



CLIMATE ACTION EDITION 2022

A photograph of five children standing on a large, rusted metal boat that is beached on a cracked, dry, and cracked surface. The children are looking towards the right. The background shows a sunset or sunrise with a warm orange glow over a body of water and some distant structures.

Ideas into action

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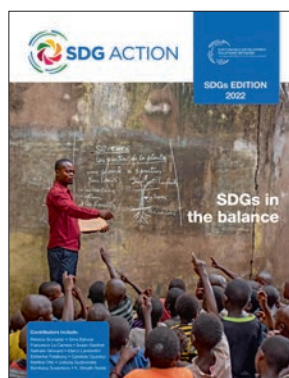
SDG Action was launched in 2021 by the UN Sustainable Development Solutions Network (SDSN) to support the UN's Decade of Action.

A resource for sustainability practitioners in all sectors, it brings timely analysis of the most pressing challenges. Its emphasis is on identifying opportunities and providing tangible ways to accelerate progress.

The website (www.sdg-action.org) features articles from world-leading experts on all aspects of the Sustainable Development Goals (SDGs) and climate action.

Two print editions are released annually, to coincide with major global diplomacy events. These editions provide a framework to understand the complex interdependencies between the SDGs, highlight priorities and dilemmas, and suggest ways to make the greatest impact, fast. The print editions are carbon-neutral and sustainably produced. The carbon emissions generated in manufacturing the paper, and printing and distributing the publications are offset. The paper used is PEFC certified from sustainable sources.

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The world cannot wait

COP27 is “the number one litmus test” of how seriously the world takes the toll on countries that suffer most from climate change, according to the UN Secretary-General. November’s summit must finally make good on promises to deliver climate action that ensures a sustainable future for all



◀ Sylhet, Bangladesh. Four million people were stranded by the recent flash floods in north-eastern Bangladesh. Two fifths of the world's population are already highly vulnerable to the negative impacts of climate change

impacts of climate change – no longer a distant threat but happening now. In 2021 alone, extreme weather driven by climate change caused over USD 170 billion in damages.

When it comes to sustainable development, in some ways the world is in a worse situation than seven years ago when the UN announced the Sustainable Development Goals (SDGs) for 2030. For example: in 2022, in light of increased global prices, the World Bank increased the extreme poverty line to USD 2.15 per person per day, up from USD 1.90. This means that more people will now qualify as extremely poor who weren't considered so before.

On top of this, countries and communities like those in Africa that have done the least to contribute to the climate crisis are being affected first, worst, and with least resources to adapt. Africa contributes no more than 3% of global emissions. Small island developing states (SIDS) contribute less than 1%. Yet these nations suffer the most.

Most African countries need to spend up to five times more on adapting to the negative impacts of climate change than they do on healthcare. According to reports by Tearfund, 11 vulnerable countries (Eritrea, Madagascar, Mauritania, Cameroon, Cape Verde, Chad, DRC, Sudan, Mali, Ethiopia, and Republic of Congo) are spending up to 22% of gross domestic product to adapt.

At the same time, the adaptation and resilience needs of least developed countries, SIDS, and Africa are growing, as the frequency and severity of natural disasters worsen. Such countries are also struggling under national debt burdens. Meanwhile,

their access to capital markets to build their adaptive capacity and resilience to future climate impacts and to protect development gains are contracting.

Despite the urgency of the situation, a core tenet of the SDGs – that they are interconnected and mutually reinforcing – is being overlooked, particularly when it comes to climate action. A reductionist approach continues to be adopted that reduces sustainability to climate action, and climate action to only mean decarbonization.

When talking about effective climate action, the conversation is often only about Goal 13, rather than considering the other SDGs. As a result, some developed countries focus on greenhouse gas emissions alone rather than also helping developing nations transition to renewable energy sources in a just and equitable manner or build adaptive capacity and resilience to the ongoing negative effects of climate change, which would require investment and advanced technologies.

Such an approach is unsustainable and needs to change. Instead, an approach must be adopted to deliver all aspects of climate action, ensure a managed, financed, and just transition, and deliver sustainable development outcomes. This is particularly true for communities and countries that are facing the worst effects of climate change despite having done the least to cause the problem.

As the UN Climate Change High-Level Champion for COP27, it is my conviction that there are five priorities that should guide climate action:

1. Taking a holistic approach

First, the urgency and the complexity of the climate crisis – and the increasing challenges facing the world, from inequity to biodiversity loss – demand actions of unprecedented depth and scale. A holistic approach must be adopted that places the world on a low-carbon and climate-resilient development pathway. Such

By Mahmoud Mohieldin,
UN High-Level Climate Action
Champion of Egypt, COP27

This year has been one of uncertainty and challenge. The world is still dealing with and reeling from the effects of:

- the COVID-19 pandemic
- global conflicts and crises
- increasing food and energy prices
- challenges in access to clean energy, particularly in Africa
- financial constraints
- the threat of an economic recession

Two fifths of the world's population are highly vulnerable to the negative

an approach must consider the provision and mobilization of finance, adaptation, losses, and damages, alongside mitigation.

From a developing country perspective, it should also consider the full context of the sustainable development agenda, such as poverty eradication, addressing hunger, increasing employment, and advancing gender empowerment. This is why the Climate Champions have prioritized the Race to Resilience campaign. This puts people at the heart of our work, with a goal of increasing the adaptive capacity and resilience for four billion people by 2030.

This is also why, during Climate Week New York 2022, the Champions launched the Adaptation and Resilience Breakthroughs. These Breakthroughs, which define common solutions and outcome targets, will accelerate adaptation action and increase resilience to climate hazards, such as floods, droughts, and lethal heat. These solutions cover food and agriculture, oceans, water, human settlements, and infrastructure systems.

2. Implementation

Second, COPs must shift from pledges and promises to implementation and investments. Operationalizing, projectizing, and action should become the key performance indicators for the success of COP27 and the following COPs.

3. Regionalization

Third, climate action must be regionalized. On the road to COP27, the incoming Egyptian Presidency of COP27, the UN Five Regional Commissions, and the UN Climate Change High-Level Champions launched a series of five regional forums on “Climate Initiatives to Finance Climate Action and the SDGs.” These forums bring together key stakeholders from public and private sectors. The aim is to scale up investment and finance to deliver on climate ambition and development

goals, and build momentum towards Sharm el-Sheikh and beyond.

The five regional forums contribute to the implementation priority through facilitating engagement with a broad set of partners and stakeholders. The goal is to accelerate public and private investment in concrete initiatives and projects in climate mitigation and adaptation in line with the SDGs. Several ready-to-be-financed mitigation and adaptation projects were presented at the recent African, Asia-Pacific, Latin American–Caribbean and Arab regional forums.

The process of project preparation and building the narrative of Champion projects ready to be funded will continue up to – and after – COP27.

4. Localization

Fourth, climate action must be localized and people centric. For that purpose, the Egyptian Government has launched the National Initiative for Green Smart Projects to implement climate action, again in a holistic manner, at the local grassroots level.

In each of the 27 governorates of Egypt, the best green and smart projects will be chosen in six categories. These projects will then take part in a national competition in October, in the presence of national and international organizations from the private sector, financial sector, and development institutions. A specialized jury will choose the winning 18 projects, which will be showcased at COP27.

The initiative will develop a comprehensive and localized investment map of sustainable green and smart climate solutions, through a bottom-up approach, in all the governorates of Egypt.

5. Finance

Last, but of utmost importance, is finance. We must ensure a just transition that also considers historically low emissions and development aspirations. It has been estimated that an increase of at least 590% in annual climate finance is

required to meet all internationally agreed climate objectives by 2030 and to avoid the most dangerous impacts of climate change.

The United Nations Environment Programme (UNEP) estimates that annual adaptation costs in developing countries will be USD 115 to 330 billion by 2030. Of the USD 29.5 billion annual climate finance committed to Africa in 2019 and 2020, only 39% – USD 11.4 billion – was targeted at adaptation activities. Only 3% came from the private sector.

For finance to be truly centered at COP27 we need to see investment in green growth, protecting the necessary natural resources, enhancing circularity, and promoting equity. Overall, seven challenges must be met:

1. The promised USD 100 billion must be fulfilled and scaled up.
2. We need to see more investments and not debt.
3. The private sector must invest more, with public finance utilized to de-risk investment in adaptation and mitigation.
4. We need more innovation in financial instruments and structures such as debt swaps and the reduction of sovereign debt.
5. Carbon markets must be established, particularly in developing countries.
6. Standards must be set for finance, and the very real concern of greenwashing addressed.
7. Budgets need to embed SDGs and climate action at their core.

Conclusion

It is imperative that the world does not look back in 50 or 100 years and realize that we had the chance but failed to deliver on climate action and enhance sustainable development. COP27 can shift the dial. But it needs everyone – governments, states, regions, cities, business, financial institutions, and others – to act with holistic, SDG-aligned action in mind, in collaboration with each other – and above all with ambition. ■



Ideas into action

At this mid-point to the 2030 deadline, it's clear that action must ramp up massively if the SDGs are to be realized and climate catastrophe averted. Initiatives such as the UN SDSN Global Climate Hub can help get governments back on track

By [Phoebe Koundouri](#), Director, ReSEES Research Laboratory, Athens University of Economics and Business; Co-chair, UN Sustainable Development Solutions Network (SDSN), Europe; Chair, SDSN Global Climate Hub; and [Ebun Akinsete](#), Head, Department of Stakeholder Analysis and Decision Support Systems, International Centre for Research on the Environment and the Economy

The year 2015 saw the birth of Agenda 2030 and the Sustainable Development Goals (SDGs).

Seven years later, as the global agenda approaches the halfway point to its 2030 horizon, it is looking less and less likely that the SDG targets will be achieved globally within the allotted timeframe.

In the aftermath of the COVID-19 pandemic and multiple geopolitical crises, 2022 marks the second year in a row without any progress being

▲ **Workers at the Aurora Wind Farm, one of the largest in Chile, with an installed capacity of 129 MW**

made on the SDGs. Some countries are even witnessing a regression on achievement against the SDGs on poverty and economic growth, as well as on inclusiveness and environmental quality.

As things stand, achieving the SDGs by 2030 seems out of reach. Experts suggest it will be impossible to attain the Goals with the current rate of investment, and that things need to change. Some predictions, like those in the Social Progress Index, put the timeline on achieving the SDGs as late as 2092. Drastic action is needed to get the world back on track, including:

- integrating the SDGs across business
- developing a global plan to finance the SDGs
- leveraging post-pandemic data innovations and novel partnerships
- crucially, recognizing how the SDGs work as an indivisible system
- looking for cross-sectoral synergies using the six SDG Transformations as a foundational framework

Since its launch in 2021 as part of the UN's Decade of Action, SDG

Action has aimed to encourage cross-sector dialogue and problem-solving to accelerate the transition to sustainability and the achievement of the SDGs. As a natural progression to this “Action,” the UN SDSN Global Climate Hub (GCH) has been launched to support governments in their journey towards achieving their SDG targets. The hub provides an advisory service backed by state-of-the-art science and technology from leading minds in the fields of climate, data and informatics, innovation, economics and finance, policy, health, stakeholder engagement, and nexus thinking.

The GCH is an SDSN Thematic Network that includes the expertise and talent of individuals and members of the SDSN Network. It aims to provide science-based recommendations for combating the climate crisis and preventing further deterioration. It does this by developing and implementing

country-specific action plans. These include solution pathways that incorporate:

- existing technologies
- the circular economy
- nature-based solutions
- digitalization
- commercializing innovation
- sustainable finance and adaptation investment schemes
- policy reforms

The GCH goes beyond traditional modeling by adopting a holistic, multi-module approach that integrates various sector-specific models and SDSN data sets using a combination of quantitative and qualitative methodologies. It utilizes a system dynamics framework to address not only adaptation but also mitigation in the context of the six SDG Transformations to generate technical, financial, and policy solutions.



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The GCH is made up of nine thematic units (see below) that work synchronously to provide a holistic overview of multi-scale phenomena. Together, they take into consideration the biophysical aspects of sustainability including environmental variables, climate models, nature, and biodiversity. They also consider the anthropocentric dimensions, such as governance, human sentiment, equity, physical and mental well-being, and social health.

1. The Climate Data Platforms and Digital Applications Unit aims to aggregate, connect, and visualize data relevant for all units of the GCH to better understand the science, technology, and innovation landscape in the context of the SDGs. The aim is to monitor and enhance policies, practices, and uptake while identifying efforts to build synergies.
2. The Atmospheric Physics and Climatology Unit will focus on analyzing global and regional climate trends, extreme events, and their impact at various timescales, to develop adaptation and mitigation strategies.
3. Building on this work, the Climate and Energy Systems Modeling Unit will use system dynamics and stochastic modeling techniques to develop decarbonization pathways of the energy system at the national level. It will utilize scenarios that take into consideration energy supply, demand, greenhouse gas emissions, and various climate solutions.
4. The Climate, Land Use, Water-Food-Energy-Biodiversity Nexus Modeling Unit (working with unit 3) will consider the relevance of land use dynamics and changes in land use and water management on various scales (from continents to river basins). It will assess the effect of these dynamics on climate change

by translating them to an associated temperature increase.

5. The Climate and Health Unit will build microclimate health assessment tools that include integrated statistical models to provide correlations between health and climate. This will support knowledge generation to facilitate the reduction of the negative effects of climate change on health.
6. The Innovation Acceleration for Climate Neutrality and Resilience Unit aims to bring together the disruptive technologies and breakthrough social innovations from the EIT Climate-KIC Hub in Greece,

a holistic perspective. They will co-develop innovation pathways (technological, social, financial, and policy) that are appropriate and fit for purpose within the local context.

9. Finally, underpinning the activities of all the other units is the Training, Upskilling and Reskilling Unit. This aims to support the green transition by educating and training people and building skills ecosystems aligned with national, regional, local, and sectoral green strategies. Its educational programs will be delivered under six themes corresponding to the six SDG Transformations.

Experts suggest it will be impossible to attain the Goals with the current rate of investment... Some predictions put the timeline on achieving the SDGs as late as 2092. Drastic action is needed

the MENA Maritime Accelerator, and BRIGAD Connect. It will support the pathways identified within the other units and accelerate the transition to a green economy and society.

7. Complementary to the innovation unit, the Just Transition: Policies, Finance, Labor Market Unit seeks to drive socially fair, high-level, political engagement structured around the six SDG Transformations. It will identify and promote global adaptation pathways that include everyone and leave no one behind – applying these pathways to all continents at national and subnational level.
8. To achieve this, the Transformative Participatory Approaches: National Living Labs and Systems Innovation Unit will leverage the SDSN's network of stakeholders to convene Living Labs. These will provide an arena for change agents to systematically deep-dive into the national climate change issues from

The GCH will provide a focal point for the global community of climate actors. It will serve to bridge the gap between the models it produces and the non-scientific community to provide useful tools for policymakers. The hub will equip policymakers with the evidence-based support they need to facilitate the development of technological, financial, and policy pathways toward achieving their climate action goals. Through this, it will bring them back on track to attain the SDGs.

This mid-point to 2030 is as good a time as any to take stock and seek fresh inspiration to drive us collectively towards the Global Goals. This edition of SDG Action does just that. It re-imagines what a net-zero future could look like, before examining the global shifts required to bridge the gaps between that future and our present.

Finally, it finishes with a call to action from voices around the globe, to inspire us all to take action now. ■

◀ **Restoring sand dune ecosystems in Madagascar to protect against climate risks. Sand blown in from the coast was making inland areas unfarmable and uninhabitable**



Walking the path ahead

Humanity should survive the decades to come, but will it thrive? A lot depends on how many costs our leaders are willing to pay up front, and how many they will wait to have inflicted upon them

By **Fred Carver**, Consulting Editor, SDG Action

When discussing climate change I am reminded always of James Mason's speech in *The Fall of the Roman Empire*: "I am a teacher, and as a teacher I know that when I have tried to teach the same lesson for a hundred times and still the pupil does not understand, then I am forced to the conclusion that perhaps there's something wrong. Either with the lesson or with the teacher."

Having tried, as so many of us have, far more than 100 times to impress upon the world's political society the urgency and severity of the need for climate action, there is still nothing to indicate that the lesson is wrong. And while I know myself to be an imperfect teacher, no one else seems to have had much success either. Rather, it may be time to suggest a third explanation: the pupil has understood the lesson perfectly – or as much of it as they are ever going to be willing to – and is just playing dumb because it is in their interests to do so.

This suggests that there's not much left to say to try to change their mind.

In some broad senses it is already in any case more-or-less too late. The points of departure necessary to embark upon a dramatically different course for the 21st century are rapidly receding in the rear view mirror. In some crucial ways, humanity has already chosen its path, and now must walk down it.

In time there will be a historical reckoning for this. Several generations made a choice, in full knowledge of the likely consequences, to inflict entirely



◀ A women's cooperative in southern Mauritania, using solar energy to irrigate its market garden. In a region heavily impacted by drought, the solar panels provide resilience, a secure food supply, and a regular income stream

unnecessary suffering upon future generations.

Reading the Intergovernmental Panel on Climate Change's Sixth Assessment Report to determine the extent of the suffering we have chosen provides causes for both comfort and anguish. While there is no certainty and no guarantees, the best and worst-case scenarios of socio-economic pathways look increasingly unlikely. We probably will have ancestors, but those ancestors will probably curse us. Mostly one is struck by the monstrous unfairness of it all: while some impacts of climate change will be felt by all, mostly it will be vulnerable communities in the Global South – those whose historic emissions are lowest – who will pay the price for the actions of those who will be relatively well protected from consequence.

Anger is an understandable response to all of this. As is increased militancy. "It is strange and striking that climate change activists have not committed

any acts of terrorism," said John Lanchester in 2007. Fatalism and despair often follow. All this too is priced into the choice that was made.

But there is an enormous range in the severity of outcomes within even these middle socio-economic pathways. And an enormous diversity in who pays the cost. We can no longer avoid our fate, but we can do an enormous amount to determine how much it hurts, and how evenly the pain is distributed. In place of despair needs to come the making and influencing of critical decisions – decisions in which there are no longer any good options (and thankfully few suicidal options), but nevertheless options that are dramatically better or worse than others. Options that will determine who survives and who thrives in the decades to come.

Invariably these options consist of the question of how much of the cost that must now be borne our political leaders are willing to pay up front, and how much they will wait to have inflicted upon us multiple times over.

Linked to this is the question of who pays: those who have the ability to pay now will often not be those against whom costs will be charged if no payment is made. Climate justice and climate reparations – the case that those who did most to cause climate change should pay most of the costs – is not just a question of fairness or karma. It is about those with the ability to do so – ability earned through the production of carbon – using that ability to spare those without.

The available choices

This issue of SDG Action outlines a number of these choices: the costs of acting, the consequences of inaction.

Jakarta floods every year, and the floods will only get worse. On p65 Triarko Nurlambang discusses what the city is doing and can do to mitigate those floods, and what will happen if it does not.

Rich countries continue to pursue a program of ensuring that the harmful social and environmental impacts of their actions are felt by countries far away from their own. On p49 Guillaume Lafortune and Eamon Drumm trace the consequences of this and the mechanisms for relocating harms.

People are moving, and will increasingly continue to move, as the changing climate alters what parts of the world are habitable, and in what forms. On p46 Julia Blocher and Kira Vinke discuss mechanisms for managing this, and the consequences of not doing so.

In our "Future Zero" section we look at what the choices we make will mean for our future warmer, lower carbon lives with respect to:

- settlements (Maimunah Mohd Sharif, p14)
- jobs (Moustapha Kamal Gueye, p16)
- consumption (Stefanie Hellweg and others, p19)
- global systems (Aromar Revi, p22)
- transport (Christopher Dekki and Alice Yiu, p25)
- cities (Cassie Sutherland, p30)
- trade (Lucie Qian Xia, p32)
- construction (Karen Scrivener, p34)

On p38 Anisha Nazareth and Dayoon Kim directly address the question of who is currently being left behind, in what ways, and why.

For decades the challenge in communicating climate risk has been in balancing urgency with despondency. It wasn't easy and perhaps we didn't always get it right. But while we were doing our best the world warmed up on us and now we have to live with the consequences.

Our choice now is to make the best of that or to make the worst of it. To decide how bad it is going to get and to decide who it is going to get bad for. ■



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Future settlements

As the climate warms, and as behavior and practices shift to mitigate and adapt, what changes will there be to the nature and location of human settlements?

By [Maimunah Mohd Sharif](#), Executive Director, United Nations Human Settlements Programme (UN-Habitat)

Today 4.2 billion people live in cities, and this number is growing by 1.5 million people every week. This increases the challenges faced by city managers. Lack of affordable housing, inadequate green and open public

spaces, climate disasters, and conflicts are threatening our urban future. If we do not rethink the way we plan, build, and manage our living environments, we risk a future with no settlements – and ultimately no people.

According to UN-Habitat's 2022 World Cities Report, current projections indicate that a 2°C increase in global temperature in 2050 will expose 2.7 billion people to moderate or high climate-related risks.

Urban areas are at the frontline of this climate disaster.

Today, some 530 cities are reporting the devastating effects of climate change, leaving over 500 million people without a stable income, and limiting their access to basic services, infrastructure, and commodities.

Urban areas are also key emitters and contributors to climate change, responsible for almost 70% of global

◀ **Children walking to school in Kibera, a climate-vulnerable informal settlement in Nairobi, Kenya. UN-Habitat's Nairobi River Life Project is designed to use nature-based solutions to provide protection for vulnerable communities like Kibera living adjacent to the river**

greenhouse gas (GHG) emissions. Despite global political commitments and targets, these numbers are continuously rising, highlighting the significant role of cities as drivers of climate mitigation and adaptation.

Sustainable urbanization

The climate battle will be lost or won in cities. UN-Habitat strongly believes that sustainable urbanization – the way we adapt urban areas and infrastructure to withstand extreme climate events through integrated planning – will give human settlements a fighting chance to survive the coming climate breakdown. Here are four ways cities can get the job done.

Firstly, build more connected and compact human settlements. Urban sprawl alone accounts for 30% of GHG emissions, highlighting the need for different models of planning our urban development and growth. Doubling the average neighborhood density can lead to a 20% to 40% decrease in vehicle use per household, thus lowering emissions, according to UN-Habitat's Global Report on Human Settlements.

