable development synergies, by, for example, integrating climate considerations in the 2030 Agenda. Moreover, the upcoming Seventh Assessment Report (AR7) of the Intergovernmental Panel on Climate Change (IPCC) can influence the policy sphere by explicitly considering the climate and sustainable development synergies through, for example, a dedicated chapter in the special report on cities and the reports by Working Groups II and III, which focus on impacts, adaptation, and vulnerability, and the mitigation of climate change respectively. This is not the first time IPCC will be focusing on synergies – the AR6 also explored the potential synergies and trade-offs between a range of climate change mitigation and adaptation options and the SDGs (see Figure 7). Finally, financing processes should also consider trade-offs and synergies of climate and SDG actions, as is the case with the Green Climate Fund's sustainable development criteria.

FIGURE 7. Potential synergies and trade-offs between the portfolio of climate change mitigation and adaptation options and the Sustainable Development Goals (SDGs). This figure presents a high-level summary of potential synergies and trade-offs based on the qualitative and quantitative assessment of each individual mitigation or option.



Source: IPCC, 2023.

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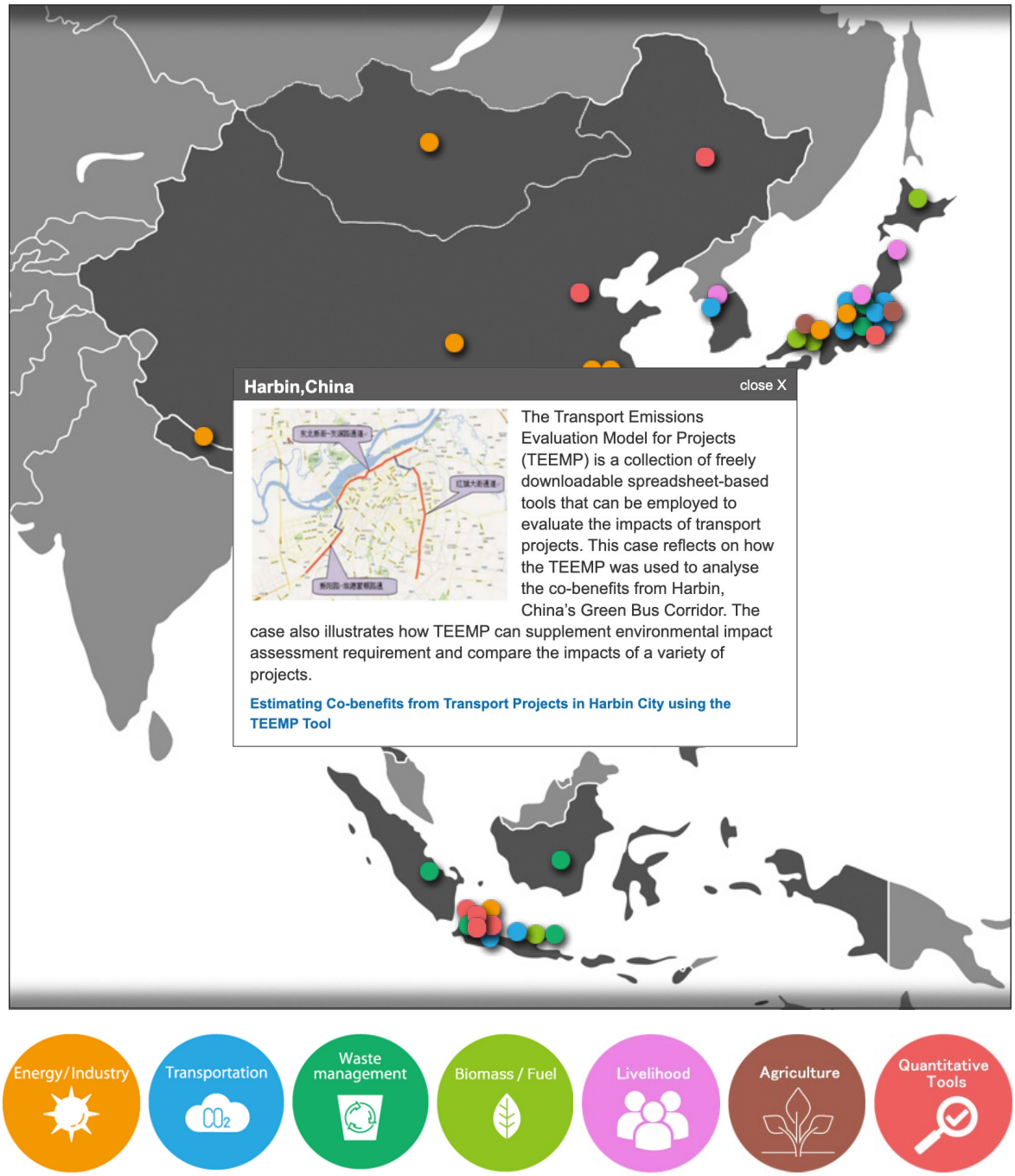
Appendix

