

CLIMATE 2020

Rising to the challenge



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Rising to the climate challenge

The vision adopted in 2015 needs to be translated into action and results, beginning now

By **Ban Ki-moon**, Secretary-General, United Nations

Ever since I became Secretary-General, climate change has been among my top priorities. From Bali to Paris, I have worked hard to elevate the issue on the global agenda and support efforts to forge a universal climate agreement. I have engaged directly with world leaders, visited some of the worst-affected parts of the world, and undertaken a wide variety of other initiatives to heighten the sense of global urgency. The reasons are clear and simple. We are the first generation to truly feel the effects of climate change. Only we can take meaningful steps to avert its worst impacts.

Climate change has implications for almost all areas of the work of the United Nations and the wellbeing of humanity. Rising to the climate challenge is essential for sustainable development. The actions needed to reduce emissions and build climate resilience are the very same that are needed to lay the foundation for prosperity and security for all.

The December 2015 breakthrough in Paris was long-needed, and promises to be a game-changer in our efforts to set the world on a sustainable footing. The adoption of the Paris Agreement on climate change, so soon after world leaders agreed the 2030 Agenda for Sustainable Development, marked a turning point. We have a real opportunity to change the course of history, with governments, businesses, civil society and individuals everywhere working in concert, guided by a transformative vision for people, planet, prosperity and peace.

The adoption of these agreements represents an important triumph of multilateralism at a critical time. Governments now recognise that the world cannot continue on its present trajectory and that business as usual is no longer a viable option. Governments have also recognised that they cannot address the complex issues of sustainable development alone. Many of today's problems are global in nature and solutions require action by all countries, developed and developing, in partnership with a wide range of empowered actors.



Arriving at the 2030 Agenda for Sustainable Development, with its 17 Sustainable Development Goals (SDGs), and the Paris Agreement on climate change was an outstanding achievement, but now the work truly begins. The task ahead is monumental, and time is not on our side. Greenhouse gas (GHG) emissions continue to rise. One person in every eight lives in extreme poverty. There are more refugees and migrants than at any time in the history of the United Nations. Rising inequality and the current wave of violent extremism are breeding a growing sense of insecurity in all parts of the world.

The vision adopted in 2015 needs to be translated into action and results, beginning now. We need to see efforts to achieve the SDGs scaled up quickly, and we need the Paris Agreement to enter into force as soon as possible. On Earth Day 2016, 175 countries signed the agreement, setting a record for the most signatures on a global



© UN Photo/ Evan Schneider

Climate change has implications for almost all areas of the work of the United Nations and the wellbeing of humanity

instrument on a single day. Large, emerging economies, high- and middle-income countries, and nations at every stage of development are all saying they want a low-carbon future that can limit global temperature rise and underpin sustainable development. Now we need to solidify their commitment. To help advance this process, I am convening an event on 21 September at the United Nations headquarters in New York for countries to deposit their instruments of ratification. We need 55

countries accounting for 55 per cent of global GHG emissions to bring the agreement into force. My dearest hope is that this will occur before my term as Secretary-General ends on 31 December.

As I look back on my tenure, and forward to the coming decades, I believe we have cause to be optimistic about our world. My experience has shown me that we have the tools to build a more sustainable future. Innovative and effective partnerships are multiplying in all regions. Clean energy sources, which promise economic growth, increased social equity and a healthy environment, are increasingly competitive with fossil fuels. Global awareness of the need for, and possibility of, a sustainable future is growing by the day.

A world of peace, dignity and opportunity is within our grasp. Much hard work lies ahead, but I leave office encouraged that we have the time, the capacity and the will to create the future we want. ●

▲ Ban Ki-moon assesses relief and rehabilitation efforts for the survivors of Typhoon Haiyan in Tacloban City, the Philippines

Climate action in support of a sustainable world

By **Patricia Espinosa**, Executive Secretary, UN Framework Convention on Climate Change (UNFCCC)

There is only one possible future for humanity and that is a sustainable one. In 2015, the global community converged on this integrated vision for the future and set in motion the pathways to an economic and social transformation to achieve it.

The vision is articulated through the Paris Climate Change Agreement, the 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction. The unity of purpose reflected in these momentous agreements will now need to leverage unprecedented scale and depth of universal action involving all actors at all levels in all regions of the world. The challenges will be enormous but the rewards of success will be even greater.

The plan requires a profound structural transformation that places at its very heart low-carbon economies and societies which are resilient to climate change.

Over the next 15 years, the objectives of these agreements – linking climate, sustainability and resilience – must see unprecedented reductions in global greenhouse gas emissions and unequalled efforts to build societies that can resist rising climate impacts. The current rate of progress will not deliver success.

A priority requirement is a much more rapid and fundamental shift in the global patterns and incentives of investment away from unsustainable power generation, infrastructure, pollution and waste. All action to address climate change is an inseparable and integrated part of the whole plan and the leadership and commitment of all governments remains central to success.

Climate action contributes directly to the greater human wellbeing that is captured in the 17 Sustainable Development Goals. It protects lives and livelihoods, improves public health, creates new industries and sustainable farming, cuts costs for governments, business and citizens and opens up new avenues of profitable investing.

Climate action is also absolutely necessary to avoid the existential crises that unchecked climate change would present to humanity. Greenhouse gas concentrations continue to rise in the atmosphere and global temperatures break record highs by the month.

To limit global warming to well below 2°C and as close to 1.5°C as possible to prevent dangerous tipping points in the climate system, global emissions must peak soon and be driven down drastically thereafter. A balance must be achieved in the second half of this century between global emissions and removals through sequestration into ecosystems or through other means.

The generations alive right now are at a unique crossroads. We are the first who can end poverty but the last who can act to avoid the dangerous climate change that could undermine the universal wellbeing that lies within our grasp.

Government leadership a foundation of future success

Success will undoubtedly require political leadership and momentum from the highest levels, but supported by a clearly presented and growing public understanding of the enormous social, health and economic benefits that will accrue to citizens everywhere.

Technological developments and smart finance are moving ever more rapidly towards these transformational goals, but nowhere near fast enough.

The power to shift all this into higher gear still rests firmly with governments, both individually and collectively. Key to the transformation will be the way national governments integrate climate action and implementation of the sustainable development and risk management goals across sectors and ministries.

More climate-friendly, coordinated laws, policies and incentives are needed. All forms of unequal treatment favouring old growth and development models based on fossil fuels and high-carbon lifestyles and aspirations must be removed soon.

But while the transformation demands new technologies and redirected investment, it does not require an entirely new way of human interaction, only closer and deeper cooperation between the levers of change – namely governments working hand in glove with cities, regions, business and investors.

Meanwhile, the well-understood economic incentives of risk and return and social goals of equity and justice remain completely relevant and deployable in the race to a low-carbon, resilient future.

Opening up the private-sector appetite to fund the transformation directly is essential. Tens of trillions of

dollars sit in banks and on corporate balance sheets at low, zero, even negative, interest rates looking for bankable projects with real returns if the right incentives, sureties and certainties are provided by national governments, supported by the international community and its multilateral lenders.

Paris climate plans and support structures offer platform to faster progress

One of the most significant outcomes of Paris was that governments publicly accepted responsibility to lead climate action. They presented a global set of national plans to take immediate action, pledging never to lower efforts over time and, whenever possible, to raise ambition. They agreed to complete in good time the details of a transparent global regime, which will account for, review and underpin greater action by all sides. And they agreed to complete but also to strengthen adequate technology and financial support to nations, including the poorest and most vulnerable, so all countries can build their own clean energy, sustainable futures.

Because well-planned and supported climate action in its many forms almost always speeds up advances in sustainability and resilience, these plans have a multiplier effect for faster progress across the board.

To reach its full potential, governments will now engineer the ambitious design of the Paris Agreement into a well-oiled machine of these fully functioning working parts capable of accelerating climate action to meet the agreement's stated aims and goals.

Essential for international institutions to focus and prioritise

Meanwhile, continued success under the UN climate regime will both strengthen and be strengthened by the other country-level initiatives across the global development, environmental, disaster risk, human rights and peace agendas.

Without decisive climate action all these other goals will be difficult if not impossible to achieve, but without serious and significant progress on development, environment disaster management, human rights and peace, combating climate change and building resilience will become harder and less certain.

This unified development agenda is therefore the core agenda for governments under the United Nations and the prime focus for UN agencies and other multilateral institutions which assist. No single process or agency can possibly adopt, or try to adopt, all aspects of the solution under its wing.

Leadership responsibility for different aspects of progress will be coordinated by those organisations best



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placed in resources and skills to effect change. Credit for progress will flow to the entire organisation rather than to its individual parts.

The will and knowledge to succeed

Achieving the aims and ambitions of the Paris Agreement is not a given. The world needs to understand the urgency and complexity of what the international community has embarked upon.

This is a multi-decadal effort to turn around two centuries of development based on fossil fuels and the mining of nature-based resources into an all-embracing sustainable path for every nation, man, woman and child.

But I am confident that world leaders and the enormous groundswell of support from cities, companies, investors and citizens can propel ambition further and faster in support of our shared vision of a climate-secure and sustainable future. ●

▲ Extracting water from a near-dry well, Gujarat, India. Climate action contributes directly to greater human wellbeing, as articulated in the 17 SDGs

Delivering on the promise

Last year in Paris, COP21 set ambitious targets for curbing climate change and achieving sustainable growth. How will the 2016 conference turn those promises into actions?

By **Abdeladim Lhafi**, Commissioner,
22nd Conference of the Parties to the UN Framework
Convention on Climate Change

Fifteen years after the seventh Conference of the Parties (COP7), Morocco will once again host countries party to the UN Framework Convention on Climate Change (UNFCCC), as COP22 comes to Marrakech from 7 to 18 November 2016.

The Paris Agreement was a major diplomatic success – a historic turning point – not only in terms of expressing the strong political will to limit global temperature rises to well below 2°C by the end of this century, but also by linking the two issues of climate change and sustainable development.

If Paris was a conference of major decisions, Marrakech will be a conference of implementation. We will need to take the concrete actions to meet the priorities set by COP21. Expectations, understandably, are high.

Nations will need to ensure that their short-term economic plans are compatible with the long-term goals of sustainable development

The issues involved in tackling adaptation and mitigation are closely intertwined. We will need to decide on the best ways to minimise the effects of extreme climate-related events, particularly in those countries that are likely to suffer most as temperatures rise.

This will be no easy task, as the problems these countries face are many and varied, including (but not limited to) food security, ensuring a clean and plentiful



supply of water, protecting soil against erosion and salinisation, and deforestation.

Nations will need to ensure that their short-term economic plans are compatible with the long-term goals of sustainable development. Specifically, we will need to ensure that, by 2020, countries each have a national plan in place for how they will develop sustainably with low greenhouse gas (GHG) emissions for the next 30 years. The goal should be to achieve GHG neutrality in the second half of the century, as stated in the Paris Agreement.

COP22 must also address the issue of finance. We must ensure in particular that developed countries honour their financial commitments, and that flows of finance are consistent with the pathway towards low GHG emissions and climate-resilient development. How finance is mobilised will be crucial. Public-private partnerships, for example, will be key.



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The transfer of technology will be an efficient tool to support countries of the global South in setting their own domestic policies – for renewable energy and water management, for example.

South–South cooperation will also help to spread best practices more adapted to the specific conditions of these countries. By establishing local expertise, and turning countries' intended nationally determined contributions (INDCs) into domestic policies, projects can be carried through in a sustainable way to meet the goals defined at COP21.

Three clear signals

If we are to achieve the goals set at Paris, Marrakech must deliver three clear signals to the world.

First, we need to signal strong political will. To enable this, we must ensure the Paris Agreement enters into force quickly (ideally before COP22), by achieving the

double threshold of ratification by i) at least 55 parties to the UNFCCC and ii) countries that together represent at least 55 per cent of global GHG emissions. We also need to achieve ratification of the Doha Amendment, the amendment to the Montreal Protocol, and the ambitious and fair Global Market-Based Measure at the International Civil Aviation Organisation.

Second, we need to signal that technical achievement of various issues (adaptation finance and capacity building, for example) should make it possible to update the INDCs to achieve even greater cuts in GHG emissions. The available data shows that we are far away from achieving the 2°C global target.

Third, the targets of the 2030 Agenda for Sustainable Development must be connected to climate change, if we are to achieve a three-way balance of economic growth, environmental protection and socially inclusive development. ●

▲ Morocco's Noor 1 concentrated solar power plant, inaugurated in 2016. According to Climate Action Tracker, Morocco is one of the few countries whose mitigation plans are sufficient to meet its INDCs

Making Paris count

After years of negotiation, last year's climate conference was rightly hailed as a success. We now need to ensure that the best deal politics could get produces the global transformation we need

By **Natalie Samarasinghe**, Executive Director, United Nations Association – UK

In December 2015 – nearly a quarter of a century after they first resolved to tackle climate change – world leaders adopted a new framework that will determine the global response to climate change for the next 15 years. Hailed as a “historic turning point” by Laurent Fabius, the Foreign Minister of France, which hosted the 21st Conference of the Parties (COP) to the UN Framework Convention on Climate Change (UNFCCC), the Paris Agreement signals unparalleled international ambition to curb global warming. But its success will depend on how it is implemented at the national and local level, and whether it will evolve into the transformative mechanism we need.

While cheers accompanied the announcement that agreement had been reached, a sigh of relief would have better captured the moment that was 23 years in the making. In 1992, the UNFCCC was created to “prevent dangerous anthropogenic interference with the climate system”. Back then it was not inconceivable that the convention might develop into a robust mitigation treaty. It made clear that all countries needed to take action, with those overwhelmingly responsible for cumulative emissions leading the way.

Two decades of delay

But it was not to be. It took two years for the UNFCCC to enter into force, another three for the Kyoto Protocol – which set binding emissions targets for 37 industrialised states – to be agreed, and a further eight for it to enter into force. Although the Protocol managed to achieve some reductions, particularly within the EU, it was hamstrung from the outset. The US, then the world's biggest emitter, did not ratify it. Major emerging economies, having argued alongside many developing states that they bore little historical responsibility for emissions, were exempt from binding targets. Canada later withdrew.

When discussions on a successor to Kyoto started in 2005, they marked the beginning of a decade of fractious COPs. Japan, New Zealand and Russia

announced they would not take on further Kyoto commitments, and the US – soon to be overtaken by China as the world's largest emitter – was unwilling to commit if large developing states were again excluded. Efforts by the UN and civil society to create a sense of urgency ahead of the 2009 COP in Copenhagen, which was billed as a ‘make or break’ moment, ended in failure. The negotiations limped along until 2012, when a Kyoto extension was eventually agreed. It included countries that represented only 15 per cent of global emissions.

With hopes for a universal, legally binding treaty fading, and the impacts of climate change already taking their toll on communities around the world, the UN and supportive governments embarked on a different course. The emphasis would be on setting an ambitious goal and securing the buy-in – and participation – of all states by seeking non-binding, self-defined commitments.

Campaigners, including UNA-UK, were initially sceptical: could these so-called intended nationally determined contributions (INDCs) ever come close to achieving the deep reductions needed to limit global temperature rise to 2°C – a level that would still pose a massive risk?

Yet over time, it became clear that this approach could bear fruit. The 2011 Durban conference saw states replace Kyoto's two-track process with a universal one. Major players appeared to be actively working towards an agreement. In 2014, China and the US jointly announced their INDCs. India proposed a review process for verifying emissions.

Last tango in Paris

With promising pre-discussions within and outside the UN process, COP21 in Paris was again billed as a ‘make or break’ moment. Many felt it was also the world's last chance.

Success was by no means guaranteed. It rested not only on years of preparation, but on two weeks of tough negotiations, which saw world leaders, notably François Hollande and Barack Obama, repeatedly contact their peers to reach agreement.



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The French used a mix of tools to seal the deal, building on the efforts of previous COP hosts such as Mexico and South Africa. They employed ‘confessionals’ – confidential places where delegates could speak privately and freely; ‘informal informals’ – which saw small groups of countries charged with ironing out specific parts of the draft text (sometimes as little as a paragraph); and ‘indabas’ – when groups of delegates met to tackle remaining areas of disagreement. A ‘coalition of high ambition’, forged by small island states and later joined by the EU, United States and others, is also seen to have played a key role, not only in ensuring that goals, such as limiting global temperature rise to 1.5°C, were not forgotten but also in keeping states – progressive and reluctant – onside to reach the consensus needed.

What we got and didn’t get

These efforts prevailed. Adopted by 195 countries, the Paris Agreement commits, for the first time, all nations to take action towards the goal of limiting “the rise in global temperature to well below 2°C above pre-industrial levels”. It further calls on them “to pursue efforts to limit the temperature increase

to 1.5°C” – a positive progression from previous documents (although it is worth noting that based on estimates by NASA and others, some fear that we are already close to approaching or surpassing that target this year).¹

The agreement also pays welcome attention to the need for increased monitoring and transparency. States have agreed to an “enhanced transparency framework for action and support”: a system through which progress on the INDCs of all countries, whether industrialised or developing, will be evaluated.

The first discussion on progress will take place in 2018, with a global stocktake scheduled for 2023. States are also required to submit new – and increasingly ambitious – reduction targets for emissions every five years, with a view to seeing global emissions peak as soon as possible, and then rapidly scaled down in the second half of the century.

However, the success of the new framework depends on whether the more vague provisions of the agreement – of which there are many – are translated into concrete action at the national and local level. For example, richer countries have pledged that by 2020, \$100 billion will be

▲ Dala, Burma, May 2016. Children collect drinking water distributed by volunteers after local sources dried up due to the effects of El Niño. The Paris Agreement emphasises the need to develop resilience to the effects of climate change



© Carlo Allegri/Reuters

▲ UN Secretary-General Ban Ki-moon embraces US Secretary of State John Kerry and his granddaughter after signing the Paris Agreement at United Nations Headquarters in New York on 22 April 2016

made available to support developing countries each year, but this provision is only included in the preamble. The agreement has also been criticised for lacking specific emission targets, monetary commitments and penalties for non-compliance.

While it recognises the need to address “loss and damage” resulting from the negative effects of climate change, the language eventually agreed was weaker than many countries, particular those most vulnerable to climate change, had wanted. And only limited progress (the development of a task force) was made on preventing and tackling climate change-related displacement, which is likely to dwarf the current refugee crisis. According to the Internal Displacement Monitoring Centre, more than 26 million people are already displaced by disasters each year.

Most fundamentally, the agreement is not legally binding. INDCs are set by their countries and even if all those submitted to date were implemented, the global temperature would still rise by nearly 3°C.

As of 3 September 2016, the agreement had been ratified by just 26 states. With China and the US on board, ratifying states now account for over 39 per cent of global greenhouse gas emissions, but there is still some way to go to reach the threshold needed for the agreement to enter into force: ratification by at least 55 parties to the UNFCCC that represent at least 55 per cent of the world’s emissions.

But while the Paris Agreement – arguably the best deal that politics could get – may seem a far cry from the robust treaty that UNA-UK and others campaigned for, with concerted effort it could become the deal we need.

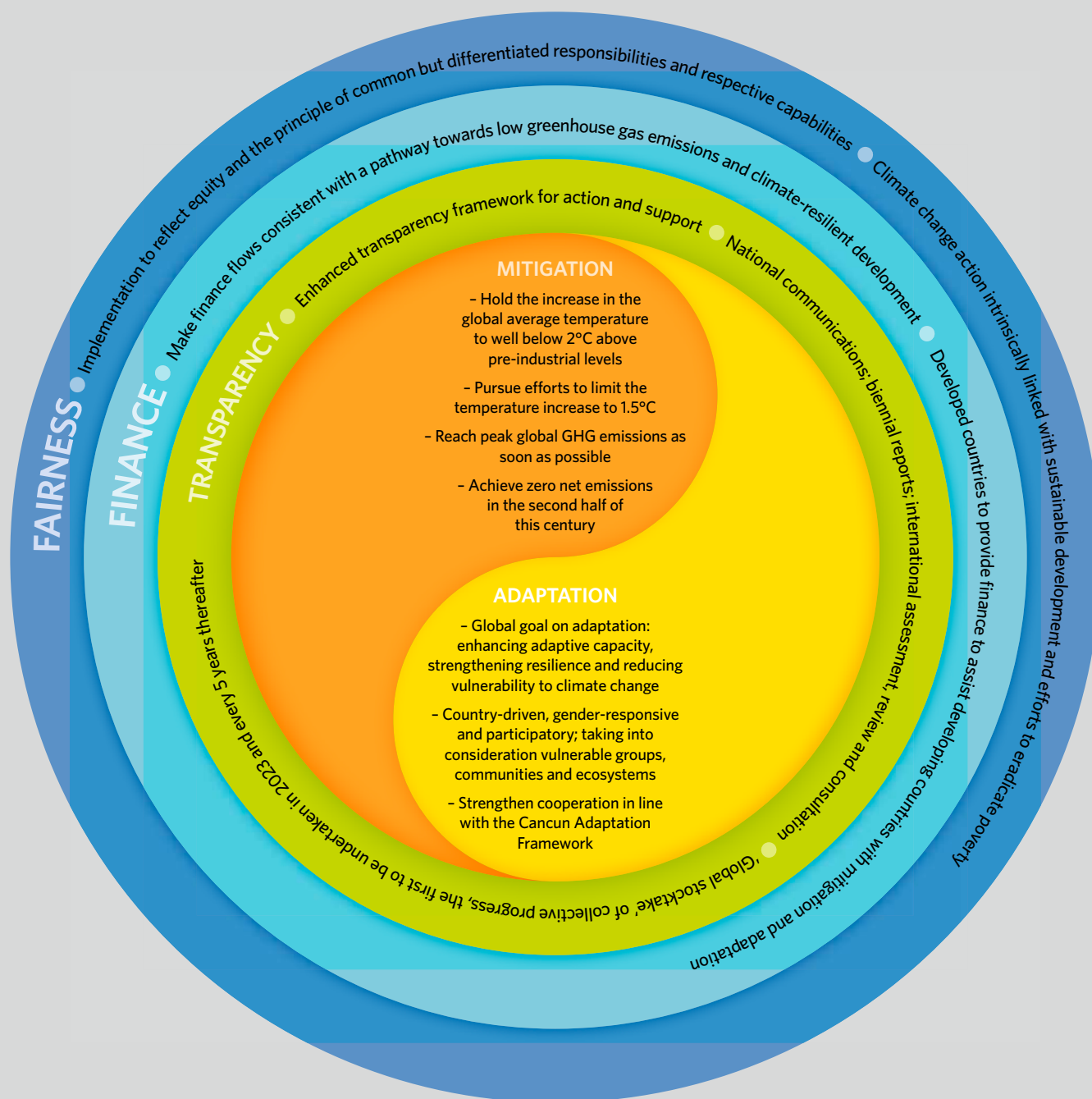
This publication brings together some 50 experts and practitioners, drawn from the UN, government, private sector, academia and civil society, to provide insights and recommendations on how to do so. It features case studies from countries, cities, businesses and NGOs that demonstrate how the agreement has already inspired and galvanised action.

It presents a range of solutions that are currently being developed and implemented, from nurturing national carbon sinks to improving renewable energy sources. And it discusses ways in which to ratchet up ambition, increase accountability and ensure long-term planning and support. This is vital if we are to achieve the global transformation required not only to protect life on Earth as we know it, but to ensure a better and more sustainable future for us all. ●

1 See e.g. Professor of Atmospheric Science Michael E. Mann and Meteorologist Eric Holthaus: www.slate.com/blogs/future_tense/2016/03/01/february_2016_s_shocking_global_warming_temperature_record.html?wpsrc=sh_all_mob_tw_ru; www.ecowatch.com/michael-mann-how-close-are-we-to-dangerous-planetary-warming-1882135248.html; www.theguardian.com/environment/2016/mar/04/is-el-nino-or-climate-change-behind-the-run-of-record-temperatures

The Paris Agreement

Adopted by 195 countries in Paris on 12 December 2015, the agreement will come into force after 55 countries, accounting for at least 55 per cent of global GHG emissions, have ratified it



Decision-makers heed the Paris call to action

The Paris Agreement may be a compact among nations, but more than any international treaty before, its success will hinge on its mobilisation of society at large

By **Elliot Diringer**, Executive Vice President, Center for Climate and Energy Solutions (C2ES)

Even before the landmark Paris Agreement has formally become international law, it's clear that the signals sounded in Paris are reverberating with many of the real-world decision-makers who ultimately must deliver on its promise.

From investors like Warren Buffett to CEOs of top global companies to the mayors of many of the world's largest cities, Paris is resounding as an unprecedented call to action. This 'signalling effect' is penetrating all levels of society, and may ultimately prove as decisive as the actions of national governments in determining the agreement's success.

The Paris moment, and the groundbreaking agreement it forged, can accelerate the low-carbon transition in three different ways. The most direct is through the implementation of the intended nationally determined contributions (INDCs) that countries pledged in Paris. These lay out the country-specific goals and policies that will define national responses to the global climate challenge in the decade after 2020.

The Paris Agreement itself will drive further action through multilateral norms and mechanisms to promote international accountability and ambition. Stronger transparency rules, and the obligation to offer a new contribution every five years, will strengthen confidence that all countries are doing their fair share. This, in turn, can open political space for each to do more.

But the most immediate – if least direct – impact of the Paris Agreement is the internalisation by influential decision-makers



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of the imperative of a low-carbon transition. Among global challenges, climate change is unprecedented in the way it permeates virtually every facet of the global economy. It follows that an effective response demands action not just by national governments but at every level, from the local to the global, in both the public and the private spheres.

Action by cities, provinces and companies has been strengthening for some time. But these 'non-state actors' have remained largely disconnected from the UN Framework Convention on Climate Change (UNFCCC) – the central forum established by national governments nearly a quarter of a century ago to guide the global response. That changed in Paris. With strong

▲ Dakar Mayor Khalifa Ababacar Sall addresses an event for renewable electricity in Africa ahead of COP21. The way 'non-state actors' connected with the COP21 process should add speed and momentum to the implementation of the Paris Agreement

encouragement from the French conference hosts, thousands of mayors, governors, corporate chiefs and other leaders came to the UNFCCC meeting carrying their own commitments. Paris became a catalytic moment yielding an unprecedented showing of action at all levels.

Even more telling are the many ways in which the signals sounded in Paris continue to resound. Among many investors, Berkshire Hathaway CEO Warren Buffett's

annual letter to shareholders is greeted as a near-oracular event. In his letter this year, Buffett cited Paris as a further impetus for the multibillion-dollar investments that have made his company one of the largest generators of clean power in the US.

Larry Fink, CEO of BlackRock, the world's largest manager of assets (worth some \$4.6 trillion), similarly highlighted the Paris Agreement in a letter urging the CEOs of S&P 500 companies to focus more on long-term value creation and less on short-term gains.

There have also been some other encouraging signs since Paris:

- A dozen companies, including Bloomberg, HP and Tata Motors joined an existing group of 58 others, including Google, Nestlé and Coca-Cola, in committing to move to 100 per cent renewable energy.
- In May, declaring Paris a “watershed” moment, Total CEO Patrick Pouyanné said the French oil giant will base future investment decisions on a 2°C scenario, pulling back from investments in tar sands and the Arctic, and shifting its portfolio towards renewables.
- Banks including JPMorgan Chase and Goldman Sachs established new lending practices or new funds favouring clean energy over fossil fuels. And a consortium of financial institutions and investors are partnering under the Catalytic Finance Initiative, originally launched by Bank of America, to direct \$8 billion towards sustainable investments.
- In a move bound to ripple across many sectors, the Moody's credit rating agency announced in June that it was building countries' Paris pledges into the baseline scenario it uses to rate public and private-sector investments.

Mayors also are reading Paris as a cue for stronger climate action. In June, two groups merged to form the Global Covenant of Mayors for Climate & Energy, comprised of the leaders of more than 7,000 cities, large and small, in 119 countries. The mayors pledged to set goals going further than their countries' respective national commitments.

To strengthen the rigour and credibility of their contributions, the mayors' group

and others are establishing methodologies to track actions and measure their emissions impact. A loose network of non-state constituencies have begun planning their own summit to showcase their efforts in mid-2018, as national governments prepare to take stock of global progress.

That the signals from Paris are being so widely received – and amplified – reflects a dramatic evolution in the global climate effort. The multilateral struggles of national governments may still occupy centre stage, but the annual UN climate conferences are becoming more inclusive affairs, welcoming and capitalising on the energies of other influential players.

This activation of investors and multinational companies, and of elected leaders responsible for the everyday concerns of millions around the globe, will likely be a key component of Paris's success.