Second, make use of nature-based solutions. These include the expansion of vegetative cover, improved infrastructure, prioritization of green public spaces, and provision of long-term options for climate change mitigation and adaptation in urban areas. In addition to their adaptive capacity, nature-based solutions are suitable to address challenges related to the disruption of basic services due to extreme weather conditions

These solutions are the core of our Nairobi River Life Project, which aims to restore the river's riparian corridor (the

vegetation growing near to the river). This will reduce floods and other risks for the most vulnerable communities living in settlements adjacent to the river in the Kenyan capital.

Third, assessments and participatory planning tools are essential. Assessments at both site and city levels, combined with public participation in planning and governance, will result in better and more inclusive (and therefore more sustainable) cities. Our public interactive tool, Block by Block, has been supporting cities to develop urban settlements that are inclusive, sustainable, and resilient to the changing climatic conditions.

// Sustainable urbanization – the way we adapt urban areas and infrastructure to withstand extreme climate events through integrated planning – will give human settlements a fighting chance to survive the coming climate breakdown

Fourth, improvements must be made to our transport systems. These are the “blood vessels” of human settlements, connecting living spaces with basic services and commodities. Even though cars are the main carbon contributors, they are also affected by climate change. Extreme temperatures result in storms and typhoons that disrupt our transport infrastructure. Future cities should adapt their transport systems to climate change by prioritizing non-motorized transport, like biking and walking, to minimize carbon emissions. This not only helps to reduce carbon emissions but also contributes to improving living conditions, health, and well-being in urban centers.

Financial considerations

Even though there is a growing global need for the development of climate-resilient urban infrastructure,

there is a wide financing gap for such investments, which is more problematic in developing cities. As of today, only around 10% of climate investments reach the local level. Hence, cities need support to unlock financial resources.

We also need to ensure that no one is excluded from financial incentives. As highlighted by the Intergovernmental Panel on Climate Change, innovative governance and financing approaches are needed to implement and manage the complex and interconnected nature of the challenges faced in cities.

I have prioritized climate adaptation and mitigation as one of UN-Habitat's four priorities for the years 2020 to

2023. As we move forward, the way cities and human settlements are planned and designed will undoubtedly have to change. However, putting the burden solely on cities will not work, as most local governments are overstretched and underfunded.

As we move towards COP27, national governments are increasingly understanding the need for urban and multilevel climate action. I have high hopes that global leaders will develop and support climate change policy frameworks that help accelerate climate action at the local level.

Such a policy shift must come with the will to finance local climate action and the capacity to deliver innovations at all governance levels, ranging from local to regional and national.

It is not too late. We can still make an informed and strategic transition towards a brighter, better, and greener urban future. ■



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Climate action is about people, not just numbers

Central to “leaving no one behind” is ensuring that workers in high-carbon sectors have every opportunity to transition to jobs in the new green economy

By [Moustapha Kamal Gueye](#), Global Coordinator, Green Jobs Programme, International Labour Organization (ILO)

Climate change is one of the greatest risks to the achievement of the Sustainable Development Goals (SDGs), particularly SDG 8 on decent work and economic growth. Jobs are affected by a range of climate issues, such as rising ocean waters, floods, heat stress, forest and other fires, and the destruction of infrastructure.

According to an ILO 2019 report on heat stress, for instance, the equivalent of 80 million full-time jobs could be lost by 2030 because it is too hot to work or because workers must work at a slower pace. This could be coupled with global economic losses amounting to USD 2,400 billion.

Meanwhile, public policies that aim to address the impact of climate change may result in unintended consequences, such as job losses due to carbon pricing or the closing of coal-fired plants.

However, the job losses caused by the effects of climate change far exceed those linked to ecological transition policies. In fact, those transition

policies come with huge job creation opportunities.

According to ILO estimates, 24 million new jobs in renewable energy, energy efficiency, and sustainable transport could be created by 2030 if the 2015 Paris Agreement on climate change is implemented. A further 78 million jobs could be created in a transition to a circular economy marked by sustainable modes of production and consumption.

And while shifting to low-carbon and circular economies in line with SDGs 12 and 13 could result in the loss of some 78 million jobs, there would still be a positive balance of 26 million jobs by 2030. In other words, it is not action against climate change, but rather inaction that will destroy jobs and livelihoods at scale.

However, the scale and difficulty of the structural transformations required should not be underestimated, particularly those related to energy systems. Among the challenges is the uneven geographic distribution of job creation and job losses, which can make it difficult for workers to access new job opportunities. For example, the province of Mpumalanga in eastern South Africa accounts for approximately 80% of total coal production and is central to the country's decarbonization plans. However, most jobs in renewable energy and related employment are in the Northern Cape region.

◀ Coal miners protest in front of the European Commission representative office in Warsaw, Poland. The country's trade unions fear the effect that the EU's 2030 Climate Target Plan will have on employment



Many other parts of the world are faced with similar challenges. That is why the notion of a just transition is fundamental to a successful ecological transition.

A just transition, as highlighted in the Paris Agreement, is about maximizing opportunities to create jobs, promote inclusive growth, advance social justice, and prevent and minimize the risks of job and income losses and economic and social disruption.

However, a just transition to a green economy will not happen automatically. It requires a series of appropriate actions in terms of policy process and content.

Firstly, social consensus is essential. Experience has shown that collective and participatory decision-making processes, which can be achieved through social dialogue, can fast-track action. Yet, at the level of social dialogue institutions, specific commitments on climate change in relation to employment are fragmented and diverse. According to the International Trade Union Confederation, of the 191 countries who submitted nationally determined contributions to the Paris Agreement, nine out of ten failed to incorporate social dialogue to ensure that workers and communities have a say in setting climate goals.

Nevertheless, there are some good examples of how social dialogue has been integrated into planned and negotiated decarbonization processes. For example, the tripartite agreement on the closure of Germany's last coal mine, Prosper-Haniel, enabled a slow and gradual phase-out of subsidized coal, a socially acceptable reduction in staff, and a package of measures for the 1,200 affected miners.

Climate action is not just about carbon dioxide numbers and targets. Climate action is about people and actors in the real economy – workers with the right skills for a green economy, enterprises that can innovate and invest, and communities capable of diversifying their economies.

Skills development, reskilling, and upskilling of workers are central to this shift to a green economy.

The ILO estimates that of the 78 million workers whose jobs might be eliminated in the shift to a green economy, most will be able to find jobs in the same occupation in another industry within the same country through reallocation. However, nearly 24 million workers are likely to be in occupations where jobs will be lost without equivalent vacancies arising in other industries. These workers will require substantial reskilling into other occupations. According to an analysis

cost, to one that recognizes that social spending is indeed an investment. Clearly, financing is linked to national capacities and there are significant differences in the capacity of countries at different levels of development. However, there are useful models and ongoing experiences to learn from.

The transition to a green economy is not gender neutral and could replicate current gender imbalances in labor markets. Of the approximately 20 million new jobs expected in sustainable

/// The job losses caused by the effects of climate change far exceed those linked to ecological transition policies. In fact, those transition policies come with huge job creation opportunities

by EY, oil and gas companies estimate that at least 43% of workers will need to be reskilled and that it may take up to 10 months to reskill or upskill the average worker. The analysis also highlights that up to 17% of workers cannot be reskilled or upskilled.

It is inevitable that certain jobs and livelihoods will be lost, which means that support programs will be needed for workers and communities. Strengthening social protection systems is central to this. Specific measures can include flexible financial transfers, affordable healthcare, and unemployment protection for those who lose work hours or livelihoods amid the phasing out of carbon-intensive industries.

While decision-makers might be anxious about the huge public and private financing needed to secure jobs and income, only around 2% of the global labor force will be affected in the green transition.

Financing for a just transition is a central pillar of decarbonization but it has been lacking in many cases. A fundamental shift in mindset is needed: from one that sees social spending in the context of decarbonization as a

energy transition by 2030, only six million jobs will go to women, since many jobs will be created in male-dominated occupations. However, it is encouraging to note that renewable energy employs approximately 32% of women, compared with 22% in the energy sector as a whole. Active labor market policies are needed to increase women's participation in the job markets of the green economy.

All these complexities mean that comprehensive and coherent policy frameworks are needed that align climate, economic, and social policies. In 2015, representatives of governments and workers' and employers' organizations at the ILO developed Guidelines for a just transition towards environmentally sustainable economies and societies for all. The guidelines provide a framework for policy guidance and a practical tool for countries.

In June 2023 the International Labour Conference will address the just transition issue, including industrial policy and technology. It will be a critical moment to take stock of policies and practices that can keep climate goals on track, ensuring that incomes and jobs are secured, leaving no one behind. ■



Rethinking consumption

We cannot hope to tackle the climate crisis without a fundamental shift in how, what, and why we consume

By [Stefanie Hellweg](#), Professor, [Andreas Froemelt](#), Senior Researcher, [Livia Cabernard](#), Post-doctoral Researcher, [Jonas Mehr](#), MSc, and [Rhythima Shinde](#), Environmental Analyst, Chair of Ecological Systems Design, ETH Zurich

Environmental impacts like climate change and biodiversity loss threaten our future.

Household consumption greatly contributes to these and other environmental impacts. But what should consumers do to conduct an environmentally friendly life? And what should policymakers do to incentivize sustainable consumption? Today's economy offers countless options for consumption, so to consume sustainably is not at all a straightforward task.

For policymakers, it is essential to understand the drivers of consumption impacts. In multiple studies, income is identified as the most relevant driver of consumption impacts (see Figure 1, overleaf). In addition to income, household size is acknowledged to play a significant role. Per capita footprints generally tend to decrease with household size, but this trend is less pronounced for high-income households.

Households in dense urban areas in higher-income countries tend to have lower impacts due to less land-based mobility impacts (shorter distances to travel, more availability of public transport) and smaller apartments. While it is difficult (or less popular) for policymakers to influence income and household size, urban densification can be influenced by urban development policies. However, the impact of location

▲ Istanbul viewed from the air. The carbon footprint from transport was one of the main differentiators between the highest and lowest impact groups in Swiss studies

on consumption impacts is less evident than that of income and household size.

Some studies also try to cluster consumer groups into archetypes, which by trend have smaller or larger environmental impacts. Such studies may help to develop targeted incentives or other political measures to lower the environmental impacts of particularly impactful households.

For example, a Swiss study shows that the household group having the least per capita environmental footprint is young parents with small children, as they tend to have low-mobility impacts,

low apartment area per person, and eat a balanced diet at home (Figure 2). Those who have a high footprint include:

- relatively well-off couples close to retirement age that live in over-dimensioned houses and spend much of their free time traveling
- young unmarried couples with high incomes who tend to travel and eat out a lot

Studies like this demonstrate that lifestyle – affected by income, age group, household size, and other factors – has direct implications on our footprint. But this is not everything. These studies also tell us that there are consumers that diverge from the general patterns. For example, research in Switzerland shows that low-impact households with comparably high income also exist. They tend to consume less mobility, live in houses with “green heating systems” (like heat pumps), and generally consume

high-quality (higher priced) goods. Such households potentially serve as a model for others.

What should environmental consumers do?

Life cycle assessment studies show that housing, mobility, and food are the most relevant consumption areas for greenhouse gas (GHG) emissions (Figure 1). For water stress and biodiversity loss (through land use or eutrophication, where water becomes progressively enriched with minerals and nutrients), food is the dominant consumption area (Figure 1). In industrialized countries, environmental hotspots for GHGs and biodiversity loss include:

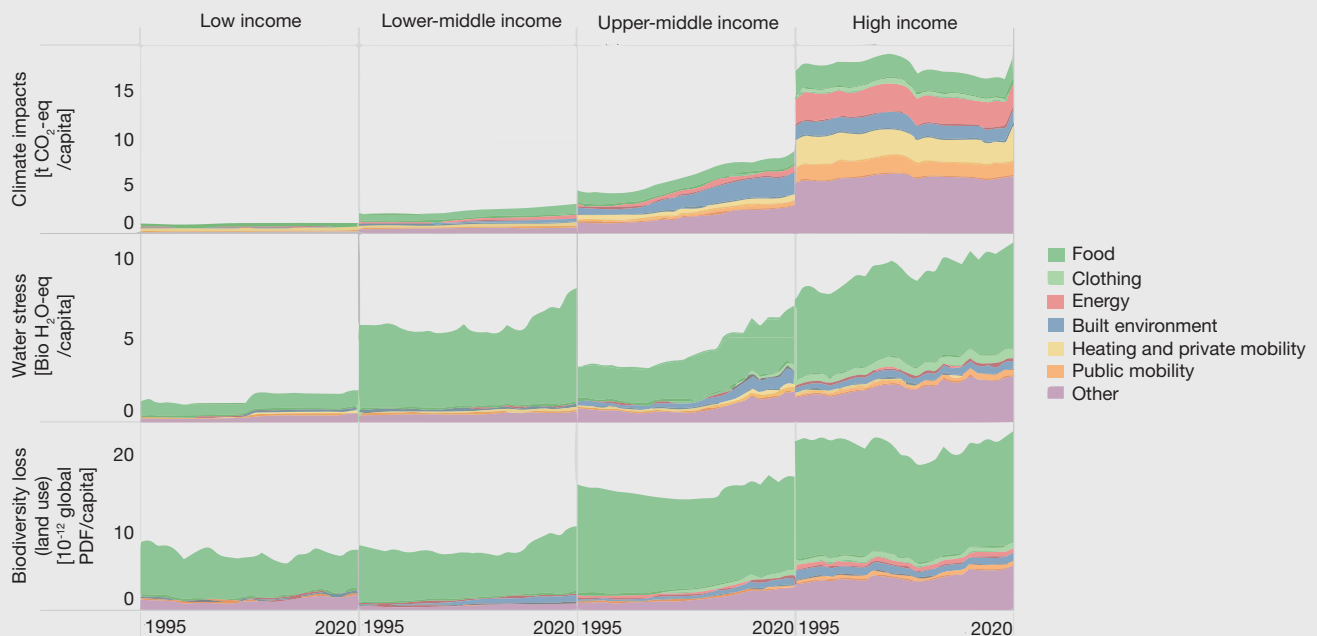
- high meat and dairy consumption
- foods from tropical regions (such as cocoa and coffee)
- food wastage
- personal mobility (especially driving cars and flying)
- heating homes with fossil fuels

From such studies, environmental recommendations have been derived such as “fly less” or “reduce food waste.” But if consumers follow some of these recommendations, does this make the footprint of their lifestyle better? Probably. But not necessarily.

This is because rebound effects may offset some of the environmental gains. Assume, for example, that a consumer reduces food waste to lower their environmental footprint and therefore needs to buy less food. This is good. But it may also save the consumer some money that they can spend elsewhere.

This is usually referred to as the “rebound effect,” where a reduction in consumption (aimed at reducing the environmental impact) does not achieve its goal fully, because monetary or time savings induce further consumption and, hence, environmental impacts. For example, a UK study shows that money saved by avoiding food waste is often spent on other consumption with

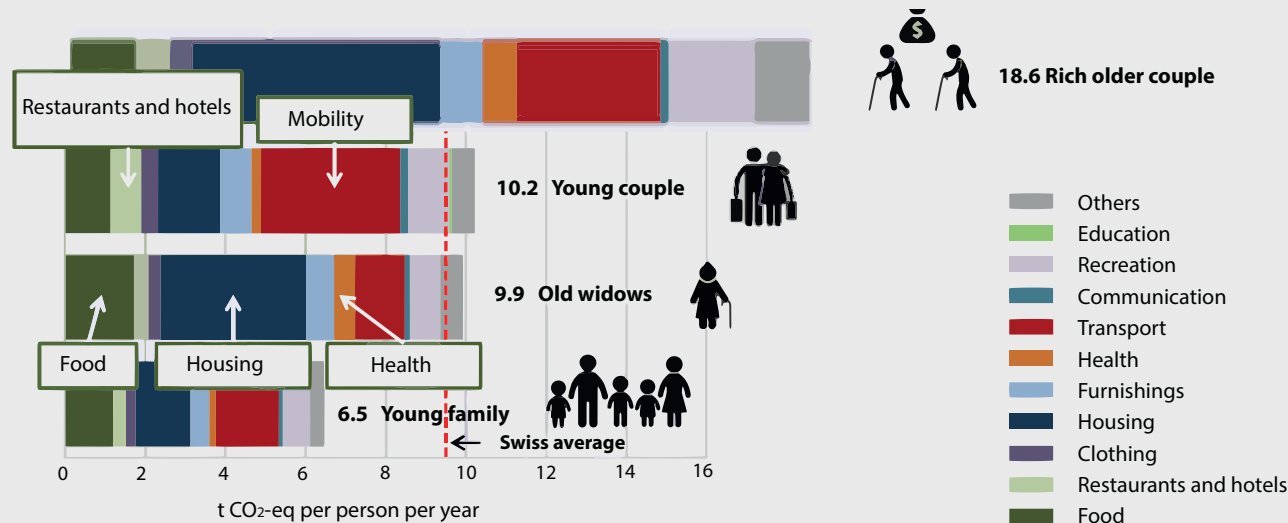
FIGURE 1:
Per capita impacts from 1995 to 2020 divided by income group countries



Data are based on the Resolved EXIOBASE3 database

Source: Stadler et al., 2018; Cabernard and Pfister, 2021. Methods for the impact assessment according to UNEP, 2016; Boulay et al., 2018; Chaudhary et al., 2015

FIGURE 2: Per capita carbon footprint of selected consumption archetypes (out of a total of 28 archetypes) in Switzerland



Source: Froemelt et al., 2018

comparable or even higher impacts. On average, for food waste reduction, approximately 80% of the initial GHG reduction saving is lost due to the impact of such alternative consumption.

So, are efforts to cut food waste reduction in vain? Should food continue to be wasted? Of course not. But we need to pay attention to what is done with the saved money or time, and to be aware of the risks of problem-shifting. In the end, it boils down to the question of how consumers spend time and money as a whole: making sure they are not just focusing on improving one consumption area and shifting their footprint from this consumption area to another.

Being aware of rebound effects is an essential start. In particular, as consumers, we can try to avoid high-impact activities altogether. Why not spend the holidays at a place nearby or, if further away, take more time to travel there by train or bike? Living in a well-insulated apartment close to our place of work reduces mobility and heating demand. Eating high-quality seasonal food with only a few animal products can improve both environmental impact and health. Such actions should preferably be combined and not be “either or.”

Consuming less also helps, especially when investing the saved money in activities, projects, and people that contribute to an environmentally friendly society. Renewable energies are a good starting point. Why not install solar panels on the roof or balcony – maybe together with neighbors? Or, if that's not possible, perhaps look to buy shares in a bigger local photovoltaic plant run, say, by the city or other investor. In addition, we can support environmentally friendly producers or organizations that foster environmental protection. This may then have a positive influence beyond our own footprint.

This consumer-centric view should be regarded alongside systemic societal changes in our whole economy. These include transitioning to a renewable energy system and creating a circular economy. We need these to make producing consumer goods more sustainable. But only a joint effort in making both production and consumption more sustainable can make a transition towards a more environmentally friendly future happen.

Today, we are taught by marketing campaigns that buying more goods and services makes us happier.

What is needed is a major rethink of consumption where we seriously evaluate which consumption really increases our well-being as opposed to consumption that we only believe is rewarding. One such example is fast fashion. According to a German study, 50% of new clothing purchased in Germany is only worn once or twice before it is discarded. Getting away from linear business models and changing marketing towards promoting high-quality, long-lasting products and services could play a big role here.

And would it not be timely for green influencers to emerge who show us how to “get more with less?” Policymakers need to act now and provide incentives for circular systems and long-lived products (and set limits to unsustainable marketing campaigns and products). It is time to rethink consumption altogether and to shift the focus to services and goods that really create well-being, while only having bearable impacts on the environment. ■

References can be found at:
www.sdg-action.org/rethinking-consumption



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A warmer world: are we ready?

Even the most optimistic predictions show a significantly warmer planet by 2100. Rather than focusing on quick adaptive fixes, as many current plans do, countries must pursue climate-resilient development strategies that address the systemic nature of the climate crisis

By [Aromar Revi](#), Director, Indian Institute for Human Settlements

Like clockwork, global headlines in 2022 have reported extreme weather events one after the other: searing heatwaves in Europe and South Asia, devastating floods in Pakistan and China, and crushing

droughts in Africa, the US, and parts of Europe. The world is experiencing close to 1.5 shocks each day – extreme events that are increasingly par for the course in the Anthropocene era that we now live in.

Climate science is unambiguous on this front. At a current global average temperature increase of 1.1°C, what

we are witnessing is a preview of impacts that lay ahead of us. The intensity and frequency of extreme weather is tied to global warming and will increase with higher temperatures. This is likely to cause widespread destruction and irreversible changes to our economy, human life, and ecosystems. In practice, in the high

◀ **Planting mangroves to provide coastal protection in Timor-Leste. Ecosystem-based adaptation provides the most effective long-term protection, without the unintended consequences that frequently accompany hard, man-made defenses**

latitudes, mountains, and many cities around the world, local and regional warming has already breached 3°C.

We need to halve global emissions in the next eight years. Otherwise, by the 2040s, we are likely to breach the 1.5°C climate guardrail. This could leave a world of 10 to 12 billion people grappling with global warming of 3°C or more by 2100.

As things stand, key goals of the Paris Climate Agreement seem to be spiralling out of our grasp. A 2022 Climate Action Tracker analysis of country climate pledges shows that meeting current 2030 targets can limit warming to 2.4°C, while business-as-usual will increase warming to 2.7°C by 2100. The most optimistic scenario in this analysis will still leave the world warmer by 1.8°C.

What lies ahead

What does higher temperature mean for our world? At 1.5°C, we are looking at climate impacts that will exacerbate food and water scarcity, and poverty, and lead to economic damages worth trillions of dollars by 2100.

The Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5°C tells us that every tenth of a degree increase above 1.5°C multiplies climate risks non-linearly, and every half degree difference brings us to an altered world. For instance, at 1.5°C an additional 350 million people living in cities will face water scarcity due to droughts. At 2°C this number increases to 410 million.