TABLE A1. An example of a map from an interactive platform that illustrates some of the best practices in the Asian region in terms of policies, programs, and/or practices that utilize the advantages of co-benefits.



Source: https://cobenefit.org/good_practice/

TABLE A1. An example of a map from an interactive platform that illustrates some of the best practices in the Asian region in terms of policies, programs, and/or practices that utilize the advantages of co-benefits.

Model	Main Target	Scope	Scale	Ease of Use	Potential Outcome(s)
GAINS Model	Economy-wide with key technologies	• Explore cost-effective emission control strategies • Air pollution, climate and health	Local and global	Technically challenging but can be learned with training and instructions	Provides evaluation of cost-effective emission controls and assessments of multiple climate, air pollution and health benefits
LEAP Model	Economy-wide with key technologies	Air pollution, climate and health	Chiefly national (though potential for local)	Moderately challenging but can be learned with training and instructions	Provides assessments of multiple climate, air pollution and health benefits
The Transport Emissions Evaluation Models for Projects (TEEMP)	Transport	Environmental impacts of transportation	City-wide analysis	Excel-based tool suite that is relatively accessible and user-friendly	Evaluating air pollution and CO_2 reductions from transportation projects
International Vehicle Emissions (IVE) Model	Transport	Estimate emissions from motor vehicles for different technologies	City and regional levels	Technically challenging but can be learned with training and instructions	Provides control strategies and transportation planning
ICCT's Roadmap model	Transport	Covers on-road vehicle activity in over 190 countries	Global	User-friendly and offers customization options	Provides trends in the transportation sector
Simple Interactive Models for better air quality (SIM-air)	Air Pollution	Simulation of interactions between emissions, pollution dispersion, impacts	Local to national	Can be integrated into Excel, can provide a familiar and user-friendly interface	Provides assessment of air pollution and its impacts
Emission Quantification Tool for Solid Waste Management	Waste management	Waste reduction, air pollution, greenhouse gases (GHGs)	Local to national	Moderately challenging but can be learned with training and instructions	Provides assessment of multiple benefits from sustainable waste management
GHG Protocol for Cities	Climate (with possible extensions to air pollution)	GPC provides a comprehensive framework for cities on emissions	City to global	GPC offers a globally accepted and transparent framework for identifying, calculating, and reporting GHG emissions.	GPC provides effective insights for cities to fight against climate change
Household Air Pollution Intervention Tool (HAPIT III)	Residential energy (cookstoves)	Household air pollution and health	Household technology	Moderately challenging but can be learned with training and instructions	Assesses possible health impacts of interventions designed to lower exposure to household air pollution
CDM SD Tool	Climate mitigation projects	Multiple sectors	Project to program of activity	Relatively straightforward qualitive assessment	Assesses multiple sustainable development impacts