Leading up to Paris, the surge of commitments by non-state actors helped embolden governments to offer up ambitious INDCs. In the years ahead, it will in many countries fall to business and to subnational leaders, as much as to national governments, to ensure that these national contributions are fulfilled.

Indeed, over the long haul, the more deeply the Paris goals are embedded in corporate and subnational decision-making, the better they will withstand the political and economic currents that may distract national leaders from the imperative of the low-carbon transition.

At the next UNFCCC conference in Marrakech, parties may look at ways to strengthen the engagement of non-state actors going forward. They could, for instance, play a role in the ‘global stocktake’ that will take place every five years. Or governments could grant permanent status to the Non-State Actor Zone for Climate Action (NAZCA) portal, an online registry launched before Paris that now contains commitments from more than 11,000 cities, regions, companies, investors and civil-society organisations.

But more important than any formal role for mayors and CEOs in the UN process is the continued uptake of the signals Paris is sending. ●

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Adaptation: putting Paris into practice

The Paris Agreement recognises that nations must do much more to adapt to unavoidable climate change. How should this be balanced with mitigation efforts?



© Logan Abassi/UN/MINUSTAH

By **Roger B. Street**, Director, UK Climate Impacts Programme

The role of adaptation in addressing the challenges associated with a changing climate has had a chequered past – internationally, nationally and locally. Despite a historical focus on mitigation (as laid out in Article 2 of the UN Framework Convention on Climate Change), there have been continued efforts at all levels to push forward adaptation to climate change.

The Paris Agreement has been praised for placing adaptation squarely onto the international agenda alongside mitigation, thereby signalling that the two are equally important. This is particularly evident in the establishment of the global goal on adaptation (Article 7 of the Paris Agreement): “enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change”. Article 7 further recognises that adaptation and mitigation are mutually reinforcing, as

▲ Aftermath of flooding in Cap-Haïtien, northern Haiti, that left more than a dozen dead and thousands homeless in 2014. The level of priority given to adaptation is a distinguishing feature of the Paris Agreement

appropriate adaptation measures could contribute to keeping global temperature rise to under 2°C.

In doing so, the Paris Agreement also recognises that adaptation can contribute to the myriad challenges that society is facing, including demographic,

socio-economic and technological. For example, adaptation efforts are seen as working in concert to support sustainable development and disaster risk management, as well as interconnected issues such as poverty eradication, human rights and environmental conservation and security.

The Paris Agreement articulates the need for a balance between support for mitigation and adaptation (see Article 9, paragraph 4 and Article 10, paragraph 6). Doing so will require addressing a number of associated challenges. One is that many people perceive adaptation as something for the longer term only, requiring investments now to address potential changes in the future. Considering the current global financial situation and the many demands to address other existing challenges, this perception has limited the interest, willingness and ability of many to invest in adaptation.

This perception is being challenged, however. The Paris Agreement recognises

immediate returns that can further justify the necessary investments and provide additional dividends (sometimes called providing adaptation and resilience dividends).

A second challenge is that adaptation is often seen as something that occurs naturally: let the market or environment simply ‘adapt’. We, as a species, have demonstrated that we are capable of adapting to different environments and circumstances, and societies have adapted in the past (some more successfully than others).

In the case of climate change, however, the situation is very different, with changes occurring quickly and in conjunction with other rapid shifts, placing pressures on society and our environments.

There is a need to build the necessary capacities in all states and across society, especially within developing countries, as these are – and will be – critical to

potential conflicts. However, there also exists the very real potential for synergies that can increase the effectiveness of the responses – to the engaging parties’ mutual benefit.

Collaboration and cooperation are critical requirements to successfully adapt to a changing climate. They are also an essential feature across all elements of the Paris Agreement, and should be applauded.

Once the Paris Agreement comes into force, there are high expectations as to what should then happen. However, realising the adaptation goal raises a number of questions, to which answers, with supportive processes and guidelines, will need to be found. For example, what information should be collected (and how) to facilitate the proposed stocktaking of countries’ commitments, including the means of establishing reference points and tracking progress? How should adequate and effective adaptation be defined?

Collaboration and cooperation are critical requirements to successfully adapt to a changing climate. They are also an essential feature across all elements of the Paris Agreement

that the current need for adaptation is significant and that early action will generate enduring benefits. This is evident in the global goal, which is both inspirational and conceptually ambitious. But what does it actually mean? How can it be put into operation in a meaningful and constructive manner? We now need to unpick and define the goal, in order to implement it.

Building capacities

One challenge – and opportunity – is reflected in recent efforts towards supporting adaptation directed at industry and the public sector. These have included identifying adaptation options that bring with them multiple benefits (i.e. those that also address other societal challenges) and that can build the necessary capacities to address future changes sustainably. Such options are seen as being able to deliver

progressing adaptation in an increasingly complex and dynamic world so that we can move towards a sustainable future.

The Paris Agreement recognises the importance of capacity-building, including in the context of promoting adaptation (and mitigation) ambition, enhancing public and private participation, and enabling opportunities for coordination across instruments and relevant institutional arrangements (see Article 6, paragraph 8).

Collaborative approach

The interdependencies (physical, financial, social and political) of the risks we are facing – and the responses we choose – will require a collaborative approach: sharing with, and learning from, all. In the case of adaptation responses, they can have far-reaching implications, including unexpected consequences and even

A common framework

Finding a way forward will require the various actors to reflect on the differentiated national circumstances, including needs, capacities and opportunities.

While a generic response will likely be meaningless, there will still be the need for a common framework within which all can operate, and which includes the means for supporting an overall assessment that reflects the status and progress towards the adaptation goal.

This means that any indicators need to allow for the fact that ‘adequate’ or ‘effective’ adaptation is very much determined by the individual nations, including the values and aspirations relating to their individual circumstances. Unlike mitigation, whereby efforts can be measured in a more quantifiable way, adaptation goals are not comparable in a meaningful sense unless they take these individual facets into account.

The work that now follows to unravel the adaptation goal and to develop practical guidance and processes that can be implemented will be significant. This is a challenge that the international community must accept. ●

Will the INDCs deliver?

Are countries' commitments to reduce their greenhouse gas emissions enough to achieve the target of limiting the global temperature rise to well below 2°C?

By **Hanna Fekete**, Policy Analyst and Founding Partner, NewClimate Institute

At the Conference of the Parties in Paris last year, governments under the United Nations Framework Convention on Climate Change (UNFCCC) confirmed their intention to combat climate change. They strengthened the objective to limit global temperature increase and – for the first time – agreed that all countries shall contribute to the mitigation of climate change.

The Paris Agreement, as a result, contains more ambitious wording around the objective to hold temperature increase below 2°C: governments agreed to limit global warming to *well below* 2°C above pre-industrial levels and pursue efforts to limit the increase to 1.5°C. Scenarios illustrating how the world can stay below a 2°C increase tell us that global emissions have to peak around 2020 and global carbon dioxide emissions have to become negative in the second half of this century.¹ For a maximum 1.5°C increase, scenarios show much faster development of mitigation actions and even lower emission levels by 2030 and 2050.²

It is also clear that to reach these global targets, mitigation is required in all regions of the world. Thus, in Paris, a large number of countries also put forward individual plans on how they want to address climate change in the future – their intended nationally determined contributions (INDCs). These plans contain, besides other aspects, actions to reduce greenhouse gases (GHGs).

Governments have developed the targets on their own, in – as the name suggests – nationally driven processes. Nations had agreed that all countries would have to contribute to mitigation of climate change,

irrespective of their wealth. However, no clear guidance on the level of ambition, which would distribute the global efforts to individual countries, exists. In general, the UNFCCC works on the principle of common but differentiated responsibilities, meaning that poorer countries should carry a smaller burden in joint efforts. However, countries have never agreed on an algorithm to quantify the responsibilities.

Lack of ambition

From the beginning of the process of developing the targets, it was thus unclear whether the aggregate of all countries' targets would meet the global objectives. In total, the submitted targets represent 190 Parties of the UNFCCC, a fact that of itself we can consider a great achievement of the international process. However, is the

not doing enough to meet the global temperature target to which they have all agreed. Taken together, the presented emission reduction targets lack sufficient ambition and will not maintain temperature below the agreed levels.

The paper also shows that currently implemented policies are insufficient to achieve the level of emissions reductions pledged in the INDCs. The website Climate Action Tracker shows whether each country's climate policies are sufficient to achieve its INDC.⁴ The outcomes differ significantly between countries. A number of countries will likely emit more than promised unless they implement additional actions. On the other hand, some countries have already put sufficient measures in place to reach or overshoot their targets, among them some large emitters. Note that

Governments in sum are not doing enough to meet the global temperature target to which they have all agreed

level of ambition enough to meet the global objectives agreed in Paris? Are the countries' GHG reduction targets collectively sufficient to hold global warming to well below 2°C, let alone to 1.5°C?

A recent publication summarises existing research on the aggregate impact of INDCs on global emissions and presents resulting temperature levels.³ Analysing more than 10 independent pieces of research on emission levels resulting from the INDCs, the authors come to the conclusion that if all countries implemented their targets as presented in Paris, the global average temperature would increase by 2.6°C–3.1°C by 2100. Thus, governments in sum are

countries that reach or overachieve targets do not necessarily have better policies – it may be that they have put forward less ambitious targets. However, on the whole, more measures are required if the INDCs are to be achieved.

Despite this rather negative assessment, there are several reasons to believe that the Paris Agreement could still be a stepping stone towards limiting temperature increase to the desired levels.⁵

First, the Paris Agreement does not fix the current mitigation targets in stone, but states that governments must review their plans every five years to see whether they can be increased in stringency or scope. The



▲ A wind farm above Santa Ana, Costa Rica. According to Climate Action Tracker, Costa Rica's policies are consistent with its INDC – a disappointingly rare phenomenon

agreement, therefore, asks governments to increase their level of ambition over time, and explicitly prohibits backsliding of ambition.

Second, the process itself has increased motivation around climate change policymaking in many countries that previously did not consider this topic much. In the run-up to the Paris conference, 190 countries submitted their plans and are now starting to work on implementing them. Overall, the requirement to develop INDCs has increased the dynamics of thinking about mitigation. Countries have also recognised the importance of other benefits that are derived from the mitigation of GHGs, such as air quality or creation of jobs. This will hopefully continue in many countries and lead to consideration of mitigation in national planning.

Third, national governments are not the only institutions combating climate change. Non-state actors, such as companies or international alliances, are making efforts to reduce emissions in specific sectors. Subnational governments are implementing mitigation plans for their region or city.

These actions are often not considered when national policymakers formulate targets. But they may well motivate governments to increase the ambition of their targets or contribute to the (over) achievement of national mitigation targets.⁶

Fourth, we continue to see technologies developing at unexpected pace. Examples include the lower cost of solar photovoltaics in recent years and the boom in electric mobility in some regions of the world. These trends may boost mitigation action and get us closer to meeting the global objectives.

It is important to maintain the momentum gained during the last year if we want countries to implement their mitigation actions and increase their ambition over time. We need to ensure that little time is lost between the formulation of the INDCs and their implementation. Some countries will require quick availability of funding to do so.

Countries can also help to improve implementation by integrating already existing or emerging sectoral plans with the mitigation actions – and making individual sectors responsible for those actions. The

targets agreed at Paris are thus merely the starting point, and further work is necessary. ●

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A time for solutions

With a global consensus that man-made global warming presents a perilous threat to the planet, how do we go about curbing temperature rises and creating a zero-carbon global economy?

By **Hoesung Lee**, Chair,
Intergovernmental Panel on Climate Change

Undoubtedly, 2015 was a landmark year in the global development agenda. Not only did the international community agree the Sustainable Development Goals (SDGs), but also, to the surprise of some doubters, nations came together at the 21st Conference of the Parties (COP21) to the UN Framework Convention on Climate Change (UNFCCC) in Paris to reach an ambitious and wide-ranging agreement on tackling climate change.

Climate action is, of course, one of the 17 SDGs, and underpins many of the others. But in this article I would like to



concentrate on the Paris Agreement, and what its implementation will mean for sustainable development. In particular I would like to look at the work of the Intergovernmental Panel on Climate Change (IPCC), as the world now seeks to turn climate action into reality.

As the leading world body for the assessment of the science related to climate change, its impacts and possible future risks, and options for dealing with it, the IPCC was a significant contributor to the successful outcome of COP21. The Paris Agreement is based on science, and reflects the findings of past IPCC assessments.

▼ Workers plant mangrove trees at a conservation garden in Jakarta, Indonesia to mark Earth Day 2009



Moreover, COP21 gave an important role to the IPCC, whose future reports will inform the 'global stocktake' process whereby nations monitor their progress towards the goal of limiting global warming to well below 2°C above pre-industrial levels and their efforts to limit the temperature increase to 1.5°C. Our last report, the Fifth Assessment Report, found that to limit warming to below 2°C would require substantial reductions in emissions of greenhouse gases (GHGs) over the next few decades and near-zero emissions of CO₂ and other long-lived GHGs by the end of the century.

To be precise, to have a likely (i.e. two thirds or more) chance of holding warming to 2°C, global emissions in 2050 would have to be 40–70 per cent lower relative to 2010, and net emissions of GHGs would approach zero by 2100. That implies that in 35 years we will have seen a rapid improvement in energy efficiency, and a tripling to quadrupling of the share of zero and low-carbon energy supply from renewables, nuclear and legacy fossil fuel, combined with carbon capture and storage (CCS),

The relationship between behavioural change and greater energy efficiency is fascinating

a technology in which carbon emissions are sequestered at the source (e.g. a power plant) and then stored safely, for instance underground.

There was less knowledge available at the time of the Fifth Assessment Report about the pathways that would take us to warming of only 1.5°C. The limited number of studies indicate pathways characterised by immediate mitigation and faster reduction of GHG emissions, including the use of negative emissions (withdrawing CO₂ from the atmosphere, for instance through technology or afforestation).

The barriers to a zero-carbon society do not arise in science. We already know

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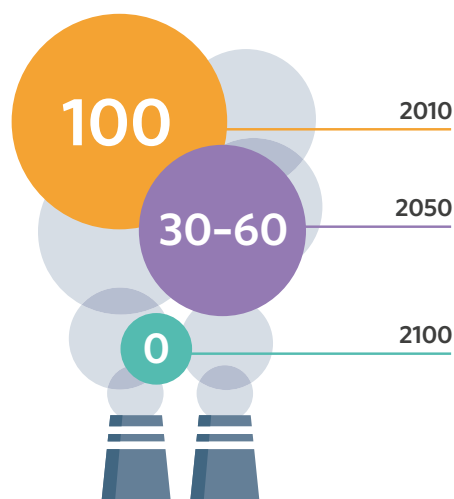
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enough to take action on the path to a carbon-free economy, and that was one of the key messages of the Fifth Assessment Report in 2013/2014 and of its predecessor, the Fourth Assessment Report, in 2007. Most of the barriers are economic, social, institutional and political. That is why the next set of IPCC reports will put a major focus on the solutions for reaching that zero-carbon society, hopefully helping to overcome those barriers by examining the options for action.

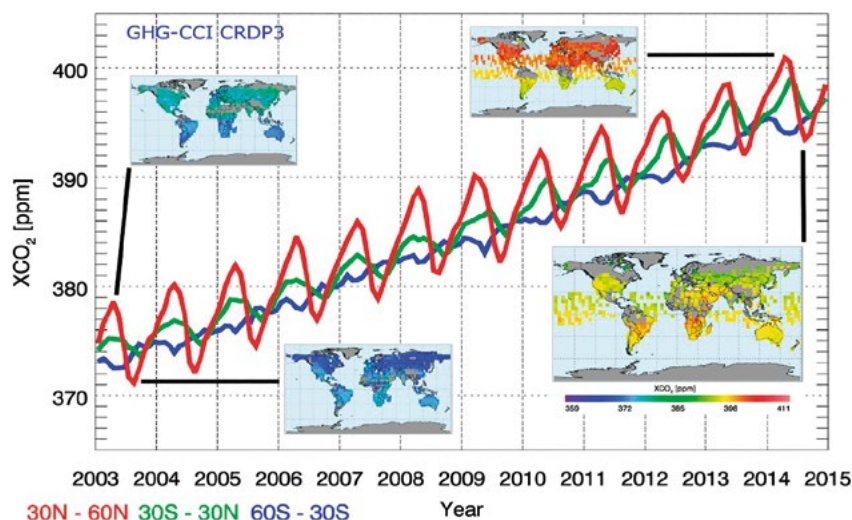
That said, there are significant gaps in our knowledge about the challenges and risks associated with some of the technologies that have been mentioned as contributing to a carbon-free economy. These include carbon dioxide removal, afforestation, and BECCS – the combination of bioenergy and CCS, where CO₂ is absorbed from the atmosphere by growing biomatter such as trees, which are then burned in power plants while sequestering the resulting emissions. We do not yet know enough about the extent to which these technologies can be scaled up, and hence what their potential is. Planting forests to absorb carbon or provide energy would eventually run up against the need for land for food. Examining these questions will be another focus of our forthcoming reports.

Without prejudging the scoping processes of the forthcoming reports, there are

To hold warming to **2°C**, global emissions in **2050** would have to be **40-70 per cent lower** relative to **2010**, and net emissions of GHGs would approach **zero** by **2100**



Carbon dioxide increase, as observed by ENVISAT and GOSAT



Source: ESA Images

some important areas of research – many overlapping between science, technology and the social sciences – that we are likely to assess. The decarbonisation of electricity generation will involve large-scale deployment of renewables, nuclear and CCS. What are the risks and opportunities here? What do we know about CCS – not only its operational safety, but also the risks of transporting sequestered CO₂ and the long-term integrity of storage?

The relationship between behavioural change and greater energy efficiency is fascinating. Climate change and cities, which are home to over half the world's population, is a growing area of research. Cities pose particular challenges to mitigation: as new cities are built and existing cities develop, how do planners avoid locking-in carbon-intensive infrastructure? And what are the prospects for sustainable transport, achieving zero-GHG mobility through renewables-based electricity or hydrogen?

Global stocktake

How can the IPCC facilitate this search for solutions? Our next comprehensive assessment, the Sixth Assessment Report, will be completed in 2022, in time for the first global stocktake one year later. We are also updating the methodologies used by countries to measure and report

▲ The inexorable rise of global CO₂ levels from 2003 to 2015. Levels are shown for different latitude ranges

their GHG emissions and removals. And we are producing three special reports: on the impacts of global warming of 1.5°C above pre-industrial levels and related global GHG emissions pathways in the context of strengthening the global response to the threat of climate change, sustainable development and efforts to eradicate poverty; on climate change, desertification, land degradation, sustainable land management, food security and GHG fluxes in terrestrial ecosystems; and on climate change and oceans and the cryosphere. The report on 1.5°C was specifically requested by COP21 and will be delivered in 2018.

All these reports will focus on the assessment of realistic response strategies in line with our mandate. We will strengthen our treatment of regional issues, as local and regional information is the most relevant for policymakers. We will improve the knowledge base for the interaction of climate change and cities, which will be one of the focuses of the Sixth Assessment Report. And the three special reports – requested by our member states and the UNFCCC – will address some of the most urgent and policy-relevant questions. ●

FCA: innovating mobility



■ Fiat Chrysler Automobiles is a global automotive manufacturing group engaged in the development, design, engineering, assembling, distributing and selling of vehicles, as well as in providing automotive services, parts and accessories. The Group operates in approximately 40 countries and has commercial relationships with customers in more than 150 countries. Through research, collaborations and more than a century of experience in the automotive industry, FCA is helping advance mobility and responding to both the environmental and social needs of the world's growing urban populations.

Effective, long-lasting results to address climate change can best be achieved through the combined efforts of government, energy producers, manufacturers, consumers, academia and the financial community. FCA has long recognised and embraced its own role in addressing the effects of climate change. We strive to reduce the CO₂ emissions of our products and processes along the entire value chain, starting from the design phase, and throughout production, distribution, use and end-of-life.

FCA's approach to providing mobility solutions strives to minimise the impact on people and the environment, by focusing on:

- improving the fuel efficiency of vehicle and powertrain technologies, both conventional and alternative;
- directly involving drivers in reducing environmental impacts of vehicles during use;
- developing and promoting new concepts that improve the mobility experience.

To achieve this, at FCA we foster innovation by encouraging creativity among our workforce, as well as through collaboration with external organisations such as universities, research centres and other institutions.

During 2015 alone, FCA invested approximately €4.1 billion in research and development (R&D), and leveraged the innovations generated by the more than 20,000 FCA employees involved in R&D around the world.

These innovations include a number of projects that address the rapid change occurring in the electric and hybrid-electric vehicle field as well as customer expectations with respect to technology content and affordability of innovation on board. Recent FCA initiatives related to energy storage technologies contributed to the timely launch of the Chrysler Pacifica Hybrid, available in the second half of 2016.

The Pacifica Hybrid is the auto industry's first electrified minivan and is expected to achieve an estimated range

of 30 miles on electric power from a 16-kWh lithium-ion (Li-ion) battery. In city driving, it is expected to achieve an efficiency rating of 80 MPGe based on US Environmental Protection Agency standards. The Pacifica also incorporates a host of other technologies that optimise energy demand, including aerodynamic efficiency, reduced weight, minimised tyre rolling resistance, Engine Stop-Start system and thermal control technologies.

The Chrysler Pacifica Hybrid will bring an affordable family-oriented vehicle to the market with balanced attributes such as fuel efficiency, performance and transportation versatility.

In addition to electric, hybrid and conventional technology, FCA invests heavily in natural gas and biofuel solutions that are aligned with the fuels available in the various markets, and that reduce vehicle emissions. FCA has been Europe's leading producer of Original Equipment Manufacturer (OEM) natural gas vehicles for more than 15 years and offers a wide range of eco-friendly, bi-fuel (natural gas/gasoline) vehicles that meet the needs of private and commercial consumers. In 2015, FCA's European leadership was reconfirmed, with more than 44,000 natural gas vehicles registered, representing a share of about 50 per cent. In the last two decades, FCA has sold more than 690,000 natural-gas-powered cars and commercial vehicles.

In Brazil, FCA has a full range of Flexfuel vehicles that run on varying blends of gasoline and bioethanol. FCA's innovation in this field is exemplified by the TetraFuel engine, the first in the world capable of running on four different fuels: bioethanol, Brazilian gasoline (refined crude oil and 22% anhydrous ethanol), gasoline and natural gas.

As consumer expectations of mobility scenarios evolve, FCA devotes resources to research, development and experimentation of innovative technologies, including autonomous-vehicle technology.

In May 2016, FCA announced a collaboration with the Google Self-Driving Car Project to integrate Google's self-driving technology into the Chrysler Pacifica Hybrid minivans to expand Google's existing self-driving test programme. This marks the first time that Google has worked directly with an automaker to integrate its self-driving system, including its sensors and software, into a passenger vehicle.

Self-driving cars have the potential to save lives and prevent accidents on the road, of which a significant portion are caused by human error. This collaboration will help FCA and Google better understand what it will take to bring self-driving cars into the world. ■

FCA

FIAT CHRYSLER AUTOMOBILES

Making the switch

With the costs of generating renewable energy no longer prohibitive, what are the challenges for ramping up sustainable energy production?

By **Nick Eyre**, Co-Director, UK Energy Research Centre and **Rob Gross**, Co-Director, UK Energy Research Centre

Renewable resources have been the dominant sources of energy for most of human history, only being overtaken by fossil fuels since the Industrial Revolution. Wood and other biomass continue to be a major source of fuel in developing countries, but the Sustainable Development Goals (SDGs) aim to end this reliance. Large hydropower plays a major role in electricity generation in some countries, but is socially and environmentally controversial, with limited scope for expansion. Other renewable resources provide only a small contribution to global primary energy – less than three per cent.¹ However, in recent years that share has been expanding, with huge growth in investment in wind and solar photovoltaic (PV) power generation in particular.

Resource availability

Renewable energy resources are less concentrated than fossil fuels, but the global resource is very large. Most renewable energy ultimately derives from the solar radiation that falls on the Earth – and this is 7,500 times larger than current global energy demand. Taking account of realistic constraints, wind power could supply all global electricity needs and solar energy could supply the whole of energy demand.² Technology and economics are the constraints, not resource availability.

Economics

Falling capital costs and improved efficiency have driven big reductions in renewable electricity costs, most notably in the past

five years in solar PV. Costs are location-specific, as resources and the costs of installation and grid connection differ.

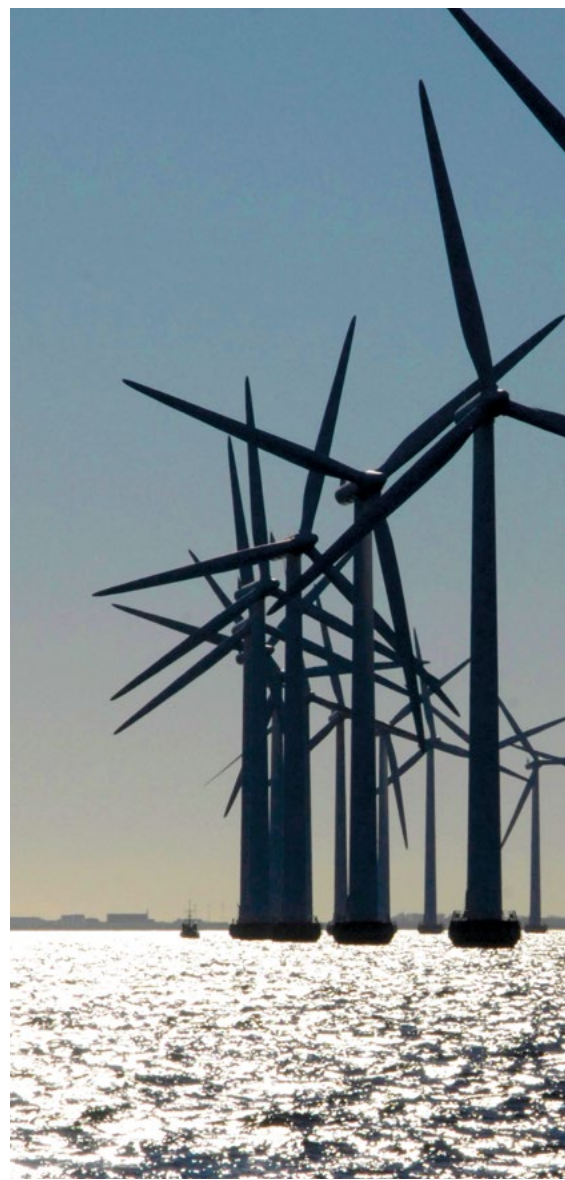
For example, the International Energy Agency (IEA) estimates the costs of wind power range from below \$50 per megawatt hour (MWh) to over \$150 per MWh.³ However, recent contract prices are in the range \$60 to \$80 per MWh for new onshore wind, and \$80 to \$100 per MWh for large PV projects,⁴ placing these renewables in the same cost range as coal, gas and nuclear power.

While grid costs are additional, and may be higher for renewables, climate change and other external costs of the other options are often neglected. Overall, the perception that renewables are expensive is increasingly outdated. In some cases renewables are already competing for electricity contracts without subsidy.

Wind and solar did not exist on a commercial scale before the early 1990s. Both have consistently grown at 20 to 30 per cent annually throughout this century. Economies of scale in manufacture and installation, strong market competition and a host of technological advances have driven costs down. It is difficult to predict for how long such trends will continue, but there is little to suggest that they will end soon. Challenges other than cost are now more critical to the growth in use of renewables.

Grid integration

Integrating renewables with variable output into electricity systems is one such challenge. Integration problems are sometimes exaggerated: power systems have always accommodated variable loads, and variable generation poses similar management issues. The ability of power systems to incorporate



variable generation itself varies, due to technical and institutional factors.

For example, in China, use of wind generation is constrained by both the limited capacity of the transmission grid and the administrative rules in electricity markets. Yet where systems are managed effectively, significant penetration of variable renewables can be achieved. For example, wind power already provides over 40 per cent of Danish electricity, and nearly 25 per cent in Ireland and Portugal.

Even higher levels of intermittency will pose challenges, however. The potential solutions are known: flexible generation,



© Francis Dean/Corbis via Getty Images

▲ Wind turbines off Copenhagen. Denmark already gets 40% of its electricity from wind power

system interconnection, flexible demand (demand response), and electricity storage. Extensive use of flexible demand can only be enabled by smart grids. These are being deployed, but widespread adoption is a major challenge for the next decade.