Under 1.5°C warming, 14% of the world's population would be exposed to extreme heatwaves once every five years. This proportion more than doubles to 37% under 2°C warming. Beyond 2°C global warming, we are likely to hit adaptation limits that bring

in their wake existential challenges to an already troubled world. How do we avert a global food crisis and grow adequate crops at a global warming of 2°C for a potential planetary population of 10 billion? How do we rebuild or adapt our infrastructure to withstand floods beyond 2°C?

Yet the primary challenges going ahead are not only environmental. They are political, economic, socio-cultural, and systemic.

We need to mitigate dramatically to stay below 1.5°C warming in the near term, because deep emission reduction is the best form of adaption. And, given what the science is telling us, we also have to prepare to adapt to the risks of a 2.7°C world. This is easier said than done. We have no

financial pledges by developed economies. Developed nations are more carbon-invested, have historically contributed more emissions, and have higher emissions per capita than most developing economies. Emission-reduction targets for developing countries will have to be balanced with their imperative to implement the Sustainable Development Goals (SDGs) by 2030.

For instance, nearly 567 million people in sub-Saharan Africa still have no access to energy and nearly 0.9 billion do not have access to clean cooking fuel. Recognizing this disparity and acting on it has proven to be a deep sticking point in international climate negotiations. This includes a promise by rich countries in 2009 of

// To move ahead on this path, political commitment and consensus on climate action between the developed and the developing world, and the privileged and vulnerable in all countries, is essential

precedence of such rapid economic, social, and institutional change in the 10,000 years of the Holocene era, which ended in the late 20th century.

Political consensus on climate inequality

To move ahead on this path, political commitment and consensus on climate action between the developed and the developing world, and the privileged and vulnerable in all countries, is essential. This consensus hinges on nations and people accepting and acting on climate change inequality, both in their contributions to climate change, and in adapting to the impacts of climate change. Both of these historical asymmetries demand that climate change action be framed within principles of inclusion, equity, and justice.

The first requires ambitious goals, targets, technological sharing, and

USD 100 billion to help developing countries, which has still not arrived.

Current geopolitics with an ongoing US-China-Russia rupture makes climate consensus even more problematic. The trickle of climate finance, especially for adaptation, continues to be the proverbial elephant in the room in international negotiations and a major barrier in global transition to net zero. A symbolic fresh start on climate finance can be made at COP27 if developed countries agree to create a loss and damages fund to assist climate-vulnerable countries and communities. There is momentum for this with over 400 organisations demanding that loss and damage finance be on the COP27 agenda.

Addressing the second climate inequality implies that nations and governments recognize that low and middle-income countries (and poor and marginalized communities within

them) are most at risk from climate change. Climate change deepens existing social, regional, and economic inequality, disproportionately affecting the most vulnerable and poor. To reduce climate vulnerabilities, we need to consider climate “in the context of sustainable development” as stated in the Paris Agreement.

Effective climate action requires collective action and alignment to meet the UN SDGs, including:

- ending poverty (SDG 1)
- decent work (SDG 8)
- ensuring universal good health (SDG 3)
- access to clean water and sanitation (SDG 6)
- affordable and clean energy (SDG 7)
- reduced inequality (SDG 10)
- gender equality (SDG 5)

Despite progress made since 2015, we are not on track to meet these Global Goals by 2030. Indeed, we have suffered reversals in many parts of the world during the pandemic.

Adaptation, mitigation, and climate-resilient development

Climate change awareness and exposure to extreme events have spurred 170 countries to develop adaptation plans to minimize climate risks. However, there is a gap between these plans and actual implementation. Most of these plans are also focused on a near-term risk and are insufficient to address the systemic nature of the impending crisis.

For instance, several countries have opted to build sea walls to act as a hard defence against sea level rise and floods. This is likely to be a short-term and costly solution. It can also lead to unintended consequences like destroying natural ecosystems or flooding other unprotected areas.

A more feasible adaptation strategy would be hybrid one. This would use a mix of ecosystem-based adaptation via the conservation of mangroves, wetlands, and living shorelines and only use hard defences in a very few places. Instead of short-term

action, governments must look at coordinated adaptation and mitigation plans that are aligned with sustainable development interventions.

Climate-resilient development (CRD), endorsed by the IPCC in 2022, is such a framework that integrates adaptation, mitigation, and sustainable development. It seeks local solutions to global problems and brings together an array of stakeholders including the public, private sector, civil society,

- urban and infrastructure
- societal choices around consumption and behavior

The energy transition is starting to take off in some parts of the world, unlike the industrial transition which is lagging. The urban and infrastructure transition has potential to accelerate CRD, especially when coupled effectively with ecosystem-based adaptation and nature-based solutions. The societal transition is

// There is no silver bullet solution to climate change. It needs a consistent and relentless focus on implementation. Having said this, the window for climate-resilient development is narrow and rapidly approaching

local communities, and the youth. Restoring mangroves as part of creating living shorelines, and creating urban forests and lakes are successful examples of ecological solutions that can help adapt as well as mitigate climate risks.

When we transform our cities with green and net-zero buildings, invest in climate-resilient infrastructure, plan for sustainable cities with compact urban form, and adopt policies to address social and economic inequality, we are practicing CRD. In coastal cities in the Global South, for instance, effective climate action plans to reduce flood vulnerability would include:

- upgrading informal settlements
- creating safe and affordable housing
- providing social safety nets for marginalized citizens

System transitions and enabling conditions

The effective operationalization of CRD requires simultaneous systems transition in five areas:

- energy
- industry
- land, water and ecological systems

a big ask, but successful COVID-19 responses in some parts of the world have shown that rapid and systemic societal change is possible.

The enabling conditions to accelerate these transitions are known and proven in many regions:

- effective multi-level governance
- climate finance
- enabling policy
- institutional capacity
- technology and innovation
- international cooperation

There is no silver bullet solution to climate change. It needs a consistent and relentless focus on implementation. Having said this, the window for CRD is narrow and rapidly approaching. CRD becomes difficult to implement as the world approaches 2°C degrees of warming.

The time to act on climate was yesterday. To reach future zero, we need to build political consensus, deploy resources to achieve deep emission reduction, prepare for transformational adaptation, and collectively pursue CRD for the well-being of all people, the economy, and the planet. ■



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Mobility without carbon

A net-zero and inclusive mobility future for all doesn't depend on futuristic, as-yet-unknown transport solutions. We already have the necessary tools, knowledge, and resources, but must urgently deploy them in new, transformative ways

By [Christopher Dekki](#), Director, Global Advocacy and Engagement and [Alice Yiu](#), Director, Policy Outreach and Strategic Communications, SLOCAT Partnership

Humanity tends to look ahead, always anxious for what tomorrow holds, and often putting off what in fact needs to be done today (or yesterday). With this comes a fanciful approach to

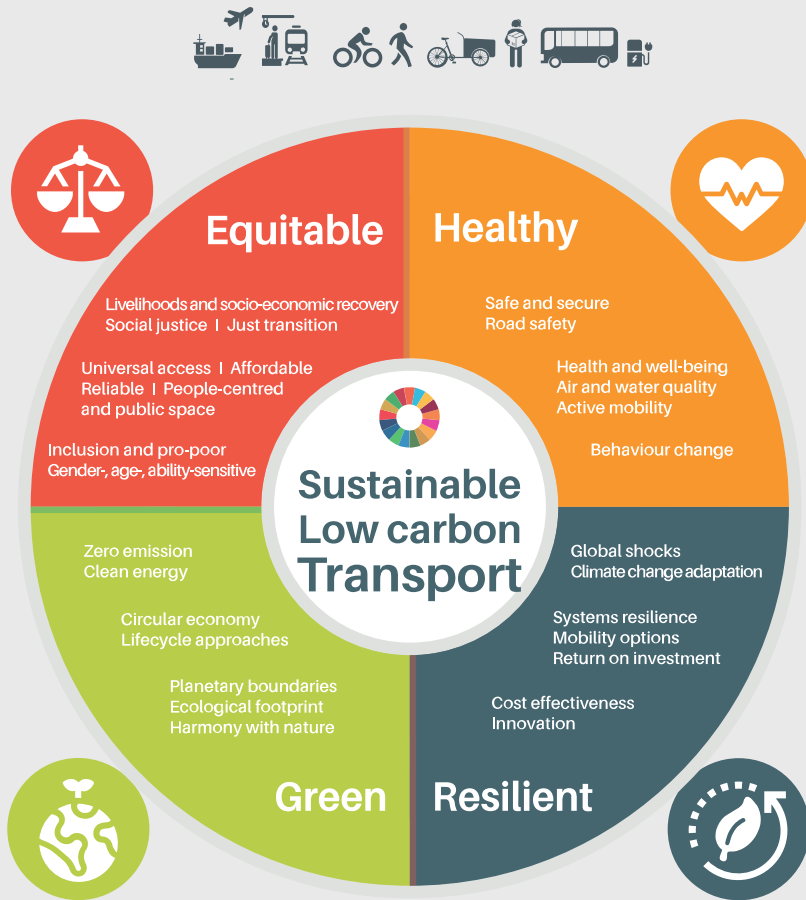
the future, one influenced by decades of media that painted it as a time of technological wonders able to solve all our problems. Sleek, clean, and wondrous, futuristic depictions of society have always given humanity a reason to look forward, showing us what is possible with human ingenuity and a little whimsy.

But the solutions to today's most pressing challenges will not arise from the dreams of tomorrow. Climate change, biodiversity loss, and other environmental

▲ Commuters in Copenhagen, Denmark. The city is one of the most ambitious in its efforts to reach net-zero. Almost half of commuter journeys are on bicycle. For public transport, the city plans to have transitioned its bus fleet to zero-emissions by 2025

emergencies, coupled with Gilded-Age levels of inequality and a breakdown in meaningful multilateralism and trust in institutions, require urgent action now with existing tools, knowledge, and

FIGURE 1:
Sustainable, low-carbon transport and the SDGs



Source: SLOCAT Partnership

implications for the success of the entire 2030 Agenda and other critical global policy frameworks. There are social, environmental, and economic “multiplier effects” that go well beyond the scale of financial investment. The SLOCAT Wheel on Transport and the SDGs (Figure 1) articulates the breadth of the positive interactions between sustainable, low-carbon transport and mobility and the 2030 Agenda. It shows that the future of mobility must be:

- equitable
- healthy
- green
- resilient

But how do we realize zero-carbon, sustainable transport and mobility systems? Which actions need to be taken on the ground, in cities and communities globally, to ensure transport and mobility can assist in this transformation? Three words: avoid, shift, improve.

The Avoid-Shift-Improve Framework (Figure 2) puts forward a series of policy measures that ensure a systemic, integrated, inter-modal, and balanced approach, critical to unleashing the full benefits of sustainable, low-carbon transport. It outlines real solutions for real urban transformation, helping cities make their transport and mobility systems more equitable, healthy, green, and resilient.

As a result, to achieve a net-zero future that puts people and planet first, our transport and mobility systems must be oriented around the following:

- avoiding unnecessary motorized trips based on proximity and accessibility, as well as spurring the transformation of land use and planning
- shifting to less carbon-intensive modes – that is, from private vehicles to public transport, shared mobility, walking and cycling, water-based freight, electrified road-rail freight, and cargo bikes for last-mile deliveries, among others
- improving vehicle design, energy efficiency, and clean energy sources

resources. Nowhere is this action more urgent than in cities, where the vast majority of people live. Urban centers are also where the highest levels of greenhouse gas emissions are churned out, either directly or through carbon-intensive proxies scattered throughout the world, producing a nonstop supply of consumer goods.

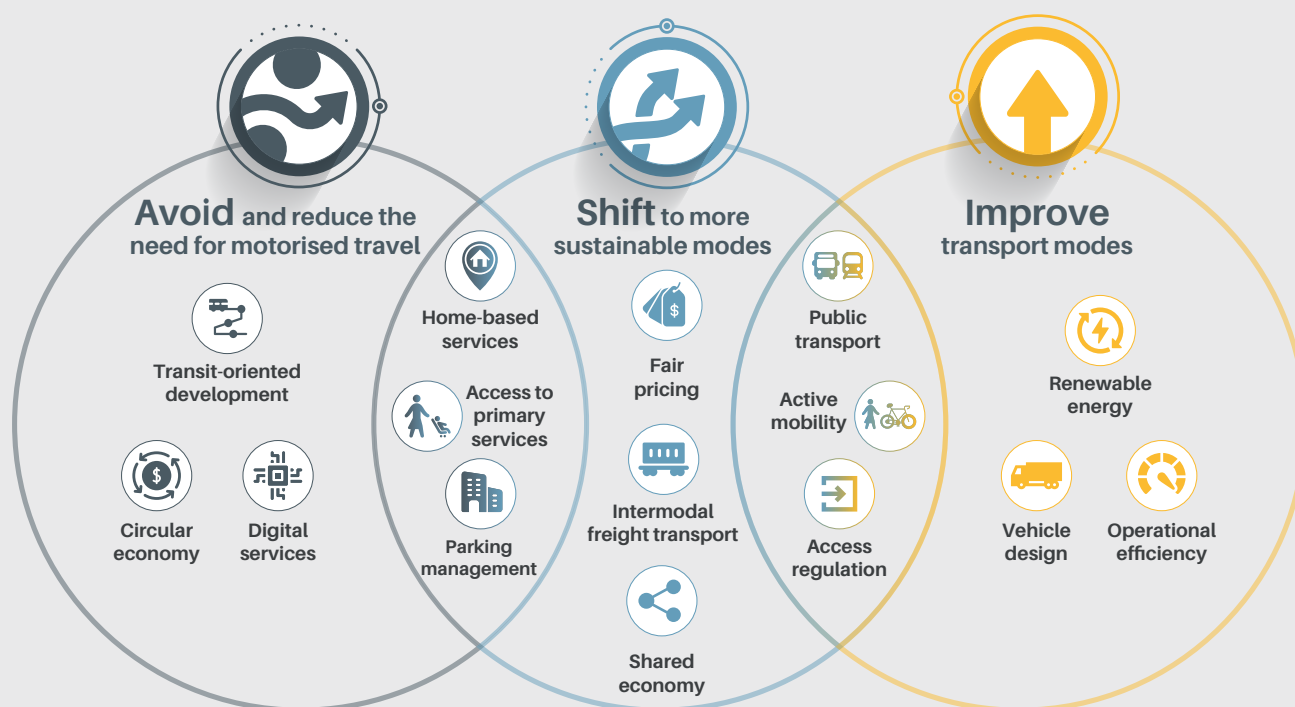
Simply put, the transformation of cities requires us to stop procrastinating, put aside the dream that the future will solve everything, and get to work making the world a better place for all.

When it comes to the way we move people and goods, the solutions are often less technologically oriented than some may expect. Essentially, we need to focus less on the flying cars

and rockets to the moon, and more on the transport modes and mobility systems that are open, accessible, and useful. With fewer than eight years left to achieve the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs), the clock is ticking. We must urgently take the transformative actions needed to enable passenger and freight transport systems for equitable, decarbonized, resilient pathways, and ultimately a net-zero mobility future for all.

Sustainable, low-carbon mobility to transform our societies

Enabling sustainable, low-carbon transport and mobility worldwide has explicit as well as implicit

FIGURE 2: Avoid-Shift-Improve Framework

* The A-S-I diagram presents a non-exhaustive list of measures for illustrative purposes only.

Source: SLOCAT Partnership, 2021

for different types of freight and passenger vehicles

“Shift” and “improve” measures – and the overall decarbonization of the transport sector – are most effective when combined with “avoid” measures. Avoid measures allow cities to limit vehicle traffic to within the capacity of roadways, and they reward travelers who use transport modes that are resource, space, and energy efficient. Many avoid measures aim to actively manage transport demand, with approaches such as congestion charging, carbon pricing for all transport modes, and incentives for behavioral modifications leading to wide-scale changes.

Thanks to the efforts of the sustainable, low-carbon transport community, there is ever-growing evidence showing that avoid and shift measures can account for 40% to 60% of transport emission reductions. They can be further complemented

by improve measures that seek to decarbonize the more car-centric focus of cities around the world. They help reduce environmental impacts, improve access to socio-economic opportunities, increase logistics efficiency, reduce congestion, improve air quality, and enhance road safety.

With most of the world's people now living in cities, and this share projected to reach 68% by 2050, sustainable, low-carbon transport and mobility options for urban dwellers are increasingly needed to manage the inherent pressures on transport demand. Building on avoid-shift-improve, the transformation of urban transport can be achieved and will surely enhance the lives and livelihoods of people the world over. This will lead to an evolution of how people come to understand transport and its collective value as a service for all. Ultimately, these efforts can move the needle towards realizing the 2030 Agenda for Sustainable Development and securing the Paris Agreement's 1.5°C target.

The ongoing pandemic, acute geopolitical instability, and planetary crises like climate change, air pollution, and biodiversity loss are the clarion calls needed for the world to realize that a better future can only be secured through human intervention in the here and now. Bold steps are needed to address the catastrophic impacts of our carbon-intense global economic system, especially when it comes to changing our transport and mobility systems.

With increasingly high commodity prices, and particularly the cost of fuel, a reduction in the dependency on fossil fuels for transport can be the catalyst for transforming our society and taking the first steps towards a just transition. We could either sit back and continue to paint the dreams of a better future, or harness this momentum to achieve the necessary transformations for a net-zero, inclusive, and resilient future for all. The time is now! ■



EV charging is transforming green mobility in Dubai

Dubai Electricity and Water Authority PJSC (DEWA) is ramping up the roll-out of electric vehicle (EV) charging stations in Dubai, providing innovative and sustainable transport solutions in the Emirate

DEWA launched the EV Green Charger Initiative in 2015 to support the vision of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to make Dubai the happiest and technologically smartest city in the world. The initiative is also helping to achieve the Dubai Green Mobility Strategy 2030, promoting green transportation.

EV charging is one of the pillars for consolidating the UAE's position

to achieve sustainable development and build a competitive economy with a strong and modern infrastructure, phasing out fossil fuels and diversifying energy sources.

The initiative prompted the development of the first public charging infrastructure for EVs in the region. Initially, DEWA installed 100 EV charging stations in highly frequented areas across the city, to encourage EV adoption. Since then, the network has expanded to more than 334 EV charging stations, providing about

600 charge points. DEWA's target is to have more than 1,000 public charging stations across Dubai by 2025.

State-of-the-art technology for Dubai's challenging climate

In developing the initiative, DEWA took into consideration best practices and lessons learned from similar initiatives worldwide, as well as the challenging local climatic conditions in Dubai.

As such, DEWA's charging stations are compliant with a higher operating temperature to ensure full functionality

in Dubai. The public charging network of Dubai mainly comprises 22kW to 43kW Type 2 AC charge points, and 50kW to 150kW CCS Combo Type 2 and CHAdeMO DC charge points.

These smart units are connected to a charge point management system, enabling DEWA to operate the chargers remotely. This reduces operating costs and decreases response time for fault clearing and maintenance (for example, through remote firmware upgrades). Users can accurately locate the charging stations on DEWA's website and smart app, as well as through a variety of digital map platforms. DEWA caters to both registered and unregistered users.

For EVs registered in Dubai, DEWA creates an EV account once the customer registers his or her vehicle with the Dubai Roads and Transport Authority (RTA). A registered user can access a personal dashboard with additional information and features. Unregistered users, meanwhile, can charge their vehicles using a guest mode feature.

A recent focus for researchers at DEWA's R&D center has been making EV charging more accessible to the public. Concerns about the charging process are currently a major cause of hesitancy among potential EV owners. Resolving this will speed the transition to EVs, and thereby reduce CO₂ emissions, improve air quality, and enhance DEWA's revenues.

This avenue of research has culminated in the patented Human Centric Smart EV Charging Station, which is the first EV charger capable of charging all types of EV vehicle using a single cable and plug. The system automatically adapts its connection and charging according to the vehicle, making the experience simple and hassle-free.

Supporting green mobility and net-zero ambitions

As a global logistics hub for transport, the Emirate of Dubai is actively seeking to manage its road transport emissions by increasing green mobility solutions

to support the Dubai Net Zero Carbon Emissions Strategy 2050.

As a member of the Dubai Green Mobility Committee, DEWA works closely with government organizations and private stakeholders to support EV adoption within Dubai through the Dubai Green Mobility Strategy 2030. As part of this, DEWA also supports the 10% annual government procurement target for electric and hybrid vehicles by utilizing these vehicles in its own fleet. This target will increase to 20% in 2025 and 30% in 2030.

DEWA previously launched a series of free charging incentives on its network to further encourage green mobility within the city. In addition, DEWA has launched the Dubai EV Community Hub, which aims to increase EV adoption by centralizing information about the latest developments in the EV landscape of Dubai.

Through its EV public charging network, DEWA provided over 8,800 megawatt hours (MWh) of electricity to charge EVs between 2015 and April 2022. This equates to approximately 58 million kilometers driven. Since the launch of the EV Green Charger initiative, Dubai has seen a significant increase in EV adoption, with the number of registered EVs in Dubai increasing from 71 vehicles at the end of 2015 to 7,331 EVs as of May 31, 2022. This upward trend is expected to continue.

In 2015, only a handful of EV models were available in Dubai, compared with approximately 25 models in 2022, and more models expected to enter the market over the next few years.

DEWA is also researching and testing emerging technologies in mobility such as "Vehicle to Grid" (V2G) that enables energy to be pushed back to the power grid from the battery of an electric car, autonomous mobility, mobile charging, and inductive charging. Moreover, DEWA is constantly enhancing its public charging network and studying the latest technologies in green mobility.

DEWA and the Sustainable Development Goals

Since 2016, DEWA has made a critical effort to align with the Sustainable Development Goals (SDGs) and support efforts for their effective delivery by Dubai and the UAE. DEWA has prioritized 16 of the SDGs into three tiers of importance. It has identified six Goals as a top priority where DEWA can have the greatest impact: SDGs 6 (clean water and sanitation), 7 (affordable and clean energy), 8 (decent work and economic growth), 9 (industry, innovation, and infrastructure), 12 (responsible consumption and production), and 13 (climate action).

A key part of DEWA's contributions to the SDGs is its work in innovation, research, and development. By conducting cutting-edge research for solutions adapted to Dubai's climate, DEWA is advancing local efforts in this field. It is creating a hub for innovation in renewable energy, diversification, and energy efficiency.