TABLE A2. Review of Co-Benefit Modelling Studies

Type of policy/sectoral focus	Health benefits	Environmental benefits	Socioeconomic benefits	Climate benefits	Source(s)
Climate Change					
Global/regional climate policies (based on IPCC scenarios)	• Reductions in premature mortality and morbidity			• Achievement of Paris Agreement targets	Markandya *et al.,* 2018; Shindell *et al.,* 2017
National climate policies **NDCs or medium-term mitigation strategies** **Integrated national level air pollution and climate policies**	• Reductions in premature mortality and morbidity	• Reductions in multiple air pollutants (PM and ozone) leading to improvements in air quality	• Reductions in fossil fuel dependencies • Creation of green jobs (in the renewable energy sector) • Improvements in energy security	• Achievement of NDC targets	Li, *et al.,* 2018; New ClimateInstitute 2015d, 2016, 2015b, 2015c, 2015a
Subnational climate policies **Carbon tax/fee** **Low carbon plans** **Technology promotion policies** **Structural changes to city's economy**	• Reductions in premature mortality and morbidity (including disability adjusted life years (DALY)) • Reduction in non-communicable diseases	• Reductions in air pollutants (PM, SO2 and NOx) leading to improvements in air quality	• Creation of green jobs • Improvements in infrastructure and land use • Reductions in health care expenditures	• Achievement of subnational climate targets	Buonocore *et al.* 2018; Liu *et al.* 2018; Jiang, *et al.,* 2017
Climate finance projects (in multiple sectors)	• Reductions in premature mortality and morbidity	• Reductions in multiple forms of pollution	• Reductions in time spent in traffic • Improvements in educational opportunities and outcomes	• Reductions in CO_2	ADB 2017
Energy					
Clean energy policies	• Reductions in premature mortality and morbidity	• Reductions in multiple air pollutants		• Reductions in CO_2	Tham, *et al.,* 2015; Mir *et al.,* 2022
Energy efficiency policies (often in heavy industries such as cement or steel)		• Significant reductions in air pollutants (PM, SO2 and NOx) leading to air quality improvements		• Significant reductions in CO2 or CO_2eq	Zhang, *et al.,* 2014; Zhang, *et al.,* 2015; Thema *et al.,* 2019
Wastewater and waste management					
Wastewater or waste to energy policies/ Project using natural ecosystems to help treat wastewater	• Reductions in premature mortality and morbidity	• Reductions in land pressures • Reductions in multiple air pollutants • Reductions in energy use	• Increases in access to energy resource (biogas) (especially for rural communities)	• Modest reductions in GHGs (from the reuse of methane for energy)	Islam 2018; Laramee, Tilmans, and Davis 2018; Hagen *et al.* 2017
Waste management/ 3Rs policies (Recycling of home appliances)			• Increases in reutilization rates of waste • Reductions in landfill costs • Increases in land for other productive purposes	• Modest to significant reductions in GHGs	Rashidi, et al., 2017; Menikpura, Santo, and Hotta 2014; Challcharoenwattana and Pharino 2015; Mittal *et al.* 2017

Type of policy/sectoral focus	Health benefits	Environmental benefits	Socioeconomic benefits	Climate benefits	Source(s)
Buildings/Infrastructure					
Low carbon/ green/ sustainable buildings policies		• Reductions in strains on the energy system (from improving energy use intensity)	• Reductions in energy costs	• Modest reductions in GHGs (not quantified)	Balaban and de Puppim Oliveira 2017; MacNaughton *et al.,* 2018; Bray *et al.,* 2017; Jennings *et al.,* 2019; Chatterjee & Ürge-Vorsatz, 2021
Transport					
Improvements in vehicle technologies **Shifting to public transport** **More active lifestyles** **Changes in urban design** **Reliance on information and communication systems**	• Reductions in premature mortality and morbidity (including disability adjusted life years (DALY)) • Lives saved due to reductions in cardiac disease, diabetes, cancer, and respiratory disease.	• Significant reductions in multiple pollutants (PM2.5 and NOx) • Improvements in air quality	• Reductions in oil demand • Reductions in travel times by lowering urban congestion • Creation of jobs (in transportation sector)	• Modest reductions in GHGs	Rashidi, 2017; Xia, 2015; Dhar and Shukla 2015; Mittal *et al.* 2017; Pathak and Shukla 2016; Chapman *et al.,* 2018; Clean Air Fund, 2022a
Food/lifestyle					
Policies promoting healthier diets and lifestyles	• Reductions in premature mortality and morbidity (including disability adjusted life years (DALY)) • Reductions in other diseases		• Healthier and more active lifestyles (with varying units of measurement)	• Reductions in CO_2 from moving and growing food • Reductions in methane from avoided decomposition in landfill or open dump	Chan *et al.* 2017; Quam *et al.* 2017
Replace solid fuels with cleaner energy sources using cook stoves		• Reduce indoor air pollution	• Women's time management • Improve household diets	• Modest to significant reductions in GHGs	Anderman *et al.* 2015; Clean Air Fund, 2022a; Mazorra *et al.,* 2020