Electricity storage at grid scale has traditionally been expensive and confined to large pumped hydropower schemes, but this is changing as some storage technology costs are falling in similar ways to those of solar PVs. Lithium ion battery costs have

fallen by a factor of four in just eight years.⁵ They could soon reach \$150 per kWh, at which point they are economic in many power systems. Other storage technologies might ultimately have even lower costs. Low-cost electricity storage is probably the key technical challenge for very high deployment of renewable electricity.

Heat and transport

If renewable electricity is to supply most of global energy, it will have to supply transport and heat, as well as the end uses traditionally dominated by electricity. Energy efficiency will be important in reducing the scale of energy demand, and biofuels may be able to play some role, although their use is constrained by concerns about competition for land.

Electrification of cars is increasingly attractive, driven by improved battery technology. But the decarbonisation of heat using renewable electricity looks likely to be more problematic for a variety of reasons, including the low cost of fossil fuels and the seasonal nature of much heat demand. Effective use of variable renewables for heating may require development of ‘power to gas’ technologies, i.e. the production and use of hydrogen, or other gases’ fuels, from electricity.

Business models

Renewable resources are extensive and widely distributed, and therefore their use will affect energy markets. Interconnection between grids in different jurisdictions requires coordinated market rules. Decentralised renewables hugely increase the number of power generators. And effective use of demand response requires electricity users to be more than passive recipients of a commodity.

In current electricity markets, prices tend to be set by the fuel costs of the marginal generator, but this is not a viable market design where fuel costs are zero. Traditional business models are already facing these problems and this is reflected in the falling market value of some incumbent utilities. Innovation will be needed in market design and governance, as well as technical systems.

Economic development

Even where renewables are economic, they tend to have higher investment costs than electricity generation using fossil fuels. And major investments are needed in transport and buildings as part of the shift to zero-carbon energy systems. These increased investment needs are challenging everywhere, but particularly in developing economies.

The global climate regime will need to address the need for investment in sustainable energy in these countries, so that it does not prejudice other development goals. On the other hand, where there is currently limited access to electricity, renewables provide an opportunity for technology-leapfrogging, avoiding investment in the polluting and inefficient fossil-fuel systems characteristic of earlier development paths.

Developments in renewable energy technologies, smart grids and batteries look likely to enable a global energy system dominated by renewable energy. But public policy will be critical to this transition. The key agreements in Paris will need to be followed through: intended nationally determined contributions will have to be reviewed and increased, with further agreements to develop carbon pricing regimes, transfer key technologies and deliver the energy objectives of the SDGs.

At national and local levels, continued support for innovation and deployment of renewables and their enabling technologies remains essential. This transition to renewables in energy systems has implications for business models and markets, requiring continued policy innovation. ●

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Putting together the clean energy puzzle in developing countries

Climate 2020 interviews Rachel Kyte, Special Representative of the UN Secretary-General and Chief Executive Officer, Sustainable Energy for All (SE4All)

Developing countries have the dual task of improving social and economic conditions for their people while also creating clean energy systems. Is this an impossible challenge or a historic opportunity?

Rachel Kyte, Special Representative of the UN Secretary-General and CEO at Sustainable Energy for All (SE4All), says that “there is real reason for hope” if policy and finance move in the right direction. Kyte previously served as the World Bank’s Vice President and Special Envoy for Climate Change, up to the Paris conference of December 2015. She then moved to

stations connected to the grid. The way forward is for them to embrace distributed power generation, improving efficiency and expanding the network, she explains.

On the other side, there are developing nations, which need energy to develop their economies. Today, 1.2 billion people, especially in sub-Saharan Africa and Asia, still lack electricity. This is a huge limitation to their prospects. The solution here is to reach, as fast as possible, isolated populations adopting disruptive technologies. All these changes will have to occur alongside each other, says Kyte. But that won’t be easy.

Energy productivity is a challenge for both developed and developing countries. For poorer economies it means being smart and accelerating change

SE4All, the body that brokers partnerships to turn the Paris commitments into action.

In this interview with *Climate 2020*, she explains what needs to happen to meet development and climate goals, and clarifies that there is no one-size-fits-all solution.

On one side, says Kyte, there are developed countries, which have to uncouple their economies from fossil fuels. This has been happening slowly due to inert energy systems based on large power

“The problem is that in many countries the planning mindset is still biased on large projects,” she explains. “Institutions that manage electricity systems are focused on grid connectivity. Their management is often not deep enough or is under-resourced. There are vested interests, and new business models or self-owned companies are usually not in the room when energy policies are made.”



Same horizon, different solutions

Despite the difficulties and the different starting points, there is a common horizon for developed and developing countries, Kyte emphasises. “The task to create energy systems that provide affordable electricity and keep global warming below 2°C is universal. Even in the UK, energy poverty is on the rise because people do not have efficient homes and cannot afford to pay for the power to stay warm.”



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The difference is in the solutions. “We need to bring together different pieces of the puzzle,” she argues. For some countries, this may mean promoting policies for the decarbonisation of the economy, while for others it may be improving the grid or covering the access gap. Depending on the needs and the available resources, each country should determine its options. In some cases, the solution may be found at regional level. “For Kenya, for instance, it

may be cheaper to buy hydro from Ethiopia and gas from Tanzania, while developing geothermal within the country,” she suggests.

“A major piece of the puzzle, often neglected, is energy productivity,” she continues. “This is a challenge for both developed and developing countries. For poorer economies it means being smart and accelerating change, using less foreign reserves to buy oil and less cash for emergency situations.”

▲ Gujarat, India. A worker at a salt pan stands beside her shelter, powered by a solar panel

Funding new business models

But who is going to fund these transformations? The International Renewable Energy Agency (IRENA) estimates that to meet the Paris climate commitments and the Sustainable Development Goals, investment in renewable energy must double by 2020

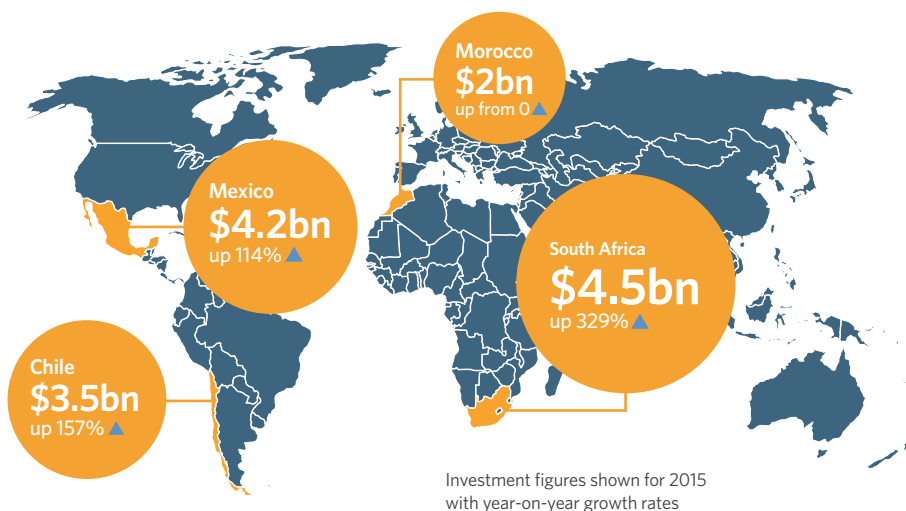
and more than triple by 2030. This means reaching \$500 billion per year up to 2020 and \$900 billion per year up to 2030. Developing markets with fast-growing energy demand will need the largest portion. Such scale of finance can only be supplied with public and private partnerships, and forging them is a goal of SE4All.

Kyte says that private capital will have to find new business models to support off-grid renewables, get the right risk profile and have the patience to deal with a new market. “We are listening very carefully to the demands of entrepreneurs. One of the biggest obstacles is access to finance in the local currency, a problem not unique to energy,” she explains.

Multilateral development banks have a role in helping the transition through the grid and supporting the creation of regional power pools. “All multilateral institutions have shifted their policies on fossil fuels, and coal is accepted only in exceptional circumstances,” Kyte says. There are also expectations from new development banks, like the Asian Infrastructure Investment Bank, which promises to be “lean, clean and green”.

Emerging economies with large coal reserves or a sizable portion of their energy coming from this fuel will be especially under pressure, as the Paris Agreement leaves

Emerging markets for clean energy investment (2015)



Source: Bloomberg New Energy Finance

Coal is also not that cheap when the environmental costs and the growing risk of investment are taken into account. This is why development should be measured by indicators besides gross domestic product, says Kyte. She suggests natural capital accounting to assess the level of resources upon which economic activities are based, and accounting for carbon pollution too. “We have to put a price on carbon

\$329 billion. The increase was particularly significant in China, Africa, the US, Latin America and India. Countries like Mexico, Chile, South Africa and Morocco have recorded three-digit annual growth.

Kyte says: “There are many examples across the world of reforming investment in consideration of climate change. Some of the most innovative and promising evolutions are indeed in developing countries.” She mentions the United Arab Emirates, Chile, Morocco and Zambia as champions of innovation in structured finance; Kenya, Tanzania and India for new business models; Europe and North America for finance aggregators; Bangladesh for the scale of microcredit.

“The spread of renewable energy is decreasing its costs. From this perspective, technology has done us a huge favour. Now it is up to policy and finance to catch up,” she concludes. ●

We cannot agree on the Paris ambition... and then continue as usual. For public institutions and the international community, this will be a real test

little room for fossil fuels in the energy mix. “Countries dependent on coal will need technological and financial support to ensure other viable options,” Kyte says. “We are in an energy transition, so there is a role for cleaner fossil fuels and efficient use of gas. But we cannot agree on the Paris ambition, promise to deliver nationally determined contributions to minimise carbon emissions, and then continue as usual. For public institutions and the international community, this will be a real test.”

and stop mismanaging the economy by subsidising fossil fuels,” she says. “Even under traditional parameters, we are not managing the economy for the outcomes we want.”

Reasons for optimism

The road ahead is steep, but things are evolving fast and Kyte is optimistic. Analysis by Bloomberg New Energy Finance shows that in 2015 investment in renewables surged to unprecedented levels, reaching

Sustainable Energy for All is a global platform created in 2011 by UN Secretary-General Ban Ki-moon to mobilise action and achieve three goals by 2030: “ensuring universal access to modern energy services; doubling the global rate of improvement in energy efficiency; and doubling the share of renewable energy in the global energy mix.”



© Andrew Wuttke/Breathe Architecture

Creating low-carbon cities

As people around the world live increasingly urban lives, cities will be at the forefront of any long-term climate solution

By **Joan Clos**, UN Under-Secretary-General and Executive Director, UN-Habitat; Secretary-General, Habitat III

The international community understands that to devise a collective and effective response to climate change, we should look at cities. Urbanisation is a powerful accelerator of growth and prosperity.

But cities also consume 78 per cent of the world's energy and emit a substantial portion of the planet's greenhouse gases (GHGs) that are brought about by human activity. With this in mind, cities are

increasingly devising strategies and taking action to curb their emissions.

Indeed, as the global community prepares for the Third UN Conference on Housing and Sustainable Urban Development, Habitat III, the theme of low-emission development is emerging strongly in the New Urban Agenda (Habitat III's proposed outcome document). There is a consensus among world leaders in favour of environmentally sound and resilient cities and human settlements, and the mitigation of emissions from GHGs.

Nations agree that we need national, subnational and local climate action that is

consistent with the objective of the Paris Agreement on climate change: to hold the increase in the global average temperature to well below 2°C above pre-industrial levels, with an aspiration to limit the temperature increase to 1.5°C.

As the world begins to rally around this New Urban Agenda, it is helpful to see how those cities that are taking the 2°C or 1.5°C targets seriously are going about cutting their emissions.

▲ The award-winning 'The Commons' sustainable and affordable apartments in Melbourne, Australia. The development model is now being replicated in the city

A recent review of major reporting platforms reveals that 72 cities have publicly committed to reduce their GHG emissions by 80 per cent or more from a base year. While this list is heavily skewed towards large cities in high-income countries, Puebla City in Mexico represents one secondary city from a middle-income country that has made a commendable commitment to making deep cuts in its emissions – a full 90 per cent reduction by 2050 from its base year.¹

A few of these leading cities plan to achieve deep cuts in only a few years: Copenhagen, for example, intends to realise net zero emissions by 2025. However, the vast majority (87 per cent) of these 72 ‘deep-cut’ cities plan to achieve their ambitious targets by 2050. By embracing very long-term planning, they are finding it necessary to upend existing planning practices. They are modifying current approaches, and even developing new tools as they go.

Conventional practice: the 20-year horizon

In conventional planning at the city level, a 20-year horizon for long-term planning is typical. This time frame is also followed in the realm of climate change. Countries’ intended nationally determined contributions (INDCs), the strategies that form the heart of last year’s Paris Agreement, include targets for 2030 or 2035.

The UN Sustainable Development Solutions Network (SDSN), launched by Secretary-General Ban Ki-moon in 2012, has forcefully argued that the 15 to 20-year time horizon embraced by the INDCs is inadequate when it comes to decisively addressing global warming. SDSN economists find that “pursuing the 2°C limit seriously” necessarily involves developing “deep decarbonization pathways to 2050”.²

They observe that focusing exclusively on a 2030 target could be “an effective dead end”, in that it could lock an economy in to ‘bridging’ approaches such as over-reliance on natural gas or developing more efficient internal combustion engines. Such technologies “leave insufficient prospects for reaching deep decarbonization by 2050”, leading the authors to conclude that a “timeframe to 2030 is... much too

Stockholm: ambitious cuts

■ The 2012 budget for Stockholm announced a bold target of becoming free of fossil fuels by 2050. Analysts have reckoned that taking such steps to decarbonise the local economy, along with embracing other measures, could reduce total per capita GHG emissions from 3.4 tonnes in 2009 to 0.4 tonnes in 2050 – an 88 per cent cut.

Following this announcement, in 2014 the city released a ‘Roadmap for a Fossil Fuel-Free Stockholm 2050’. This lays out several alternative pathways, such as seeking to improve the energy efficiency of existing buildings by either 30 or 50 per cent, or emphasising different pillars of the ‘avoid-shift-improve’ paradigm in the transport sector. It further gauges the costs and benefits of those alternatives.

This analysis of alternative pathways is helping to inform the debate on the way forward. In 2015, Stockholm’s City Council adopted the more ambitious goal of becoming free of fossil fuels by 2040 – 10 years earlier than previously planned. A draft strategy to achieve that goal is currently under broad consultation, with a decision expected on or after September 2016. ●

Sources: City of Stockholm, ‘Roadmap for a Fossil-Free Stockholm 2050’, and ‘Stadens Klimat- Och Miljöarbete’ (last accessed 23 June 2016).

short to ensure consistency with deep decarbonization by 2050”.

Short-term plans, long-term pathways

The SDSN then goes on to make a recommendation that is as applicable to cities as it is to nations. Policymakers should provide “a framework for ensuring that short-term action is consistent with long-term emission-reduction objectives... Short-term policy measures need to be nested in long-term pathways”.³

Indeed, something very much along those lines is starting to occur in vanguard cities. In 2007, New York City announced its

initial target of reducing emissions by 30 per cent by 2030 from a 2005 base year.

Then, in 2013, it published a report on the pathways to make deep carbon reductions, asking whether achieving an 80 per cent reduction by 2050 was feasible.⁴ Finding the goal to be viable, it then went on to “identify the lowest cost pathways and highest priority near-term actions needed to reach this goal”. The report concluded that reaching the 30 per cent target by 2020 rather than 2030 as originally planned, through accelerated action, was the surest way to “put the City on a trajectory to achieve 80 by 50”. The following year, officials announced a very long-term, deep-cut goal: to reduce emissions by 80 per cent by 2050, from the 2005 base year.

So, to nest shorter-term actions inside very long-term pathways, local planners are seizing on new approaches and modifying the tools already at their disposal. Stockholm, for example, is currently exploring alternative, very long-term, low-carbon pathways via a ‘roadmap’ approach (see box).

Another modified planning practice, embraced by New York City’s 2014 climate plan, involves first setting interim targets to periodically assess progress and ensure that the city is on track to achieve very long-term goals. Then, “if progress does not materialise, the City will enact [new mandatory measures]... to set our buildings on a path towards 80 by 50”.⁵

Other cities, bumping up against the limits of their individual powers, are lobbying and seeking to coordinate with others to achieve deep cuts. Indeed, cities in the C40 Cities Climate Leadership Group report that “over 75 per cent of the challenges [their] cities face” in addressing climate change “cannot be managed unilaterally”.⁶ As a result, C40 cities are “partnering and collaborating” – with higher levels of government, other cities and the private sector – to achieve ambitious targets.

Long-term planning: action needed now

City planners are becoming increasingly aware of the urgency of achieving deep cuts in city emissions, and the need to modify tools to provide for very long-term planning to that end.



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▲ The Makoko slum in Lagos Lagoon, Nigeria. With a population in excess of 20 million, Lagos is one of the fastest-growing cities in the world. Poor infrastructure and limited access to sanitation makes it particularly vulnerable to climate change

The Carbon Neutral Cities Alliance embraces just such an approach. This Alliance was born at a June 2014 meeting in Copenhagen of 17 progressive cities from nine countries. The initiative has since published a 'Framework for Long-Term Deep Carbon Reduction Planning' that furnishes local leaders determined to effect deep cuts with tools, tips and best practices.⁷

Then, in December 2015, UN-Habitat and 45 endorsing partners came together at the Paris Climate Summit to release the first version of their 'Guiding Principles for City Climate Action Planning'.⁸ Partners that have endorsed these guiding principles include: networks of cities (e.g. United Cities and Local Governments, ICLEI – Local Governments for Sustainability, South African Cities Network and the Federation of Canadian Municipalities); individual cities; planners (e.g. American Planning Association); international organisations (e.g. World Bank, Global Environmental Facility, UN Environment Programme and the UN Office for Disaster Risk Reduction);

and many others. Principle number one is “being ambitious”, encouraging cities to at least meet and preferably exceed the targets set for reducing GHG emissions by their respective countries. The second version of the guiding principles may well include expanded guidance on very long-term planning as a means for setting cities on deep-cut pathways. Cities emit a significant proportion of the world's GHGs, and as the world continues to urbanise, cities' share of emissions will surely increase.

Towards a new urban model

We must therefore move away from urban development that is power-hungry and creates ecological risks, towards a new urban model that is productive, safe and reduces GHG emissions.

The prerequisites for low-carbon and resilient cities include sound urban planning, legal frameworks that enable action, and a model of urban finance that can provide for the supply of climate-friendly infrastructures, while promoting a compact and diverse urban structure in which economic prosperity is encouraged. When these three pillars are put in place, the urban model will generate more solutions than problems. ●

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Securing energy sustainably

How can energy strategies tackle climate change without compromising energy security?



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By **Emily Cox**, Research Associate,
University of Sussex

Since the beginning of the 20th century, nations have expressed concerns over their energy security. Energy provision today plays a fundamental role in the economy and in people's everyday lives: energy services are needed to power modes of transport, light factories and workplaces, cultivate food, manufacture and distribute products, and cool and warm residences.

In many industrialised nations, it is seen as imperative that the energy system can deliver affordable energy in the volume required at any given moment, and politicians are wary of the threat to their political legitimacy in the event of energy shortages or severe spikes in consumer fuel price.

More recently, it has become apparent that the way in which we produce and consume energy will need to fundamentally change if we are to avoid potentially catastrophic climate change. Various policies and regulations to restrict greenhouse gas emissions are now becoming commonplace across the world, and the recent Paris Agreement signalled the willingness of the international community to work together to cut carbon emissions.

However, this has created an additional complication to the challenge of providing secure, affordable energy supplies, and there may be some unavoidable trade-offs between climate and energy security goals.

For example, nuclear power has extremely low carbon emissions, but raises numerous potential security concerns including investment uncertainty, public opposition,

▲ An amusement park in Kalkar, Germany, built on the site of a nuclear power plant that never entered service. The German phase-out of nuclear, due to safety fears, meant that they did not reduce GHG emissions between 2011 and 2015 despite massive investment in renewables

nuclear waste management and, in some countries, the danger of nuclear weapons proliferation. Renewables such as wind and solar are clean and waste-free, and costs are decreasing rapidly. But these sources of power are intermittent, which makes it much more challenging to ensure that adequate electricity supply is available when and where it is required.

Finally, biomass could provide flexible low-carbon electricity, heating and transport, but there are major uncertainties regarding costs and sustainability. The international feedstock market is in its infancy, making

it difficult to predict and mitigate potential future trade risks.

Part of the reason that trade-offs exist between climate change and energy security goals is the issue of timescale. Climate change is a long-term, global stress on the energy system, whereas threats to energy security may create very immediate local impacts such as fuel price spikes or electricity shortfalls. This means that historically, policymaking has tended to subjugate climate concerns to short-term energy security fears.

For example, a considerable number of large economies around the world (including Australia, Canada, China, Germany, India, Poland, Russia, South Africa and South Korea) remain heavily dependent on coal to meet domestic energy demand or for export purposes, despite the incompatibility of mining and burning coal with carbon reduction goals. Meanwhile, nations such as Canada, the UK and the US are pursuing the extraction of new forms of unconventional oil and gas, notionally because of concerns about the security of imported fuels.

However, a crucial aspect of energy security (and one that sets it apart from climate change) is that there is no agreed-upon means of maximising it. Fears about energy security tend to be so salient in the minds of the public that the term 'energy security' is frequently used by policymakers to justify various policies that may even be contradictory.^{1,2}

Developing strategies

The fossil fuel policies described above focus on reducing reliance on imports. However, there is little evidence that imported fuels are necessarily less secure than domestically produced ones,^{3,4} and the potential benefits of international cooperation and mutual dependency tend to be played down. For example, exploiting indigenous resources of unconventional fossil fuels often results in significant delays and uncertainty caused by public opposition, which may be just as much of a threat to a nation's energy security as potential threats arising overseas.

In the longer term, failure to mitigate climate change could result in serious physical risks to energy systems, as well as investment risks from failing to keep up

with increasingly stringent environmental regulations. Developing energy strategies that have a holistic view of energy and climate risks is an ongoing challenge, but one that could generate synergies and advantages in multiple areas.

For example, eastern European countries are expanding their use of renewables and reducing their energy demand, which can reduce coal usage at the same time as avoiding over-reliance on Russian gas. A strategy of increasing power production from renewables also tends to increase the diversity of the energy mix, which can act as a hedging mechanism against unpredictable energy security risks.

Importantly, it is crucial to avoid focusing efforts to improve energy security on the supply side. Demand reduction can generate co-benefits by improving energy security and

The term 'energy security' is frequently used to justify various policies that may even be contradictory

affordability while reducing environmental impacts. Furthermore, gas and electricity networks are consistently undervalued in terms of their impact on energy security. Experiences in Germany have shown that without significant and timely investment in electricity networks, transmission bottlenecks arise and renewable generation is curtailed.

Efficient expansion of the networks can facilitate sharing of electricity and gas across wider geographical areas, which can significantly improve resilience and can help to integrate intermittent renewables onto the electricity system. Energy security strategies often focus narrowly on trying to predict and avoid causes of insecurity (for instance by reducing fuel imports). However, it is also crucial to create systems which can respond to energy security threats, for instance by increasing system flexibility and resilience.⁵

It is also important to recognise that energy security and carbon reduction are about actors and policies as well as

technologies and markets. For example, significant energy security threats may arise from public opposition to new infrastructure, an issue which is often overlooked in energy security strategies. Making deep cuts to carbon emissions may also require active behaviour change on the part of consumers, for instance by switching to electric vehicles or reducing peak electricity demand. Finally, and most importantly, secure, low-carbon energy systems will only be realised if sufficient investments are made in energy infrastructures.

Policies should work to maximise investor confidence, both from the traditional large utilities and from emerging new business models such as community schemes. This includes avoiding making sudden or unexpected policy decisions, and recognising that a change in policy aimed at a single technology will impact investment across the system. This was demonstrated by the drop in investor confidence in the UK following the sudden withdrawal of funding for carbon capture and storage.

Improving energy security while simultaneously cutting carbon emissions is a highly challenging goal, and it is important to recognise the reality that there may be numerous trade-offs between different objectives. Nevertheless, certain synergies may also be possible, for example by pursuing 'low regrets' options, such as demand reduction, and by building flexible, resilient systems that can respond to unpredictable threats. The imperative to mitigate climate change creates new challenges, but also new opportunities for secure and sustainable energy systems. ●

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Reaping exponential benefits

Proponents of exponential technologies eulogise their ability to transform societies over the next 25 years. What is their potential to help tackle climate change?

By **Paul Bunje**, Principal and Senior Scientist, Energy and Environment group, XPRIZE

We are living in a time of exponential change. Transformations in our environment and climate are accelerating in response to rapidly rising carbon dioxide emissions. The growing threat of climate change has the power to undermine most areas of society and threatens economic development globally. The outsized importance of climate change to global development is reflected throughout the UN's Sustainable Development Goals, highlighted by Goal 13 for climate action.

Fortunately, technological progress is also driving exponential change, whereby the rate of new technology development is growing rapidly. We continue to experience an unprecedented, exponential increase in computing power with more and more individuals connected to the internet than ever before and networked sensors measuring everything from what happens inside one's body to the forces that govern our planet.

Exponential technologies, such as advanced robotics, artificial intelligence, distributed manufacturing (3D-printing) and nanotechnology, all share the fact that they are developing rapidly into accessible and flexible problem-solving tools that can be used to achieve grand impact in a highly scalable way. As a result, as exponential technologies improve, myriad different industries can simultaneously harness their power. They provide a foundational toolkit applicable to many different problems.

The intersection of these exponential forces – climate change and technology – provides us with a rare opportunity to begin solving the incredibly complex challenge of global greenhouse gas emissions by

leveraging tools that, by their nature, provide the ability to scale impact.

At the centre of our global challenge is the need to take real climate action and rapidly decarbonise our energy supply. As such, it will be imperative to apply exponential tools to every part of the energy system to accelerate the pace of change.

Reducing CO₂ emissions from our energy supply can and should take the form of: increasing the proportion of carbon-free energy sources (e.g. renewables); capturing CO₂ emissions from the burning of fossil fuels and either utilising or sequestering the carbon; improving efficiencies in the use and transmission of electricity (e.g. energy-efficient devices and home appliances, smart grid and distributed power generation); and dramatically improving the structure and quantity of energy demand across industries and communities.

Exponential technologies are already being applied in the electricity market in a way that is either displacing fossil fuels or changing demand to improve efficiency dramatically. Consider the advances that have occurred in solar photovoltaic (PV) power: the price per kilowatt-hour of solar PV has dropped exponentially over the past two decades, with the price curve accelerating recently.

This is precisely the type of exponential curve that is lauded in computer engineering, yet it has been even faster than the famed Moore's law (whereby computing power has doubled every 18-24 months for the past 40 years). Further advances in materials science and nanotechnology are resulting in new breakthroughs for solar, wind and other renewable sources of electricity.

On the demand side of the equation, the rapid growth in smart-grid technology – which relies on ubiquitous sensors and cloud-based information technology –

has in many developed countries begun to result in demand management that can efficiently manage their society's power requirements. This means these countries need to generate less total electricity to satisfy economic demands.

With the growth in the 'internet of things' – wherein devices ranging from appliances to cars will be connected to the internet – it will be increasingly possible to smooth energy demand across a wide system and rapidly improve energy efficiency.

Potential for innovation

These advances in efficiency are important because it means we can use less energy (and thus produce less CO₂) while still enabling all of the services and work that energy provides. In many parts of the world, access to electricity remains low or non-existent, which serves to impede economic and personal opportunity. But in some of these places, innovators are capitalising on exponential technology, such as mobile telephony, to build new business models that create affordable, carbon-free electricity.

Consider the Kenya-based company M-Kopa, which utilises mobile money and a novel business model to supply small renewable power systems for customers in the developing world. The digitisation of finance enabled by mobile phones means that there are now alternatives to the traditional central-utility model that dominates most developed countries.

Micro-utility or distributed energy systems like this have the potential to leapfrog large national-grid infrastructure in much the same way that mobile telephones leapt over the need to build landline-based infrastructure in much of the world, with benefits and technologies that flowed back into more industrialised countries.



▲ Schoolchildren study by the light of an LED lightbulb, powered by M-Kopa solar technology in Kenya – a service paid for using mobile money

Fossil fuels are not only the primary source of climate-altering greenhouse gas emissions, but they are anticipated to form a substantial part of our energy supply in the foreseeable future. Mitigating CO₂ emissions from fossil fuel-based energy production will therefore be critical. Already, tremendous advances in materials research have led to new, highly efficient methods of capturing carbon from the exhaust of a power plant.