The EV charger project is just one example of how Dubai is actively seeking to manage its road transport emissions, as part of the Dubai Net Zero Carbon Emissions Strategy 2050. Through this, DEWA is supporting the UN SDGs, with direct contributions to SDG 11 (sustainable cities and communities) by exploring the potential of green mobility solutions to revolutionize transportation in the Emirate.

In recognition of its efforts in sustainable development and support of the UAE's efforts to achieve the UN SDGs, DEWA won the prestigious European Foundation for Quality Management (EFQM) UN Sustainable Development Goals Challenge in 2021. ■

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Zero-carbon, climate-resilient cities

As the world's urban population rises dramatically this century, the sustainability of cities will be make or break for our survival. While the scale of the challenge is huge, many cities are showing how zero-carbon, climate-resilient urban centers are possible

By [Cassie Sutherland](#), Managing Director, Climate Solutions and Networks, C40

Zero-carbon, climate-resilient cities are ones where people live in communities where all necessities are within a short walk, bike ride, or public transport trip. They are filled with green spaces that are accessible to all and provide cool spaces for residents to escape the heat. The air is clean, with electric public transport and vehicles on the roads, instead of petrol-guzzling ones. Renewable energy is widely used, harnessing the power of the sun and wind. Noisy, polluting construction machinery does not dominate the city. Buildings are comfortable, affordable, and made of materials beyond traditional concrete.

Securing this zero-carbon urban future is important. More than half of the world's population lives in cities. Cities are home to most of our built assets and economic activity. They produce 60% of global greenhouse gas emissions and consume 78% of the world's energy. By the end of this century, about 85% of the world's population will be in urban centers, according to the Organisation for Economic Co-operation and Development.

Yet cities are also some of the biggest victims of climate change. Their concrete-heavy infrastructure

worsens heatwaves and heavy rains. Their proximity to the sea and large bodies of water – historically an advantage – will result in more disastrous effects from rising tides. Ambitious action by cities is critical, therefore, to tackling the climate emergency.

C40 is a network of nearly 100 global cities that together represent over 700 million residents and one quarter of the global economy. Its mission is to halve the emissions of its member cities within a decade, while improving equity, building resilience, cleaning the air, creating jobs and prosperity, and ensuring a better quality of life for all. The mayors of this global network of cities are demonstrating the kind of leadership that this moment requires and implementing changes at a much faster pace than national governments. The result is cities that are cleaner, greener, and fairer.

Leading by example

C40 cities are leading by example to transform themselves into model, zero-carbon, climate-resilient cities of the future. Transformation of buildings and transport fleets is helping to slash emissions and generate efficiency savings.

For instance, New York City has upgraded over 1,500 city-owned buildings to reduce the amount of energy needed to light, heat, and cool the buildings. These upgrades have delivered a 73% reduction in harmful air pollution (PM2.5) and avoided energy costs of up to USD 87 million since 2014.

In Bogotá, the city owns and operates the bus fleet, and now only purchases electric buses. This switch to greener transportation is:

- reducing air pollution for residents
- slashing carbon emissions from transport (the sector responsible for the bulk of emissions in the city)
- enabling financial savings thanks to the reduced operational and maintenance costs of electric buses compared with highly polluting diesel buses

Creating green jobs

Cities create good, green jobs that provide critical livelihoods, and contribute to managing climate hazards and events. Renovating homes for energy efficiency represents one of the single biggest job creation opportunities and protects families from rising bills – creating three times the number of jobs as investing in fossil gas. Based on C40 research, upgrading homes, schools, and workplaces to make them more energy efficient, along with the construction of efficient new buildings, has the potential to create:

- 13 million decent jobs in the United States
- over 850,000 jobs in Italy
- over 900,000 jobs in South Africa

In Barcelona, providing energy assessments and efficiency upgrades has already saved households who are experiencing energy poverty €225 per year on their electricity bills.



◀ High Line Park in New York, US. The elevated, linear park was created on a disused freight rail line and provides green space and pedestrian walkways along 1.5 miles of the west side of Manhattan

planning and are greening schoolyards, pedestrianizing streets, prioritizing walking and cycling, and renovating existing buildings for new uses rather than demolishing them and building anew.

Bringing nature in

To manage the rising impacts of climate change on our cities, it is vital that nature is brought into the city and new materials are used to manage heavy rainfall and rising temperatures. In Guadalajara, 67,000 new trees will be planted across 70 green corridors. Over 50 new public gardens will be introduced to cool down the city, and provide shade and leisure space.

The city of Phoenix is a global leader in using cool pavements to cool local areas. Cool pavements reflect sunlight and thereby reduce the urban heat island effect. They are also a scalable solution with quick results. Phoenix streets with cool pavements tend to be 10.5°F to 12°F (or 5.8°C to 6.6°C) cooler at the hottest time of the day than streets without. This reduces the need for energy-hungry air conditioning and reduces heat-related health issues, such as respiratory problems and heat exhaustion.

Cities as a blueprint for action

What we do today will determine whether or not there is a thriving future for our communities, our cities, and the natural world around us. We know that climate breakdown and rising inequality – compounded by the COVID-19 pandemic – require an unprecedented response to match the scale of the crises. Cities are showing that a zero-carbon, climate-resilient future is possible, and are providing us with the blueprint for others to follow suit. ■

Local clean energy

By promoting local clean energy, residents benefit from the investment and jobs involved in clean energy installation, production, management, research, and development. According to a report published by the World Resources Institute, investing in solar photovoltaic equipment manufacturing creates 1.5 times as many jobs as the same amount spent on fossil fuel production.

The city of Houston is investing heavily in solar, creating one of the largest urban solar installations in the United States on a closed landfill site. The project will provide new jobs for the city but also generate electricity for 12,000 homes, which will be discounted for low-income residents.

Transforming food systems

Cities are transforming food systems to be healthy and sustainable. Almost a third of global emissions are associated with food systems, but estimates

suggest that 830 million people in the world will suffer from hunger in 2022. Quezon City in the Philippines has been creating jobs and improving nutrition by converting idle land into urban farms and Addis Ababa has improved nutrition for almost half a million primary school children through sustainable school feeding programs.

Improving quality of life

Cities need to be liveable places. As urban populations grow there is a risk that zero-carbon targets would come under threat, due to rising levels of construction and increased pressure on services. Moving to a “15-minute city” (where everything a resident needs is within a short walk, cycle, or public transport trip) is one way of tackling this and promoting local lifestyles in large cities. This model can help cities reduce emissions and pollution from cars, while improving quality of life.

Cities from Paris to Buenos Aires are adopting this approach to city

Trade's role in climate action

International trade can play a vital role in tackling climate change and achieving sustainable development. But it calls on governments to set aside national interests and open up access to environmental goods, services, and technologies for all countries

By [Lucie Qian Xia](#), China Policy Fellow, Grantham Research Institute, London School of Economics and Political Science

Historians say the past is a foreign country. While predicting what future historians would say about the current era is uncertain, the story would certainly not be inconsequential. The defining crisis of our time – climate change – is increasingly interlocked with a confluence of other crises including health, food, security, finance, and trade.

The future we want is clear: that of a net-zero, climate-resilient, nature-positive, resource-efficient, and economically sustainable world. Climate science tells us that the shape of the future will depend on our immediate actions: global greenhouse gas emissions must peak by 2025, and then we must see urgent and deep reductions in emissions by 2030 to achieve net zero by 2050.

Measures to address the climate crisis must be compatible with policy ambitions for economic growth and human advancement. The 17

Sustainable Development Goals (SDGs) embody a shared blueprint for planet, people, and prosperity, now and into the future. SDG 17 highlights that international trade is “a means of implementation” for the achievement of all the SDGs. On the road to net zero, the question is not whether trade matters for accelerating climate ambition, but how and to what extent can trade measures address climate change.

A symbiotic relationship

Conventional wisdom purports that trade and climate are irreconcilable. The idea is that either:

- the environment must be sacrificed to achieve a certain level of economic development
- economic growth must be undermined to cultivate environmental sustainability

However, the interlinkages between climate change and trade are much more intense. Economic and environmental factors are interdependent, and success in one sector requires action in other sectors to be sustained over time.

In 1992, the United Nations Conference on Environment and Development led to the adoption of the UN Framework Convention on Climate

◀ Wind turbine blades ready for export at Lianyungang docks, China. China is the dominant force in manufacturing renewable energy equipment and has driven down the cost of renewable energy globally



© Wang Chun/VCG via Getty Images

Change (UNFCCC). It also witnessed the signing of the Rio Declaration, one of the most important global declarations establishing a link between sustainable development, economic growth, and environmental protection. The declaration called on all countries to “cooperate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation.”

In 1994, the signing of the Marrakesh Agreement established the World Trade Organization (WTO). It enshrined the link between sustainability and the opening up of trade, recognizing that while trade “should be conducted with a view to raising standards of living” it should also allow for the “optimal use of the world’s resources in accordance with the objective of sustainable development.”

The symbiotic relationship between climate and trade has important implications for enabling the international climate and trade regimes to work in a more synergistic fashion. There is ample untapped potential for policymakers to go further in making use of climate provisions in trade agreements and trade-liberalizing commitments in climate action plans and strategies.

Renegotiating the climate–trade nexus

Trade is by nature relational. International trade agreements and rules that embed sustainable development provisions and promote green investment would provide incentives for the multilateral trading system to both further the symbiotic supportiveness of free and fair trade and address the climate crisis. The key issue is to strive for an optimal combination of trade liberalization and climate policies that harness the benefits of trade while minimizing environmental costs.

Trade and climate synergies could be enhanced through negotiating future multilateral, plurilateral, and bilateral trade agreements. The WTO-based international trade regime could potentially restructure market

relationships in a climate-friendly manner by providing incentives for climate change mitigation and adaptation.

According to the WTO, reducing or eliminating import tariffs and non-tariff barriers for climate-friendly goods and technologies could result in a reduction of their price, therefore facilitating their production and deployment at the lowest possible cost.

A prime example emphasizing that trade needs to be part of the solution to climate change is the Environmental Goods Agreement (EGA). Negotiations to establish the EGA started in 2014 but have stalled since 2016. The EGA envisages liberalizing the trade of environmental goods and services to meet environmental and climate goals, including through:

- addressing supply chain obstacles to sustainable trade
- generating useful economic resources to allow the transition from fuel-intensive industries to less polluting industries
- lowering the cost of green energy technologies

Revitalizing climate-trade negotiations will be vital to the achievement of SDG 10 (reduce inequality within and among countries).

Trade-liberalizing commitments in climate instruments such as countries’ national climate plans have yet to be fully explored. If international trade agreements incorporate some of the climate measures included in nationally determined contributions (NDCs), submitted to the UNFCCC for the implementation of the Paris Agreement, it could be another way of strengthening the capacity of countries to honor their climate pledges.

Mainstream circularity

The extent to which trade can create positive synergies with climate mitigation and adaptation is closely linked with not only the international trading system but also the design of domestic policies. Climate change is inherently contextual. Domestic conditions for liberalizing trade of goods and services are related

to essential circular economy activities, crucial for the long-term transition to net zero.

Rising environmental impacts are due to unsustainable consumption and production. Governments around the world need to implement more ambitious, short-term and long-term action plans and strong measures to make their economies more circular. The circular economy is a future-oriented and broad-based approach to using resources sustainably throughout the product life cycle. In contrast to traditional, linear economic growth models, circular economy solutions, albeit still relatively niche, have proven to create opportunities for economic diversification, resource savings, and better human health and environmental outcomes.

Transitioning to a circular economy will reduce pressure on natural resources and create sustainable growth and jobs. It is essentially underpinned by a whole-of-society, human-centered approach, and speaks directly to SDG 16 on peace, justice, and strong institutions. The interlinked nature of the SDGs should inform mainstreaming the idea of a global circular economy into national plans and sustainable development strategies.

Towards a better future

Freer and fairer trade is not an end in itself. It is interlinked with important environmental and human values and the realization of all the SDGs. The future of trade must find a balance between promoting trade liberalization and creating the enabling conditions for countries to implement their climate promises under the UNFCCC, so that trade contributes to addressing the climate crisis and economic diversification.

Achieving the SDGs as a universal agenda requires policy coherence at all levels – national, regional, and global – where trade and climate are one part of the puzzle. A better future is possible, in which trade and climate can be integrated, complemented, and empowered to serve humanity. ■

Building for climate

The construction industry accounts for more than a third of the world's carbon emissions. The sector must urgently ramp up new methods to slash CO₂ from the construction lifecycle if we're to achieve net zero

By [Karen Scrivener](#), Laboratory of Construction Materials, EPFL

The world is facing a dilemma between climate, economic, and social goals. Around one billion people live in slum conditions, many without access to decent sanitation. Continued construction is a key element to achieving most of the Sustainable Development Goals. The demand for affordable construction materials will therefore increase – especially in the Global South, which is experiencing high population growth and fast urbanization.

The critical question is: how can we meet this demand without negatively impacting climate change and other environmental goals?

Concrete and other materials based on cement are by far and away the most widely used construction materials, due to their ease of use, flexibility, and low cost. There is a widespread misconception that these materials have a high environmental impact, as they are responsible for around 7% to 8% of annual CO₂ emissions. However, this is simply due to the vast amounts of cement-based materials we use – around 30 billion tonnes per year. On a per kg basis, the emissions from cement-based materials are among the lowest of all materials.

In addition, cement-based materials cannot be replaced in any meaningful way by other materials, purely from a resource perspective. It has been estimated that to replace just one quarter of concrete

with wood we would have to plant new sustainable forest one and a half times the area of India. Even if this could be done it would take 30 years or so to produce timber.

There is no miracle, “new” cement out there that can avoid the associated CO₂ emissions. Nevertheless, there are many ways in which the environmental impact of construction can be reduced.

Three ways to minimize emissions

Minimizing CO₂ requires working through the whole value chain of construction. For example, for cement-based materials, it must start with the production of “clinker” – the product of a cement kiln, which when ground provides the basis for more than 99% of cement used today. We must reduce to the minimum necessary:

- the amount of clinker in the cement to achieve the required performance
- the amount of cement in the concrete
- the amount of concrete needed for a building

If all these steps could be brought together it is estimated that, even with known technologies, overall CO₂ emissions due to cement-based materials could be reduced by about 70% to 80%.

How do we achieve this? At the clinker level, the process is already well optimized. Areas of potential progress are increasing the use of alternative fuels and further heat recovery. Alternative fuels are various kinds of non-recyclable waste, such as car tires. Their use is highly effective to avoid landfill and to safely breakdown materials such as plastics. Many cement plants, particularly in Europe, already operate with levels of alternative fuels above 90%, but the

level of substitution in most of the Global South is only a few percent. Increasing this is largely a question of waste management – making large enough disincentives to avoid waste being sent to landfill or simply dumped. Improving the amount of waste into fuel would make a significant contribution to reducing fossil fuel demand and to better waste disposal.

At the level of cement, using other materials to partially substitute clinker is a strategy that has been followed for several decades. Two of the most used substitutes are:

- “fly ash,” a residue of burning coal for electricity
- ground-granulated blast furnace slag (GGBS or “slag”), a by-product of producing iron from iron ore

Today the availability of these materials is limited to around 15% of consumed cement. Both materials come from highly carbon-intensive processes that will (hopefully) disappear in coming decades.

The other, most widely used, substitute material – fine limestone – is available in effectively unlimited amounts, but cannot be used at high substitution levels without a loss of properties. Due to these limitations the average level of substitution worldwide has stagnated at around 20% for the past 10 to 15 years. Fortunately, the development of limestone calcined clay cement (LC3) technology in our laboratory at EPFL, and with partners in India and Cuba, provides a new way forward.

LC3 uses a coupled substitution of limestone together with calcined clay to produce cement with excellent

◀ Nepal, rebuilding homes destroyed in an earthquake. The new buildings are designed to be more resistant to future shocks. Cement and concrete are set to remain the mainstay for construction, but intelligent refinements in the way they are produced and used could reduce their carbon footprint by as much as 70-80%

savings – for example, shorter spacings between columns, or avoiding deep basements and cantilevers. Building height also matters: a single 50-storey skyscraper requires twice as much material for vertical elements than two 25-storey buildings.

A coordinated approach

An increasing number of actors in the industry are looking to lower emissions, but are challenged by the fact that the sector involves a large number of uncoordinated, competing businesses and has small profit margins. To achieve the large potential for CO₂ savings, different parts of the construction industry must work together better. Investors, owners, operators, planners, developers, architects, and designers all influence the construction decision-making process. They are therefore all responsible for optimizing construction sustainability.

There is a strong need to establish an organisational framework, including the various stakeholders, to ensure that adequate incentives to act sustainably are identified and implemented throughout the value chain. Global benchmarking of construction practices, materials, and their carbon intensities can contribute to identify opportunities to reduce emissions.

One action that stakeholders can take now is to join the Global Consensus on Sustainability in the Built Environment – GLOBE. It aims to “direct the attention of the global community... to the critical importance of the built environment for sustainable development.” I encourage all those active in construction to join this consensus and work together to realize climate-friendly buildings and construction. ■



© UNDP Nepal

properties at high levels of substitution. Calcined clay is clay which has been heated to around 800°C. This disrupts the crystal structure and produces a very reactive clinker substitute. Similar mechanical properties to classic “ordinary Portland cement” (which has around 90% clinker) can be obtained with only 50% clinker, 30% calcined clay, 15% limestone, and 5% gypsum. Even though some energy is needed for the clay calcination, this represents a saving of around 40% in CO₂ emissions.

Clay suitable for calcination is extremely abundant worldwide, especially in the Global South where the biggest demand for buildings will be in the coming decades. Currently there are four plants producing LC3, with at least 20 more expected within the next two years. On a global scale, increasing the substitution level has the potential to save 400 to 800 million tonnes of CO₂ per year compared with business as usual.

Large savings are also possible at the next level, concrete. Simply choosing a good aggregate size or using superplasticisers can lead to CO₂ reductions of around 30% to 50%. On a global level, such savings would be helped by wider use of ready-mix concrete (where good control of the concrete recipe is easier) rather than on-site mixing. Even in more developed countries where ready-mix comprises the vast majority of the market, large savings in cement (and CO₂) can be achieved by modernizing concrete recipes, using modern admixtures, and getting rid of outdated concepts like minimum cement content.

The final level of optimization is the amount of material in a building. Savings here can be as simple as sticking to the codes and not systematically adding another 10% to 20% of materials “just to be on the safe side.” Smart use of codes and lean design can often lead to even higher

Applying the land-water-food-energy nexus

To achieve net zero and unlock progress on multiple SDGs, we need new, coordinated action to manage the complex interplay between food, land, energy, and water systems



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By **Claudia Sadoff**,
Executive Managing Director, CGIAR

Mounting scientific evidence points to food systems being responsible for around a third of global greenhouse gas emissions. Thus, food systems transformation is increasingly recognized as critical on the path to net-zero emissions.

But the transition to net zero demands that we embrace the complexity inherent in food systems that are interconnected with water, energy, forestry, and biodiversity. All are systems that are strongly intertwined with each other, and all are critical to rural livelihoods, food and nutrition security, and gender and social inclusion.

And a system (like a network) is only as strong as its weakest link.

In food systems there's little point in increasing crop yields if supply chains are not equipped to take the extra burden. Equally, there will be diminished returns if high-yielding varieties of seed are introduced without ensuring a reliable water supply. And the best irrigation policy in the world will make little difference if farmers don't have good seeds.

An understanding of these interdependencies is at the heart of the Sustainable Development Goals (SDGs) where the goals are mediated across energy, food, and ecosystems.

Systems thinking helps avoid the unintended consequences of siloed interventions that could jeopardize

sustainability and possibly exacerbate conflict. It allows us to benefit from a broader pool of innovation from across different sectors.

Systems thinking has also guided a reform of CGIAR in the last few years. The reforms unite 11 research centers, looking at different aspects of food, land, and water systems into an integrated operational structure. By operating as “one” CGIAR, we are breaking down barriers to deliver more innovations developed with today's

▲ Aerial view of the Ganges Delta in Bangladesh, showing aquaculture alongside the Sundarbans, the world's largest mangrove ecosystem. The Ganges basin is one of the most at-risk areas from climate change in the world

more interconnected challenges in mind. The reforms aim to encourage partnerships and good governance across boundaries and sectors. We aim to foster strong institutions and actors willing to overcome silos, think big, and adopt new tools to tackle systemic challenges.

The breadbasket basins of the Indus and the Ganges in South Asia are an example of a region where a more holistic systems approach will reap rewards. The area is one of the most at risk from climate change in the world. Ground and surface water abstractions are among the most unsustainable. Poor policies, deforestation, and pollution have contributed to severe ecosystem degradation. The combined risks put 7% of the world's food production at risk, with potentially devastating impacts on the well-being, health, and livelihoods of an estimated one billion people.

Governments in the region are calling for:

- scaling sustainable and inclusive on-farm water management practices for improved livelihoods and nutrition, and jobs
- renewable energy as a priority intervention
- nutrition and gender equality in access to safe water for multiple uses

However, policies are too often incoherent, fragmented, and inefficient.

As part of its reform, CGIAR is implementing a portfolio of research initiatives that are designed to tackle these large-scale challenges.

The Nexus Gains Initiative will work in key transboundary river basins including the Indus and Ganges but also the basins of the Blue Nile and the Aral Sea. Underlying systems there are suffering biodiversity loss and fragmented ecological integrity. Many areas are hotspots of land degradation and resource overuse. Gender inequality is acute.

The initiative will seek out and work with public and private-sector investors looking for guidance on where and how to support sustainable development for water, food, energy, forest, and

ecosystem services. Key will be to design approaches that negotiate trade-offs as we pursue the desired equitable economic and social outcomes, while also ensuring environmental sustainability.

You can expect, for example, innovations focused on increased resource use efficiency and strengthened ecosystem functions. This means improved water productivity that considers all water users, so strengthening governance across water, energy, food, forests, and biodiversity systems. And we'll arrive at these goals through a focus on capacity development and partnerships to unlock these cross-sectoral gains.