About the Expert Group on Climate and SDG Synergy

Co-conveners

United Nations | Department of Economic and Social Affairs

United Nations Framework Convention on Climate Change

The report is part of the series of four Thematic Reports contributing to the final, Synthesis Report, which together constitutes the 2024 edition of the Global Report on Climate and SDG Synergy led by the Expert Group on Climate and SDG Synergy. Co-convened by the United Nations Department of Economic and Social Affairs (UNDESA) and the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat in May 2023, the Group consists of 14 renowned experts from diverse thematic and geographic backgrounds. Its task is to provide up-to-date analysis and recommendations based on scientific evidence and innovative approaches on how to tackle climate and SDG action in synergy. The Group is composed as follows:

Co-leads

- **Luis Gomez Echeverri** (Colombia) International Institute for Applied Systems Analysis (IIASA)
- **Heide Hackmann** (South Africa) Future Africa, University of Pretoria

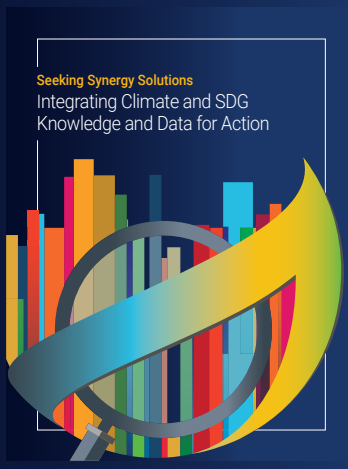
Members

- **Barbara Buchner** (Austria) Climate Policy Initiative
- **Mercedes Bustamante** (Chile) University of Brasilia
- **Felix Creutzig** (Germany) Technical University of Berlin
- **Meagan Fallone** (New Zealand) Step Up Advisers, Ltd. and CARE,
- **Kaveh Guilanpour** (United Kingdom) Center for Climate and Energy Solutions (C2ES)
- **Ma Jun** (China) Institute of Public and Environmental Affairs (IPE)
- **Måns Nilsson** (Sweden) Stockholm Environment Institute (SEI)
- **Tulullah Oni** (United Kingdom/Nigeria) University of Cambridge and UrbanBetter
- **Youba Sokona** (Mali) Former Vice Chair of Intergovernmental Panel on Climate Change (IPCC)
- **Soumya Swaminathan** (India) M S Swaminathan Research Foundation
- **Kazuhiko Takeuchi** (Japan) Institute for Global Environmental Strategies (IGES)
- **Diana Urge-Vorsatz** (Hungary) Central European University (CEU) and Vice Chair of IPCC

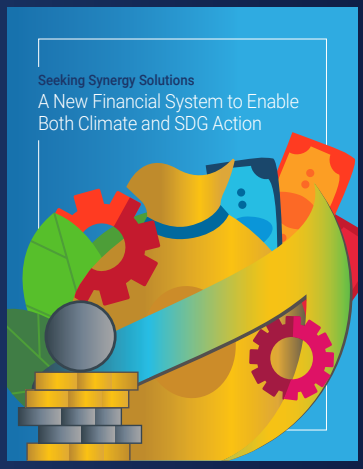
2024 Climate and SDG Synergy Expert Group Thematic Report Series

For more information, please visit
Climate and SDG Synergy website

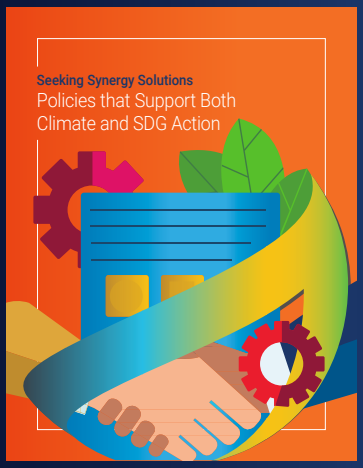
Thematic Reports series



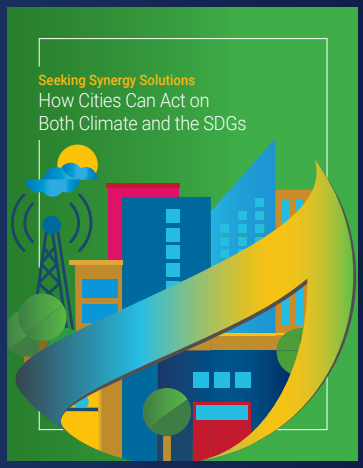
Seeking Synergy Solutions – Integrating Climate and SDG Knowledge and Data for Action



Seeking Synergy Solutions – A New Financial System to Enable Both Climate and SDG Action



Seeking Synergy Solutions – Policies that Support Both Climate and SDG Action



Seeking Synergy Solutions – How Cities Can Act on Both Climate and SDGs