In addition to this work in carbon capture and storage is the opportunity to begin utilising that carbon dioxide in other ways. The XPRIZE Foundation is running a prize competition, worth \$20 million, for teams that can convert the most carbon dioxide from a power plant into products with the highest net value. There are 47 entries, representing 47 different approaches to converting carbon dioxide.

This is an example of how exponential tools, such as a prize competition that sources from a global crowd of innovations, can rapidly identify and incentivise the development of new technologies.

Increasing the pace

There is a substantial amount of pessimism about the ability to tackle the issue of carbon emissions. Some of this is likely born of our justifiable impatience in seeing solutions. But recent advances have shown that the pace of those solutions is quickening – precisely as we would expect in an exponential pattern.

When observing an exponential curve, it can be difficult to distinguish the difference from a straight line; the change appears similar even if it is destined to ultimately increase exponentially.

For years, we have been in this linear-appearing phase of exponential growth in technologies that can mitigate CO₂ emissions. But the rate of technological development is increasing rapidly, indicating that we may soon be able to harness solutions at a substantially greater rate. By integrating solutions from across the production chain of carbon emissions – from energy generation to waste management and consumer behaviour – we may more quickly see solutions increasing in scale.

Integrating multiple elements of a complex system results in important network effects, where one piece influences

multiple other pieces in a positive feedback loop. This integration will drive exponential increases in our CO₂ mitigation efforts.

For example, renewable energy that is generated in excess of demand (e.g. wind power at night) can be used to convert captured CO₂ from a fossil fuel-burning power plant into a liquid fuel or other stored form of energy. This, in turn may then help reduce demand for fossil fuels during peak power demand. Combining technologies as diverse as renewable electricity generation, demand management, carbon capture and carbon conversion could thus see a rapid reduction in gross CO₂ emissions.

These technologies are at varying stages of commercial readiness. Capitalising on the power of exponentials – crowdfunding, crowdsourcing, information and communication technology, prize competitions, etc. – can enable a huge number of people, communities and institutions to both innovate and deploy climate solutions at scale.

It may not be easy to see at first, but we have the power to shape our energy future. And we have an obligation to use technology as widely and sustainably as possible to combat the causes of climate change. ●

Decarbonising transport

With demand for transport ever rising, and fossil-fuel engines still dominant, the sector needs to undergo a fundamental transformation if the global warming targets set in Paris are to be met



© Peeter Viisimaa

By **Cornie Huizenga**, Secretary General, Partnership on Sustainable, Low Carbon Transport (SLoCaT)

The 2015 Paris Agreement set a clear target for reducing greenhouse gas (GHG) emissions, by agreeing to limit the increase in the global average temperature to “well below 2°C above pre-industrial levels” and to pursue efforts to limit the increase to 1.5°C, recognising that this would “significantly reduce the risks and impacts of climate change”.

With transport carbon emissions still rising and travel demand expected to double in some transport sub-sectors, over the next decades up to 2050, a mere evolution of current transport policies will not be enough. Limiting climate change to 1.5°C means nothing short of decarbonising transport soon after 2050 in the most advanced regions (by 2070 in some other parts of the world). Transformational changes in thinking, policy, technology and investment are therefore required.

emissions. Demographic, behavioural, business and technology-driven trends are driving large increases in transport demand, in a sector currently still 98 per cent dependent on fossil fuels. An additional 2.3 billion people are expected to live in cities by 2050, placing further pressure on urban transport systems, and creating an explosion in urban passenger trips and freight deliveries.

At the same time there are still about one billion people living in rural areas that do not have access to an all-season road. Improving access for both urban and rural populations are targets in the Sustainable Development Goals (SDGs), agreed by the UN in 2015. Because of this growing demand for transport, emissions could double by 2050. Since transport infrastructure-related decisions ‘lock in’ transport demand for decades to come, public policy in the next few years will determine whether we are set on course for a high- or low-carbon transport future, especially in rapidly motorising countries.

achieving the 1.5°C target. Decarbonising transport will also mean embracing policies to avoid unwanted or unnecessary trips and shift journeys to lower-carbon modes. This will require comprehensive policy and behavioural changes.

In short, the transport community needs to embrace an ‘avoid–shift–improve’ framework to create a balanced set of transport options to reduce emissions and maximise development benefits.

Price signals also influence behaviour, so transport-related prices should reflect external costs (from pollution, noise, accidents etc.) and thus encourage travel choices that benefit society as a whole. Regulatory strategies, such as targeted road pricing as well as a general carbon tax, can simultaneously reduce car use dominance, stimulate private investments in clean vehicles and fund improvements in public transport. Fuel subsidies that are still in place in many parts of the world, meanwhile, hinder the transition to low-carbon transport and should be phased out.

To guide the transformation, we need a broad consensus on a comprehensive global roadmap that links policy, investment and behaviour, as well as technology

The Partnership on Sustainable, Low Carbon Transport (SLoCaT) and its partners are committed to supporting the implementation of the Paris Agreement in the transport sector. Working with Michelin Challenge Bibendum, SLoCaT has created the Paris Process on Mobility and Climate (PPMC) to mobilise action on transport and climate change. A key part of the PPMC follow-up strategy is the development of a global roadmap for decarbonising the transport sector.

The transport challenge

Transport currently accounts for about 14 per cent of global anthropogenic GHG

Tackling climate change is not the only challenge facing transport. Roadway congestion undermines the efficiency of, and quality of life in, urban areas. Road collisions kill 1.3 million people every year, and air pollution from motor vehicles kills even more. We also need transport to be more accessible and affordable, as often those people in greatest need of access to jobs and services can’t afford a bike or bus fare. These developmental objectives, in addition to the climate-change challenge, are also part of the SDGs and associated targets.

Linking policy, behaviour and technology

New technological improvements such as electric or hybrid vehicles and ride-sharing apps attract deserved attention, yet by themselves will be insufficient to ensure that transport does its bit towards

A roadmap for transforming transport

To guide the transformation towards low-carbon and sustainable transport, we need a broad consensus on a comprehensive global roadmap that links policy, investment and behaviour, as well as technology, in a coordinated manner. The aim of such a roadmap is to put transport onto a path to decarbonisation early in the second half of the century. The transformation of the transport sector will be greatly aided by implementing a series of ‘quick-win’ actions to kick-start progress towards a longer-term shift.

There is already broad consensus on the need, in cities, for passenger transport systems based on more walking, more cycling, more efficient public transport and shared-mobility solutions to support sustainable development and climate-change goals. Likewise, there is agreement on the need for appropriate pricing structures for transport. In all of these areas, quick-win actions can and should be deployed.

There has been less attention given to freight transport, although improved efficiency in logistics systems can reduce

◀ **The transport of choice, Amsterdam, Holland.** Sustainable transport in cities will require a shift to walking and cycling



© Thomas Peter/Reuters

demand and help shift high-carbon road freight solutions to less emitting solutions, including rail and water transport. The dominance of the freight sector by commercial actors means that if regulations and price signals are correct, the sector will rapidly adopt new solutions.

A successful development of a common global roadmap for the transport sector will require close coordination with other sectors. The growing importance of non-traditional fuels like electricity – and, in the future, possibly hydrogen – calls for close coordination with the energy sector. A better linkage of transport planning with urban planning, resulting in more compact cities, is critical in lowering the need for transport among the rapidly growing urban population in the world.

Effective action on transport and climate change, and therefore also the global roadmap, needs to balance action on land transport, which falls under the United Nations Framework Convention on

Climate Change (UNFCCC), with action on international shipping and aviation, which is regulated by two UN specialised agencies, the International Maritime Organization and International Civil Aviation Organization respectively.

The global roadmap will include a series of actions to guide policy, behaviour and technology. These are global in nature, but the manner in which they are deployed will be dependent on local circumstances, and thus the roadmap must be flexible enough to reflect different conditions in more-developed, emerging and least-developed countries.

From Paris to Marrakech

The Paris Agreement brings to an end a long period of uncertainty about climate action, and there is now widespread interest across the transport sector to step up implementation. Fortunately, we know what needs to be done, as there are many examples of safe, clean, efficient and

▲ Hydrogen, long touted as the fuel of the future, will soon make a bid for the mainstream. Honda's Clarity, its first mass-market fuel-cell vehicle, is due to be released later in 2016

affordable transport solutions supporting sustainable development for all (including disadvantaged groups such as the young, the elderly and people with disabilities). The challenge now is to scale up these efforts with comprehensive, concerted action on a global scale. If governments are serious about delivering on the Paris Agreement, they need to break with the past and adopt innovative policies to deliver transformational change.

The global transport decarbonisation roadmap, under development by the PPMC, in the aftermath of Paris for initial presentation at the next UNFCCC conference in Marrakech, can help to focus the efforts of governments and non-state actors alike to achieve the transformational changes needed to put the transport sector on the right track to help reach a 1.5°C destination. ●



Green signals

Italian railway signalling specialist **Ansaldo STS** explains why championing the needs of society and the environment is central to the company's business model

■ In recent years the world has changed dramatically. To be successful as a business, it is no longer enough to have a good product. Now, companies need to understand the needs of both their customers and of wider society, offering solutions that create value for both.

At Ansaldo STS, this is a question we ask ourselves every time we think about the physical realisation of our railway and metro components, or about the design of a great line: how can we, through our projects, create value for the entire community? Not only for those who specifically use our transport systems, but all the people who come into contact with them.

This must be a daily commitment: to face new challenges with the determination to find new solutions. Ansaldo STS, as part of the Hitachi Group, has always sought to contribute to social wellbeing through technological development. By combining advanced IT systems, the internet and cloud technologies, we aim to provide new solutions to improve quality of life on a global scale.

This single vision – albeit derived from different sources – keeps us focused on finding solutions to the various problems society faces, for which technological innovation can play an important role.

We also continue to reduce our impact on the environment. Our policies on energy saving and sustainable mobility mean we consistently rank highly

with CDP (formerly the Carbon Disclosure Project), an initiative that works with organisations to help them measure and disclose their greenhouse gas emissions.

We also continue to invest heavily in environmental research and development: we participate in research projects with national and EU institutions and promote technological and managerial training in partnership with Universities.

Simply put: we believe it is our role to create innovative solutions to help all of society. ■

ABOUT US

Ansaldo STS designs, builds, installs and operates signalling systems and components to manage and control railway and metro lines all over the world.

To find out more about our work on sustainability, please visit our website:

www.ansaldo-sts.com/en/sustainability

Ansaldo STS

A Hitachi Group Company

Nurturing natural carbon sinks

Earth's natural carbon sinks – plants, soil, oceans and atmosphere – are facing major threats from climate change. What can we do to protect them and promote their efficacy?

By **Pieter P. Tans**, Lead Scientist, Global Greenhouse Gas Reference Network, Earth System Research Laboratory, US National Oceanic and Atmospheric Administration

By nurturing natural sinks, can we compensate for the emissions of carbon dioxide (CO₂) that are produced from the burning of carbon-based fuels? The amounts required are astounding. During the growing season (May to September), current annual global emissions of CO₂ are larger than total net uptake by all forests, crops, grasslands, etc. in the Northern Hemisphere.

Furthermore, the largest portion returns to the atmosphere through respiration outside of the growing season – but not all of it. Global terrestrial ecosystems appear to sequester on average a few billion tonnes of carbon, or 10–20 per cent of global emissions, from fossil-fuel burning. (Note that one tonne of carbon equals 3.67 tonnes of CO₂.)

This removal from the atmosphere lowers the amount of the Earth's invisible infrared light that is intercepted by CO₂, allowing it to continue through to space and thus cool the Earth somewhat, but the long-term prospects of this benefit are uncertain because the mechanisms are not well understood. We know that climate change depends on cumulative emissions of CO₂ because the carbon that we extract from geologic reservoirs will not disappear from the ocean–atmosphere system for thousands of years.

Carbon storage (often called 'sequestration') in terrestrial ecosystems is vulnerable. Ecosystem succession, forced by climate change and direct human intervention, as well as fires, could return the carbon to the atmosphere. In other words, this form of carbon storage is not permanent – it will require ongoing human management.

Today's large terrestrial carbon sink

The existence of a large terrestrial sink has been inferred from mass-balance arguments. We know how much coal, oil and natural gas we burn, and we know from very accurate measurements the fraction that remains in the atmosphere. The remainder must have entered the oceans and/or the terrestrial biosphere.

We have a reasonably good idea of the 'excess' CO₂ that is now in the oceans, from our understanding of ocean chemistry and from measurements made throughout the oceans over several decades. That leaves a remainder that must be attributed to terrestrial ecosystems, which include organisms and organic matter in soils, the carbon content of which is hard to measure directly (Figure 1). This remainder includes both positive emissions from biomass burning and negative emissions from uptake elsewhere.

Since CO₂ is one of the important plant nutrients, it has been postulated that its ongoing increase is fertilising additional growth, an effect observed under optimised conditions in greenhouses. However,



it is widely recognised that outside of greenhouses, the enhanced growth can be limited by many other factors such as temperature and humidity, soil moisture and shortages of the major nutrients nitrogen, phosphorous and potassium. It can also be limited by trace nutrients (such as zinc, iron, etc.) that are required for active sites in enzymes.

Experiments of CO₂ enrichment of outside air, by releasing pure CO₂ at controlled rates, have had mixed results. Globally, the amount of reactive nitrogen that is available to terrestrial ecosystems has been approximately doubled, primarily through the industrial production of nitrogen fertiliser and from acid rain deposited far from its fossil-fuel combustion sources.

Global biogeochemical models try to incorporate the effects of these co-limiting factors to varying degrees, but it remains hard to validate the models. Recently, Terrer



© Lauro Alves/AFP/Getty Images

and co-workers discovered that symbiotic relationships between plant roots and fungi (called mycorrhizae) in forest soils alleviate the nitrogen limitation, allowing for sustained CO₂ fertilisation at temperate and high latitudes.¹

We need to understand the unintended fertilisation effects mentioned above because they are very large and they could potentially stop once the CO₂ increase first slows down and then starts to decrease. A portion of the sequestered carbon would likely then be biologically consumed, returning as CO₂ to the atmosphere.

Deliberate sequestration

Planting new forests on currently ‘marginal’ lands or restoring destroyed forests is one option. It would compete with other land use, like food production and urbanisation. Switching from conventional to conservation tillage or no-till agriculture

would better preserve soil organic matter. Adding biochar to soil can preserve organic carbon while also improving water and nutrient retention.

This is, of course, far from an exhaustive list, but the potential carbon storage per year in each of these appears to be small relative to the unintended fertilisation that has been underway already for a few decades. Deliberate carbon sequestration would have to be incorporated into present land use that would otherwise compete for space: for example, producing food in such a way that soil organic matter is enhanced instead of depleted. However, there are many other compelling reasons to nurture our ecosystems and soils vastly better than we currently do.

Biological mass extinctions

The great biologist Edward O. Wilson presents overwhelming evidence that human

▲ Taim Ecological Station on fire, in Rio Grande do Sul state, southern Brazil. South America is one of the regions most at risk of mass extinction

civilisation is in the middle of causing the sixth great mass extinction in the last half billion years of Earth’s history.²

The risks for future generations associated with a massive reconfiguration of ecosystems containing far fewer individual species are probably even larger than the risks stemming from climate change itself. In fact, climate change and ocean acidification significantly increase the risks of mass extinctions both on land and in the oceans.

Wilson acknowledges that our understanding of the interactions of species in ecosystems is still in its infancy. He states that: “At least two-thirds of the species on Earth remain unknown and unnamed, and of the one-third known, fewer than one in a thousand have been subject to intensive

biological research". Because of this vast lack of knowledge, he proposes that we set aside half of all land and half of all oceans as a nature preserve, off limits to human exploitation.

Currently, about 15 per cent of land and three per cent of ocean area has been set aside that way, in patchwork fashion, as National Parks, etc. In other words, the best 'nurture' strategy would be to leave half of the Earth alone. Even then, the designated wilderness half of the Earth would still experience high greenhouse gases, chemical air and water pollution (including plastic waste slowly degrading into microparticles), invasive species from the other half, and climate change.

Revised economic priorities

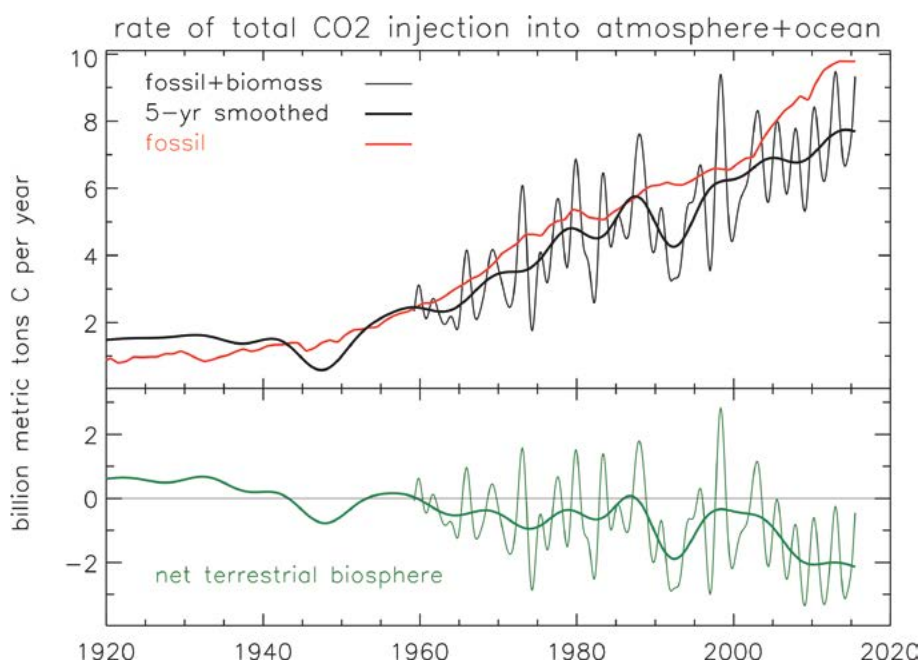
Our current economic system has greatly improved the material living standards of perhaps two to three billion people, but it has also set a trap for us. The maximisation of gross domestic product (GDP) has become the standard of success. Unfortunately, it only measures the rate of throughput of goods and services that are being paid for. It does not measure wealth, either of natural ecosystems or man-made infrastructure. Deforestation through logging or replacing tropical forest with palm oil plantations increases GDP, but there is no accounting of the wealth that is lost, much of it forever.

The evolving facts of climate change and mass extinction demonstrate that the throughput of goods needs to decrease drastically: we need to stop the one-way production of throwaway goods. In a 'circular' economy, all waste is a resource to be tapped. Throwing things away merits a tax, probably paid up front. In a broader sense we need to figure out a new economic system that can provide for the common good, namely housing, food, healthcare, employment, equality, security, individual freedom and education, without always having to grow in order to function.

Our financial system depends on debt, for which interest needs to be paid, which in turn demands growth so that we can all pay our loans. In addition, unless corrected, this system also inherently fosters growing

Figure 1. Recent mass balance of the global carbon cycle

The observed (ice cores and atmosphere) atmospheric history is used to estimate ocean uptake with a simple empirical pulse response ocean carbon model.³ A few model parameters have been set such that the ocean increase of CO₂ since pre-industrial times, observed during the World Ocean Circulation Experiment/Joint Global Ocean Flux Study during the 1990s,⁴ is reproduced, as well as the rate of increase of the ocean storage of excess CO₂ during 1990–2010, inferred from minute changes in the O₂/N₂ ratio observed in the atmosphere.⁵



Upper panel: Total CO₂ injection is the sum of the observed rate of atmospheric increase plus the amount that is calculated to enter the oceans. It is the sum of fossil-fuel emissions and net emissions from the terrestrial biosphere (there is no other substantial source).

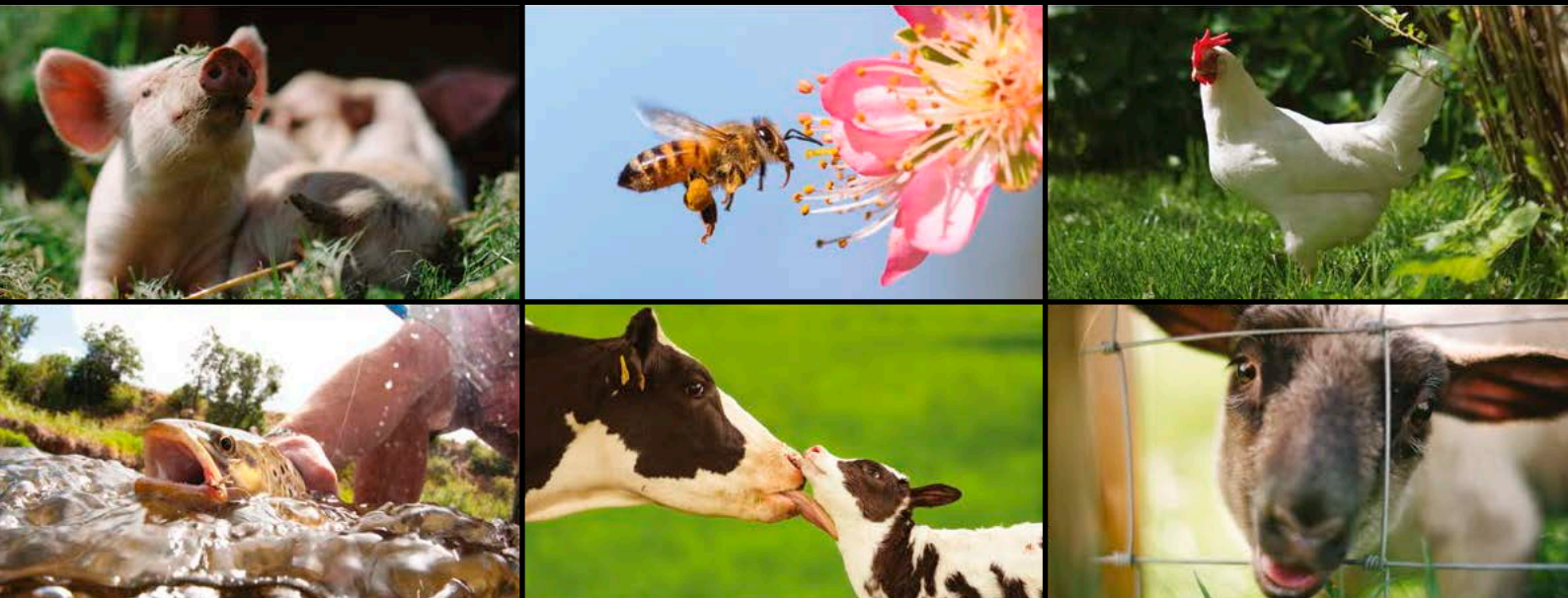
Lower panel: When the fossil-fuel contribution is subtracted from the total CO₂ injection, the net terrestrial emissions turn out to be mostly negative (meaning net uptake by terrestrial ecosystems) since the middle of the 20th century.

inequality because most of us are always paying interest to those who have much more than they can ever consume. Zero interest is perhaps one of the pillars of a new economy.

For the immediate future, it would be a start if new alternative measures of economic success would be introduced, first alongside GDP, and then gradually replacing it as being more relevant to human welfare. ●

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HOW WE LIVE DOESN'T HAVE TO COST THE EARTH OR ANYONE'S LIFE



LEAVE US OFF THE MENU



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Every year a few billion of the Earth's human population unnecessarily kill 70 billion land animals and trillions of fishes for food. Every individual one of them is a sentient life, who, like humans, seeks to avoid pain and continue living.

Using their bodies as food consumes vast amounts of resources including deforested land, water, fossil fuels and food. Meanwhile, one billion humans are hungry and millions of children die of starvation annually.

In 2006 the UN published *Livestock's Long Shadow* documenting how animal agriculture contributes more GHG emissions than the whole of the transport sector. Since then several reports have supported this fact. They may disagree on statistics but all concur on the significant contribution of animal agriculture to GHG emissions and climate change. Most of the information in the public sphere focuses on CO2 but animal agriculture is responsible for significant emissions of two potentially more harmful GHGs: methane and nitrous oxide.

It doesn't have to be this way. Human health does not require the consumption of animal foods; in fact, an increasing body of research supports the health benefits of a 100% plant diet, and documents the damaging effects of animal foods. If the human world went vegan and consumed a diet composed of 100% plants, we could cut food related emissions by 70%; this figure is higher than and more easily achieved than any other lifestyle change.

This is not news to readers of a publication on climate change. But it doesn't reach the public in any meaningful way. A sufficient percentage of the population care enough to change their lifestyles so that they do not inflict unnecessary pain on others or leave in their wake a planet that cannot sustain their children and the rest of life. They are the people who cycle to work; buy locally produced food, who rarely, if ever, take a flight, who turn off taps, lights and the thermostat on their heating system.

It may not be feasible for people to change how they heat their houses; or to avoid fossil fuel in order to travel to and from work. Changing to renewable energy takes time and money. But everyone can change how they eat. Today. At no cost.

The public is capable and willing to change how they live. 62% of people surveyed in the UK indicated that they were willing to give

up animal flesh while 36% were willing to give up dairy products. Doctors prescribing a plant diet for the prevention and treatment of diabetes found that it was remarkably well accepted by patients (Trapp & Levin, 2012). The number of vegans in the UK has risen by 360% in the last decade; most of them informed city dwellers between the ages of 15 to 34, motivated by ethical reasons.

The use of other animals is an issue that affects every life on earth from the micro level of individuals to the macro level of species existence. The public have a right to be made aware of the issue in an honest, unequivocal and uncompromising way. We no longer ask for less smoking; all Government warnings and health professionals call for complete cessation. To call for less animal foods when all of them contribute to climate change gives a confusing public message.

Veganism needs to be firmly on the climate change agenda. People deserve to know the truth. It is as much a human right as it is an animal right.

For more information and help on going vegan please see www.goveganworld.com where you can download a free vegan kit.

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Good intentions don't equal good climate policy

Many initiatives hailed as beneficial for the climate have failed to deliver or even had damaging consequences. What lessons can be learned and what risks are posed by current initiatives?

By **Varun Sivaram**, Douglas Dillon Fellow, Council on Foreign Relations

Confronting climate change will require building political coalitions in support of climate action as well as executing policies that reduce global greenhouse gas (GHG) emissions.

The Paris Agreement made unprecedented progress on the first front. Nearly every government in the world signed onto the agreement, and organisations across the private sector and civil society voiced their support for climate action. But though progress on the first front is necessary to advance the second, it is insufficient. That is, even broad consensus and a political mandate to curb emissions will not guarantee effective climate policies.

In the best case, poorly designed and executed policies will fail to reduce emissions at the rate required to forestall catastrophic climate change. In the worst case, they may do more harm than good. So as countries develop domestic climate policies and flesh out an international climate framework, policymakers should avoid three common pitfalls.

First, by constraining the range of available solutions to reduce emissions, they can turn a difficult task into an impossible one. Second, too often, policymakers design policies with blinders on – that is, with an eye only to local or theoretical effects – and in doing so miss the bigger, real-world picture of how global emissions may change. And third, through policies that advance existing clean-energy solutions today, they can stunt innovation into

superior technologies that could have a bigger impact tomorrow.

Policymakers around the world have already stumbled into all three of these pitfalls. Fortunately, as the political mandate for climate action grows, leaders can take advantage of the lessons from these examples to improve their policies moving forward.

Pitfall one: constraining the range of available solutions

Germany's well-documented *Energiewende* (or energy transition) provides an excellent example of a well-intentioned climate policy failing to reduce emissions because of constraints on the range of available solutions. In particular, Germany excludes nuclear energy – a power source that produces zero GHG emissions – opting

increases in wind and solar power), while nuclear energy fell from 25 per cent to 16 per cent. As a result, Germany could not deploy zero-carbon power sources to displace dirty coal-fired power, whose emissions rose slightly over the same period.

This means that Germany's energy consumers – who face electricity rates nearly three times higher than those in the United States, partly to fund the expansion of renewable energy – are paying dearly without reducing their country's emissions.

Many factors have contributed to driving Germany's emissions trajectory off track from its ambitious targets. Strong public opposition to nuclear power in the wake of the 2011 Fukushima nuclear disaster created political pressure to shut down nuclear plants. And economic competition from protected wind and solar generators made

Policymakers often fail to reconcile the broader effects with the narrow contexts of their policies

instead to achieve its climate targets through aggressive deployment of renewable energy. Unfortunately, the emission reduction from ramping up renewable energy has been annulled by the simultaneous phase-out of nuclear power.