As decision-makers, governments, and researchers have recognized that food systems are part of a bigger network that also includes land, ecosystems, and water, we are beginning to develop strategies that account for all the ways in which they interact. But we have a long way to go to transform these systems to achieve the future we want.

Fortunately, proven and sustainable solutions exist for achieving both greater food security and reduced emissions. Scaling them in parallel to focusing on new innovation is also critical, especially in the face of the current food systems crisis.

One example of an innovation spanning water, energy, and food systems already championed by CGIAR is solar-powered irrigation. A pilot project in Gujarat, India, connected 3,500 solar pumps to the grid, with a 25-year agreement with the local power utility to buy back surplus power. The project is increasing energy access and alternative income while incentivizing smart groundwater use and reducing carbon footprints. The success of the pilot inspired a multi-billion-dollar Government of India initiative to promote solar irrigation.

Another example of a solution that cuts across food, land, and water systems is the development of rice that can be direct seeded, without the need for puddling (which requires both

enormous volumes of water and emits a similar level of methane to livestock).

Improved varieties can allow farmers to conserve water (especially important in countries such as India where groundwater is increasingly scarce) without reducing their yields, income, or food security. At the same time, these varieties can reduce methane emissions, which are more potent than CO₂.

The unprecedented challenges of the last few years have stalled progress towards the SDGs and zero hunger (SDG 2) in particular. The harsh truth is that we were not prepared. And the lesson learned is that we must expect the unexpected. COVID-19 won't be the last pandemic. And we have not seen the end of the wars which are upending global food security.

The effects of climate change we're experiencing today are only the beginning. But there are reasons to be optimistic for a post-2030 world. Over the past 50 years we have seen the development of multiple innovations to improve farm productivity, livelihoods, and resilience to shocks. These are innovations backed by research to provide the scientific evidence of what works and where, so that policymakers, farmers, private enterprises, and the public can make the right choices depending on their environments.

Many of these innovations can and are being scaled still further through even broader partnerships to meet the urgent needs of this food crisis, but also the wider transformation of food, land, and water systems necessary to achieve net zero. The appetite to continue the critical work to uncover new innovations through research has also not diminished. And it's through a continued commitment to science and research that we will be able to reduce emissions in a way that enhances – not undermines – fundamental human rights and needs, including the right to food and decent livelihoods.

Bridging the gap between food, land, and water systems will unlock progress on multiple SDGs and help us recover progress to 2030 – and build a more resilient world for future generations. ■

Leaving no one behind

Systemic inequalities mean lower-income countries are often sidelined when nations gather to set climate policy. Giving communities who suffer most from climate change a meaningful seat at the negotiating table is essential if we're to steer an inclusive course on climate action

By [Anisha Nazareth](#), Associate Scientist, and [Dayoon Kim](#), Research Associate, Stockholm Environment Institute

Structural inequality and the climate crisis are mutually reinforcing. We cannot tackle one without the other. The top 10% of humanity – a majority in the Global North – account for 52% of global carbon emissions and have depleted nearly a third of the world's carbon budget. The climate crisis itself is propelled by colonial-era legacies of resource extraction and limitless consumption made possible through the exploitation of land and labor in the Global South. Both

developing and developed nations have cited poverty and inequality as reasons for delaying climate action.

Meanwhile, inequality is widened by the climate crisis, which threatens to undo decades of action on other development goals. Despite contributing the least to the climate crisis, poorer communities, particularly those in low and middle-income countries (LMICs), are facing and will continue to face:

- disproportionately higher exposure to pollutants and disease (Sustainable Development Goal (SDG) 3)
- insecurities around food, water, and energy (SDGs 2, 6, and 7)
- income and livelihood destruction (SDG 8)

To be effective, climate action needs to tackle systemic inequalities like structural racism and the global imbalances of power imposed by colonialism. Some reforms to international climate negotiations can go a long way toward rectifying these longstanding injustices.

International cooperation around the climate crisis plays out through the United Nations Framework Convention on Climate Change (UNFCCC) process. This plays an increasingly important role in setting the norms, priorities, and goals for climate action. However, current international cooperation often widens inequality gaps rather than bridges them. For instance, existing climate mitigation



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scenarios maintain energy use in the Global North at a per capita level of two to three times higher than the Global South. These scenarios also rely on negative-emission technologies that often result in land-grabbing in the Global South. Carbon pricing is projected to place undue financial stress on lower-income households, particularly those in LMICs. Climate change adaptation and mitigation initiatives have led to the encroachment of indigenous land and eviction of indigenous communities, referred to as “green grabbing.” The UNFCCC process has also consistently failed to yield adequate climate finance for adaptation as well as loss and damage, driving vulnerable countries and communities deeper into debt.

This is because the UNFCCC process itself is vulnerable to external global power dynamics and the inequalities they create and maintain. Inequities in the global travel regime (visa barriers and, during the pandemic, travel and quarantine restrictions) discourage participation and inclusion of negotiators and civil-society organization representatives from the Global South in climate negotiations. Actors in

the Global South face financial and capacity-related challenges in engaging with the negotiations. Financial barriers often result in smaller delegation sizes and/or less staff to effectively engage in negotiations. The UNFCCC trust fund sponsors two delegates per party from low-income or vulnerable countries. However, having two delegates is not enough to follow and engage with all sessions, forcing countries with less capacity to negotiate in groups rather than put forth individual country positions.

Capacity-related hurdles include the language barriers faced by delegates from non-English speaking countries or simply a lack of experts around specific climate issues in low-income countries that renders them dependent on advisors from the Global North. The experts they do have must multitask and engage with several negotiation topics, leaving them stretched and unable to focus on a single issue. In addition, the Global North’s close engagement with mainstream media gives them an advantage in shaping the negotiations’ narratives of climate leadership, upstaging the Global South.

The UNFCCC does not sufficiently account for in-country power dynamics. Indigenous people’s rights and practices were widely disregarded in many countries’ intended nationally determined contributions, which were often drafted without meaningful consultations with indigenous communities. In addition, the lack of indigenous peoples’ voting rights in climate negotiations exacerbates the subversion of indigenous communities’ sovereignty by settler colonial states. Inclusion of youth in national climate policy discussions, despite few successes, continues to be absent or

superficial across many countries. The international climate policy resulting from these processes does not reflect the lived experiences and needs of communities facing the brunt of the climate crisis.

As long as the UNFCCC process fails to actively address power dynamics, climate injustices can be exacerbated at both local and international level, as was the case during the pandemic. Researchers and observers from the Global South found it disproportionately more difficult to participate and influence the outcomes of climate negotiations, because the pandemic widened or worsened the impact of existing inequalities between countries.

Fixing the inequity problem

The UNFCCC process needs to enable climate action that is based on the principles of climate justice. To foster a more effective process, it needs to extend beyond protecting itself from external power dynamics by providing aid and space for representation and move into taking an active role in shifting these power dynamics. Potential first steps include:

- thinking about rules and regulations for country delegations so countries have more equitable representation and are negotiating on a more equal footing. This could be in the form of placing caps on delegation sizes or increasing funding and training for Global South delegations
- building solidarity between Global North and Global South civil society to boost awareness about Global South interests among communities in the Global North – who can then pressure their governments to act
- the knowledge systems and research that informs the process must include more perspectives and methods from Global South and indigenous experts

International climate diplomacy is yet another arena fraught with colonial-era inequities. By recognizing these and working to reverse them, we can move forward with advancing effective and inclusive climate policy. ■



◀ **Fisherman in Fiji. Fiji is one of the most vulnerable countries to climate change and is increasingly at risk from rising sea levels, cyclones, floods, and land slides. The UNFCCC process is stacked against the Global South, making it difficult to influence climate negotiations. Further, many countries’ NDCs fail to respect the rights and practices of indigenous people**



Innovating for net zero

New technologies will play a vital role in achieving net zero. Getting them on stream and in widespread use fast enough to prevent climate catastrophe calls for bold and urgent action to unblock essential investment

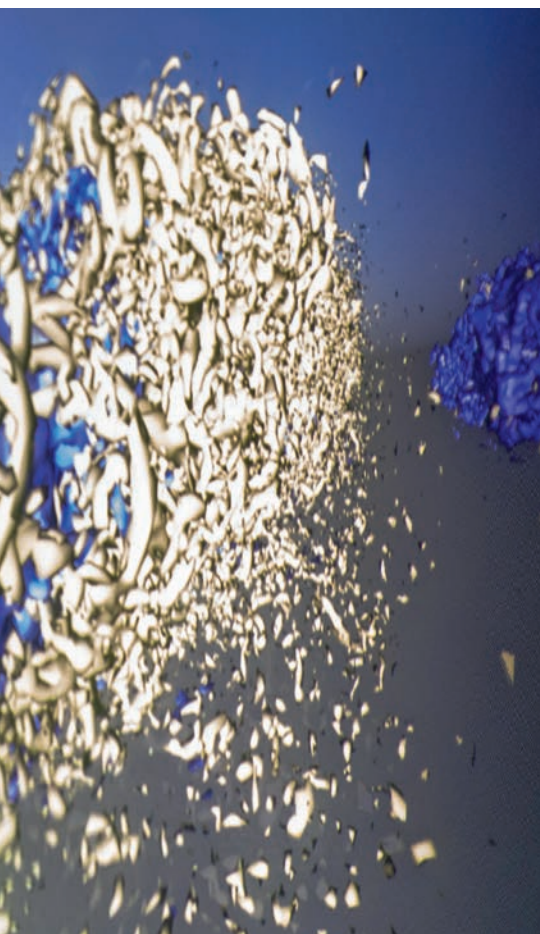
By [Anna Valero](#), Senior Policy Fellow, Centre for Economic Performance, London School of Economics and Political Science

Despite heightened ambition at COP26, it is clear that the world is still moving too slowly to keep temperature rises to well below 2°C by the end of the century and avoid the very worst impacts of climate change. Extreme weather events, including record-breaking heatwaves and droughts in Europe and unprecedented

flooding in Pakistan, highlight the ever more urgent need for large-scale and accelerated action to remain on track to reach net-zero greenhouse gas (GHG) emissions by 2050.

The innovation and diffusion of new technologies is at the center of achieving net zero. More broadly, innovation is urgently required for economies to improve productivity, resource efficiency, and resilience. This is imperative in economies that have faced weak growth and stagnant living standards since the financial

crisis, and new pressures due to the pandemic and current energy crisis. The next wave of technological change can drive sustainable economic growth as the transition to net zero intertwines with digital transformation. But achieving this will require net zero to be embedded into national and regional growth strategies, with coordinated policies that overcome market failures and barriers to investment. It follows that to meet the interconnected Sustainable Development Goals on climate, energy,



◀ **A demonstration at the Energy Systems Integration Facility at the National Renewable Energy Laboratory, US**

There is reason for optimism in terms of what is possible. We have seen that clean technologies are particularly effective at generating economies of scale in production and innovation. According to the Intergovernmental Panel on Climate Change (Working Group III report on Mitigation of Climate Change), the 2010 to 2019 period has seen sustained decreases in the unit costs of solar energy (85%), wind energy (55%), and lithium-ion batteries (85%).

(R&D) is the existence of knowledge spillovers, which imply that innovators are unable to fully capture all the benefits of their innovations, even with an effective system of property rights in place. This results in underinvestment relative to what society needs. Further market failures arise where imperfections in capital markets limit investment – innovative projects can be long term and payoffs uncertain.

There is evidence that both of these barriers are enhanced in the case of clean technologies: where knowledge spillovers (as measured using forward citations in patents) appear to be particularly high, and where

// There is strong evidence that policies and market incentives have driven investment in renewable technology innovation, and that technology costs have declined

growth, and industry, we need to simultaneously increase the amount of investment and innovation in the economy, and influence its direction towards sustainability.

Investment in existing and emerging technologies

In its Net Zero by 2050 roadmap, the International Energy Agency (IEA) estimates that most global emissions reductions to 2030 will come from net-zero-aligned (or “clean”) technologies that are readily available, such as renewable energy, nuclear, electrification of transport, and improving energy efficiency. But half of the reductions to 2050 will come from technologies that are in an earlier stage of development, with further innovation required. These include advanced batteries, hydrogen electrolyzers, and direct air capture and storage (carbon dioxide removal is now considered necessary for meeting net-zero commitments).

Understanding the ultimate causes and paths of innovation trends and accelerations, and how policy can influence these, is challenging. But there is strong evidence that policies and market incentives have driven investment in renewable technology innovation, and that technology costs have declined with cumulative deployment.

Given the steep learning curves experienced in renewables, low-carbon solutions are already competitive in the electricity sector. With increasing investment, SYSTEMIQ estimates that clean technologies could become competitive in sectors representing 90% of emissions by 2030. The key question then is: how can investment be channeled such that market tipping points are reached as quickly as possible?

A coordinated policy approach can overcome barriers to investment

A general justification for government support for research and development

investments in early-stage technologies have been viewed by many investors as riskier than other areas.

Clearly, there are further market failures that hold back investment in the development and deployment of clean technologies. First, the GHG externality. In the absence of a robust carbon price, markets do not internalize the price of carbon emissions, thus reducing the incentive to invest in clean technologies. On the flipside, markets do not capture the societal co-benefits associated with decarbonization, such as cleaner air.

In addition, because net zero requires the transformation of energy, transport, and urban systems, significant problems of network coordination and design need to be overcome. Issues of inadequate information on technologies and product options (needed to guide decisions of consumers, investors, and workers through the transition) are also important.

While specific policies to fix these market failures are required, strong path dependencies in the

production, deployment, and diffusion of innovation make it hard to shift to clean technologies and sustainable growth quickly without a coordinated set of mutually enforcing policies and institutions being in place.

This is a key insight stemming from the economics literature on endogenous directed technical change, which concludes that optimal policy consists of both carbon taxes and other levers, including public support for clean R&D to move economies onto a sustainable growth path.

Increasing public investments in clean R&D

Given the urgency of the climate challenge, it is clear that more R&D is required to develop new technologies and improve existing ones. Putting a number to this is challenging: expenditure on R&D is one measure of innovation input, and the extent to which it translates to the desired solutions is uncertain (and likely to vary across technology types and context). But we know that publicly funded R&D, in innovative economies, is important for generating innovation spillovers and for crowding in private-sector investment. Examining the data on public R&D spending, by technology area, over time, can help size the gap.

Data from the IEA shows that public investment in energy research, development, and demonstration in the US (the largest spender among IEA member countries) has been on an upward trajectory since 2017. But, at USD 9 billion in 2021, this is lower than levels seen around 1980.

There is a similar pattern in the UK (the fourth largest spender, at USD 1.3 billion in 2021). However, the rise in recent years is largely accounted for by nuclear rather than renewables (which saw a larger rise during the 2000s). Overall, publicly funded energy R&D accounts for 0.04% of gross domestic product (GDP), only a third of that spent on health (at 0.12% of GDP, according to data from the Organisation for Economic Co-operation and Development).

// The energy and climate crises require the same solution: accelerating the transition to renewables, improving energy efficiency, reducing waste, and protecting those that are most vulnerable. COP27 occurs at a crucial time

Considering comparative advantage and likely returns to innovation across countries and technology types can also help inform places where investments in R&D should be increased. For example, a recent UK analysis of patenting (a standard measure of innovation output) with my colleagues Ralf Martin, Dennis Verhoeven, and Arjun Shah shows that the UK specializes in a number of clean technologies including offshore wind, ocean energy, and carbon capture, utilization, and storage.

These are areas where the economic returns to public investments (taking into account both private returns and spillovers to other innovators) are particularly high. Given patterns of regional specialization, investments in these technologies have the potential to contribute to more regionally balanced growth. There is therefore a strong case for targeting support and investment towards these areas, on both climate and growth grounds.

There is a growing evidence base in terms of the specific policies and frameworks needed to engage the private sector in innovation (see also Popp and others' review of the literature on environmental innovation). Environmental regulations, public grants, and tax incentives for R&D are key. So too are measures to foster collaboration between universities and industry. Together, these will help to create and de-risk business models for the commercialization of new technologies. More fundamentally, they will set the clear direction of travel on policy to reduce uncertainty for businesses.

A sense of urgency and public support

Before the pandemic, it was common to refer to the World Wars as an analogy of what is required to tackle the climate crisis. These were times when countries urgently mobilized resources for a shared purpose.

COVID-19 now provides a recent example of a global crisis that necessitated rapid, international action. The development and deployment of vaccines, take-up of new technologies, behavior change, and policy responses that enabled this (including support for businesses and individuals that needed it) demonstrate that today's societies can make rapid changes when we recognize clearly the need to do so and when incentives are aligned with the urgency of the situation.

Public understanding and support are crucial for the ability of policymakers and businesses to deliver net zero and its many co-benefits. Protecting and building this must therefore be a priority, particular in the current energy (and cost of living) crisis being faced in many economies that rely on gas supplies disrupted by Russia's invasion of Ukraine.

The energy and climate crises require the same solution: accelerating the transition to renewables, improving energy efficiency, reducing waste, and protecting those that are most vulnerable.

COP27 occurs at a crucial time. Reflecting this urgency in coordinated approaches to generate the required investments must be a priority, converting COP26's ambition to delivery. ■



Technological missing links

As the IEA warns, most of the reductions in emissions needed to achieve net zero rely on technology that is not yet commercially mature. While tech will provide no magic bullet, its rapid development to scale up decarbonization is essential. What are the technological gaps we must focus on filling now?

By **Emi Minghui Gui**, System Lead
– Energy, Climateworks Centre

Climate action is at a critical time. Many commercially ready technologies are available to enable the transition to net-zero energy today. Yet, the pace of the clean energy transition has, so far, not been rapid enough to achieve the Paris Agreement goal to limit global temperature rise to 1.5°C.

There is an urgency to understand what the main gaps are in clean energy technologies for more rapid

decarbonization. In search of missing links, the following topics currently dominate discussion online:

- carbon capture, utilization, and storage (CCUS)
- “powerfuels,” including green hydrogen and ammonia
- energy storage, to firm up variable renewable energy
- digitization for greater energy efficiency and utilization

These topics reflect and support key areas for energy decarbonization in the race to net zero, so let’s delve into each.

▲ Final stages of construction of the green hydrogen plant at Puertollano, Spain. Powerfuels, such as green hydrogen, are one of the major technological gaps that need to be addressed if we are to achieve rapid decarbonization

Clean coal and gas through CCUS

Many cities and towns globally are still powered by fossil fuel power plants. To completely and immediately abandon these assets (which account for tens of thousands of gigawatts) may be impossible and wasteful in the short term.

The question is: can CCUS be deployed quickly to decarbonize these assets?

Carbon capture has been in development for the last five decades. To date, over 70% of carbon capture's applications have been in oil and gas recovery projects, according to a report from the Institute of Energy Economics and Financial Analysis.

Yet, only 300 million tonnes of carbon have been captured worldwide – a drop in the ocean compared to what is required to achieve the Paris Agreement goals. The technology is also known to face major challenges economically and requires significant infrastructure investments in pipelines and storage facilities, directly in competition with investments in other technologies and solutions.

Powerfuels

The Global Powerfuels Alliance defines powerfuels as “synthetic gaseous or liquid non-biofuels that draw their energy content from renewable electricity.”

Powerfuels include hydrogen, synthetic methane and propane, and synthetic liquid fuels and chemicals. The feedstocks used to produce powerfuels can come from primary fossil fuels (coal, wood, gas, oil) and their derivatives – including waste such as plastics and used tyres.

Powerfuels such as green hydrogen and ammonia can help decarbonize sectors that are hard to electrify, such as aviation, maritime transport, and industrial manufacturing processes in steel, cement, and chemicals.

The production of powerfuels, however, relies on an energy-intensive conversion process, requiring the supply of thousands of gigawatts of extra renewable electricity. Investing in prolonging the fossil fuel lifeline when energy access and energy poverty are yet to be solved can be controversial. A similar moral and practical paradox exists in the food-to-biofuel debate. Therefore, the use of powerfuels should prioritize hard-to-abate sectors and be produced from waste where possible, thereby yielding the greatest economic, social, and environmental benefits.

With more than 80% of global energy still being supplied by fossil fuels, both CCUS and powerfuels are technologies to help decarbonize fossil fuels and industrial sectors that are hard to electrify, treating effects rather than the root cause. In this context, opportunity costs of alternative options (for example, renewable energy and energy efficiency) should not be neglected in the investment and decision-making processes.

Rapid scale-up of renewable energy including solar and wind

With that background, let's focus on clean electricity generation – that is, renewable energy.

The recent rise in gas and oil prices has seen solar and wind gain greater cost advantages, as well as a heightened role in supporting energy security. But given their intermittency, grid firming capacity and grid flexibility need to be enhanced. Energy storage is a mature and key grid firming technology that can help balance the variability of renewable energy to

But how much renewable electricity will we need to decarbonize the electricity grid, industry, transport, and the built environment? IEA's Roadmap for Net Zero by 2050 gives a pathway for rapidly scaling up solar and wind this decade, including a more than tripling of the amount installed annually by 2030 compared with 2020.

Rooftop solar and more efficient small-scale wind turbines, such as tulip turbines, could help to achieve net zero at the district and municipality level. Localized energy systems are particularly cost competitive and efficient. They can provide greater energy access and alleviate energy poverty for remote and rural communities, helping to achieve the Sustainable Development Goals.

Reducing energy intensity through smart technologies and energy efficiency

Energy efficiency and demand management is considered as a “no-regrets” option and can help save hundreds of billions of dollars in

As a primary energy source, renewable electricity needs to be significantly scaled up to achieve the Paris goals. Such a scaling up will also support the growth of the sustainable economy globally

minimize investment requirements on the grid and enhance supply reliability.

As a primary energy source, renewable electricity needs to be significantly scaled up to achieve the Paris goals. Such a scaling up will also support the growth of the sustainable economy globally, which will help to reduce the need for CCUS and support the production of powerfuels to decarbonize the hard-to-abate sectors. The need for speed will also favor wind and solar, the construction time of which is around one third of that for equivalent hydro, geothermal, and nuclear power generation.

new generation and grid investment. Smart technologies and solutions can help industries, businesses, and consumers use and manage their energy consumption more efficiently without putting any extra burden on their operation or daily life.

Energy efficiency has the potential to reduce emissions globally by 40%, according to a McKinsey study. Along with more efficient lighting, appliances, and products, digitization and demand-side technologies are key emerging technologies to help realize this vast potential. In this context, digitization refers to using smart hardware and



software to better gather and utilize data to enable:

- smart data and analytics
- improved control and automated systems for industry
- building and home energy management systems
- smart grids
- smart cities
- advanced manufacturing

Like electric vehicles and battery storage, demand-side modular technologies (such as battery-to-grid, modular nuclear, and hydrogen or ammonia fuel cells) can potentially be the wildcard technologies. They can improve system efficiency and flexibility, further disrupting the current centralized industry and infrastructure. Aside from technology maturity, the diffusion of these technologies and interventions will require overcoming economic, institutional, and behavioral barriers. This is particularly true in the buildings and transport sectors, as experienced in many parts of the world.

Beyond technology

A Climateworks and ASEAN Centre for Energy study highlighted some of the economic and institutional barriers

and challenges in achieving energy transition and net-zero goals.

These include market distortions and inefficiencies due to fossil fuel subsidies, and inadequate pricing of carbon externalities. There is also a lack of financial incentives and few examples of viable business models to attract renewable energy and energy efficiency investments. In addition, there is a need for greater grid capacity and connections to accommodate more renewable energy and flexibility in the electricity network. Human capacity for action and implementation can also be a significant constraint in determining how fast the energy transition could happen.

The need for critical minerals and the global supply chain presents another challenge. According to Asia Europe Clean Energy (Solar) Advisory (AECEA), China's solar photovoltaic (PV) manufacturing capacity is estimated to reach 500 gigawatts by the end of 2022, making up 80% of global solar PV supply. This is estimated to grow to 95% in the coming years, according to the IEA Special Report on Solar PV Global Supply Chains. Rapidly building up the global supply chain will help to further bring down the costs of

▲ **Research into high-efficiency photovoltaics (PVs) using perovskite quantum dots. Perovskite is relatively cheap to produce and, in theory, has the capability to increase the efficiency of silicon PVs by 20%**

technologies. It's also critical to support global energy security – one of the lessons learned from the EU's reliance on the supply of Russian gas.

It is likely that all solutions will be needed to achieve the UN Secretary-General's goal to build a coalition to achieve net-zero emissions by 2050. Ultimately, the less resource and energy-intensive technologies with large commercial potential hold the greatest promise for the sustainable energy transition, and therefore should be prioritized. Global collaboration on the technology supply chain and clean technology research and development will be critical to enhance the accessibility and availability of clean technologies. This calls for leadership and collective efforts from both the Global North and South to bring together engineers, financiers, entrepreneurs, and energy system experts to drive the implementations and applications for decarbonization. ■



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Enabling migration as adaptation

As the climate warms, more people will be forced or will want to move, both within and between countries. How do we ensure that migration is supported, equitable, and beneficial for migrants and for sending and receiving communities?

By [Julia Blocher](#), Project Lead, Potsdam Institute for Climate Impacts Research (PIK), and [Kira Vinke](#), Head, Center for Climate and Foreign Policy, German Council on Foreign Relations (DGAP)

Climate change changes lives. It uproots families and shatters livelihoods. Managing the multidimensional impacts of extreme events requires new layers

of resilience. The ability to migrate in anticipation of a shock can increase the capacities of exposed populations. But without adequate policy responses, climate extremes will result in forced displacement rather than proactive, adaptive migration or managed retreat.

In 2021 alone, the Internal Displacement Monitoring Centre recorded 23.7 million displacements due to disasters worldwide. These

disasters included sudden-onset events like flooding and storms, not all of which were linked to climate change. While no numbers are available for people moving in anticipation of such events or due to slow-onset events, it is believed that this represents a large and growing population.

It is generally accepted that the people forcibly displaced by sudden-onset natural hazards are not

◀ **Families, displaced by drought in the Somali region of Ethiopia, at a camp for internally displaced people near the town of Gode.**
Migration is often proactive and in anticipation of adverse environmental conditions

improving their adaptive capacities by moving, but are removing themselves spatially from potentially deadly risks. While research around the world has shown that displaced people often return in the aftermath of crises, in many fragile contexts – such as in Afghanistan, DRC, and Papua New Guinea – displacement becomes protracted.

Predicting the number of people who will be forced to leave their homes in the future due to disasters and climate impacts is difficult, as multiple factors are involved in migration decision-making behavior. The second Groundswell report from the World Bank published in 2021 provides different scenarios for climate change-related population distribution change across six regions:

- East Asia and the Pacific
- Eastern Europe and Central Asia
- Latin America
- North Africa
- South Asia
- sub-Saharan Africa

The projected number of internal climate migrants in these regions ranges between 44 million (at the low end of the more climate-friendly scenario) and 216 million people (at the high end of the pessimistic reference scenario).

The emergence of migration as adaptation

The concept of migration as adaptation to climate change was crystalized over a decade ago in academic and policy debates, heralded by the landmark Foresight report on migration and global environmental change published by the UK government in 2011. Prior debates on climate change-related population movements often assumed

migration is a “last resort” option for impoverished and vulnerable peoples in climate-prone areas. The focus had therefore been on developing policy solutions that sought to build ecological resilience and reduce migration pressures.

The framing of “migration as adaptation” exposed the reality that migration decision-making is often proactive and organized in anticipation of unfavorable environmental conditions. Through financial contributions and so-called social remittances, migrants enhance their individual, households’, and communities’ capacities to cope with impending ecological damages. While some previous migration research focused on individuals as the unit of analysis, this line of thinking considered the effects of migration on origin and destination communities more holistically, without losing the notion of migrant agency that is core to the discourse.

Adaptation for whom?

The sometimes-saccharine framing of migration as a positive force for transformational societal change eventually gave way to understanding of the highly inequitable opportunities for migration, as well as the limits to local communities’ ability to adapt to rapidly evolving climate destabilization. Importantly, research on migration in general tends to demonstrate that the most vulnerable and socially disadvantaged members of communities are least able to migrate.

At the global level, opportunities for migration across borders are largely based on the natural lottery of nationality and social status. Moreover, numerous factors intersect to disadvantage certain members within households and communities: people who are poor, less educated, differently abled or elderly, and women, are often left behind in the literal sense.

Many agree that migration only holds potential for adaptation for specific groups of people and under specific circumstances. Studies from West

Africa and South Asia, for instance, have promoted an understanding of immobility as the counterpart to mobility. Those left behind lament the local “brain drain” and even “ghost villages” (as they are known in India and China).

Migration outcomes, meanwhile, vary widely. Adverse effects like poverty spirals and new dependencies in places of arrival can trap people in their destination. Without adequate financial resources, education, or training, and lacking social and legal protection, migrants may be unable to return. They may even experience debt bondage in ill-regulated labor markets.

Limits to adaptation

More recent work on migration as adaption has also evolved with the known and growing severity of climate change. Even lower levels of warming will have devastating effects on certain communities, for which even the most positive outcomes of temporary migration have only remedial effects. Over longer time horizons, migration can also fail to secure people’s livelihoods and result in maladaptive outcomes for migrants and their families.

For some communities, particularly those in low-lying atolls, there may be no sustainable option but to move away from the hazardous environment. Yet, most people prefer to stay where they are, known as sedentary bias. New research, such as the European Commission-funded HABITABLE project, seeks to go beyond previous understandings of habitability, which primarily consider ecological and biophysical limits to human habitation. Instead, scholars are now taking a systemic approach and including a greater consideration of psycho-social, political, and cultural concepts of habitability.

For example, in crisis areas, some community members are often found to stay put to protect their tenured land, and may only leave once health services and education are no longer functional.

Bifurcated identities in the Pacific islands

While culture and practices in low-lying Pacific island states have historically included retreating from coastal zones following extreme environmental events, current cases of significant out-migration and community relocations exist outside of “normal” migratory patterns. Communities’ ancestral lands are less favorable for human habitation due to extreme weather events and the gradual loss of habitable and arable land (as in the case of land subsidence, sea level rise, coastal erosion, saltwater intrusion, and frequent or recurrent meteorological hazards).

Beyond these ecological changes, important social and cultural factors leave exposed communities and specific vulnerable groups with fewer capacities to cope in place. “Modern” risk reduction measures have supplanted these communities’ traditional strategies of risk-sharing with trading and kinship partners who are now located across artificial international borders.

Paradoxically, labor out-migration of some community members accelerates this loss by wearing down the shared cultural fabric. This deep deprivation – linked to the emissions of industrialized countries – should also be seen in the context of the colonial legacy and the aftermath of the Pacific War which continues to mark culture, governance, and economies in many island states to this day.

Research in Papua New Guinea and Fiji found that climate impacts can result in the creation of bifurcated, altered, or hybrid identities: the loss of shared social and cultural identities, spaces, and meanings. This evolution affects the perceived habitability of a place and the ability of the community to successfully adapt in a new location.

Migration as risk diversification in East Africa

In East Africa, studies have shown that migration and mobility more broadly

can help households diversify income risks. Pastoralists, for example, may engage in temporary labor migration to support their household in rural areas.

However, new research from PIK finds that repeated exposure to shocks over time is associated with an increased probability of out-migration in Tanzania, especially for rural and agricultural households. As climate change impacts become more frequent

strengthen work to build adaptive capacities in local areas to support origin areas and people who are unable or unwilling to migrate. Nature-based solutions like farmer-managed natural regeneration (FMNR), a community-led reforestation technique, can stabilize agricultural livelihoods and improve soils. Insurance schemes for smallholder farmers

As climate change impacts become more frequent and severe, household adaptive capacities are diminished to the point that sending a household member to migrate is one of the few options left

and severe, household adaptive capacities are diminished to the point that sending a household member to migrate is one of the few options left.

Future policy options

The key to address these heterogeneous challenges is a multitude of approaches and flexibility in their implementation. While the effectiveness of adaptation options is dependent on rigorous and imminent mitigation, we introduce five main steps to boost resilience, so that migration can become an adequate adaptation option.

1. National governments can improve legal pathways for international migration of people at different skill levels, as per objectives laid out in the Global Compact for Safe, Orderly and Regular Migration (2018). Concrete ways forward could include additional quotas and capacity for the issuance of humanitarian visas for climate-displaced people or a climate passport for people whose homeland has become uninhabitable. Such measures could be tied to the reaching of certain warming levels, such as the 1.5°C limit, which could be crossed within the next 10 years.
2. Governments, non-governmental organizations, and partners can
3. Governments and partners can better integrate climate migration and displacement into urban planning. Fostering polycentric instead of monocentric urbanization, which goes hand in hand with the growth of megacities, may improve the capacities of cities to adequately respond to incoming groups of migrants. Labor market development and investments into medium-sized regional centers could reduce pressures on capital cities with large informal settlements.
4. Vocational trainings suitable to the urban labor market should be created that benefit both new arrivals and long-term settlers in impoverished urban areas. Pre-departure trainings can help migration choices and provide information on basic legal rights of migrants.
5. Research funds should be directed towards finding solutions to enable migration that could be effective adaptation, taking more systemic approaches. Interdisciplinary approaches and more research from institutions in most vulnerable countries are needed. ■



How to curb negative international spillovers?

Rich countries show no signs of decoupling their economies from the harmful environmental and social impacts they generate abroad. This must urgently change if we're to achieve the SDGs and limit temperature rise, but requires bold international action

By [Guillaume Lafortune](#), Vice President and Head of Paris Office, and [Eamon Drumm](#), Senior Program Officer, UN Sustainable Development Solutions Network (SDSN)

The Sustainable Development Goals (SDGs) adopted by all UN Member States in 2015 are a global responsibility. Reducing child and forced labor, stopping deforestation, and many other SDG

outcomes require deep international collaboration. Yet, too often, policies and actions undertaken in rich countries only account for their impacts domestically – even as they generate negative environmental and social impacts abroad. These are known as “negative spillover effects.”

In an October 2022 speech to the Centre for Global Cooperation, US Secretary of the Treasury Janet Yellen noted that “emerging markets and

▲ Container port in Genoa, Italy. Consumption in rich countries is generating high levels of ‘negative spillovers’ in the developing world: 40% of greenhouse gas emissions caused by the European Union are generated abroad

developing countries are often most acutely affected both by global shocks and by spillovers from the policies of advanced countries.”

Rich countries are responsible for the bulk of negative spillover effects, especially those embodied in the consumption of goods and services and unsustainable supply chains. This is the key finding of the 2021 Global Commons Stewardship Index, a joint publication of the University of Tokyo, the UN SDSN, and Yale University. SDSN has also been documenting these effects for many years in its International Spillover Index as part of its Sustainable Development Report, and in its European work.

We find, for example, that 40% of greenhouse gases (GHGs) emitted by the European Union are in fact generated abroad. The EU's consumption is responsible for 17% of tropical deforestation worldwide, according to WWF. SDSN and the University of Sydney have further documented how, each year, close to 400 workers die in the production of textiles used by EU citizens.

Biofuel mandates in Europe and other major economies have accelerated

tropical deforestation and land displacement in other parts of the world. Growing demand for raw materials, notably for renewable energy and other technologies in the EU, fuels GHG emissions and forced labor in other parts of the world. And the shipment of waste to countries and regions that cannot manage it has profound ecological and health impacts abroad.

There are no signs of structural decoupling between economic prosperity and negative spillovers. While many – including the US, Japan, France, and Germany – have managed to decrease their domestic CO₂ emissions in absolute and per capita terms compared with the early 2000s (though still too slowly to meet Agenda 2030 and Paris targets), there is currently no evidence of a structural decrease in CO₂ emissions from their imports.

Overall, high-income countries were responsible for more than 80% of cumulative imported CO₂ emissions between 2010 and 2018. This is one

more pillar of evidence that, when it comes to climate change, rich countries have a historical responsibility to act and to lead international efforts.

What rich countries must do now

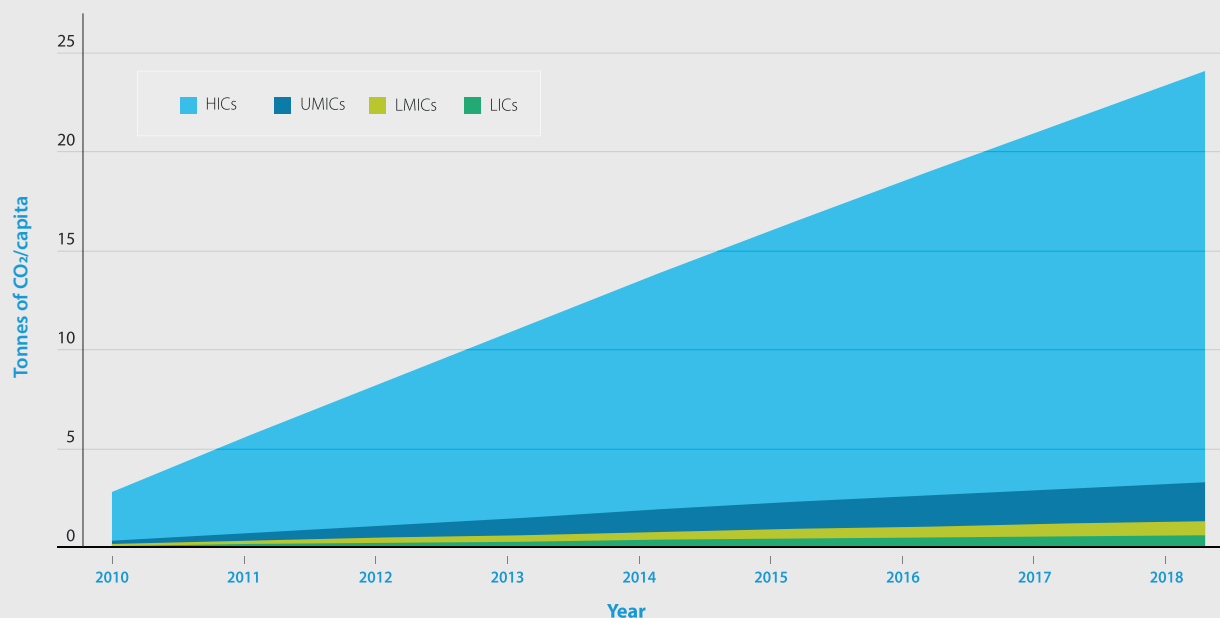
To curb these negative spillover effects and better support countries in their global responsibility to achieve the SDGs and climate goals, rich countries need to act on three major levers.

1. Action at home

First, domestic tools may help generate a level playing field and provide the right incentives. Due diligence regulations that make companies accountable for impacts generated throughout their supply chains, national targets, and strong data systems at national, industry, and company levels can help. In April 2022, Sweden announced its intention to become the first country to set a target on consumption-based carbon emissions.

Public management practices and procedures, particularly public

FIGURE 1: Rich countries are responsible for more than 80% of cumulative imported CO₂ emissions over the period 2010-2018



Source: Sachs, J., Lafortune, G., Kroll, C., Fuller, G., Woelm, F. (2022). From Crisis to Sustainable Development: the SDGs as Roadmap to 2030 and Beyond. Sustainable Development Report 2022. Cambridge: Cambridge University Press. Based on Lenzen et al. (2020)

procurement and regulatory impact assessments, should also be leveraged to prevent unintended consequences of domestic policies. If well designed, import bans – like the one recently adopted by the EU to tackle imported deforestation, or existing policies in Canada and the US to ban products made using forced labor – and border adjustment mechanisms may also help.

However, domestic instruments – especially import bans and tariffs – must be part of a larger package of efforts to support investment in cleaner production systems and digital technologies in developing countries. Otherwise, domestic border measures may be perceived by the rest of the world as hidden protectionism, which could slow or stop bold efforts to achieve the SDGs and climate action in developing countries.

In the same speech, Secretary Yellen rightly emphasized that “we must also help developing countries transition their economies away from carbon-intensive energy sources and expand access to clean energy. [...] If the global community benefits from investments in climate, then the global community should help bear the cost.”

2. SDG diplomacy

The second policy lever is therefore SDG diplomacy. This involves two pillars:

- international financing for sustainable development
- technical and research collaboration

Rich countries must lead on developing a global plan for financing the SDGs that covers official development assistance, blended finance instruments, specific climate mitigation and adaptation funding, and safeguarding the global commons. Countries (with and alongside multilateral development banks (MDBs) and public development banks) must also deepen their technical cooperation and share know-how to better understand policies, investments, technologies, and pathways that

can support SDG transformations in developing countries.

Unfortunately, rich countries have failed to deliver on many of their existing commitments. In 2021, only five OECD Development Assistance Committee member countries (Denmark, Germany, Luxembourg, Norway, and Sweden) achieved the target of dedicating 0.7% of gross national income to official development assistance. And things may get worse because of increased budget pressure and shifting policy priorities, especially in Europe. Rich countries have also fallen short in delivering on their commitment to mobilizing USD 100 billion each year by 2020 to mitigate further rises in temperature and help poorer countries adapt to climate change.

Rich countries (especially those in the G7 and G20) have an obligation to implement the call made by UN Secretary-General António Guterres in September 2022 for an “SDG Stimulus” to address the limited fiscal space in low and middle-income countries. It could build on positive moves made at COP26 in November 2021, including pledges by the US and the EU to slash methane emissions and the EU’s commitment of €1 billion to protect world forests. It would also complement new forms of North–South Partnerships, such as the new Partnership for a Just Transition for South Africa.

Large infrastructure projects led by the EU (Global Gateway), China (Belt and Road), and the US (Build Back Better World) should work together to support cleaner energy and production systems globally. The G20 can also support international governance reforms, notably via the World Trade Organization.

It is also crucial to reinforce the role of MDBs (such as the World Bank) and the IMF to better connect access to financing and sustainable development policies. Finally, global taxation reforms should also help curb profit shifting and unfair tax competition so that governments have more revenues to invest in SDG transformations.

3. Responsible consumption

The third lever involves responsible consumption. The war in Ukraine and energy crises in Europe and other regions have rebalanced public discussion and awareness, which was until recently overwhelmingly dominated by “production side” measures (including targets on renewable energy, or electric car production) towards sustainable consumption and energy efficiency.

This was emphasized in France by President Macron’s call in September 2022 for increased “sobriété énergétique” (energy savings), followed by an action plan by the French government. Transitioning towards healthier diets, lower food loss, less waste, and the circular economy (including by recycling electronic waste) can help reduce rich nations’ global footprint and its impact on food and mineral supply chains, among others.

Supporting R&D and innovations in energy storage but also in the manufacturing and design of renewable energy infrastructure (including solar panels) are key priorities for curbing spillovers embodied in the consumption of raw materials and other supply chains.

Conclusion

Deglobalization and protectionism should not be the main response to address unsustainable supply chains. A sound and ambitious global response to curbing international spillovers should build on partnerships and on concerted efforts, led by rich countries and the G20, to improve living standards in developing countries and invest in clean technologies and infrastructure needed to achieve the SDGs and climate goals.

November’s COP27 in Egypt, the 2023 SDG Summit, and 2024 Summit of the Future (both in New York) must provide a strong, clear impetus for SDG actions and financing that will help curb negative spillovers and make the international trade system more sustainable. ■



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Masks off, gloves off

Oil and gas companies turn record profits, while their fossil-fuelled emissions rapidly accelerate climate change. Tackling the problem means challenging these powerful economic interests and the political access it affords them



◀ At COP26, Glasgow, the fossil fuel industry had over 500 registered delegates, more than the host nation

year brings increasingly severe forest fires, droughts, and floods.

Three-quarters of climate-warming emissions come from burning fossil fuels. Limiting temperatures to 1.5°C, as outlined in COP21's Paris Agreement, means leaving the vast majority of known reserves in the ground. However, doing so challenges the financial interests of one of the most powerful industries in the world. A recent study by Professor Aviel Verbruggen shows the oil and gas

from vested interests. There is an opportunity to do so at COP27. If grasped, the world may yet find the ambition needed to avert catastrophic climate change.

Problem of lobbying

Oil companies like Shell, Exxon, and Total knew the impact on the climate of burning fossil fuels decades ago. Rather than acting, which would mean jeopardizing their business models, they sowed doubt around the science and manufactured their own "facts."