Although Germany's target is to reduce GHG emissions by 80 to 95 per cent by 2050, emissions remained flat between 2011 and 2015. Over this period, renewable energy grew from 20 per cent of the power supply to 31 per cent (driven largely by

it even more difficult to keep the plants open. Still, the fact remains that Germany has taken its largest zero-carbon source of energy off the table, constraining its climate policy options.

Across the Atlantic, the US is grappling with its own internal policy debate over fracking, a technique that has enabled its producers to extract substantial oil and gas from unconventional reservoirs. So far, the US has not constrained its options, and as a result the substitution of coal by natural



gas in the power sector has accounted for the majority of a 12 per cent decline in US emissions over the last decade. What's more, US exports are now contributing to lower global prices of liquefied natural gas, particularly in Asia, where coal-to-gas switching by countries like China and India can considerably reduce global emissions.

The lesson here is that a low-carbon but not zero-carbon energy source – natural gas, which is half as carbon intensive as coal – can contribute to reducing emissions. Although the US should not constrain its climate policy to eliminate this option, it should ensure that fracking does in fact reduce emissions and does not compromise safety.

The Obama administration recently released rules to reduce fugitive methane emissions from the oil and gas industry, an important step toward securing the climate benefits of gas. And states and the federal government are taking steps to limit

fracking from contaminating water supplies or causing earthquakes.

Pitfall two: missing the bigger picture

Within a constrained set of options, policymakers often fail to reconcile the broader effects with the narrow contexts of their policies.

In the US, the state of California is an instructive case. Widely considered a climate leader, California has passed a broad portfolio of climate policies, many of them eminently sensible in isolation. But taken together, the bevy of disparate policies – including a cap-and-trade scheme, a low-carbon fuel standard, a mandate for renewable electricity, and others – can interact with and undercut one another unexpectedly.

For example, under an economy-wide carbon cap-and-trade system, in which Californian firms can purchase and trade permits to pollute, the total level of emissions is determined by the sum of the

▲ Pump jacks and wells on the Monterey Shale formation in California. Without stringent regulation and oversight, methane emissions from fracking may offset any gains from gas-for-coal substitution, as well as posing the threat of groundwater contamination and earthquakes

carbon permits sold. Apparent reductions from other climate policies, like fuel-switching driven by the low-carbon fuel standard, will actually create more room under cap and trade for another part of California's economy to emit more GHGs.

In fact, the cap-and-trade policy at the centre of the undercutting interactions within California's climate portfolio is itself less effective than intended. This again is a result of policymakers failing to see the bigger picture: in this case to consider the real-world functioning of a cap-and-trade scheme that works well on the blackboard. California's scheme – as well as other schemes elsewhere in the US and Europe – has resulted in carbon permit prices that are

less than a third of most economic estimates of what the price should be. This is because economic growth is tough to forecast and has an outsize impact on an economy's GHG emissions.

Policymakers who misapprehended anaemic economic growth set a cap that was too high, resulting in carbon prices that are too low to cause substantial GHG emission reductions. A simpler policy – a carbon tax – may be less elegant on paper but would work much better at sending a strong and predictable price signal to reduce emissions.

Still, any scheme to put a price on carbon will require policymakers to take a truly global perspective to ensure that in response to their policies, emissions around the world actually decrease, which is the ultimate objective of climate policy.

Economists have long warned that a carbon price in one country could shift emissions-intensive economic activity, like manufacturing, to another country, a phenomenon known as emissions leakage. To mitigate it, countries may need to set up an elaborate system of border tariff adjustments, so that countries that do not set a price on carbon cannot freely sell their goods to countries with a carbon price.

Such a system could well contravene international trade laws and will entail tricky negotiations. The lesson is that policymakers should adopt a global perspective to recognise that effective carbon pricing will actually be substantially harder than just passing a domestic policy – a feat in itself for many countries.

Pitfall three: locking out new technologies

Finally, policymakers should beware enthusiastic support for existing clean-energy technology that could have the unintended consequence of putting new technologies at a disadvantage and preventing their commercialisation and adoption.

To radically reduce emissions and displace existing energy infrastructure, all the while fuelling economic growth around the world, we badly need new and improved clean-energy technologies. But in many cases, these technologies face a tilted playing field against established clean-energy technologies, and public policy can



▲ Touring a virtual nuclear reactor at the Idaho National Laboratory, a leader in Generation IV nuclear technology – this technology is potentially safer, cheaper and more effective than the dominant light-water reactors, but its development is hindered by 'technological lock-in'

further erect barriers to their emergence. The canonical example of 'technological lock-in' in clean energy is the nuclear light-water reactor. The US Navy selected this design for its submarines in the 1950s and subsequently used it for its civilian nuclear reactor fleet and sold it to countries around the world.

Today, 90 per cent of all nuclear reactors in the world are light-water reactors, even though subsequent Generation IV technologies may offer better safety, cost and performance attributes. In the US, legacy regulations tailored for light-water reactors have made it overwhelmingly difficult for other technologies to break in.

Two emerging examples of clean-energy technology lock-in should cause concern. First, the rise of silicon-based solar power, fuelled by tax credits and subsidies around the world, has erected a nearly insurmountable barrier to market entry for new solar technologies. Although the cost of silicon solar has fallen dramatically in recent years, it is still unlikely that the technology will reach the low cost necessary to provide

30 per cent or more of the world's electricity needs by mid-century, a level likely needed to meet the world's climate targets.

Exciting alternatives to silicon, lacking targeted public support, may not achieve the scale necessary to drive the cost of solar further down. And a similar story may be unfolding in energy storage, where lithium-ion battery technology dominates the market and is increasingly difficult to dislodge as firms like Tesla ramp up its production. But without new energy storage technologies, electric vehicles may remain uncompetitive compared with fossil-fuelled cars, and power grids may only be able to accommodate large amounts of unpredictable renewable energy through expensive upgrades.

Thus, well-intentioned policymakers who are deploying clean energy today may be steering the world's energy infrastructure down a dead-end rather than enabling breakthrough technologies to expand the set of options available to reduce global emissions. Recognising such pitfalls is a crucial first step to designing effective policies that actually accomplish their objective of long-term GHG emission reduction and climate-change mitigation. Indeed, policymakers would do well to remember that the road to a warmer climate is paved with good intentions. ●



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Enforcing environmental rules

The Volkswagen emissions scandal revealed cynical fraud on a shocking scale. How was this allowed to happen, and what can be done to stop other industries from flouting environmental rules in pursuit of profit?



© Chesnot/Getty Images

By **Jennifer Morgan**, Executive Director,
Greenpeace International

One day, when people look back at the history of national laws and regulations and international treaties, the story they will read will focus on the big transformations and changes that occurred: the Clean Air Act, clean water regulations, a global climate change agreement. What probably won't be in the history books is the detail of the measurement, reporting and verification systems at the heart of the same laws and treaties – core components that determine whether those laws and treaties were a success or a failure.

Often written or negotiated by a small group of experts due to the complexity of the issues involved, these detailed provisions are a key factor in whether the public, in the end, is protected from pollution or not. You don't need to look very far to find a clear example of this in recent history: Dieselgate – the Volkswagen (VW) deception that endangered the health of millions of people. How could such deception be possible and what do we have to do in the automobile sector, among others, to prevent this from happening again?

The problem

When one reads the literature and the reporting on the VW scandal there are a few key problems that rise to the top. The International Council on Clean Transportation, an instrumental institution in documenting and exposing the problem, and Transport & Environment, an expert NGO on these issues, have published widely on the matter. In summary, what they find is that a mixture of loopholes and corporate cheating allowed this breach to occur.

The combination of the lack of independent testing and verification, the lack of a clear and strong enforcement authority, and mixed signals on how high penalties could be, were major factors in the VW scandal.

◀ Paris, France, blanketed in smog in November 2015, ahead of COP21. Diesel pollution endangers the lives of millions living in large cities

Indeed, the independence of monitoring agencies from industry is a crucial element in the story. In Europe, automobile manufacturers can choose their approval agencies, which are paid for their services by the industry itself. Recently, Greenpeace Germany published a report called *Schwarzbuch Autolobby* (or *Black Book: Car Lobby*), which clearly outlined the deep connections between the German automobile industry and the German government. Ministers and officials at both the state and national level are effectively in a 'revolving door' – spending a few years in industry, then in government, and then back to industry.

This of course makes it extremely easy for the interests of the auto industry to be very well represented in policymaking circles. If you combine a system in which a company can choose and pay its verifiers with the dominance of that industry in the state national government, then Dieselgate should come as no surprise at all.

It is imperative that such breaches don't happen in the future – in any sector. To avoid such scandals, a multi-levelled approach is needed.

The national level

Clear national laws

These should focus on protecting people from dangerous pollution. They must mandate clear, effective and independent monitoring and verification systems to carry out the work on a regular basis. That authority should have the oversight of implementation, and be able to draw on the best data from credible sources. Self-monitoring or industry-chosen institutions do not work and should be replaced.

Capacity

The national authority that carries out the monitoring and verification has to have adequate capacity to do so. These processes take time and can require significant human and other resources. These should not be industry funded.

High fines and reparations

The responsible directors and officers of cheating corporations should be held

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personally liable, and non-compliant corporations should be forced to pay substantial reparations to the communities they have recklessly polluted. VW and other cheats must be forced to repair the social damage their actions have caused.

Governing for and by the people (not the industry)

It is vital that interested industries are not unduly influencing national policymaking.

The international level

Additionally, an effective international monitoring, review and verification system should also be in place. This adds an additional level of accountability at the nation-state level and can provide incentives, pressures and capacity-building to put in place credible national systems.

The Paris Agreement made good progress in putting such a system in place. Each and every country is required to report on its greenhouse gas emissions every two years, based on a set of international standards. There is also a process to independently verify the data and the information that countries submit. There will be a country-level assessment by experts and then an international dialogue about that country's performance. Through such transparency should come greater accountability. Of course, each country will require the capacity to actually implement the transparency system, and thus a set of measurement, reporting and verification capacity-building initiatives is part of the Paris package.

The Paris Agreement also includes an article on compliance that, at this point in time, will most likely take a facilitative approach. While some countries – particularly small island states – and NGOs tried to achieve more, this was unfortunately not possible, politically at least, in 2016. It will, however, stay on the table for the future.

The people level

In the meantime, victims of climate impacts are not waiting around. In the Philippines, for example, a group of petitioners have asked the Commission on Human Rights to order the companies responsible for the lion's share of cumulative global emissions



© Chip Somodevilla/Getty Images

of industrial CO₂ and methane – the ‘carbon majors’ – to submit their plans on the steps they will be taking to eliminate, remedy and prevent the devastating effects of climate change in the Philippines.

On 27 July 2016 the Commission sent an order requiring the carbon majors to file a response within 45 days. While it cannot provide damages or individual remedies, this administrative action is a building block for judicial litigation in the Philippines, where organisations could seek concrete remedies requiring a carbon major to prevent causing harm.

There are further ways in which people can engage in monitoring and verifying company and country action. Global Forest Watch is an independent initiative that is free and easy to use. It is based on big data and allows anyone to create custom maps, analyse forest trends, and participate in holding companies and countries accountable for deforestation. It is a form of radical transparency that provides data in real time to whoever is interested. No more covering up, no more special interests, just people and their smartphones taking action.

▲ Michael Horn, President and CEO, Volkswagen Group of America, giving evidence at the House of Representatives Energy and Commerce committee

This is just one example of the ‘citizen science’ that is building a robust and independent evidence base in real time. Similar efforts are underway in the power sector and in various cities around the world. While the bottom-up data gathering in the UN Framework Convention on Climate Change will remain the foundation, big data and citizen science are already forcing governments to move faster and go deeper in being transparent about what is happening on the ground – a very powerful development to hold polluters accountable.

Conclusion

Hopefully the VW scandal has sent a clear signal to other corporations that this type of deception will not go unnoticed, nor unpenalised. The key, of course, is to prevent it from happening in the first place. A combination of clear laws, independent verification and people power shows the way forward. ●



Sustainability in practice

City Express Hotels reinforces its commitment to society through its sustainability programme

City Express Hotels, a leading Mexican hotel chain, is a socially responsible company with a clear objective: to generate social, environmental and economic value in the cities where it has a presence.

The chain's sustainability programme reflects its strategic efforts in the areas of corporate governance, business ethics, quality of life, energy savings, environmental innovation and connection with surrounding communities. It includes environmental certifications, programmes for entrepreneurial support and an overall philosophy of corporate social responsibility. City Express Hotels has positioned itself as one of the leading Mexican companies in terms of innovation and sustainability, becoming the first hotel chain in the country to receive a number of international certifications, including:

EDGE Certification (Excellence in Design for Greater Efficiencies): created by the International Finance Corporation of the World Bank, especially for those who seek to encourage the development of green buildings in emerging markets.

BIOSPHERE Certification (Responsible Tourism): awarded by the Responsible Tourism Institute, sponsored by UNESCO, it aims to constantly improve environmental and social impacts.

LEED Certification (Leadership in Energy and Environmental Design): awarded by the United States Green Building Council, it recognises architectural and urban design projects that demonstrate a commitment to sustainable planning and green architecture.

City Express Hotels is also part of the United Nations Global Compact initiative, embracing the principles that relate to the protection of human rights. In March 2016, City Express Hotels was, for the second time, awarded the title 'Socially Responsible Company' by the Mexican Center for Philanthropy. This accolade once again distinguishes the chain as one of the best companies in Mexico in terms of corporate governance, business ethics, environmental commitment, quality of life and social engagement.

City Express Hotels also seeks to drive high-impact projects that generate a value to society and increase the social and economic wellbeing of the communities where it operates by supporting a range of projects aimed at boosting entrepreneurs. These include:

The Pool: an entrepreneurial project incubator.

Cleantech Challenge: the most important contest focusing on green initiatives in Mexico.

Epic Lab: empowering business makers and communicating best entrepreneurial practices and tools in communities where the chain has presence through strategic alliances with universities in Mexico.

Startup Weekend: supporting the programme promoted by UP Latam, a non-profit organisation that helps develop entrepreneurial communities around Mexico.

It should be noted that as part of the chain's labour inclusion initiative, a programme has been implemented for individuals with hearing disabilities, offering equal job opportunities. In accordance with its commitment to protect the environment, City Express Hotels has earmarked 140 million pesos for adopting sustainable measures and initiatives that include: energy and water savings, waste reduction, as well supporting social responsibility projects according to its sustainability programme.

Through its commitment to society, sustainability, the environment and ethical practices, City Express Hotels positions itself as one of Mexico's leading innovative businesses. ■

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Towards a new business as usual

Governments alone can't tackle climate change. As drivers of the world economy, companies must now embrace and champion climate-friendly practices in their day-to-day operations

By **Emily Farnworth**, RE100 Campaign Director, The Climate Group

Too few companies are aware of the impacts that climate change might have on their future growth. But there's good news: the long-term commitment of governments provided by the Paris Agreement, coupled with the growing affordability of clean technology, means that world-leading companies are increasingly taking climate action seriously – because it makes business sense.

The threat of climate change to a company may not be as easy to spot as, say, dangerous working conditions or irresponsible behaviour towards the workforce. These are highly visible issues with obvious, immediate and long-lasting impacts, and explain why health and safety and employment rights are ingrained across business operations.

By contrast, only 50 per cent of CEOs surveyed by PricewaterhouseCoopers earlier this year identified climate change as a threat to business growth.¹ And yet a separate survey of multi-stakeholders by the World Economic Forum found that a climate-change catastrophe was the biggest potential threat to the global economy in 2016 – ahead of weapons of mass destruction.²

Even if we manage to keep the global temperature rise below 2°C, as required by the Paris Agreement, our reliance on fossil fuels, coupled with unchecked deforestation over the last century, means that business won't escape entirely unscathed.

Already, increasingly common extreme weather events such as flooding and drought are putting supply chains at risk, with food and beverage companies that invest heavily in natural capital among the most obviously affected. Swiss Re has warned of future high economic costs, citing, for example, the billions of pounds in damaged infrastructure and lost revenue in the US caused by Hurricane Sandy alone.³

Companies have a responsibility to mitigate the risk and to future-proof their business, but this is not the only driver for climate action. As the world moves to reach net zero emissions well before the end of this century, business is in an era of inevitable and unstoppable change. The shift to a low-carbon economy is well underway, and with wind and solar power investment now overtaking fossil fuels, no business wants to get left behind.⁴

We're seeing companies go further and faster on renewable energy because they have so much to gain. Renewable power provides greater control over energy costs: in developing markets like India, it can provide greater energy security for an affordable price. And no matter where your operations, demonstrating leadership on the environment is something consumers not only want to see, but now expect.

Led by The Climate Group in partnership with CDP, the RE100 campaign

► The world's largest solar thermal power-tower system at Ivanpah in the Mojave Desert, California is part-owned by Google. As a RE100 member, Google has committed to running its global operations using entirely renewable power





© Ethan Miller/Getty Images

brings together the world's most influential companies – such as IKEA, Google and Unilever – who are committed to using 100 per cent renewable power across their global operations. The business case is now so compelling that sustainability teams are using it to get senior executives' support for a 100 per cent renewable goal – highlighting positive impacts on the bottom line.

As Chief Financial Officer of Dentsu Aegis Network Nick Priday recently put it, “it's important we decouple carbon from growth to achieve long-term savings on our operations and become resilient to resource scarcity and price fluctuations.”

Dentsu is not the only company to recognise the risks and prosper from action. Leading French bank Crédit Agricole's new renewable electricity contract, which it negotiated at the end of 2015, is expected to save it €9 million over three years. Leading Indian automobile manufacturer Tata Motors reported that in 2014–15, the generation of wind power at just one of its plants resulted in financial savings of 163.5 million Indian rupees (equivalent to approximately \$2.4 million), through avoided electricity charges.

Not every business will be a low-carbon leader, but the right choices for tackling climate change are completely aligned with business growth. A commitment to 100 per cent renewable electricity is a level of ambition that will engage senior leadership across procurement, operations, finance

A commitment to 100 per cent renewable electricity is a level of ambition that will engage senior leadership across procurement, operations, finance and sustainability teams

and sustainability teams, helping to embed action into the heart of a business.

However, the action isn't stopping there. RE100 members are also going beyond their own operations, influencing their peers to act on renewable power, cut carbon and build resilience into their supply chains. Unilever, for example, cut carbon emissions from energy use across its manufacturing network by one million tonnes in 2008–15.

Environmental and commercial rewards: Unilever case study

■ In 2015, multinational consumer goods company Unilever set a target to be carbon positive in its operations by 2030. As well as working to source 100 per cent of its energy from renewables, the company seeks to generate more renewable energy than it consumes – making the surplus available to the markets and communities in which it operates around the world.

Unilever has long been recognised for its environmental leadership. The company knows that the increasing likelihood of extreme weather events such as floods and droughts poses a threat to its supply chain and operations, and that by becoming carbon positive, it can reduce risk while achieving lower operational costs, greater resilience in its energy supply, and a closer relationship with its communities and consumers.

Unilever recognises that achieving 100 per cent renewable energy depends in part on the broader changes taking place in energy markets worldwide. That is why it is helping to drive positive change through its membership of RE100 – a collaborative initiative of the world's most influential companies committed to 100 per cent renewable power.

In May 2015, Unilever reached a major milestone when its manufacturing network achieved an annual saving of one million tonnes of CO₂ compared to 2008. The company reduced CO₂ from energy by 39 per cent per tonne of production since 2008, resulting in cost savings of around €330 million.

Unilever's Partner to Win programme is one example of how the company is lowering CO₂ emissions through innovation. The company works with selected key suppliers to bring leading-edge products to the marketplace, such as climate-friendly ice cream freezers that use energy-efficient, hydrocarbon refrigerants, and compressed deodorants that require less packaging and extraction of raw materials. Unilever is sharing its revolutionary technology with competing manufacturers in a bid to help the whole deodorant industry cut its aerosol footprint by 25 per cent. ●

One of its suppliers, International Flavors and Fragrances, followed the consumer goods giant to join RE100 last year.

Meanwhile, IKEA and telecommunications provider BT are

to develop cleaner and more efficient portfolios. As more and more states, regions and even countries set 100 per cent renewable-energy goals, the market will expand even further.

As business works to do its bit to deliver on the Paris Agreement, there is still a lot to play for. Leading companies continue to find new and innovative ways to grow sustainably and adapt to climate change. Those who fail to seize the opportunities or act on the risks will simply not thrive in the new clean economy.

Climate-friendly practices are becoming the new business as usual. Responsible growth has never been so appealing. ●

encouraging their customers to embrace renewable power, through solar panels and LED lighting, and by switching to greener tariffs at home.

There is a growing movement of businesses, cities and citizens, all working together, to accelerate the clean-energy transition. They are sending a clear message to investors and utilities that the demand for renewables is there, and that it's time

- 1 www.pwc.com/gx/en/ceo-survey/2016/landing-page/pwc-19th-annual-global-ceo-survey.pdf
- 2 <http://reports.weforum.org/global-risks-2016/global-risks-landscape-2016/#landscape>
- 3 www.theclimategroup.org/news/why-insurance-part-solution-michel-lies-swiss-re
- 4 www.bloomberg.com/news/articles/2016-04-06/wind-and-solar-are-crushing-fossil-fuels

Protecting communities, forests and the climate



■ **RSPO-certified smallholders can access the growing market for certified sustainable palm oil**

Palm oil is the world's most widely consumed vegetable oil and, as the population grows, demand is rising. The highest-yielding vegetable oil crop, palm oil requires less than half the land required by other crops to produce the same amount of oil, making it the least expensive vegetable oil in the world.

It is essential for economic development in South East Asia, particularly in Indonesia and Malaysia, which together produce over 80% of palm oil. But its cultivation has also become synonymous with negative environmental and social impacts.

In some regions, palm oil cultivation has caused deforestation. Palm oil plantations have been developed without consultation with local communities. Some have even been responsible for forcibly displacing people from their land. Violations of workers' rights to fair payment and safe working conditions have also occurred.

In producing countries, millions of smallholders and their families work in the palm oil sector. Palm oil plays an important role in the reduction of poverty in these areas. In Indonesia and Malaysia, a total of 4.5 million people earn their living from palm oil production. Stopping the production of palm oil altogether would create significant problems for these people who support their families by working in this industry.

The Roundtable on Sustainable Palm Oil (RSPO) was formed in 2004 to promote the production and use of sustainable palm oil through a credible global standard and engagement of stakeholders. We are an international, not-for-profit, multi-stakeholder association with more than 2,500 members. Over 2.56 million hectares have now been

certified to the RSPO standard for sustainable palm oil, producing more than 20% of global supply.

Smallholders are critical, producing more than 40% of palm oil, but suffering from lower yields. We want to support more smallholders to become RSPO certified, in order to produce more oil using less land, reducing the threat to forests and biodiversity, and raising level of income among poor farmers.

The RSPO Smallholder Support Fund aids smallholders with capacity building to improve agricultural practices and it fully reimburses their audit costs. Smallholders who are certified by RSPO can access the growing market for certified sustainable palm oil and help global consumer goods companies meet their commitments to sustainable palm oil.

To date the RSPO has helped 131,432 individual smallholders gain certification and helped facilitate partnerships between smallholders, NGOs and the private sector. ■

RSPO will transform markets to make sustainable palm oil the norm. More info: www.rspo.org



RSPO

Roundtable on Sustainable Palm Oil

Tracking progress after Paris

Ensuring that countries deliver on their pledges to reduce greenhouse gas emissions calls for transparent and robust international accounting rules – and some deft negotiation

By **Lambert Schneider**, Associate,
Stockholm Environment Institute

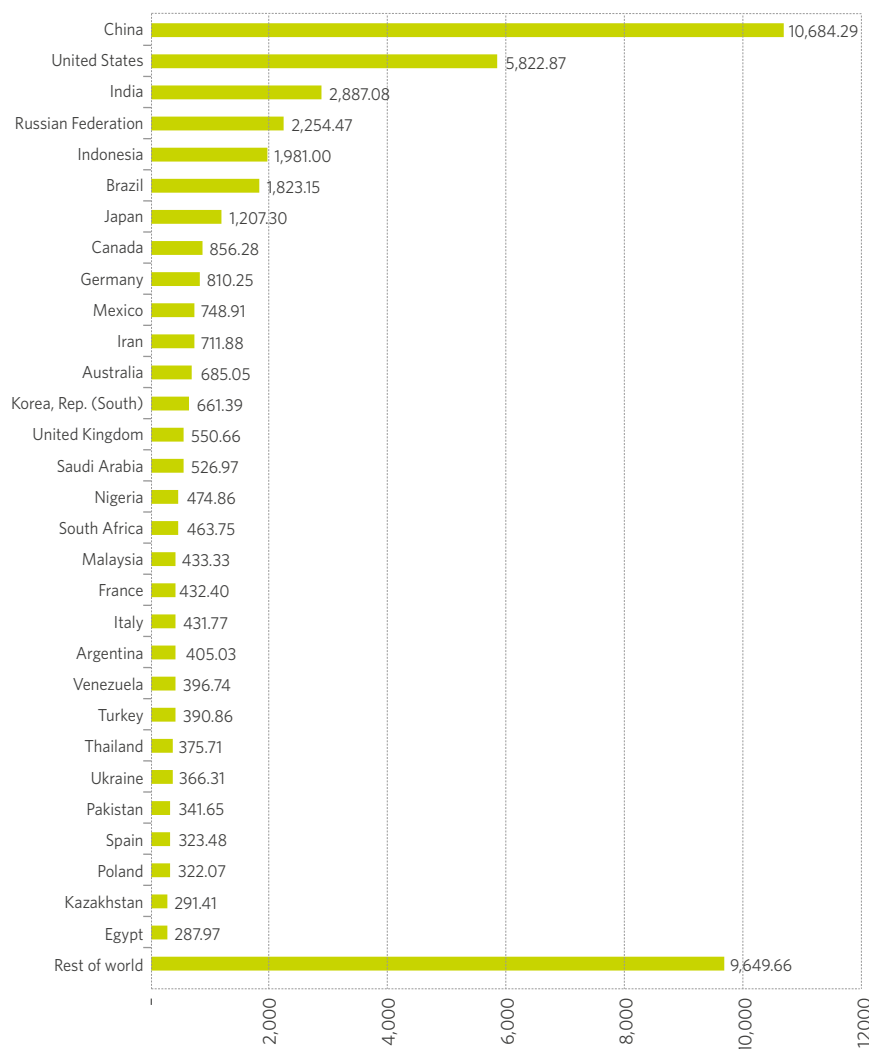
After the historic adoption of the Paris Agreement, parties are now negotiating the rules for its implementation. Over the next few years, numerous decisions on the various elements of the agreement have to be elaborated. They matter. International implementation rules will be critical for the success of the agreement: they could help achieve ambition and ensure environmental integrity – or create loopholes that undermine efforts to achieve the agreement's objectives.

Under the Paris Agreement, all countries are required to submit every five years nationally determined contributions (NDCs) that stipulate their actions to reduce greenhouse gas (GHG) emissions. Tracking and assessing how countries achieve their NDCs is a critical element of the agreement. Article 13 of the agreement establishes a 'transparency framework'. This framework could create the transparency necessary to understand what countries' NDCs actually mean, provide information as to whether countries are on track to achieve their NDCs, and ensure that a tonne of emission reductions pledged on paper also represents a tonne of reductions into the atmosphere.

Formulating and understanding NDCs

Transparency starts with the formulation of NDCs. Under the Kyoto Protocol, emission-reduction targets were established as absolute, economy-wide emission budgets for specific GHGs and time periods. In contrast, the Paris Agreement does not prescribe the nature and scope of parties' NDCs. This resulted in highly diverse and sometimes unclear mitigation contributions,

Total GHG emissions including land-use change and forestry – 2012 MtCO₂e



Source: WRI/CAIT

posing several challenges, including:

- **Single-year targets:** Many NDCs include only a target for 2030 and do not specify emission levels in the period up to 2030. For the climate system, however, it is the cumulative emissions that matter.

Single-year targets generate considerable uncertainty with regard to cumulative emissions. Their impact depends strongly on whether countries take action early on, or whether they delay emission reductions until 2030.