While today they are publicly more accepting of the science, they continue to lobby against policies which would reduce the use of fossil fuels, such as renewable energy

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industry has made €3 billion a day for the last 50 years, while quarterly profit postings by the likes of BP, Shell, and Exxon have broken all records. To ensure these profits continue, the industry has spent billions on lobbying decision-makers at national, regional, and UN level. Their aim has been to weaken or delay policies that could wean the economy off their core product.

Should the UN, which prides itself on multilateralism, still allow these companies to take part in the negotiations when there is such an obvious conflict of interest? The UN's Framework Convention on Climate Change (UNFCCC) could look to the World Health Organization's Framework Convention on Tobacco Control (WHO FCTC) for inspiration on how to address the conflict and protect public interest policymaking

targets. Instead, oil and gas majors and their lobby groups argue for "technology-neutral" policies, which would allow industry itself to decide how to cut emissions. Carbon markets fit this bill and have been a key policy repeatedly championed by the fossil fuel industry.

In the European Union, BP was key in successfully lobbying for the bloc's flagship emissions trading system (EU ETS), defeating the campaign for a carbon tax. Once its policy had been accepted, the fossil fuel industry and its lobby groups then set about introducing numerous loopholes to weaken its effectiveness and boost profits. Between 2008 and 2014, energy-intensive companies made €24 billion in windfall profits thanks to free handouts of emission permits, while the ETS's impact on emission reductions was negligible.

By **Pascoe Sabido**, Researcher and Campaigner, Corporate Europe Observatory

A third of Pakistan was under water this August due to extreme flooding. Millions lost loved ones and livelihoods. Climate change is impacting those that did the least to cause it, but not only them. In Europe, Australia, and North America, historically the biggest emitters, every

Any successful lobbying depends on political access. In the first two and a half years of the current EU administration, headed up by Ursula von der Leyen, research by Friends of the Earth Europe revealed that the EU had 500 meetings with the fossil fuel industry – the equivalent of almost one every working day.

At COP26 in Glasgow, an investigation by Corporate Europe Observatory, Corporate Accountability, Global Witness, and Glasgow Calls Out Polluters revealed the fossil fuel industry to have the largest delegation at the talks. More than 500 lobbyists were registered to attend, more than twice the size of the delegation of the host nation. Canada's delegation included lobbyists from Alberta tar sands company Suncor.

The delegation of Equinor, Norway's state-owned oil and gas giant, included Amber Rudd, chair of its UK International Advisory Group. Until September 2019 Rudd was a UK cabinet minister under Prime Minister Boris Johnson and had previously served as Secretary of State for Energy and Climate, before going through the revolving door. Hiring ex-politicians is a common way for fossil fuel companies to gain political access, profiting from their existing networks and know-how.

Oil and gas industry influence was evident in the UN negotiating halls. While the final text references “phasing down” coal, the conspicuous absence of oil and gas alongside it are a testament to the power of their lobby groups. David Hone, head of climate at Shell, had previously boasted during a side event at COP24 that his oil company helped write part of the Paris Agreement: the part that included carbon markets.

While the oil and gas majors make public statements in support of the Paris Agreement, their business plans foresee an increase in fossil fuel production up to 2030 and continued extraction beyond 2050. PR and lobbying play an important role in hiding this contradiction. In the three

years following COP21, InfluenceMap research shows the five oil and gas majors (Shell, BP, Total, Chevron, and Exxon) spent more than USD 1 billion on misleading climate-related PR and lobbying. Clearly going against the goals of the Agreement, the desired outcome was to maintain the companies' social license and justify expanding fossil fuel operations. These figures are not one-offs, and consistently high spending is a key reason why they secure such high levels of political access. Respecting the Paris Agreement and keeping temperature rise below 1.5°C requires addressing the vested interests of the fossil fuel industry.

Learning from the tobacco treaty

Public health officials faced the same obstacles and tactics from the tobacco industry that we see today from the fossil fuel industry. That's why the WHO included Article 5.3 in its FCTC, which recognizes the “fundamental and irreconcilable” conflict between the interests of the tobacco lobby and the interests of public health officials. To unlock the necessary ambition, the FCTC called on governments to “protect public health policies from

called for a conflict-of-interest policy at the UNFCCC. These have been mirrored by civil-society groups from around the world. However, progress has been consistently blocked by the US, EU, and other historical polluters such as Canada and New Zealand. In the vacuum, national and regional-level initiatives have sprung up in the EU under the Fossil Free Politics campaign, launched by Corporate Europe Observatory, Friends of the Earth Europe, and Greenpeace Europe.

COP27 represents an important opportunity to once again address conflicts of interest at the UN level. The UNFCCC secretariat – ordinarily in favor of a multi-stakeholder, “everyone is welcome” approach – is now conducting its own review around participation at the talks. A public campaign to “Kick Big Polluters Out” has been launched to build broad-based support. Inside the talks, a cross-constituency coalition of environmental, youth, feminist, and trade union groups has come together around the issue for the first time. It's calling for a conflict-of-interest policy and an accountability mechanism to enforce and monitor it. If successful, it could greatly reduce the influence

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the commercial and other vested interests of the tobacco industry.” In practice this meant a firewall between public health officials and the tobacco industry, limiting lobbyists' access to only when strictly necessary for regulating. This firewall applied not just at the UN level, but also to every government that signed the treaty.

The parallels are clear, which is why countries representing almost 70% of the world's population have

of the fossil fuel industry and other climate-harming interests over the talks and unblock much-needed ambition. If it fails, given the current trajectory, that ambition is unlikely to materialize.

With the stakes so high, we must urgently address these vested interests. As one longstanding observer of the negotiations put it: “When you're trying to burn the table down, you don't deserve a seat at it.” ■



Prince Sultan Bin Abdulaziz International Prize for Water

Recognizing Innovation



Winners for the 10th Award (2022)



Creativity Prize

1) The team led by Thalappil Pradeep (Indian Institute of Technology, Madras, India)

for the creation and successful deployment of environmentally friendly "water positive" nanoscale materials for the affordable, sustainable and rapid removal of arsenic from drinking water. Team members include Avula Anil Kumar, Chennu Sudhakar, Sritama Mukherjee, Anshup, and Mohan Udhaya Sankar.



Dr. Thalappil Pradeep

2) The team led by Dionysios D. Dionysiou (University of Cincinnati, USA)
for the development of innovative advanced oxidation technologies and nanotechnologies for environmental applications, particularly in the removal and monitoring of emerging contaminants. Team members include Wael H.M. Abdelraheem, Abdulaziz Al-Anazi, Jiong Gao, Ying Huang, and Vasileia Vogiaz.



Dr. Dionysios D. Dionysiou



Surface Water Prize

Dennis D. Baldocchi (University of California Berkeley, USA)

for the development and implementation of effective models to understand, evaluate and predict evapotranspiration and water-use efficiency in various environments under climate change conditions.



Dr. Dennis D. Baldocchi



Groundwater Prize

Linda M. Abriola (Brown University, USA)

for pioneering research on toxic Dense Non-Aqueous Phase Liquids (DNAPLs) in groundwater, ranging from the simulation of their fate to effective methods for cleaning contaminated sites.



Dr. Linda M. Abriola



Alternative Water Resources Prize

**The team of Menachem Elimelech (Yale University, USA) and
Chinedum Osuji (University of Pennsylvania, USA)**

for wide-ranging advances in nanostructured materials for next-generation water purification, focusing on implementation issues like manufacturing, sustainability, self-assembly, and biofouling.



Dr. Menachem Elimelech



Dr. Chinedum Osuji



Water Management and Protection Prize

The team led by Matthew McCabe (KAUST, Thuwal, Saudi Arabia)

for employing CubeSat constellations in the sustainable management and security of linked water-food systems, along with estimates of agricultural water use at unprecedented spatial and temporal resolutions and with global coverage. Team members include Bruno Aragon (KAUST) and Rasmus Houborg (Planet Labs, USA).



Dr. Matthew McCabe

Invitation for Nominations

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Nominations open online until 31 December 2023

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Wanted: data on pricing climate risks

Private markets function on data – but the data to accurately price climate risks in investment decisions is sorely lacking. We must urgently fill this information void or private finance will fail to contribute to climate action



◀ **The aftermath of floods in Verviers, Belgium. Many private investors hold the false belief that financial markets price in climate risks**

impacts (Sustainable Development Goal 13), private investors can and do play an important role in the development of projects and products that contribute to climate action.

However, private market actors are often guilty of holding false beliefs about climate change: namely that climate risks are already priced in, and that the impact of anthropogenic climate change can be offset by financing an energy transition. Neither of these views is realistic or fact-based. To be a genuine force for climate action, private markets should focus on the creation of investment knowledge about climate risks that does not currently exist.

Can markets fully price climate risks today? It seems very unlikely. The science of climate change does not currently offer the information granularity that private investors need to process differences of exposure to climate risks between two businesses located on the same continent, let alone the same city. Climate change promises to increase the likelihood of events that would completely change the long-term availability and substitutivity of resources in ways that are both unpredictable and irreversible. Today, the information about what climate change entails for the myriad individual financial assets simply does not exist. A close look at climate stress tests in the banking sector, which require a high level of generalization at the sector level, is testament to this lack of information.

Some may point to the recent financial performance of certain greener types of financial assets as evidence that “green is priced.” But empirical research has shown that this “green premium” effect is the result

of higher demand for such assets (leading to higher valuations). Once this transitory excess demand (as well as traditional risk factors) are taken into account, there is no additional financial performance of greener assets. (See, for example, “Dissecting Green Returns” by Pastor, Lubos and Stambaugh of the University of Chicago and Pennsylvania, 2021, or “The Green Infrastructure Premium,” Amenc and Blanc-Brude of EDHEC, 2022.) Moreover, if markets priced climate risks, greener assets should be considered less risky and have lower, not higher, returns.

Market predictions

Markets can be good at processing new climate information about the near term. For example, looking at weather future contracts that allow trading options on future temperatures, there is evidence that markets can be highly accurate at predicting the evolution of future temperatures, and do take the latest climate science into account (see “Market expectations of a warming climate” by Schlenker and Taylor in the *Journal of Financial Economics*, 2021). However, such predictions can only be made a few months ahead of time.

Markets do not know the future. Instead, they place bets on business activities: repeatable, reversible events that only change the nature of the economy and impact the availability of resources incrementally and at the margin. But climate risks are too complex to predict or model with any accuracy and entail systemic changes, some of which are irreversible and therefore the consequences of which are unknowable. Faced with an almost complete absence of information, it is not possible for markets to fully process climate risks, let alone reflect them in asset prices.

The second fallacy that markets too often promote is the idea of an energy transition away from fossil fuels as the obvious next step in a long series of technology and business-led fuel substitutions. In fact, there has never

By **Frédéric Blanc-Brude**,
Director, EDHEC Infrastructure
Institute, and CEO, Scientific Infra

Since COP26 and the commitment by members of the Glasgow Financial Alliance for Net Zero (GFANZ) to accelerate the decarbonization of the economy, there has been some finger pointing and accusations of cynicism and even greenwashing directed at the financial sector. Still, it is clear that when it comes to taking urgent action to combat climate change and its

been a single energy transition in the history of modern capitalism.

The data collected by the BP statistical review is an easily consulted reminder that the world economy has been using or burning more wood, coal, gas, and oil every year in absolute terms for the past 400 years. Of course, over time more potent (cheaper) forms of energy have been substituted for existing ones for certain uses (such as heating). But new energy sources have largely allowed for technological development and economic growth: the production of new goods and services. The age of oil requires more steel, which requires more coal, and allows cutting and processing wood at the lowest cost ever thanks to oil-guzzling chainsaws and roto-chopper horizontal grinders. In absolute terms, private markets have only ever achieved an accumulation of energy uses, never a net substitution.

Investment knowledge

Today, the financing of new renewable energy sources plays an important role in limiting new emissions in the context of a continued growth of consumption and energy use (rising from about 20,000 terawatt hours (TWh) in 1930, to 120,000 TWh in 2000, and 180,000 TWh in 2021 for primary energy consumption). But this “transition” has only contributed to meeting new energy demand and has yet to make a dent in the global use of other sources of energy in absolute, physical terms (in total TWh rather than dollars per unit produced). The amount of energy that is needed by the world economy is so colossal in absolute, physical terms that even the least ambitious scenarios from the Intergovernmental Panel on Climate Change require a significant amount of (currently inexistent) carbon capture technology for any substantial decarbonization to take place.

Such beliefs in omniscient markets that already know the price of climate risks or in easily financed transitions away from old sources of energy – when in fact humanity always uses

more of all available sources of energy – create a false sense of security, including among policymakers. They promote the notion that private investor initiatives and alliances can sort it all out by 2050.

In effect, private markets can only do one thing: process the information that already exists and is available to the buyers and sellers of real and financial assets at a given point in time, to form asset prices. Economic and financial resources are then allocated on the basis of these prices. But using all available information today cannot be equated with knowing (and pricing) everything. Markets often fail to allocate resources efficiently, let alone

// Because addressing climate change is fundamentally a problem of information, private markets not only can but should be a force for climate action

fairly. Still, we know they tend to do a better job than most other forms of economic regulation.

Today, the lack of investment knowledge about climate risks combined with such false narratives increases the likelihood that private capital will fail to contribute significantly to climate action, thus creating entire cohorts of disenchanted Stuart Kirks (the former global head of responsible investing at HSBC’s asset management division). This would not only be too bad, but also a tragedy. For what other institutional setup than markets can possibly process the complex knowledge that characterizes climate change? Can digest it, create claims on different states of the world, and allow for an adequate allocation of resources given the actual risks faced by humanity? Governments or regulators certainly have an even worse track record.

Because addressing climate change is fundamentally a problem of information, private markets not only

can but should be a force for climate action. They are the best institutional arrangement available to process such complex and dynamic information. Private investors should thus focus on moving away from easy narratives and focus on the creation of more and better information about climate risks for the market. This information and the investment knowledge it would create has a market value and can be a viable private endeavor instead of the unattainable “public good” it is often presented to be.

Concrete steps to achieve this shift among financial institutions include:

- training all key management and marketing staff in the science of climate change to avoid the development and dissemination of false beliefs about its nature, impacts, and scale
- contributing to independent data consortia and adopting common but independently validated norms and standards
- putting an end to self-certification schemes such as “green bonds” or “sustainable infrastructure” to create reliable information about climate risks
- supporting independent research on the relationship between large-scale climate dynamics and asset-level risk exposures to allow the proper management and pricing of climate risks in financial assets

Being a force for climate action is fully business compatible. But it requires market participants to equip themselves with the information and the investment knowledge that will make climate risks effective inputs in investment decisions. ■



The business case for the SDGs

To transform our world, the SDGs must also transform business. With just seven years left to the deadline, we must explore bold, new ways to encourage companies to genuinely engage with the goals and embed sustainable, climate-friendly practices for the long term

By [Martha McPherson](#),
Director, Ever Sustainable

The corporate world is eager to engage with the SDGs. Globally, Google data shows a steady increase in searches for “Sustainable Development Goals” over the past five years. Anecdotally, the number of clients I hear mentioning the SDGs, sometimes very early on in a strategy development process, feels like it is growing month to month. The high-

profile Conference of the Parties has certainly helped drive awareness of sustainability issues like the climate crisis.

Meanwhile, knowledge of the ins and outs of the 17 SDGs, at both goal and indicator level, has burgeoned dramatically. The 16,000 business signatories of the UN Global Compact have access to online business hubs and tools, as well as local networks linking business with civil society and government.

▲ The ‘SDG Moment’ event at the start of the UN General Assembly’s High-level Week. Despite the corporate world’s evident eagerness to be associated with the SDGs, substantive alignment with the SDGs has long way to go. Accusations of “rainbow-washing” are becoming more widespread

But with all the tools available, all the interest demonstrated, and all the genuine passion for this important international framework, there is still significant pace to make up for

businesses to be truly aligned with the SDGs.

In a world where greenwashing is the newest slur to be levied at business, with companies facing legal action for making green claims that cannot be substantiated, the SDGs seem like the unruly cousin – an unregulated, opt-in, no-repercussions framework. No one is going to hold a chief financial officer's feet to the fire if they haven't achieved the alignment goal they set for SDG 3.

At the same time, there is nothing to be lost in demonstrating to investors and other stakeholders that your business is au fait with the goals by placing a roundel on your corporate communications. "Rainbow-washing" – the name for greenwashing when it applies to the SDGs – is heard in the corporate world more and more frequently, but there are as yet no legal or financial ramifications for doing it.

Both too open and too closed

The SDGs are like motherhood and apple pie. Everyone likes the concept: the 17 goals are wide-ranging and horizon-broadening, and they are hard to disagree with. It is difficult to state, at any level of a business, whether you are an intern or the CEO, that you are opposed to ending global hunger. That wouldn't go down well by the water cooler, or in the global Zoom room. And yet, it is relatively abnormal for companies to engage with the SDGs at a deep operational level – in a way that engages with business growth, research and development, innovation, transformation, and that fundamental shift needed towards new, greener, more socially oriented, and sustainable economic markets.

Instead, businesses tend to pick the SDGs that their operations are closest to. They tie the goals into their already-existent sustainability strategy, and hope their efforts in that direction will naturally have an impact. This is a good start. One would hope that, having linked SDGs into their sustainability frameworks, the goals would naturally feed upwards into a business's operations.

But it is not so simple. Strategies are nothing without key performance indicators and targets, and getting down to the indicator level of the SDGs is where businesses often find their first hurdle. There are 231 unique indicators that sit underneath the 17 SDGs, and the way that they are scripted does not always allow business to meaningfully engage.

For an agriculture business which has, in theory, a close relationship to SDG 2 (end hunger, achieve food security and improved nutrition, and promote sustainable agriculture) it may be impossible to feel that there is meaningful contribution to be made to any of the indicators, which measure elements like:

- prevalence of undernourishment (2.1.1)
- presence of anaemia in women (2.2.3)
- agricultural export subsidies (2.b.1)

It is very hard to engage with SDG 17 (strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development) unless you are a government, non-governmental organization, or international finance body. And that is because the SDGs were built through complex, long-form international negotiation and diplomacy with many actors. Businesses were far from the core players, and the outcomes were not designed only to engage them.

This does not mean we need to start from scratch. While the issues outlined above might feel far from a business's day-to-day activities at first blush, it is almost certain that such indicators are stored up in their supply chain. Somewhere in those 231 indicators, most businesses should find something to which they can meaningfully contribute. Indeed, firms may find that the exercise helps them to think laterally and holistically. How could a manufacturing business meaningfully contribute to 1.4.1 – an increase in the proportion of population living in households with access to basic services?

Perhaps, if they were a kitchenware manufacturer, they could donate some of their excess stock to community groups whose basic needs are not currently met. Or they could keep a percentage of goods at low enough costs for such groups to access them on an ongoing basis. Both are potentially exciting outcomes for a business to consider and, in doing so, line up with wider thinking about the role of businesses in wider communities, and variations of stakeholder capitalism.

Currently, the former activity – donating goods – would likely be characterized under a standalone charitable initiative. The latter activity would form part of a pricing strategy. But neither would involve operational change. Should the prompt from the SDGs really be towards these short-term, initiative-led approaches? Or should it indicate instead more transformative change, supporting firms – and so, our economies – to move in a long-term direction, radically shifting their operations to support sustainable development?

This "investigate-the-indicators" methodology is a high-friction, high-investment approach to the SDGs. It involves deeply combing the indicators for something that might not be evident, and may not be operationally important. Will the kitchenware manufacturer find indicators across multiple SDGs? Will they be able to respond to the interconnected manner within which the SDGs should be realized? And are there genuine contributions to be made to the achieving of the SDGs that firms may be able to provide, but are not currently captured in existing indicators?

As a default outcome, then, businesses are often left with top-level alignment, and little room for maneuver underneath. The SDGs at goal level are open enough for any business to argue that they have considered them within their planning. But in their granular, indicator form they are too closed for firms to feel like they can genuinely contribute.

What happens next?

There are seven years left until 2030, when the clock runs out on the SDGs and we look to the next generation of the framework. In those seven years, I believe we need to be more experimental to draw the power and finance of the private sector into the SDGs' vision. These experiments would be usefully focused on business operations rather than initiatives, and on long-term transformation rather than short-term impacts.

One experiment could be to promote the hooking of the SDGs into the innovation, research and development, new business, and sales and marketing functions of business, drawing them into the strategic center of business activity. The same approach has proven valuable for the wider sustainability or ESG (environmental, social, and governance) drive within business. How

▼ A Fair Trade-certified factory making garments for Patagonia in Valladolid, Mexico. Patagonia has gained a reputation for its efforts to build sustainability into its operations and supply chains

would a new product or service offering be developed if it was to be targeted at SDGs 4 and 9? How would design teams react if they knew the customer demographic particularly valued SDG 7? Using the SDGs to shape out a new business canvas, rather than retrofitting it into existing activities, could lead to transformational outcomes.

A second experiment here is to develop a secondary set of indicators, diversified from the current suite, that are actionable for the private sector. These should be more open than the current indicators and give specific guidance to different sectors to help them work towards the goals, galvanizing work towards, not just alignment to, the goals. Co-creation with business could lead to peer learnings and deeper buy-in for the SDGs, and gain insight from the business community – all useful as we look towards 2030.

A third route could pick up the legal fight. There is a role for the SDGs in state and region-level business legislation, to make the legal risk that accompanies greenwashing

real for rainbow-washing too. The recommendations of the Task Force on Climate-Related Financial Disclosures, a mandated reporting requirement in the UK from 2022 for companies of a certain size, has shifted climate risk and opportunity to the mainstream, and is an example of where regulation has moved the dial on strategy. Some nations have already embedded the SDGs into investment policy. Scotland is a good example of this being done within the context of nationwide innovation and development, with the SDGs at the heart of its National Performance Framework.

Extensive work has been done to embed the SDGs in places where the barrier to adoption is low, and interest is high – in academia, education, and the charities sector. Business, with its high contribution to global emissions, and its footprint on employment, the economy, and the natural world, should be the designated focus for the next seven years. It is the power and the potential of this challenge that keeps me working with businesses on the SDGs. ■



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Climate-proofing to sustain peace

Vulnerability to climate change is higher in many places suffering war, yet peacebuilding efforts often fail to consider climate impacts. In a warming world, where conflict and crisis persist, ensuring that efforts to sustain peace also support climate action must be a top priority

By [Catherine Wong](#), Team Leader
– Climate and Security Risk, United Nations Development Programme

As we took stock of the scale of devastation in Pakistan (described by the UN Secretary-General as evidence of the “sheer inadequacy of the global response to the climate crisis, and the betrayal and injustice at the heart of it”), thousands of miles away in Florida a category 4 hurricane made landfall, causing loss of life, and billions in losses and damages.