- **Business as usual (BAU) estimates:** Several countries pledged to lower their emissions relative to a BAU scenario for 2030. BAU emission scenarios are uncertain, due to their underlying assumptions on economic growth, technological progress or international fuel prices. Some countries appear to exaggerate their future emissions, rendering their targets less effective. Others have not yet specified their BAU emissions, leaving it uncertain what their targets mean.
- **Scope:** Some pledges do not cover the entire economy, do not cover all GHGs, and/or do not relate to GHG emissions. These range from broad targets for renewable energy deployment or energy efficiency improvements to specific policies or measures, such as the reduction of emissions from morning peak-hour vehicle use. Targets covering only part of the economy may leave emissions unabated and could complicate accounting rules. For specific policies and actions, it may be difficult to robustly quantify their GHG emissions impact.
- **How to account for emissions and removals from land:** This has considerable impact on emission-reductions targets. Many NDCs have not clearly specified accounting rules, raising uncertainty on the actual ambition of targets.
- **Conditional targets:** Many developing countries made pledges that are conditional upon support provided by industrialised countries. It is often not clear what type of, and how much, support would be needed to achieve the pledges.

Defining emission-reduction pledges in a transparent, consistent and comprehensive manner is important for both understanding what countries pledged and assessing their progress in achieving their pledges.

Transparency of action

Article 13 of the Paris Agreement requires countries to report regularly on their GHG emissions and progress made in achieving their NDCs. Tracking progress will require taking into account the diversity of NDCs

and the capacities of developing countries. Countries may need to establish national systems that define and measure specific indicators that are relevant for the type of target, such as the capacity of renewable power installed or the energy consumption per gross domestic product. Tracking progress could also include the elaboration of emission projections, to understand whether countries are on or off track to achieving their target.

The information reported by countries will undergo an international technical expert review to assess the achievement of the emission-reduction pledges and consistency with internationally agreed rules. This process provides several essential functions and benefits: because the targets set out in the NDCs are not legally binding, a binding international review process could make the agreement more effective, by building up pressure for countries to meet their targets.

The international review process will also inform a regular global stocktake to assess the collective progress towards its long-term goals. Finally, it can enhance transparency, trust and accountability among parties, and help identify and share solutions, thereby encouraging further action by parties.¹

International carbon markets

Article 6 of the Paris Agreement allows countries to use international carbon markets to fulfil their emission-reduction pledges. International carbon-market instruments could reduce the overall costs for mitigation but, if poorly designed, could also lead to higher global GHG emissions.

To ensure carbon markets meet their objectives, three issues are particularly important:

- **Accounting for the vintage of transfers:** Robust accounting of international transfers requires considering the vintage of internationally transferred mitigation outcomes. If a country accounts for emission reductions achieved over several years in another country to meet its target in 2030, this could lead to higher cumulative global GHG emissions compared to achieving

the same target without international transfers.

- **Avoiding transfer of 'hot air':** The experience of joint implementation under the Kyoto Protocol shows that the international transfer of surplus carbon market units from countries with targets above their BAU emissions can undermine global mitigation action.² Some NDCs are not ambitious and possibly even above the countries' BAU emissions,³ involving the risk that international transfers from these countries could lead to higher global GHG emissions.
- **Avoiding double counting:** The Paris Agreement requires countries to ensure that double counting of emission reductions between two countries is avoided. Avoiding double counting requires robust accounting and tracking of the issuance, transfer and use of carbon market units.

Looking ahead

With the entry into force of the Paris Agreement likely to be earlier than anticipated, developing robust international rules in a timely manner is crucial to ensure the effectiveness and integrity of the agreement. In the negotiations ahead, an important cross-cutting – and controversial – issue will be what and how much international oversight is required and which aspects can be left to the discretion of parties implementing the agreement. Robust rules will require reconciling the large diversity in NDCs and country contexts, capacities and interests with the need for transparency, consistency, comparability and integrity at international level. ●

1 Van Asselt et al. "Maximizing the potential of the Paris Agreement: Effective review in a hybrid regime." Stockholm Environment Institute Discussion Brief, 2016. www.sei-international.org/publications?pid=2992

2 Kollmuss et al. "Has Joint Implementation reduced GHG emissions? Lessons learned for the design of carbon market mechanisms." Stockholm Environment Institute Working Paper, 2015. www.sei-international.org/publications?pid=2803

3 See, for example: <http://climateactiontracker.org> and www.climate-energy-college.net/indc-factsheets/

Pricing carbon

If there is one thing guaranteed to affect economic behaviour, it's price. Is taxing our use of carbon the magic bullet to drive humans away from fossil fuels?

By **Helen Mountford**, Director of Economics, World Resources Institute; Program Director, New Climate Economy

Support for carbon pricing is growing around the world. Around 40 countries and over 20 cities, states and regions have adopted or will shortly implement carbon pricing. The World Bank estimates that this covers about 12 per cent of global greenhouse gas (GHG) emissions, triple the coverage of a decade ago.

Now that the Paris Agreement has been reached, we can expect carbon pricing to continue to spread. According to the International Emissions Trading Association, 90 governments expressed interest in it as a part of their Paris Agreement pledges.

China, for example, is planning to scale up its current pilot projects to implement a national emissions trading system (ETS) starting in 2017. It is likely to be much larger than any other ETS in existence. And South Africa plans to introduce a carbon tax in 2016.

It's not just governments either. At least 435 companies used internal carbon pricing in 2015, and almost 600 said that they anticipate doing so in the next two years. This includes some of the biggest energy companies in the world. Shell applies a price of \$40 per tonne of CO₂e and ExxonMobil \$80 per tonne to guide their investment decisions.

The rationale for carbon pricing

Carbon prices have a number of benefits: they are often the most economically efficient way to reduce GHG emissions; they can help to raise government revenue to support a range of public priorities; they incentivise continued innovation; they provide wider health benefits by reducing

fossil-fuel use and the related air pollution; and they provide a clear and credible price signal to guide business expectations.

We're seeing increasing evidence that countries and regions with carbon taxes can reduce GHG emissions without harming the economy. For example, the first five years of British Columbia's carbon tax, in which prices reached CAD30 per tonne of CO₂e, saw growth rates that were comparable with the rest of Canada, while emissions fell by around 10 per cent. Sweden first introduced its carbon tax in the early 1990s, with prices now reaching around \$130 per tonne of CO₂e. Over that time, its economy grew by nearly 60 per cent while emissions fell by 23 per cent.

In the United States, the nine states in the Regional Greenhouse Gas Initiative (a cooperative effort to cap and reduce emissions from the power sector) experienced higher economic growth than other states from 2009 to 2013. At the same time, they reduced their emissions by 18 per cent compared to a four per cent reduction on average in other states.

Another important benefit of well-designed carbon price instruments is that they raise fiscal revenues that can be put to productive uses, including to reduce existing distorting taxes. For example, British Columbia has used its carbon tax revenues, around \$1 billion or three per cent of the total budget, to offset reductions in income and corporate taxes.

The health benefits of carbon pricing can be immense. Local outdoor air pollution associated with fossil fuels currently causes 3.7 million premature deaths each year worldwide, according to the World Health Organization. Consistent and long-term



carbon pricing will lead to a shift away from fossil-fuel use, which will help decrease these health effects. Combined with measures that directly reduce air pollution, carbon pricing has possible health benefits valued at \$73 per tonne of CO₂ abated, according to research done for the Global Commission on the Economy and Climate.

One final advantage of carbon pricing is that it can send a clear signal to markets. Strong, predictable and rising prices can help to align expectations on the direction of change, thereby steering production and consumption choices and the type of investments that are made. A well-designed carbon price will give businesses the certainty they need to shift to the low-carbon economy of the future.

Overcoming barriers to carbon pricing

Despite the clear economic and environmental advantages of taxing carbon, where carbon prices are in place they are often too low, and almost all schemes exempt some of the most polluting activities or fuels, so the full potential of their benefits is not realised. While carbon prices vary



or social security payments, reductions in marginal income tax rates, or financial help to invest in energy efficiency measures that can offset higher energy bills. Clear and well-communicated approaches to phase in carbon taxes and phase out fossil fuel subsidies are essential to smooth the transition, along with dedicated policies to help address distributional impacts on affected groups, in particular on poorer households.

Designing carbon pricing for success

Carbon pricing works best when tailored to the national level, and as part of a well-aligned package of climate policies. This of course includes reforming fossil-fuel subsidies, which are essentially negative carbon prices. Fossil fuel subsidies cost around \$550 billion per year globally, and disproportionately favour the rich, even though they're often aimed at helping the poor.

Now is a good time for reform, because low oil prices can offset the impact of reforms on household energy or fuel spending. As with carbon pricing, many countries are moving forward on fossil-fuel subsidy reform. Indonesia is an example of recent effective reforms that also addressed the needs of the poor. There, increases in the prices of gasoline, diesel and electricity were offset with a \$2.6 billion compensation package for the poor. In India, reform of cooking gas and liquefied petroleum gas subsidies was paired with complementary measures for those affected, including direct benefit transfers linked to biometric identity cards.

The Global Commission on the Economy and Climate has called for all developed and emerging economies, at a minimum, to commit to introducing or strengthening carbon pricing by 2020, and to phase out fossil-fuel subsidies.

A consensus is emerging that carbon pricing is one of the most effective, economical ways to tackle climate change. To progress further, governments need to include carbon pricing in a package of smart policies, act together rather than unilaterally, share best practices with others who are attempting reform, and employ compensatory measures for those most affected by the changes. Reform will require concerted effort, but the pay-off will be enormous. ●

significantly, 85 per cent of priced emissions are at less than \$10 per tonne of CO₂e. Many countries continue to provide large subsidies and tax breaks to support fossil-fuel exploration, production and consumption – essentially encouraging their use, and working in effect as a 'negative carbon tax'.

One of the reasons for the lack of ambition is a concern about competitiveness. Governments worry that if they unilaterally enact a carbon tax, businesses will migrate to other countries without the same regulations: so-called carbon leakage. While this is a widespread concern, recent evidence actually shows that carbon leakage has not materialised on a significant scale in practice. And the latest research suggests that, even at higher carbon prices, the impacts on industrial competitiveness in Europe are likely to be low.

International cooperation can help overcome competitiveness concerns and other impediments to carbon pricing. If multiple countries or regions make policy changes in unison, they won't have to worry about carbon leakage to the others. We can accelerate progress by building

▲ Buying petrol by the bottle in East Kalimantan, Indonesia. Recent tax increases have been accompanied by measures to assist the poor. With around 40% of the population living close to the poverty line, past fuel tax increases have led to violent protests

coalitions of willing actors, including through international fora like the G20 or the new Carbon Pricing Leadership Coalition, which brings together more than 26 governments, 90 businesses and 30 other strategic partners to build the evidence base for effective carbon pricing. They can provide political leadership and establish a focused platform to learn from each other and develop guidance on technical, administrative and economic cooperation aspects of carbon pricing.

Another common objection to carbon pricing is that low-income households and certain sectors will unfairly bear the brunt of the costs. But successful reforms have addressed this, for example by using a share of the carbon pricing revenues to compensate affected groups for any increases in the cost of living, such as higher energy bills. These need to be well targeted, and can, for example, be provided through cash transfers

An international court for the environment?

How effective are current international courts at protecting communities when human activity causes environmental damage? Is there a case for a new mechanism to ensure that climate commitments are upheld?

By **Stuart Bruce**, Legal Research Fellow, Centre for International Sustainable Development Law

In 1972, the UN held its first major intergovernmental conference on the environment. Since then, regional and multilateral environmental treaties have proliferated in number, scope and geographic reach.

These treaties contain a wide range of non-punitive compliance mechanisms (for example, obligations to monitor and report on implementation). But when it comes to environmental disputes, there are fewer tools available. Binding adjudicative measures are less common in environmental treaties than in other areas of international law, such as investment protection.

Nevertheless, the number of disputes before international courts and tribunals that involve environmental concerns is growing, whether they arise from domestic law, environmental treaties or economic treaties. This trend is driven in part by the increasing awareness of, and tensions between, exploiting the natural environment for economic gain and its conservation for sustainable health, cultural, social, economic, scientific and other purposes.

This trend is most evident in two contexts. First, in investor–state dispute settlement (ISDS), where individuals and companies can use international arbitration to challenge the right of states to impose and modify environmental laws, among others.

Second, in state-to-state disputes before the International Court of Justice (ICJ), the International Tribunal for the Law of the Sea (ITLOS) and the World Trade Organization, as well as other international bodies.

In addition, in the early 2000s, the Permanent Court of Arbitration (PCA) created specialised optional arbitration and conciliation rules for disputes relating to the environment and/or natural resources. Although seldom used in practice, those rules have been included in some commercial contracts, and the PCA has been designated as the administrative body for disputes under certain environmental treaties.

Beyond these rules and institutions, there is no specialised international court or tribunal with competence over international environmental matters. This is despite the fact that much modern-day activity within individual states causes transboundary and global environmental harm and contributes to ever-worsening global climate change.

Whether an international adjudicative body for the environment would be feasible or beneficial is hotly contended. This article briefly addresses two key issues: (i) whether existing international institutions can adequately address modern disputes involving the environment, and, if not, whether they can be modernised; and (ii) whether it would be beneficial to create a new, specialised adjudicative body for the environment that functions within the global dispute settlement system (as has occurred in domestic legal systems).



The existing dispute settlement system

Numerous challenges confront the determination of international environmental disputes. First, there is no clear definition of an ‘international environmental dispute’. Whether a dispute is classified as ‘environmental’, ‘economic’, ‘maritime’ or other is largely a value-based characterisation by states with sovereign policies in mind.



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Second, it is uncommon for the factual and legal issues in a dispute to relate exclusively to environmental issues. Third, international environmental law is not a self-contained system, and its treaty language is often vague rather than legally meaningful.

As a result, it is often unclear which law is most applicable to a dispute and which international court or tribunal has better

jurisdiction over the dispute, creating risks of forum shopping and fragmentation of international law.

Many argue that generalist courts such as the ICJ, or specialised bodies such as the ITLOS, are more appropriate forums for hearing state-to-state disputes that involve the environment, due to their broad jurisdictional competence and ability to

▲ Humpback whale in Wilhelmina Bay, Antarctica. Although the ICJ has struggled with complex environmental data in the past, it demonstrated greater competence in its handling of the Whaling in the Antarctic case in 2014

engage experts, and that arbitral tribunals are better suited to private disputes. Others note the deficiencies in the constitution and/

or practice of existing bodies in addressing environmental issues and suggest that it is because of these challenges, along with the increasing global nature of environmental concerns, that a specialised institution should be created. Two key criticisms are:

- i) Existing tribunals can be inflexible in dealing with complex, technical and scientific environmental data, even though their rules may allow the appointment of experts (although the ICJ has improved considerably on this front since its decision in ‘Pulp Mills on the River Uruguay’ in 2010, evidenced by its handling of the ‘Whaling in the Antarctic’ case in 2014 and ‘Construction of a Road in Costa Rica along the San Juan River’ in 2015, as have some ISDS tribunals, such as in the recent *Perenco* case).
- ii) Non-state actors are increasingly either contributors to transboundary environmental harm, for example through burning fossil fuels that contribute to climate change, or victims of it, such as those affected by catastrophic but infrequent accidents such as the Bento Rodrigues dam disaster. However, non-state actors generally cannot bring claims or be sued under international law and do not have standing before international adjudicative bodies.

While procedural rules could be amended to provide standing, for example, some consider that the existing institutions are just too limited.

A new, dedicated environmental court or tribunal?

One alternative could be to carefully design a new, specialised international court for the environment. Political support for this concept has been mixed since the late 1980s, but appears to be gaining ground in some quarters. At present, however, most states would not support the concept, despite calls in the 1992 Rio Declaration, the 2012 UN Conference on Sustainable Development and the 2015 Sustainable Development Goals, among others, for better public and open participation in

international disputes, including those related to the environment.

But there may still be benefits from imagining a different international adjudicative landscape, not least of all to show us how existing institutions could be enhanced. When designing such a court, its eventual legal architecture would have to consider issues such as the breadth of its mandate (the definition and type of environmental disputes covered), the scope of jurisdiction (whether it would apply to states only or to non-state actors as well) and the applicable law.

Whatever the model, from a cost and capacity perspective, a threshold test should be imposed to ensure that only the most serious matters are heard before the court or tribunal.

There are many potential benefits of an international environmental court. First, the court could provide a centralised system of dispute settlement that is accessible to a range of actors, including individuals, corporations and civil society. Second, a pool of dedicated scientific experts could assist the judges and

burden associated with the proliferation of treaty bodies. Sixth, it could help to build trust among states, individuals and the business community through the provision of workable solutions to modern environmental concerns.

In practice, there are two pathways to forming a new court or public tribunal: through an international treaty, either within or external to the UN system, or by UN resolution. Some conceptualise the body as an arbitration tribunal (rather than a UN tribunal) that is geographically mobile. In that model, the quickest, cheapest and easiest way to set it up would be by mutual agreement between parties to a dispute involving the environment to submit to the jurisdiction of the arbitral tribunal and to be bound by its award. Similar approaches have been pursued in the Biodiversity Compact and the Bangladesh Accord on Fire and Building Safety, where companies have agreed to arbitrate issues involving human rights and the environment.

It is unlikely that an international court or tribunal for the environment would

There are two pathways to forming a new court or public tribunal: through an international treaty, either within or external to the UN system, or by UN resolution

arbitrators. Third, it would strive to clarify legal obligations, harmonise international law related to the environment and complement existing regimes, thereby increasing legal certainty and predictability. Fourth, it could encourage the use of preventative and, where necessary, injunctive measures to minimise ongoing environmental damage. Fifth, it could become the standard compliance and dispute settlement mechanism for environmental treaties (of which over 500 exist), such as the UN Framework Convention on Climate Change, Kyoto Protocol and the Convention on Biological Diversity, thereby reducing the financial and human resources

become the sole solution to environmental governance and dispute resolution. It is, however, an idea worth considering and has been recommended by the International Bar Association as a potential long-term endeavour. In the interim, contemplating better models for resolving international environmental disputes can provide solutions to modernise the existing dispute settlement regime. ●

For a more in-depth analysis, see the forthcoming publication: Stuart Bruce, *“The Project of a World Environment Court”*, in Christian Tomuschat (ed), *The OSCE Court of Conciliation and Arbitration* (Brill, 2016).



Insurance to manage climate risk



*By Marisa
Parmigiani
Head of
Sustainability,
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Italy is one of the most vulnerable areas of Europe when it comes to the expected impacts of climate change. In Italy (as, indeed, in Europe as a whole) climate change is likely to amplify regional differences in terms of the quality and availability of natural resources. Significant impacts are expected on economic sectors that depend on weather conditions (such as agriculture, fishing or tourism), as well as on human health.

A recent report by the environmental group Legambiente reveals that seven million people in Italy live in areas exposed to risks of landslide or flood. The survey examined 1,444 Italian municipalities containing areas of "high hydro-geological risk". It revealed that 77 per cent contained houses built on areas at risk, 29 per cent had whole districts in high-risk areas, while another 51 per cent contained industrial plants.

However, these results are at odds with the very low awareness – among citizens, small and medium-sized enterprises (SMEs) and public bodies – of the risks linked to extreme weather events such as floods, landslides or heat waves, and of the tools that exist to assess and manage those risks. A worryingly high rate of Italian SMEs go bankrupt after having to suspend their operations for more than a week after suffering damage from extreme weather events. In Italy, the low rate of insured companies and households for this type of damage means extreme weather events have high social impacts as well as economic and environmental consequences. Disaster recovery costs are borne by the state, and are therefore a burden for citizens.

These challenges call for a rethink of the roles of both public administration and insurers, to create instead an innovative public-private scheme to prevent, manage and transfer the risks linked to the effects of climate change in a sustainable, long-term way. This has been repeatedly underlined at both international and EU levels in recent years.

These are some of the considerations that led Unipol Group to launch the DERRIS (Disaster Risk Reduction Insurance) project, which has been co-funded by the European Commission under the Financial Instrument for the Environment (LIFE). The DERRIS project is trialling an

innovative model of multi-stakeholder collaboration involving public administrations, insurance companies, academic institutions and SMEs. The ultimate goal is to build an innovative public-private insurance scheme that triggers virtuous behaviours regarding protection, prevention and adaptation to the effects of climate change, and increases local resilience. This would, in turn, reduce the costs of extreme weather events that are covered by public spending.

Huge opportunity

DERRIS will activate two main levers. First, the project will enhance knowledge and skills transfer from the insurance company to SMEs and public bodies, through self-assessment tools that will enable businesses to assess and reduce their risks related to climate change and to handle emergencies. Second, DERRIS will work to define an innovative financial instrument, involving both public and private players, to fund climate change adaptation actions and to promote urban resilience. This is all the more challenging considering that climate change adaptation interventions do not have direct and easily measurable economic returns.

These are the challenges that Unipol Group and the partners of the DERRIS project will tackle in the coming three years. The issues that are at stake are striking: to provide efficient tools of risk assessment and management, and innovative financial schemes, with the aim of increasing local urban resilience to climate change. The opportunity is huge: building a model of an innovative public-private insurance scheme that can be replicated on a bigger scale, thus multiplying its impacts at a local level. ■

For further information, see: www.derris.eu



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Crunch time for the Green Climate Fund

Despite laudable aims of helping the world's poorest cope with climate change, the Green Climate Fund has no shortage of critics. What must it do to ensure that its good intentions translate into tangible outcomes?

By **Christa Clapp**, Head of Climate Finance, CICERO, and **Germana Canzi**, Head of Programme and Marketing, Climate Strategies

Following the Paris Agreement on climate change, 2016 has become a pivotal year for a key climate finance institution: the Green Climate Fund (GCF). Having recently approved a range of new projects, the GCF is making progress. But there are still some fundamental things that need to happen for it to become more effective.

The GCF was created in 2010 to channel a portion of the billions of dollars that are needed to fight climate change and adapt to its impacts. Shifting public and private investment from 'brown' to 'green' is an essential part of fighting climate change. Rich countries have pledged to mobilise \$100 billion a year by 2020 in funding for poor countries to adapt to climate change and reduce emissions.

The GCF has ambitions to be a fundamental piece of this puzzle. Yet it has taken several years for the South Korea-based fund to actually become operational, and until recently not much money had been disbursed. So the organisation had come under considerable criticism from civil society groups for not providing funding fast enough.

But things are rapidly changing. In the past few months the fund developed more detailed policies to receive, manage

and disburse finance. It also named its first 'accredited entities' – the institutions that can channel funding to projects and programmes. This year the organisation has also committed to becoming more transparent and to webcast its meetings. And it has resolved to approve projects worth around \$2.5 billion in 2016 alone.

Why the Green Climate Fund?

Some observers have wondered why a completely new organisation is needed, as opposed to channelling finance through development banks or existing climate-related funds. But the idea behind the GCF is not to compete with multilateral development banks in financing large infrastructure projects. Instead, the GCF has a climate-specific mandate to finance programmes that mobilise local stakeholders on both mitigation and adaptation.

This is the principle behind 'enhanced direct access', a pivotal theme of the GCF. This is a system where both funding decisions and management take place at the national level in recipient countries. This plan was recently boosted with \$200 million of pilot funding. Implementing this, however, requires broader institutional capacities at national level than are currently available. It also creates the need for an evolution on the part of national planning and focal points in developing countries.

In addition, adaptation and resilience to climate change often takes place at the local level, highlighting the need



to improve the links between local communities at the front line of climate change and national planning capacity.

However, many developing countries are not actually ready, or don't have capacity, to write the proposals to access the funds. This is part of the reason why the proposals approved so far in 2016 represent only a fraction of the \$2.5 billion committed for this year.

Division of labour

Of course it also is important to avoid duplication with work done by other climate and development finance institutions. The



GCF strategic planning process should focus on enhancing complementarity, effectiveness and efficiency through a division of labour with other institutions and funds.

According to Climate Strategies' founding member and Managing Director of Oxford Climate Policy Benito Müller, the GCF could act as a kind of "wholesale agent", with other funding entities working as "specialised retailers". It is highly likely that there will be a demand for internationally funded micro projects for many years to come. Such projects would need to be catered for by an international

▲ Families take shelter from the floods on a railway track in Kurigram, Bangladesh in July 2016. One of the first Green Climate Fund investments approved in November 2015 was for 'climate-resilient infrastructure mainstreaming' in Bangladesh

division of labour, either through outsourcing or through some form of explicit or implicit understanding between the GCF and other international funders.

And this is precisely what has happened in the approved KawiSafi Ventures Fund project, to be managed by a private-sector company based in Delaware, US, which will approve individual micro investments (up to \$10 million) to SMEs in Rwanda and

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Kenya. Similar programmes could also be established via public-sector entities, such as the energy efficiency bond programme approved by the GCF and administered by the Inter-American Development Bank (IDB).

What next?

As hard as it is to ensure the \$100 billion-a-year commitment is honoured, this is actually a small portion of the overall climate finance required to limit global warming to no more than 2°C above pre-industrial temperatures, which is in the scale of trillions rather than billions. The World Resources Institute says that by 2020, about \$5.7 trillion will need to be invested annually in green infrastructure, much of it in the developing world. To put that figure in context, the International Energy Agency estimates that subsidies to fossil fuels amounted to around \$544 billion in 2012.

So there are many who wonder whether the GCF will really tackle areas that other finance won't reach – and whether it can manage to become a catalyst for other,

much bigger finance flows, according to its aims for transformative delivery of climate finance. To support such a climate finance transformation, the fund should be able to take on risks that other funds or institutions are not able or willing to take.

As a next step, the GCF should work hard on integrating risk-mitigation instruments to maximise private-sector leverage. The board recently decided to adopt interim risk and investment guidelines that are meant to help attract proposals capable of higher leverage ratios and higher impact. The energy efficiency bond mentioned above – which allows the IDB to bundle small and medium demand-side energy-efficiency projects throughout Latin America and the Caribbean and issue a partially guaranteed bond to private investors – is a good example of this approach.

The application process and readiness requirements should also be simplified to improve access to financing for developing countries. Some countries lack the capacity to develop strong proposals to align with the GCF investment framework. The

▲ Salt being harvested near Saint-Louis in northern Senegal. A project to restore the agricultural productivity of salinised land in Senegal is another of the first tranche of eight investments made by the Green Climate Fund

GCF has a readiness support programme to strengthen engagement with the least developed countries and support their preparatory activities.

Finally, if through these new proposals and a streamlined application process the GCF managed to scale up disbursement significantly, this could improve confidence in its operational capacity and function. The GCF, as a financial instrument of the UN Framework Convention on Climate Change, has been bogged down by balancing competing interests and consensus-based decision-making. If the GCF Board and Secretariat were able to find an efficient model of operation as they scale up in staff and financial distribution, this would greatly enhance the fund's credibility as a key piece of the puzzle to mobilise much-needed funding to implement the Paris Agreement. ●

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What role for carbon trading?

Has the Paris Agreement breathed new life into cap-and-trade schemes, recently accused by some critics of being dead in the water?

By **Richard L. Sandor**, Chairman and CEO, and **Rafael Marques**, Managing Director, Environmental Financial Products LLC

Paris, the 'City of Lights', is known for an endless list of things: art, culture, food, philosophy, fashion and science to name a few. However, in the environmental world it has achieved a new renown. It was the birthplace in 2015 of the Paris Agreement: an international agreement in which 195 countries achieved a consensus on the next steps to address climate change. This was the greatest milestone since the Kyoto Protocol was adopted in 1997.

Beyond generating consensus, another important feature of the Paris Agreement is that it sends important signs about the advancement of emissions trading as a policy tool. Article 6 of the agreement offers structures that help support current and future market-based efforts in various parts of the world. (It is estimated that over 65 nations currently have implemented or are considering an emissions trading programme for their respective jurisdictions). The Article also supports the eventual linkage of different trading regimes; broader use of emissions mitigation measures; and a call for the greater use and incorporation of sustainable development into national policies and goals.

Both the Kyoto Protocol in 1997 (in the case of greenhouse gas emissions) and the Clean Air Act of 1990 in the US (in the case of sulphur dioxide emissions) provided 'enabling' language that, while not explicitly mentioning a market structure or rules, helped to start successful emissions markets around the world. We would like to make the case that the agreement reached in Paris is not a mere accident in its use of enabling

language, but that it clearly builds on the successful experiences of both the Acid Rain Program in the US and the European Union Emissions Trading System (EU ETS).

Economic rationale

As a quick background, the work of Nobel Laureate Professor Ronald Coase at the University of Chicago, on how to reach an optimal solution to the issue of negative externalities through private negotiation, became the theoretical basis for emissions trading, commonly known as 'cap and trade'.

The economic rationale for emissions trading is simple. It sets a cap on aggregate emissions in order to reduce harmful pollutants and their impacts, with each participant being assigned a fixed number of 'allowances' representing the right to emit a unit of the pollutant. A participant who reduces emissions below their allocated number of allowances can sell the extra excess reductions, and is incentivised to do so to another participant. The latter can use them to hedge their compliance needs – at a cost – until they can install new technologies to meet their reduction targets. In the meantime, systemic reductions are achieved at least cost to society.

The implementation of a wide-scale cap-and-trade system was first tested in the US, which is still to this day one of the most successful examples of a cap-and-trade system in the world. The US Environmental Protection Agency's (EPA) Acid Rain Program, enabled by the Clean Air Act Amendments of 1990, facilitated the reduction of sulphur dioxide emissions (the main cause of what was commonly known as acid rain) from power generation (i.e. the main sources covered by the Acid Rain Program) from 18 million tonnes in 1990 to three million tonnes in 2012.

This was 78 per cent lower than 1990 emissions and considerably below the 2010 mandated cap of 8.95 million tonnes. To achieve this permanent and significant reduction, each generating unit was assigned a fixed number of allowances, each representing the right to emit one tonne of SO₂. Each unit could then choose how it would reduce its emissions. Flexibility was key: a unit that reduced emissions below the number of allowances it was allocated could sell the extra allowances (or excess reductions) to another unit that might use them to compensate for emissions above its individual target.

Independent estimates by the EPA show a 40-to-one benefit-cost ratio. In 2010 alone, healthcare costs were reduced by \$120 billion at a cost of between one and three billion dollars. Estimates indicate that between 30,000 and 40,000 lives were saved in that year.

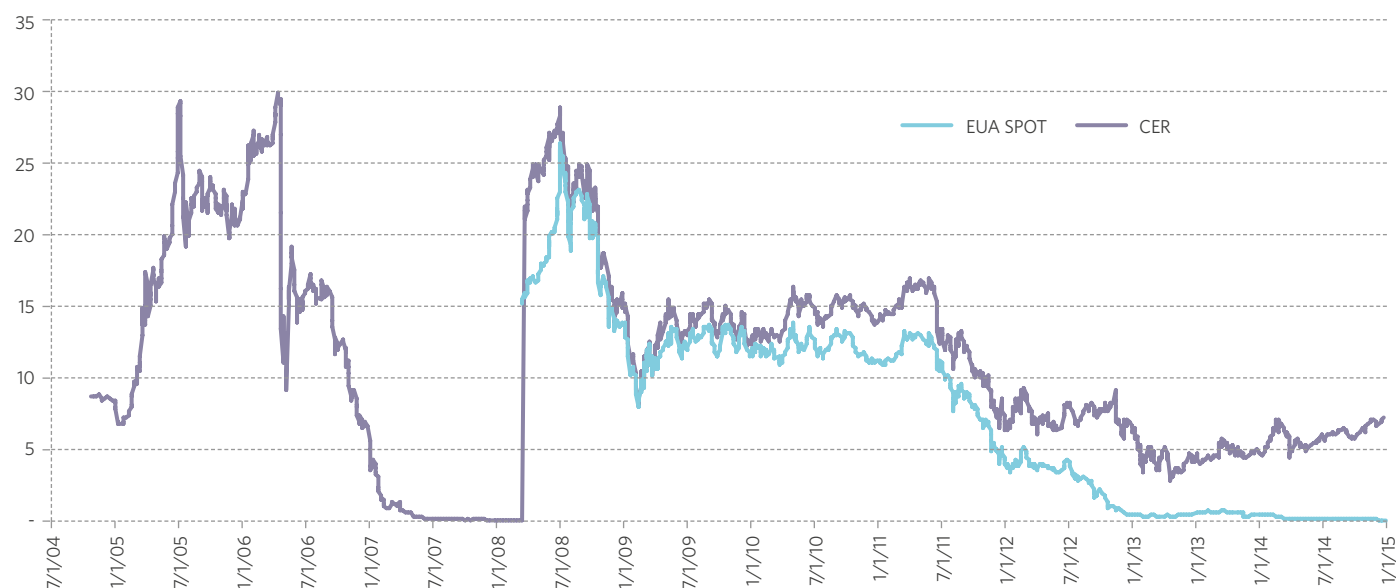
In Europe, a multinational system for the European Union started in 2005 and has now become the world's largest carbon market. The EU reduced carbon emissions by 24 per cent by 2014, six years ahead of its 2020 mandated target of 20 per cent. However, numerous articles in the popular press erroneously announced the failure of the EU ETS, citing low prices while overlooking this incredible accomplishment. This seems to be a typical case of 'curing the fever by breaking the thermometer'. The price is merely an output of the programme design and of its fundamental drivers. It is sounder policy to modify the underlying design (for example, imposing more stringent targets) than to try to artificially raise or fix the price.

Alive and well

Contrary to public perception, as presented in the mainstream media, the evidence on

Price trends for EU emission allowances (EUAs) and certified emission reductions (CERs), 2005–14

EUR/EUA, EUR/CER



Source: EEX (EUA price), 2015; ICE ECX (CER price), 2015. Graph produced by European Environment Agency

the ground is that cap and trade is alive and well, not only in Europe but also in America. Since 2009, 10 states on the east coast of the US have been participating in the Regional Greenhouse Gas Initiative, with a goal of reducing power plant emissions by 10 per cent by 2018 from 2009 levels.

More importantly, California, a state which is often a national trendsetter in innovative areas such as entertainment and technology, began a cap-and-trade programme in 2012. The programme is performing well and providing a much-needed price signal function. Open interest in Californian allowance futures (the measure of the breadth of a market) is now larger than established commodities such as oats and lumber.

On 1 October 2013, California and the government of Québec announced the completion of an agreement that harmonises and integrates their two cap-and-trade programmes. California is also working closely with other western US states and Canadian provinces. Like seat-belt laws, cap-and-trade policies in the US are going to emerge via a bottom-up approach, from

individual states – yet another data point that suggests that innovations in this area are percolating at the local level.

Countries such as Mexico and South Korea have passed enabling legislation, while emerging economies such as Brazil, India and China are pursuing cap and trade. China is piloting seven different cap-and-trade programmes that will cover around seven per cent of China's total emissions, or roughly the total amount emitted by Germany each year. This critical development is already having a tremendous impact on the discussions about the future of emissions trading as a policy tool. It is no surprise that California and China have signed a memorandum of understanding to explore ways to link the two programmes.

The environmental marketplace is vibrant with activity around the world. Contrary to the notion that the world will have a unified environmental market, we are witnessing a 'plurilateral' system that includes regional, state and national markets. In the US, California is leading the way. China is also in the vanguard with its seven separate cap-and-trade pilot markets and its intention to start a national programme next year.

▲ There are lessons to be learned from the experience of the EU ETS. The sharp economic slump in 2008 resulted in an abrupt decrease in emissions, leading to the accumulation of surplus allowances, which hampered the market from functioning effectively

In addition, emerging markets that begin developing environmental policies by setting energy efficiency goals are also ones to watch. India has been focusing on promoting energy efficiency but could soon morph into cap and trade, which would be a positive development on the world stage.

Markets in emissions and 'rights to use' have helped to solve environmental problems and created enormous investment opportunities. They have achieved this by commoditising the externality and then pricing it. The same concept could also be applied to water quality and quantity issues.

Although beyond the scope of this piece, developments in water markets are a trend that readers should also pay attention to in the next decade. The convergence of the environment and finance is here to stay, and the developments of the Paris Agreement seem to confirm this trend. ●

Transitioning from talk to action

What is the role of investors in implementing the Paris Agreement?



Frédéric Janbon
CEO, BNP Paribas
Investment Partners

COP21 was pivotal in the fight to curb global warming, as 195 countries plus the EU undertook to collectively build a low-carbon global economy. We no longer ask whether the transition will happen, but how long it will take, and how and who will finance it. Reaching agreement was mainly down to governments; implementing it requires collective action, including, critically, by investors.

Paris made history by establishing a clear, unmoveable goal and direction of travel, but was also notable for how efficiently the United Nations Framework Convention on Climate Change (UNFCCC)¹ built inclusiveness beyond governments, involving more than 4,000 Non-State Actors (NSAs) representing corporates and investors, as well as public representatives such as cities and regions. The UNFCCC gave stakeholders a sense of ownership and belief that future success depends upon them.

Threefold strategy

As an asset manager, we were among the NSAs invited to participate. We responded by declaring our commitment² to measuring and publicly disclosing annually the carbon footprint of our investment portfolios³ and acting to gradually reduce their carbon intensity.⁴

We were proud to be among the first mainstream asset managers to sign the Montréal Carbon Pledge, formalising this commitment by joining the Portfolio Decarbonisation Coalition. We also published our climate change policy of gradually moving portfolio holdings towards a sub-2°C scenario in line with the agreement, including favouring green investments.

Our strategy is threefold: actions and initiatives on allocation of capital, responsible stewardship, and commitment and transparency.

Meaningful data

Reducing carbon intensity requires identifying and assessing investee companies' exposure to carbon risks, both direct physical impacts of climate change and 'transitional', or financial, risks associated with adjusting to a low-carbon economy.

These relate to revaluing assets due to energy transition and include the impact of disruptive or innovative technologies on markets, and policy and regulatory framework changes.

Achieving this requires full, meaningful quantitative and qualitative data on companies' exposures and risk mitigation strategies, CO₂ and carbon intensity performance, and 2°C stress-testing when appropriate.⁵

The G20 has commissioned a task force, chaired by Michael Bloomberg, to develop consistent climate-related financial risk disclosures for use by companies to provide information to investors and other stakeholders.

Defining clear carbon reduction targets also requires knowing how, and through which policies, countries aim to meet their Climate Pledges. This is vital in assessing how companies' strategies and performance fit their countries' nationally determined contributions (NDCs) and subsequent climate-related policies.

Understanding the collective effect of NDCs towards the global target is also equally important. Flexibility was favoured in the interests of reaching agreement, with little consistency implied regarding the scope, format or detailed content of pledges.

Major shifts needed

The future requires more consistency, accuracy and transparency, as current qualitative and quantitative information is difficult to compare and monitor. Climate talks have moved towards more technical discussions about metrics, monitoring processes and standards.

Limiting global warming to sub-2°C therefore calls for major shifts in the allocation of resources and development and adoption of cleaner, more efficient technologies.

"The investment community must play a prominent role in green financing. We are committed to further expanding our low-carbon product offering, but scaling up investments to necessary levels means overcoming some real hurdles"

The estimated potential investment needed is US\$1.3 trillion annually until 2050.⁶ In comparison, the global asset management industry manages US\$55 trillion.⁷

The investment community must play a prominent role in green financing. We are committed to further expanding our low-carbon product offering, but scaling up investments to necessary levels means overcoming some real hurdles. With our Institutional Investor Group on Climate Change (IIGCC) colleagues, we encourage governments to help by⁸:

- providing stable, reliable and economically meaningful carbon pricing that helps redirect investment;
- strengthening regulatory support for energy efficiency and renewable energy, where needed to facilitate deployment;
- supporting low-carbon technology innovation and deployment, including financing clean energy research & development;
- developing plans to phase out fossil fuel subsidies; and
- considering the impact of unintended constraints from financial regulations on investments in low-carbon technologies and climate resilience.

The Paris Agreement created the policy signal needed to unlock investor action. How far that action goes depends on its implementation – Marrakech is key – and on the policies governments implement to meet their contributions.

We need policy support as much as countries need investors to meet their national plans and, ultimately, the global sub-2°C target.

As a leading asset manager, our commitment to acting responsibly is central to our overall approach. We will continue to play a key role by supporting, implementing and proposing sustainable solutions. ■

1 www.unfccc.int

2 <http://climateaction.unfccc.int/>

3 PRI-managed Montréal Carbon Pledge www.montrealpledge.org

4 Portfolio Decarbonization Coalition (PDC), run by the UNEP, and its Finance Initiative (UNEP FI) and the Carbon Disclosure Project (CDP) <http://unepfi.org/pdc/>

5 See more at: www.iigcc.org/publications/publication/gic-disclosure-letter

6 International Energy Agency, 2014: Energy Technology Perspectives 2014

7 www.efama.org

8 www.iigcc.org/publications/category/global-climate-policy

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Finance for a future

The financial community played a constructive role in the Paris Agreement – it must now provide leadership in the transition to a sustainable global economy. Eric Usher, Head of the UNEP Finance Initiative, talks to Climate 2020



© Viviane Moos/Corbis via Getty Images

The success of the UN climate conference in Paris (COP21) surprised even the optimists, says Eric Usher, Head of the UNEP Finance Initiative. Financial institutions, recognising the threat that climate poses to the global economy, added their momentum to achieving that outcome.

From the start of COP21 there was a feeling of optimism. “I’ve been to negotiations like this before,” says Usher. “In Paris there was a much more confident atmosphere. There was a readiness for

governments to say that the time to act is now.”

The talks ended with the 195 countries at the meeting agreeing to keep the increase in the global average temperature to below 2°C above pre-industrial levels and to try to stay within 1.5°C. But the Paris Agreement is just the start: everyone, particularly the financial community, must now translate words into action.

Making climate change a priority

The UNEP Finance Initiative is an

▲ Protests against tar sands as part of the massive People’s Climate March in New York 2015. Investors must be more active in holding companies to account for their role in climate change

interface between the UN system and global finance. Founded almost 25 years ago, it is a membership organisation with over 200 members, around half of those from developing countries. More than 90 per cent of the world’s largest banks are members, along with many of the big insurance and re-insurance companies.

Usher spends much of his time visiting CEOs and convincing them to “set aside an hour a month, or a week, or a day” to the threat of climate change and other sustainable development challenges. “We act as the main link between our members and UN negotiations,” he says. “We explain what is going on, and we help them to provide input to these often hard-to-understand processes.”

Usher agrees climate change isn’t the top priority of every CEO. One reason for this is that business leaders only tend to focus on the quarterly reporting cycle imposed by the capital markets, while addressing climate change requires longer-term investment thinking.

Therefore it is Usher’s job to convince business leaders that, although climate change isn’t destabilising the world economy just yet, when it does, it may be too late to do anything about it. Insurance

portfolios to decarbonisation. During COP21, the UN Secretary-General Ban Ki-moon, French President François Hollande and Ministers Fabius and Royal, all referred to the PDC in their speeches as a leading example of investor engagement on climate change.

This, says Usher, put pressure on COP21 delegates: a large proportion of the global finance community were convinced enough of the risks to take action themselves.

Discerning the financial risks

Usher has been making this argument for years. Even so, he believes that Bank of England Governor Mark Carney put things most succinctly in September 2015 in a speech at Lloyds of London called ‘Breaking the tragedy of the horizon – climate change and financial stability’.

Carney identified three clear risks. Firstly, physical risks. Weather-related events like

Businesses were willing. Public and private organisations were spurring each other on.

Taking responsibility

Implementation of COP21 is a challenge, as is working out who is responsible for specific carbon emissions.

“Take an auto-maker, for example,” Usher says. “Is an auto-maker responsible just for its own emissions, or for the emissions of the cars it produces? Does the same go for the shareholders who finance the auto-maker? We need to get clarity on these sorts of issues, with the responsibilities clear and the expected actions pragmatic.”

Besides sorting out responsibilities for carbon emissions, there’s also the issue of who will finance the low-carbon economy. Banks and insurers may well divest themselves of stocks in coal companies, “but taking your money out of a dirty industry doesn’t mean you will put it into clean alternatives. The finance community needs to stop being part of the problem, but also increasingly look to finance the solutions”.

And this, says Usher, is a role that investors can play. Shareholders, institutional investors and pension holders regularly hold companies to account for unethical investments. They must do the same thing for climate change. “There has to be a consumer consensus. Investors won’t deal with companies that are involved in child labour, tobacco, munitions. Why should climate change be any different?”

This, he says, will create a profit imperative for carbon consumers to act now, and not wait for the “tragedy of the horizon”. Business and government are pushing each other to take action. If consumers apply more pressure to business, he says, then that would create a real engine for change.

Is this realistic? The global economy is still in the shadow of the financial crisis of 2008, so surely when the next crash comes along, won’t carbon awareness slip from agendas? Usher thinks not. “Everyone has their priorities, and things change,” he says. “But when the crash of 2008 happened, nobody thought it was an excuse to start investing in child labour again.” ●

Investors won’t deal with companies that are involved in child labour, tobacco, munitions. Why should climate change be any different?

companies are already seeing a significant uptick in weather-related claims.

During the lead up to COP21, Usher says there were encouraging signs that this message was getting through. Two examples included the Global Investor Statement on Climate Change and the Portfolio Decarbonization Coalition (PDC). The UNEP Finance Initiative was involved in both.

The Global Investor Statement on Climate Change called on policymakers to address climate change. “It was signed by over 400 investors worth more than \$24 trillion in assets – that’s a third of global capital markets,” explains Usher. Signatories stated that they were ‘acutely aware of the risks climate change presents to our investments’, an acknowledgement that required them to act and to call on governments to do so as well.

The PDC mobilised 25 investors to commit \$600 billion of their investment

floods and storms can, and do, damage property and disrupt trade. The insurance industry, Carney said, is seeing the start of that now, but more is to come.

Secondly, Carney cited liability risks, or “impacts that could arise tomorrow” when parties that suffer loss from climate change seek compensation from those they hold responsible. This, said Carney, could hit carbon extractors and emitters the hardest.

Finally, he identified transitional risks. As we move towards a low-carbon world, some companies will be winners, others will be losers. Assets will change in value. Balance sheets will be hit.

“Carney’s involvement was a watershed moment,” says Usher. “It was the first time that a major actor in the financial industry, a central bank governor no less, said that the world’s financial systems and climate change are inexorably linked.” These, say Usher, were the forces in play when COP21 started. Governments were willing.



How green are green bonds?

Green bonds are becoming an increasingly popular financial instrument for generating investment in environmentally sustainable projects. But are they always as green as they could, and should, be?



◀ Amazonians protest at the construction of the Belo Monte hydroelectric dam in Brazil. The use of a green bond to fund the controversial Jirau Dam in 2014 raised questions about the lack of scrutiny and regulation

predictions that the market would reach \$100 billion in 2015. While these proved wide of the mark, 2016 issuances will again set a new record.

Starting with issues from international public banks, such as the European Investment Bank and the World Bank, green bonds were then taken up by western companies, including private-sector banks. They are now going global, especially thanks to issuances from Chinese and Indian banks.

Investor signal or marketing claim?

Concerns remain among investors as well as NGOs that the 'green' claim is open to abuse. Certification schemes like the Climate Bonds Standards have great potential, but have not yet achieved wide uptake.

Meanwhile, widely referenced guidelines such as the industry-led Green Bond Principles, of which BankTrack is an observer, are rather broad and explicitly avoid opining on what is and is not green. Instead the principles point to several broad 'categories of eligibility', while making clear that these are neither exhaustive nor definitive. Depending on your point of view, the green label can be described as a signal to investors to aid the identification of green investments, or as an unregulated marketing label, which can be applied as long as the issuer believes they can get away with it.

Despite the clear scope for environmentally egregious investments to be funded by green bonds, the majority of issuances to date have appeared positive and uncontroversial. However, with most bonds financing a range of projects across different industries, coupled with inconsistent availability of data, detailed analysis is challenging. The risk of censure from industry colleagues and civil society alike appears to be the main factor dissuading issuers from taking risks.

The most notable controversy in the green bond market to date came in 2014, with an issuance from GDF Suez (the company since rebranded as Engie).

The €2.5 billion bond issuance was the largest corporate bond issued at the time, and among the projects it financed was the Jirau Dam in Brazil. This massive, already-completed hydropower project has contributed, together with another dam on the same river, to the flooding of 362 square kilometres of rainforest, as well as being associated with labour rights violations, adverse impacts on indigenous communities and destruction of habitat. After strong community resistance against the dam over many years, supported by campaigns by International Rivers, Amazon Watch and Survival International among others, Engie putting green-bond finance into this project was rubbing salt in the wound.

'Clean coal' and other 'green' projects

Since 2014, there have been some other examples of green bonds financing environmentally dubious activities, but these have been few and far between, and altogether less egregious. Anecdotal evidence suggests that criticism of the GDF Suez bond, from BankTrack among others, has dissuaded some other corporates from coming forward with green bond issuances, particularly where these might meet with controversy.

"Companies are second guessing whether to participate in green-bond markets, as scrutiny by environmental groups raises the bar on what constitutes a climate-friendly security," reported Bloomberg in March 2016, citing NGO criticism of the bond as a possible reason for lower-than-expected market growth in 2015.¹

However, as the market internationalises, there are signs the risk of controversies is again growing. One worrying sign came from the Export-Import Bank of India (Exim), which made its first \$500 million green bond issue in March 2015. Scrutiny of the bond revealed that some of its proceeds will go towards the Khulna–Mongla railway line, which will deliver supplies of coal to the proposed, and highly controversial, 1,320 megawatt Rampal power project in Bangladesh.²

The rail line financed by the green bond was one of the reasons for the Rampal

By **Ryan Brightwell**, Researcher and Editor, BankTrack

Green bonds are the new black in the world of environmental finance, generating hype and column inches that have sometimes outshone the market's growth. Issuance of green bonds – fixed-income securities labelled 'green' to indicate they will raise capital for environmental projects – quadrupled in size from 2012 to 2014 to reach some \$36 billion, leading to

project site's proposed location, close to the Sundarbans, the world's largest mangrove forest and a UNESCO World Heritage Site.

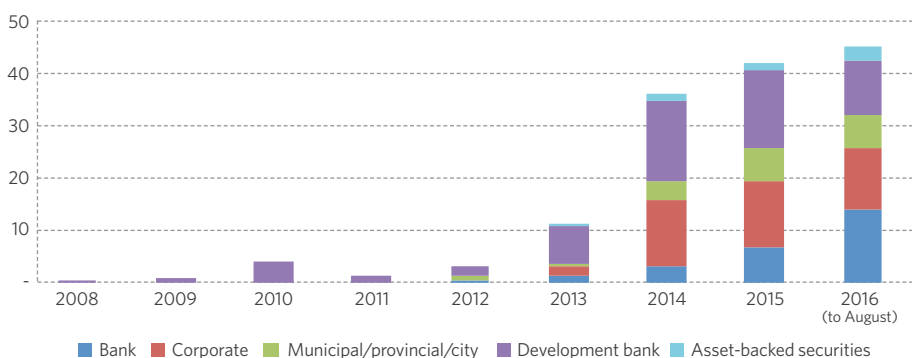
This is not the type of project that springs to mind when one thinks of green bonds. According to the Green Bond Principles, green bonds are meant to “finance new and existing projects with environmental benefits”. Yet this railway line is a strategic part of the infrastructure for a coal plant that threatens to make devastating impacts on the local environment.

The news that big, emerging economies like India and China are getting involved in green bonds is crucial for the market's growth. But the rules of China's engagement in the green bonds market have also created space for a dangerous development: green bonds for coal.

In December 2015 the People's Bank of China released its Green Projects Catalogue defining what it considers acceptable use of proceeds for Chinese green bonds, and so-called ‘clean coal’ technologies were included.³

Clean coal is, of course, a grossly misleading oxymoron – even at its most advanced, such technologies only reduce plant emissions, and do nothing to address

Green-labelled bonds – amount issued (\$bn)



Source: Climate Bonds Initiative

green bonds data, although others are happy to count them towards their green bond totals. But however you work the numbers, the issuance shows that green bonds for coal are now with us, and with further large issuances from China on the cards, more are likely.

Setting standards and exiting fossil fuels

Meeting the climate target agreed by the international community in Paris last year will require many trillions of dollars to be mobilised to finance a swift transition to a low or no-carbon economy. Bond markets

for green bonds, which effectively prevent them raising finance for fossil-fuel and large hydropower projects as a bare minimum, is urgently needed.

It is also important to remember that genuinely green bonds can only be issued by genuinely green banks. Even as green finance becomes the new black, many of the same banks that boast of their growing role in issuing and underwriting green bonds are at the same time ensuring that finance continues to flow towards the ‘old black’: coal and extreme fossil-fuel projects.

Last year, the journal *Nature Climate Change* published a striking graph showing how the majority of the most active banks in the green-bond market provide much greater financing to coal-based activities.⁵ Without urgent action to curb fossil-fuel finance across the whole of banks' balance sheets, a burgeoning green-bond market will be no defence – rhetorically or physically – as the floodwaters begin to seep into lobbies on Wall Street by mid-century. ●

It is important to remember that genuinely green bonds can only be issued by genuinely green banks

the massive social and environmental impacts associated with coal mining. Added to this, making coal plants more efficient only extends their life, when closing them is recognised as the only route to restricting global warming to substantially below 2°C.

And the prospect of green bonds for coal is not merely theoretical. The Climate Bonds Initiative (CBI) reported that the inaugural green bond of China's Industrial Bank, released in early 2016, funded ‘clean coal’ projects with about 26 per cent of its proceeds.⁴

The CBI has removed this and other green bonds that risk funding coal from its

have a significant role to play in this, so the emergence of a large green-bonds market that is genuinely environmentally sound and socially just is urgently needed. Yet the apparent re-emergence of green bonds linked to controversial projects threatens the industry's reputation.

The harmonisation of China's green-bond guidelines with international practice, which has to date eschewed finance for ‘clean coal’, may come in due course. But there is also a risk of contagion – other countries potentially following China's lead as they join the market – that could be hugely damaging. The development of robust and widely accepted standards

- 1 See www.bloomberg.com/news/articles/2016-03-07/bond-market-asking-what-is-green-curbs-climate-friendly-debt
- 2 See www.eximbankindia.in/sites/default/files/cert.pdf
- 3 www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/Preparation-Instructions-on-Green-Bond-Endorsed-Project-Catalogue-2015-Edition-by-EY.pdf
- 4 See www.climatebonds.net/2016/07/market-blog-world-first-certified-climate-bond-victorian-govt-aud-300m-chinese-issuers-go
- 5 www.nature.com/nclimate/journal/v5/n2/full/nclimate2495.html#access



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Financing a low-carbon economy: framing the policy response

Achieving the goals defined at Paris will require trillions of dollars of investment over the next few years. What policies must governments enact to make this happen?

By **Rory Sullivan**, Visiting Senior Research Fellow, Centre for Climate Change Economics and Policy, University of Leeds

In its flagship annual report, *Global Landscape of Climate Finance 2015*, the Climate Policy Initiative estimated that \$391 billion was invested in low-carbon and climate-resilient actions in 2014. The same report also noted that the International

Energy Agency has estimated that around \$16.5 trillion will be required from 2015 to 2030 to align the global energy system with one that is consistent with the goal of keeping global temperature rise to less than 2°C above pre-industrial levels. In other words, the current rate of investment is running at about one third of what is required if we are to avoid dangerous climate change.

It is very clear that this gap cannot be filled by governments alone. Much of the capital will need to come from the private sector: from corporations, pension funds, insurance companies and investment managers, among others. Delivering investment on the scale

▲ A Maasai herds cattle past wind turbines near Nairobi, Kenya. Developing-world climate projects can present private-sector investors with a complex array of risks

required will demand governments to adopt game-changing interventions in relation to both climate change policy and climate finance policy.

The needs for climate change policy are well understood. Private investors – individually and through initiatives such as the Institutional Investors Group on Climate Change – have been very clear that climate change policy should:

- provide appropriate incentives to invest;
- recognise that scale is critical to addressing risk – scale allows unit costs to be reduced and allows expertise in the development and deployment of new technologies to be gained;
- be of appropriate duration – investors, in particular those making large investments in areas such as infrastructure and power generation, need long-term policy certainty;
- be effectively overseen – the relevant regulatory or oversight bodies should have the ability and authority to ensure that climate change and related energy policies are effectively implemented.

The needs for climate finance policy divide into two. The first relates to the general issues around investing in emerging markets, which is where much of the capital investment will be required.

Investors in these markets are concerned about issues such as currency risk and local market capacity and expertise on, for example, the practicalities of deal structuring and financing. Fortunately, many of the tools required to manage these risks are already available, well understood and widely applied.

Examples include export credit guarantees and currency hedging instruments. Furthermore, development finance institutions have a long record of working with local financial institutions to build skills and capacities, and can provide a range of practical support measures (such as dedicated credit lines) that can accelerate the development of climate finance industries in these countries.

But addressing market risks is only part of the picture. The other important issue for climate finance policy relates to the

characteristics of the specific projects that need to be funded. Different categories of climate change projects present very different issues and challenges when trying to attract private-sector investment.

Policy interventions therefore need to be tailored to the specific projects in question, and to account for factors such as the amount of capital required, the financial risk–return characteristics of the investment, project duration and technology involved.