The destruction caused by climate-related extreme weather events will likely continue to feel unrelenting for many others on the front lines. Scientists have found that we are much closer than we thought to triggering



◀ The flooded village of Canal, South Sudan, situated on the confluence of the Nile and Sobat rivers. South Sudan has been devastated by a six-year-long civil war that broke out shortly after it achieved independence from Sudan

climate and environment as policy agendas are often deprioritized in fragile and conflict-affected contexts. This is the case even when adaptation and access to energy in these same countries are greatly needed and when conflict itself contributes to the destruction of the actual assets needed to adapt to and mitigate climate change.

Progress to peace may not be conducive to climate action either, due to post-conflict economic

Prioritizing peace and climate action

A successful climate agenda in countries suffering conflict and fragility must not only contribute to peacebuilding objectives, but should go a step further and climate-proof efforts to sustain peace. Peace and security actors have in recent years begun to understand this and to consider climate risk more holistically.

Take, for example, the UN Security Council, the African Union Commission, the EU, and the Pacific Island Forum. Climate change has been recognized in resolutions, mandates, and strategies. NATO has conducted an impact assessment and is also developing an action plan on climate change and security. In terms of policy, strategy, and planning, there are nationally

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tipping points in the Earth's systems. And still we continue to test the limits of adaptation. The 2021 and 2020 Adaptation Gap reports show that investments are not keeping pace at all with needs and are indicative of the direction of these trends. In light of this, the UN Secretary-General set a target in March 2022 to ensure that everyone be protected by early warning systems by 2027. Coverage in Africa, however, is just 60%.

There is so much to be said about what we can do. But some of the questions that we can't answer – about the continued lack of prioritization of climate action and, likewise, the challenges we struggle to surmount in doing so – relate to conflict, fragility, crisis, and insecurity. While no one denies they are pressing and urgent,

recovery and increased pressure on natural resources. The need for higher prioritization cannot be understated. An estimated 40% of intrastate conflict over the last 60 years has been linked to natural resources. Where conflicts are linked to natural resources and/or environmental degradation, recurrence is twice as likely within five years.

While there is no direct link claimed or asserted between climate and conflict, the Sixth Assessment Report of the Intergovernmental Panel on Climate Change shows that vulnerability to climate change is higher in places suffering violent conflict. Solutions that address climate-sensitive livelihoods and contribute to women's empowerment can reduce risks to peace. Strengthening adaptive capacity, meanwhile, can mitigate the potential negative impacts of climate-related displacement.

determined contributions under the Paris Agreement and national adaptation plans that do consider climate-related security risks and can serve as a blueprint for policy mainstreaming.

On the ground, although much peacebuilding work takes place in environments highly vulnerable to climate change, it is still for the most part "climate-blind." One exception is the 2018 Regional Strategy for the Stabilization, Recovery, and Resilience of the Boko Haram-affected Areas of the Lake Chad Basin by the Lake Chad Basin Commission and the African Union Commission. It observes that, confronted with climate change, desertification, and the loss of traditional livelihoods, local populations may "explore alternative livelihoods, including violent extremism." It includes climate-fragility assessments

to inform the planning process and stresses that “all future investment in socio-economic development must be climate-proofed.”

Post-conflict stabilization efforts can serve as an opportunity to deploy low-carbon technologies at the outset of reconstruction efforts. Such efforts can avoid costlier retrofitting later on, and help shift from humanitarian and emergency response to adaptation and resilience. Climate change vulnerability, impacts, and risks are also important to state-building and to our efforts to prevent violent extremism, just as they are to peacebuilding. In contexts where natural resources are constrained, they may be instrumentalized against local populations. Non-state armed groups may play a regulatory role in the management of natural resources or may even assume the role of alternative service providers in response to climate-related extreme weather events, particularly where there is a low state presence. This can not only strengthen these groups’ perceived legitimacy, but can also help aid recruitment efforts. In demobilization, disarmament, and reintegration efforts, the role of natural resources as well as climate change and environmental degradation (as they impact on climate-sensitive livelihoods) can be key to success and sustainability.

Climate finance and the elusive peace dividend

To climate-proof the work of sustaining peace, we will require not only more agile climate financing, we will also need to understand climate finance in a way that goes beyond socio-economic co-benefits and considers the peace co-benefit or “dividend.” So far, this has been missing. Peace, like conflict, is notable for its absence in the global goal on adaptation compilation report, the first global stocktake on the state of adaptation efforts, experiences, and priorities, and the ongoing debate on the New Collective Quantitative Goal on Climate Finance. From the perspective of Agenda 2030, there is little synergetic understanding of the nexus between

Sustainable Development Goals 7 (affordable and clean energy), 13 (climate action), and 16 (peace, justice, and strong institutions).

However, the UN’s work in this space is helping to promote innovation. UNDP’s study on climate finance for sustaining peace (with the Climate Security Mechanism and Nataij Group, launched at COP26) shows that countries affected by conflict and fragility and suffering some of the highest levels of climate change vulnerability receive the lowest levels of climate finance. Between 2014 and 2021, non-fragile states received USD 161.7 per person in multilateral climate finance through the vertical funds. Fragile states, however, received just USD 10.8 and extremely fragile states only USD 2.1. Clearly, fragility and conflict matter in climate finance.

This subject was debated for the first time by UN Security Council members under the Presidency of the United Arab Emirates (also the COP28 host) in an Arria-formula meeting, Climate Finance for Sustaining Peace and Security, in March 2022. This highlighted the importance of aligning climate finance with conflict prevention

face, particularly in Africa and fragile and conflict-affected settings. Notably, in September 2022, the organizers, the Cairo International Center for Conflict Resolution, Peacekeeping, and Peacebuilding, collaborated with UNDP to convene the very first technical consultations on the scope of a new potential initiative on climate responses for sustaining peace under the Egyptian COP27 presidency. Its four priorities are:

- accelerating climate finance for sustaining peace in Africa
- advancing the climate adaptation and peacebuilding nexus
- building peace through climate-resilient food systems
- advancing durable solutions to the climate-displacement nexus

Conclusion

Giving higher priority to climate action and sustaining peace is needed both in conflict-affected and fragile states, as targets are not static. To adapt to global warming of 2°C to 4°C, finance for adaptation will need to increase to between USD 280 billion and USD 500 billion a year by 2030, by which time an estimated two-thirds of the world’s extreme poor will live in fragile states.

Countries affected by conflict and fragility and suffering some of the highest levels of climate change vulnerability receive the lowest levels of climate finance

and peacebuilding strategies. Using the occasion of the 50th anniversary of the 1972 UN Conference on the Human Environment (Stockholm+50), Kenya launched a Call for Financial Action towards the Nexus between Climate and Security.

This momentum has continued on the road to COP27, as climate finance and peace also featured in the Third Aswan Forum for Sustainable Peace and Development. This drew attention to the finance gap that developing countries

Climate finance remains risk-averse despite the urgent need to increase allocations in these environments that have suffered underinvestment. One of the strongest arguments for prioritizing climate action and finance in countries suffering fragility and conflict is the business case for investing in prevention first, rather than relying on response alone. In this regard, investing in climate-proofing the work of sustaining peace should be a matter of highest-priority climate action. ■



Flood risk: Jakarta case study

If global warming reaches 3°C – our current trajectory – rising sea levels will likely threaten the land on which over 10% of the global population currently resides. Asian countries are particularly exposed and Indonesia's capital, Jakarta, epitomizes the challenges faced

By [Triarko Nurlambang](#), Department of Geography, SDGs Hub, University of Indonesia

In the last few decades, Jakarta has continually faced two problems: traffic congestion and flooding. The flooding problem has existed since the city began to develop in the 17th century. Now, it seems Jakarta suffers flooding every year. Why?

Central and eastern Jakarta is in the lower reaches of the Ciliwung watershed, while the west of the city lies in the Cisadane watershed with its 13 rivers. The northern part of Jakarta is a basin. In other words, much of Jakarta is a water storage area.

Land use change in recent decades in Ciliwung has reduced vegetated areas and open spaces. This has significantly affected the local water

▲ Construction of a seawall against the backdrop of an abandoned mosque, claimed by the encroaching sea in the Maura Baru district, Jakarta, Indonesia

system, increasing the surface water runoff. Meanwhile, rivers in Jakarta are less able to hold and drain the runoff, due to increased sedimentation and more domestic and industrial waste being dumped in the water. Jakarta's

Spatial Planning Law stipulates that 30% of the city be open and vegetated land. However, extensive development means the actual figure is only about 10%. Consequently, there is much less land available to absorb surface water and river runoff.

At the same time, Jakarta is experiencing increased tidal flooding. One factor is thought to be rising sea levels due to climate change. But far more critical is land subsidence of 10cm or more a year in Jakarta's coastal areas. A business-as-usual trajectory predicts that 40% of Jakarta will be under water by 2050, stretching up to 5km inland from the current coastline.

Jakarta's subsidence is caused by increased load on the land. The city's development area contains many high-rise buildings, each demanding massive amounts of water. Surface water cannot meet the demand, so much of the water comes from deep wells. This continuous depletion of deep groundwater means the ground above it is sinking.

To compound this, the city is also on a flood plain in an area that recorded average monthly rainfall of 171.79mm over the last four years. Generally, flooding occurs when monthly rainfall tops 200mm. In January 2020 rainfall hit 618mm and in February rose to 1,023.4mm, leading to extensive flooding over several days. Future flooding poses obvious risks for the city's 10.65 million residents, many of whom live in densely packed housing developments along the banks of the river. But with 60% of Indonesia's money supply located in Jakarta, any risk to the city threatens the entire Indonesian economy.

Efforts and obstacles

To address the problem, central government, Jakarta's provincial government, and neighboring provinces have carried out various spatial planning efforts, including hydrological technical control measures. In 2008, a spatial policy was formulated for the Greater Jakarta, or Jabodetabekjur,

area. In 2020 the policy was updated in line with dynamic regional development realities.

The plan stipulates that each building must not cause increased water discharge to the drainage or river flow systems, a principle known as zero delta q. In addition, the plan also emphasizes strategies to:

- green the upstream area of the watershed as a protected area
- rehabilitate forests and land
- green the catchment area
- organize the border area of the river and its tributaries, including controlling development on the river border

The plan also reaffirms the need to maintain green open space at a minimum of 30% of the urban area.

Other measures implemented by the central government and the province of Jakarta include:

- building three reservoirs in the central Ciliwung watershed (higher than the coastal area) to mitigate flood risk
- maintaining the west and east flood canals (built by the Dutch about 100 years 50 years ago, respectively), which control sedimentation to smooth the flow of the river into the sea
- several programs to improve the function of lakes and ponds in the Jakarta area and its polder system (tracts of low land reclaimed from bodies of water)

Despite these efforts, major obstacles to successfully saving Jakarta from flooding remain. These include:

- problems around land acquisition
- low levels of community participation
- poor cooperation between local and central government
- a lack of systemic and holistic understanding of natural systems, especially hydrological systems

Residents' awareness of the flooding hazard still appears to be

lacking, as flooding continues to occur where people live. Generally, people are staying in flood-prone areas as they are more concerned with the value of assets and socio-economic activities that have been carried out for many years. Despite various public service advertising campaigns, much more must be done to increase the population's resilience to flooding.

A strategy for sustainable development

Given the scale of the problem, and these challenges, Indonesia's Parliament has approved a bill to move the national capital from Jakarta to outside Java, to the province of East Kalimantan. This strategic decision to relocate Indonesia's capital city will reduce the burden of flood management in Jakarta. Furthermore, it is hoped that relocating the capital can provide the impetus for putting Indonesia on a course to sustainable development.

Realistically, managing the risk of flooding is already an inseparable part of achieving Agenda 2030. As Robert Glasser, Special Representative of the Secretary-General for Disaster Risk Reduction, stated in 2015:

"Development that is not risk informed cannot be sustainable. Recurring disaster losses are a significant brake on poverty eradication. The implementation of the Sendai Framework for Disaster Risk Reduction is essential for the achievement of the Sustainable Development Goals [SDGs]."

Flooding is specifically referenced in SDG 11 (sustainable cities and communities) and SDG 13 (climate action). In many urban areas flooding impacts both workers' homes and workplaces, disrupting or even eliminating jobs (SDG 8 on decent work and economic growth, and SDG 9 on industry, infrastructure, and innovation). The local economic effects can be even more pronounced if floods occur in an agricultural area in a village.

As a natural phenomenon related to the dynamics of life and development

► Satellite images of Jakarta, Indonesia in 1990 (top) and 2019 (bottom) showing the massive expansion of the city over three decades, which has entailed replacing forest and vegetation with impervious urban landscape

activities, flooding will directly impact too upon SDG 1 (no poverty) and SDG 2 (zero hunger). The indirect impact of flood events can also negatively impact other Goals such as SDG 5 (gender equality) SDG 15 (life on land).

The development agenda set out in Indonesia's Medium-Term Development Plan or Jakarta's Detailed Spatial Plan must be carried out by the local government working with all other stakeholders in the area. Of course, the work will require sufficient development budget, human resources, and implementation facilities.

However, a forthcoming study on the coordination and capacity of SDG implementation in Indonesia (by the Asian Development Bank and United Cities and Local Governments) shows that there is a weak point in the readiness and capacity of human resources among government, businesses, and social institutions. Similarly, it notes that the ability to manage floods is hampered by a lack of planners and implementers. Broadly speaking, Indonesia is still reactive to flooding, leading to significant losses and casualties.

Creating a new culture around flood risk

We already know what is fueling the acceleration of flood-prone areas in Indonesia: population growth and distribution, decision-making around socio-economic activities, and too much development in flood-risk areas. To achieve a society with high resilience that can also develop sustainably, we must embark on an intensive process of strengthening knowledge to create a new widespread culture of attitude and behavior around managing flood risk. ■



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Protecting global public goods fairly

How can you achieve an equitable balance for investment, responsibility, accountability, and authority for natural resources that function as a global public good? Can efforts to restore the Amazon rainforest provide an instructive example?

By [Carlos Nobre](#) and [Dolors Armenteras](#), Co-Chairs, Science Panel for the Amazon

This past Northern Hemisphere summer, full of extreme climatic events such as floods, droughts, and heatwaves, is a stark reminder that social and environmental crises are on the rise everywhere. Climate change illustrates the staggering differences in population inequality and vulnerability, both between and within countries. But the crisis is also an opportunity to openly and collectively understand that a stable climate is one of the most important global public goods of all.

The Amazon provides a vital defense against climate change. The rainforest holds more than 13% of the planet's biodiversity and the largest amount of fresh water in the world. But the region is under a deterioration trajectory that, among other effects, is resulting in less removal of carbon from the atmosphere, less rain, and a rise in temperatures.

Reversing this trend and finding pathways for protecting the Amazon

◀ **The remote community of Pekín, in the Bolivian Amazon. Protecting the Amazon will play a key role in stabilizing the global climate, benefiting people everywhere**

will play a key role in stabilizing the global climate and protecting biodiversity. This in turn will benefit people everywhere. We must therefore weigh the costs of protecting the Amazon against these global gains.

The Amazon tropical forest has evolved over more than 40 million years. During that time, optimal conditions of climate and ecology – ideal temperatures, and year-round availability of water – have allowed the

The rainforest is also very efficient in recycling water. This contributes to a significant increase in rainfall and creates a short dry season. It also causes huge amounts of moisture to be exported outside of the Amazon basin. These are the so-called “flying rivers” that contribute to many rainfall systems in tropical and subtropical South America.

However, the Amazon now faces a perilous future trajectory. The

// The Amazon tropical forest has evolved over more than 40 million years. Optimal conditions of climate and ecology... have allowed the emergence of the greatest diversity of plants, animals, and microfauna

emergence of the greatest diversity of plants, animals, and microfauna.

The rainforest's closed-canopy structure causes most of the sun's energy to be absorbed at the tops of the trees. This in turn causes large amounts of water from the plants to evaporate into the atmosphere, rather than warming the air. Indeed, the tree-top temperature does not exceed 30°C. No more than 4% of solar radiation reaches the forest floor, keeping the ground moist and non-flammable. This prevents the spread of fires ignited by lightning strikes.

interactive combination of climate and land use changes, especially the high rates of deforestation, forest degradation, and its increased vulnerability to wildfires, threatens the large southern Amazon region with imminent “savannization” that will result in open-canopy, degraded ecosystems.

There is plenty of observed evidence that the region is rapidly approaching this tipping point. Compared with 1979, the dry season is now already four to five weeks longer, 2°C to 3°C warmer, and 20% to 30% drier. The

southern forest has now become a source of carbon – unlike the less altered part of the forest that removes CO₂ from the atmosphere.

Once this tipping point is exceeded, it will take just 30 to 50 years for more than half of the forest to degrade, with some estimates putting the collapse at up to 70%. Below and above the soil, the Amazon stores more than 150 billion tonnes of carbon. Turning such a large portion of the forest into a degraded ecosystem would release up to 300 billion tonnes of carbon dioxide into the atmosphere. This would be yet another severe obstacle to reaching the Paris Agreement target of limiting global warming to 1.5°C. The collapse would also induce much warmer temperatures over tropical South America and reduce rainfall in vast areas within and outside the Amazon basin, affecting food production in all those regions.

To stop this cataclysmic event, it makes sense to develop agroecological systems in the rainforest that seek to restore altered landscapes to the state that enabled such rich and resilient evolution over millions of years. In other words, we need nature-based solutions, rather than cutting down the forest for the carbon-intensive agriculture of livestock farming. Agroecological systems mix trees of different species and sizes to produce fruits, oils, essences, and other agroforestry products. This is the bioeconomy that needs to be encouraged with large investments to occupy the already degraded areas of the Amazon.

Global coordination for action

If we agree that the megadiverse aquatic and terrestrial systems in the Amazon are also global public goods, they can be used as examples of approaches that can help tackle the global climate and biodiversity emergency. A concerted response of governments and multilateral institutions to protect the Amazon is possible if cooperation becomes a global norm.

The UN Secretary-General's initiative Our Common Agenda offers a vision of global cooperation through inclusive, networked, and effective multilateralism. Several of the initiative's key proposed actions take a top-down approach for the protection of our planet, promotion of peace, prevention of conflicts, sustainable finance, and boosting of partnerships.

Perhaps the most important issue that faces the Amazon is how to reform a global governance to directly protect the region. Critical to achieving a sustainable Amazon are effective instruments that enable international cooperation to mitigate the risks that undermine progress.

// We need nature-based solutions, rather than cutting down the forest for the carbon-intensive agriculture of livestock farming. Agroecological systems mix trees of different species and sizes to produce fruits, oils, essences, and other agroforestry products

The intergovernmental Amazon Cooperation Treaty Organization (ACTO) was created to encourage sustainable development and social inclusion in the region. The 2019 Leticia Pact, meanwhile, included commitments to share information and coordinate efforts to fight deforestation and forest fires and restore degraded areas in the region. However, countries have yet to meet their commitments to the pact.

Specifically, effective legal structures, including those intergovernmental entities and initiatives, along with non-governmental organizations, will be critical in overcoming four great international challenges.

The first is to combat illegal activities connected with deforestation, forest degradation, wildfires, and mercury pollution from gold mining. Successfully combating transnational organized crime demands international

cooperation to tackle corruption at all levels, eliminate any legal loopholes, and minimize differences in the law enforcement approaches and capacities of different countries.

The second is to shift priorities in terms of the type and scale of investments in vital sectors such as energy supply, transportation, industry, food, and agriculture. We must use resources sustainably to build green value chains that support resilient economies. Through this, we can create an innovative bioeconomy of healthy standing forests and flowing rivers, supported by science and technology.

The third challenge is to address the weak governance and public

participation in decision-making. Here, we must not only strengthen the role of government and institutions, but must also involve local people and communities in decisions about usage rights of territory and natural resources. We must ensure the integration of stakeholders, from local to international.

The fourth is how to effectively share knowledge, experience, and data that are essential to protecting the Amazon. This requires strong transnational cooperation and coordination.

To save the Amazon, and protect the global climate, cooperation is critical. We must strengthen cooperation between both Amazonia and non-Amazonia countries, and between all types of stakeholders: governments, civil society, financial institutions, the private sector, and indigenous peoples and local communities (IPLC) organizations. ■

About SDSN

The UN Sustainable Development Solutions Network promotes integrated approaches to implement the SDGs and the Paris Agreement on Climate Change, through education, research, policy analysis, and global cooperation



The UN Sustainable Development Solutions Network (SDSN) was set up in 2012 under the auspices of the UN Secretary-General. SDSN has created a global networks program: a membership-based alliance of top-tier knowledge-generating institutions focused on sustainable development, organized in national and regional clusters. As of 2022, SDSN has over 1,700 members in 50 networks across 144 countries.

In 2016, the SDSN expanded its mission with the creation of the SDG Academy. The SDG Academy creates and curates free, open educational resources on sustainable development and offers them as a global public good.

SDSN is guided by a Leadership Council, which brings together global

sustainable development leaders from all regions and all sectors, including civil society, public, and private sectors. The Leadership Council acts as the board of SDSN.

SDSN's global strategy is informed by its Six Transformations Framework, which is designed to mobilize transformative efforts toward the SDGs.

With commitments to the SDGs made by nation states, universities, private business, and civil society, SDSN's research and policy analysis work is helping promote solutions to realize the goals. SDSN synthesizes knowledge for sustainable development through our work on SDG pathways, data, policies, and financing. SDSN is the producer of the renowned Sustainable Development Report and World Happiness Report.

The SDSN Association is an independent 501(c)(3) nonprofit organization in the United States and a nonprofit Association 1901 in France. These entities host the Secretariat of SDSN, which supports and manages SDSN's programs and projects and the SDG Academy.

SDSN has offices in New York, Paris, and Kuala Lumpur. ■

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