When looking to encourage private finance to invest in climate change-related mitigation or adaptation, policymakers need to start by acknowledging the need to provide appropriate risk-adjusted returns for the providers of these funds. They then need to understand:

- which type(s) of private investors are likely to be interested in investing, and what returns are likely to be sought by these investors;
- what risks these private investors are likely to see, and how these risks might best be managed – within this, it is particularly important that policymakers understand that the greater the risk (or the perceptions of risk), the greater the returns that will be expected.

Are transaction costs significant?

The examples of renewable energy and energy efficiency illustrate the issues that remain with regard to private-sector investment.

Despite rapid gains in competitiveness in recent years, the reality is that renewable energy electricity generation is often uncompetitive compared with conventional power plants – a situation that is frequently exacerbated by fossil-fuel subsidies. Even where regulatory mechanisms exist that might level the playing field, they tend to be discounted by private-sector actors and financiers who often consider the incentives provided as insufficient to compensate for the risks that investors face, or see these regulatory mechanisms as lacking dependability.

This perceived lack of dependability is particularly important in the case of large renewable energy projects, since they tend to involve relatively large up-front capital

investment and have project lifetimes of 20 years or more.

Renewable energy projects also face other challenges. Financial markets in many developing countries lack the maturity and depth needed to provide project finance at the required scale and tenor. There may be a lack of refinancing vehicles, making it difficult for project developers to exit their investment.

Another issue is novelty. This relates both to the technologies themselves (they may not have sufficiently long track records, for example) and to the countries in which they are deployed (where policymakers may be reluctant to support what they see as new technologies, or where there is uncertainty about issues such as operating costs). Finally, renewable energy projects often require significant investment in transmission and distribution infrastructure.

These challenges faced by developers and financiers promoting large-scale renewable energy infrastructures require policymakers to consider:

- i) adopting policy measures that ‘level the playing field’ between renewable and other energy sources. These do not have to involve public subsidy but could include measures such as feed-in tariffs for electricity from renewable sources or renewable energy quotas;
- ii) actively supporting the development of renewable energy until it gets to the point where concerns about technology risk and reliability have been addressed;
- iii) supporting the development of a domestic financial system that is able to provide services at the required scale and tenor.

Energy efficiency presents quite different challenges from a policy perspective.

Projects generally require much less capital investment, with finance usually provided by banks, providing either corporate or project lending, and the project sponsors themselves as providers of equity capital.

These investments face four common challenges. First, the costs and benefits are often not clear. While there is often a theoretical case for investment, the actual savings that are achieved depend on factors



© Jorge Silva/Reuters

such as management time, disruptions to production, staff training and information gathering and analysis. Second, companies tend to favour projects that lead to business expansion, continuity and increased revenues rather than investments (such as energy efficiency improvements) that primarily lead to cost savings. Third, banks may be unwilling to provide finance, because energy efficiency equipment often has a low collateral asset value, and such equipment is often difficult or uneconomic to remove and use elsewhere. Fourth, there can be significant upfront transaction costs associated with researching and analysing energy efficiency opportunities.

Therefore, the developers and financiers of energy efficiency improvement projects need a different set of public interventions to those required for renewable energy. Policymakers need to consider:

- i) encouraging electricity utilities to provide incentives that encourage improvements in efficiency;

- ii) raising awareness of the business case for energy efficiency;
- iii) reducing interest rates for energy efficiency-related loans and increasing the availability of loans for this purpose (through, for example, extending zero or low-interest public credit lines to commercial banks);
- iv) providing technical assistance such as energy audits and assistance with the development of project proposals.

Governments that want to deliver low-carbon investment at scale – whether at the domestic or international level – therefore need to:

- ensure that they have an effective and credible climate change policy framework, including overarching goals and targets, credible policy frameworks for specific sectors, and effective institutions;
- ensure that the skills, tools and expertise used to finance other forms of infrastructure are available to support low-

▲ Men rest after salvaging metal in the derelict 'Tower of David' skyscraper in Caracas, Venezuela, under former President Hugo Chávez, epitomised country risk through its prolific expropriation of foreign investments

carbon investments in emerging markets;

- adopt policy measures and financing instruments that are relevant to the specific types of low-carbon investment that are being made – different types of low-carbon investment have different financial and risk–return characteristics, and policy needs to be tailored to these characteristics.

Well-designed policy on climate change and climate finance can be hugely effective at attracting private-sector investment – as we see most spectacularly in the case of the global deployment of renewable energy.

The challenge now is to replicate this success in other areas – energy efficiency, climate change adaptation, the REDD+ forest initiative – and in less-developed countries. ●

Evaluating carbon sequestration

Deforestation and land degradation have hugely impacted the planet's natural ability to remove atmospheric CO₂. Projects to restore the balance are well underway, but quantifying their success is difficult, calling for a new multidisciplinary analytical approach

By **Geeta Batra**, Chief Evaluation Officer, and **Juha I. Uitto**, Director, Independent Evaluation Office, Global Environment Facility

Much effort is being devoted to evaluating the impacts of aid and investment projects on the rate of loss of tropical forests, and the related climate benefits, in the Americas, Africa and Asia, using satellite-based measures of forest cover. Despite these efforts, the valuation of the benefits accruing from avoided losses – i.e. standing forests and concomitant carbon sequestration – is relatively unknown.

Multidisciplinary approach

What is known is that avoiding deforestation is an economically attractive option, as it is one of the cheapest ways of reducing emissions, in terms of dollars per tonne of carbon.¹ Applying a multidisciplinary approach, with a diverse set of tools, provides a better understanding of the drivers of degradation, and the valuation of benefits. This approach is currently being utilised in the context of the Global Environment Facility (GEF).

To determine the extent of carbon sequestration, we employ a variety of geospatial and statistical tools to assess the factors influencing the outcomes of the GEF-funded programme in land degradation.²

The land degradation focal area is the window that supports efforts by countries eligible for GEF support to combat land degradation, specifically desertification and deforestation in rural production landscapes. This investment relates directly to the GEF's role as a financial mechanism

of the United Nations Convention to Combat Desertification.

Forests contribute significantly to carbon sequestration through holding large carbon stocks. When forests are cut, they can no longer hold the carbon, thus having an impact on climate change. Carbon stocks cannot be observed directly from satellite imagery. However, they can be estimated through examining factors associated with carbon stocks, particularly vegetation biomass.

The normalised difference vegetation index (NDVI) is one of the most widely used vegetation indices to estimate carbon stocks. To date, empirical studies employing remote sensing to estimate carbon storage have done so at a local or country level and have shown that NDVI can strongly predict the extent of carbon stocks.

We quantify the causally identified impact attributable to GEF projects along

and night-time lights, to account for socio-economic differences in locations.

The analysis covers the entire GEF land degradation portfolio: altogether some 200 projects and approximately 450 locations. The projects were geocoded and are fairly heterogeneous in terms of their scope, design and geographical location. They are mostly located in areas with a relatively low population density and level of electrification. The physical geographic characteristics of the project locations are highly variable in terms of temperature, precipitation, elevation and slope, and not all the projects are located in areas that have forest cover.

Evaluating impact

Classification and regression-tree approaches³ have been commonly employed over the last two decades to aid in the classification of remotely sensed

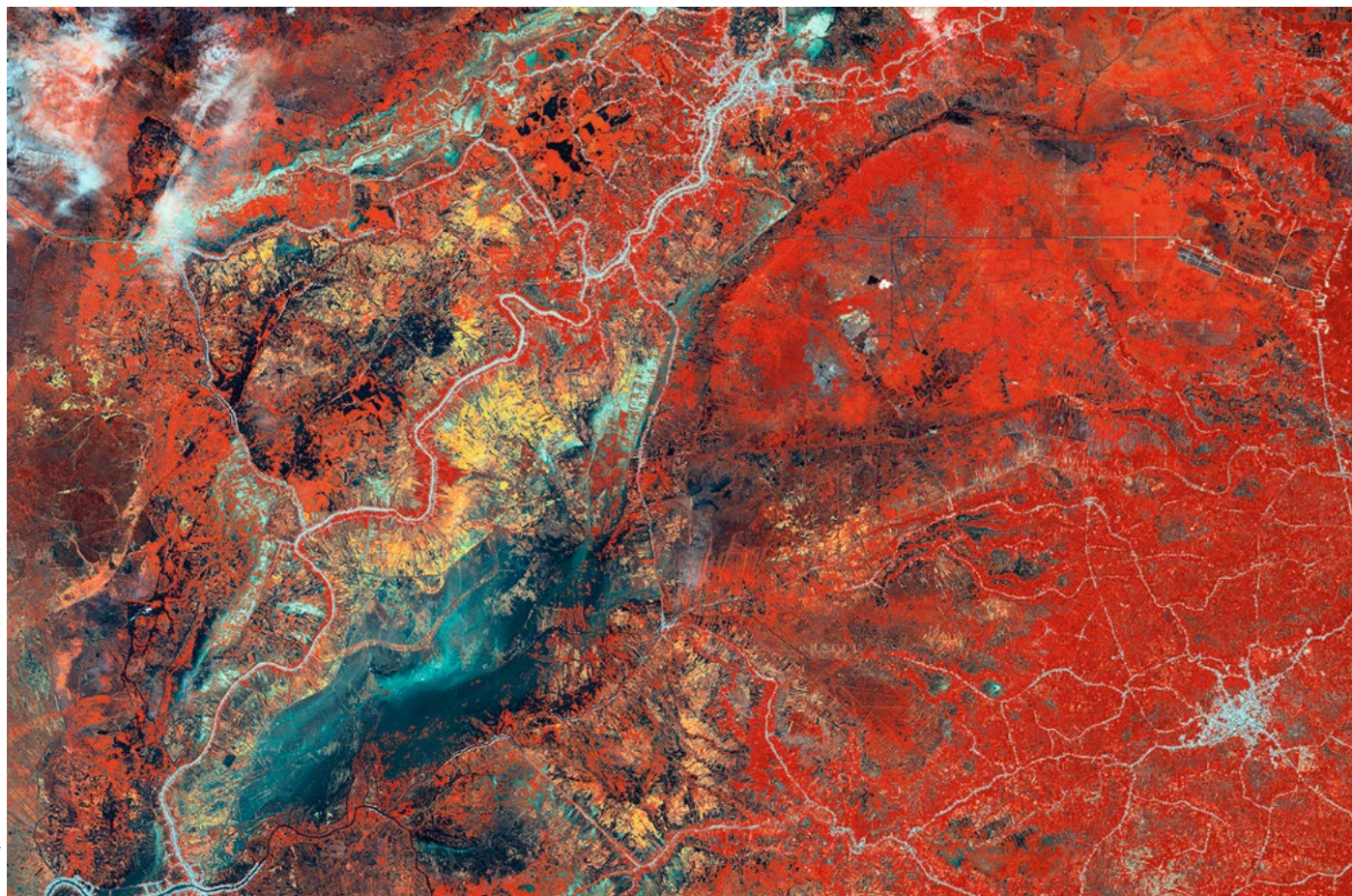
Quantifying the tonnes of carbon sequestered, and assessing the corresponding value directly attributable to the interventions, is challenging but now well within reach

four dimensions (vegetation productivity; forest fragmentation; carbon stocks and sequestration; and land cover change), using satellite outcome measurements. We employ propensity score matching methods to examine the impact of GEF projects, and related geographic heterogeneity, on these four impacts.

Other data integrated into the analysis include long-term climate data, population data, distance to rivers, distance to roads

imagery. They can be used to identify causal effects of an intervention. Based on these approaches, we have found that, in general, GEF projects have had a positive impact on NDVI, forest cover and reduction in forest fragmentation, with variation in the estimated range of impacts across countries.

We were also able to detect certain determinants that explain the relative success of the projects. Those projects



▲ A satellite image of South Kalimantan, Indonesia. False-colour images in infrared provide detailed information on vegetation, such as plant type and health – brighter red indicates thicker vegetation

with relatively longer durations performed better, and environmental (slope, elevation, temperature, precipitation) and social (population density, urban distance) characteristics all proved important in mediating the impact of the projects.

There is some evidence that projects closer to urban areas were slightly more successful in mitigating forest cover losses. Projects were also heavily influenced by the initial state of forest fragmentation – i.e. the pre-trend of average forest size is an important factor in determining the heterogeneity in project impacts.

Based on the analysis of GEF-funded projects, relatively higher levels of carbon sequestration have been observed in Senegal, southern Niger, Kyrgyzstan and Vietnam.

Methodological limitations

Understanding the factors that influence the various impacts is a first step. Quantifying the tonnes of

carbon sequestered, and assessing the corresponding value that is directly attributable to the interventions, is challenging but now well within reach, thanks to this multidisciplinary approach.

Examining the causal impact of these interventions on environmental outcomes has been a central goal of the multilateral agencies but there has hitherto been limited engagement in using spatially explicit, geocoded aid information due to limitations in both data and methods.

These methodological limitations primarily stem from distinctions between modelling efforts seeking to predict relationships commonly taught and accepted by the geographic community (i.e. spatial regression or classification trees), and efforts that seek to establish causal relationships similarly taught and accepted by the economics community (i.e. propensity score matching or difference-in-difference modelling).

Recently, efforts have been undertaken to merge these disciplinary approaches to explain the impacts of these interventions, of which this analysis provides an example. This integrated approach to evaluation and research provides a promising avenue towards better quantification of climate benefits from reduced land degradation and deforestation. ●

- 1 TEEB. The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A Synthesis of the Approach, Conclusions and Recommendations of TEEB. 2010.
- 2 This paper draws on ongoing methodological research being carried out by the Independent Evaluation Office of the GEF and AidData: “Value for Money in Land Degradation Projects of the GEF.” 2016, forthcoming.
- 3 Classification and regression trees are machine-learning methods for constructing prediction models from data.

Improving the carbon footprint with indices

Climate change presents significant risks to assets that can be faced with sustainable index concepts

■ Last year's United Nations Climate Change Summit in Paris concluded with the adoption of a momentous agreement between nearly 200 countries to limit global warming below 2°C, clearly signalling that the world is ready to take a step in the right direction to mitigate climate change. Though primarily a political signal, the agreement has increased pressure on companies along with investors. One major message of the climate change conference was that carbon emissions will no longer be economically justifiable in any business model in the future.

In recent years, it has become apparent that fossil energy has no bright investment future. As world leaders attempt to address and stem the effects of global warming, long-term investors in particular are becoming increasingly aware of the risks climate change presents to their assets. Companies are also beginning to act more responsibly; almost 600 companies and investors have already joined We Mean Business, a coalition of organisations working with thousands of the world's most influential businesses and investors.

One of the organisations is the Montréal Carbon Pledge, which drives investors' commitment to measure and publicly disclose the carbon footprint of their investment portfolios on an annual basis. Support for the Montréal Carbon Pledge is coming from investors

across the globe: more than 120 investors with over US\$10 trillion in assets under management have been participating, since the Paris Climate Change Conference. Several leading institutional investors, like the Norwegian Sovereign Wealth Fund or Allianz Group, have decided not to invest in businesses relying on fossil energy.

This decision is forward-looking: a change towards a more sustainable investment approach is also demanded from the governmental side. In 2015, France has introduced mandatory carbon reporting for portfolios of pension funds, insurance companies and other institutional investors. Other countries want to implement similar obligations as governments are pushing hard. Obviously, institutional investors are expected to reflect the growing concerns about climate change in their portfolios. So far, however, it has not been as easy to implement sustainable investments. Pension

funds, for example, are often obligated to follow a pre-defined benchmark. As a result, and in order to avoid undesired tracking errors, they can only rely on indices that embed low carbon filters. Some investors may want to get the most out of the leading sustainable companies only, while others would consider companies and their whole supply chain additionally.

Reliable and independent data as the basis for sustainable indices

Reliable and certified data are the basis for any low carbon strategy. Yet, many investors do not have the time and expertise to analyse the carbon emissions of every company or do not have access to all necessary data. Therefore more than 800 investors, who account for more than one third of assets worldwide, rely on the data of CDP – the former Carbon Disclosure Project – a leading international non-governmental organisation. CDP manages the world's largest database of its kind with information on more than 2,000 listed companies. Its data helps investors to analyse the environmental risks and financial opportunities across their portfolios.

STOXX partnered with CDP to use their dataset of corporate environmental information as a high-quality source to calculate the STOXX Low Carbon index family that was introduced earlier this year. The index family provides a range of innovative solutions for investors with different low-carbon strategies, based on established benchmark and blue-chip indices such as EURO STOXX 50 and STOXX Europe 600. Investors can choose to address climate risks without giving up their benchmark respectively. As an example, the EURO STOXX 50 Low Carbon Index has reduced carbon emissions by half, while retaining similar risk and return figures compared to the EURO STOXX 50 Index over the past three years. The STOXX Low Carbon Indices consist of four sub-families offering varying degrees of carbon exposure. Using the indices, investors can mitigate their carbon risk, without changing their overall risk-return profile, or exclude fossil fuel holdings altogether.

The STOXX Industry Leaders Low Carbon Indices are one of the sub-families and allow investors to gain diverse exposure to industry leading companies, while having reduced the carbon footprint by more than 80 per cent over the past three years. At the beginning of 2015, price hikes supported the performance of most indices. The STOXX Europe Low Carbon 100 Index for instance outperformed its parent index during the sideways and downward trend afterwards, outperforming it by more than 10 per cent

“The STOXX Low Carbon Indices consist of four sub-families offering varying degrees of carbon exposure. Using the indices, investors can mitigate their carbon risk, without changing their overall risk-return profile, or exclude fossil fuel holdings altogether”



compared to the STOXX Europe 600 since January 2015. Therefore this concept could be attractive to investors not bound to a benchmark.

Climate change risks and opportunities hidden in supply chains

According to CDP, the companies' own emissions often account for just 15 to 25 per cent of the total emissions across their supply chain, a fact not considered in the majority of cases. There is a small group of companies that besides implementing programmes to reduce their own emissions, also employ strategies to reduce emissions of their whole supply chain. These companies are rewarded with a place on CDP's A list, based on their emissions reduction actions and results. This group is recognised as being the most transparent and fact based. The selection criteria are strict: just 113 companies worldwide were included in the 2015 A list.

Investors can invest in this holistic approach with the help of the STOXX Global Climate Change Leaders Index, which is the first index available to market participants that tracks the CDP A list. CDP A list research showed that this small group of Climate Change Leaders accounted for US\$23 billion in climate change investments; almost half of the US\$50 billion invested altogether. The index has reduced carbon emissions by nearly 80 per cent with annualised returns of more than nine per cent over the past three years. Hence, investors can support the forward-looking, effective strategies and significantly reduce climate risks in their portfolio straight away.

The UN Climate Change Summit has underlined the importance of minimising global carbon emissions in the

future. Many governments and companies are aware of their responsibilities and investors can support their efforts. Passive investing is a crucial part of being prepared for future investment requirements. Low-carbon index strategies do not only cater to a socially responsible investment approach, but have shown to perform similarly to, or even better than, their traditional counterparts. ■

ABOUT STOXX

STOXX Ltd. is a global index provider, currently calculating a global, comprehensive index family of over 7,500 strictly rules-based and transparent indices. Best known for the leading European equity indices EURO STOXX 50, STOXX Europe 50 and STOXX Europe 600, STOXX Ltd. maintains and calculates the STOXX Global index family which consists of total market, broad and blue-chip indices for the regions Americas, Europe, Asia/Pacific and sub-regions Latin America and BRIC (Brazil, Russia, India and China) as well as global markets.

STOXX

For further information, visit: stox.com/lowcarbon

Time to price energy right

Ensuring that fossil-fuel prices reflect their true cost to the environment is critical for promoting the transition to greener economic growth. Can governments build on the political will shown at Paris and put energy price reform into action?

By **Ian Parry**, Principal Environmental Fiscal Policy Expert, Fiscal Affairs Department, International Monetary Fund

Essentially, all countries over-consume and over-invest in fossil-fuel energy. The reason is that households and firms are not fully charged for the costs of using fossil fuels, which include both the supply costs and their environmental costs. Fossil-fuel combustion is the major cause of rising atmospheric concentrations of heat-trapping gases, as well as outdoor air pollution, which causes over three million premature deaths a year.

The extent of undercharging is quite staggering (see Figure 1). According to IMF estimates, fossil-fuel subsidies – broadly measured by the difference between prices needed to reflect combined supply and environmental costs, and current prices, multiplied by fuel use – amounted to \$5.3 trillion in 2015, or 6.5 per cent of global gross domestic product (GDP).

Undercharging for carbon emissions accounted for about a quarter of this global subsidy; undercharging for local air pollution damage about a half; the failure to fully reflect broader environmental costs of vehicle use (like road congestion and accidents) in petroleum product taxes another 12 per cent; and the failure to apply fully general consumption taxes to energy six per cent (see Figure 1).

Sometimes discussion of energy subsidies focuses on energy producers, such as those in the Middle East and North Africa, keeping domestic energy prices below international prices, but this source of underpricing energy accounted for only six per cent of the global subsidy. Energy

subsidies, moreover, are pervasive across countries and regions: advanced countries, for example, accounted for a quarter of global energy subsidies, and emerging and developing Asia about a half.

Broken down by fuel product, coal is the main culprit, accounting for about three fifths of the global subsidy, reflecting its high rates of carbon and local air emissions. Natural gas (a much cleaner fuel, especially for local air pollution) accounted for a tenth of the subsidy, and petroleum products (which are already subject to significant taxation in most countries) about three tenths of the subsidy. It is ironic that coal, the dirtiest fuel, has rarely been taxed.

Fully reflecting the supply and environmental costs in energy prices needs to be the centrepiece of efforts to address the major environmental challenges of the 21st century. The most effective way

A requirement for energy generated by renewables, by contrast, promotes only the first of these responses. Getting energy prices right also establishes the price signals that are essential for redirecting investment and financial flows towards low-emission technologies.

There are some nuances in designing energy price reform. For example, upfront taxes on coal supply need to be combined with rebates to reward downstream adoption of technologies (like sulphur dioxide scrubbers at coal plants) that reduce air pollution emission rates. Or, if administratively feasible, emissions out of the smokestack can be directly priced instead.

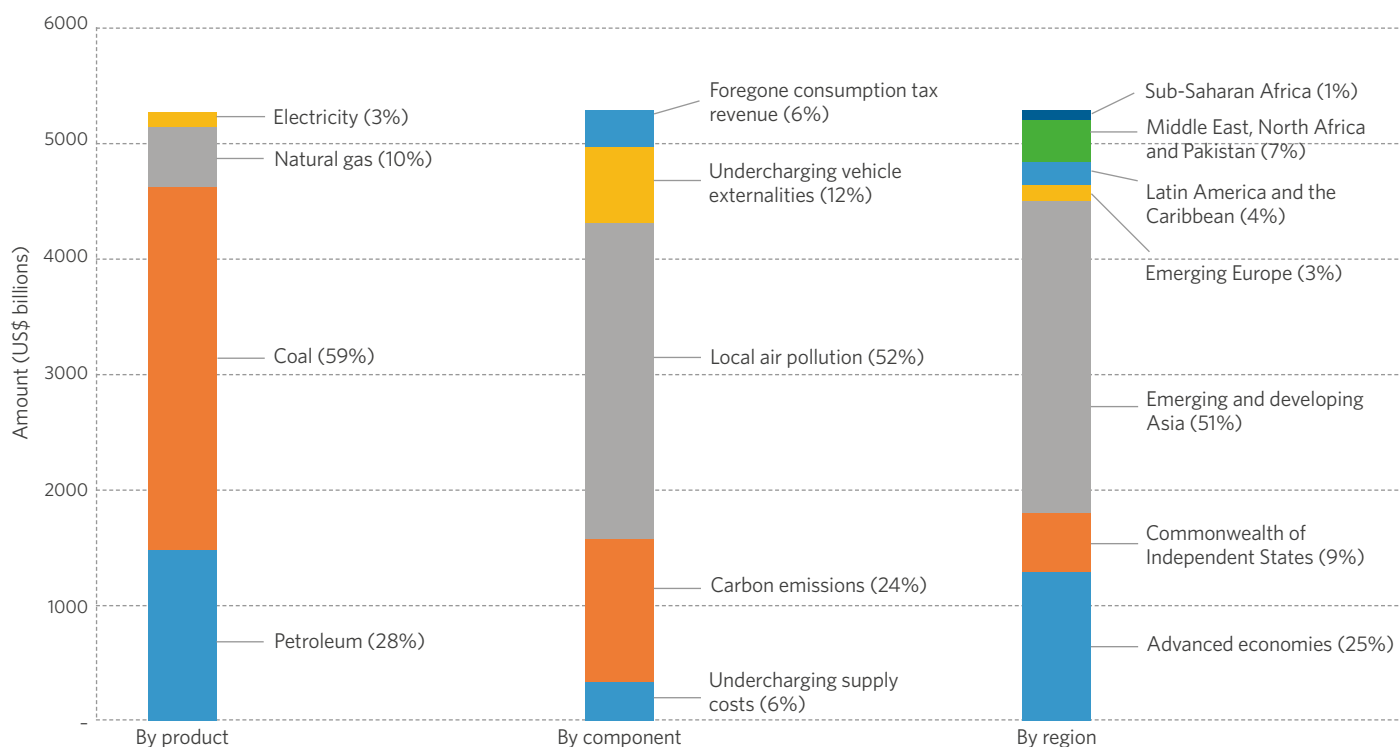
However the details are worked out, the environmental benefits of getting energy prices right would be huge: about a 25 per cent reduction in global carbon emissions and a 60 per cent reduction in premature deaths from fossil-fuel air pollution.

Almost 90 per cent of global GHGs remain unpriced... reform needs to go well beyond liberalising energy prices to factoring environmental costs fully into energy taxes

to reduce use of a (dirty) fuel is to raise its price, as this promotes the entire range of behavioural responses for reducing it.

For example, taxing coal reduces its use by making coal-generated electricity more expensive, encouraging a switch to other forms of electricity generation such as renewables, gas and nuclear, as well as reducing overall demand for electricity. It also leads to reduced coal use in other sectors (like steel production).

The fiscal rationale for energy price reform should not be understated either. Getting energy prices right at the global level would generate an extra four per cent of GDP in new revenue – less than the amount of the energy subsidy (because fuel use falls in response to higher fuel prices) but easily enough in the average developing country (though not all of them) to pay for public health spending or to eliminate corporate income taxes. The fiscal rationale

Figure 1: Global energy subsidies, 2015

Source: David Coady, Ian Parry, Louis Sears and Baoping Shang. 2015. "How Large Are Global Energy Subsidies?" Working Paper 15/105. Washington, DC: International Monetary Fund

for energy taxes can be especially strong in countries where revenues from broader fiscal instruments are severely hindered, due to a large portion of economic activity occurring in the informal sector.

One argument against energy price reform is that it harms the poor. However, most of the burden (typically 90 per cent or more) of higher energy prices is borne by the non-poor. Nonetheless, price reform needs to be accompanied by measures (like strengthened social safety nets) to compensate the poor, which will use up a minor portion (around 10 per cent or less) of the new revenues.

Another argument against higher energy prices is that they can harm the competitiveness of energy-intensive, trade-exposed industries (aluminium, cement, petro-chemicals, etc). However, using energy tax revenue to cut broader taxes on labour and capital provides a general offsetting boost to competitiveness. Efficiently allocating

a country's scarce resources implies that those firms that are unable to compete with properly priced energy should eventually cease operation, but transitory measures to help the adjustment process are needed, such as worker relocation schemes.

Policy reform

We are seeing some promising policy reforms on the ground. For example, 40 countries now have some form of carbon pricing at the national level, and China has announced it will join this group in 2017. And we are seeing energy price liberalisation in many countries such as Angola, Egypt, Haiti, India, Indonesia, Jordan, Mexico, Morocco, Saudi Arabia, UAE and Yemen, which, not long ago, seemed a remote prospect.

While welcome, these policy developments are only the start of the process. Almost 90 per cent of global greenhouse gases remain unpriced at present. Reform needs to go well beyond

liberalising energy prices to factoring environmental costs fully into energy taxes.

Nonetheless, there are grounds for further optimism. On average, around three quarters of the benefits of energy price reform are domestic rather than global – so countries can move ahead unilaterally with reform and make themselves better off, rather than needing to wait for others to act.

Countries are under significant peer pressure to demonstrate progress on emissions commitments made by 195 governments for the 2015 Paris Agreement on climate change. Finance ministers are continually on the lookout for new sources of revenue, given historically high fiscal pressures. And lower international prices for petroleum, coal and natural gas provide a window of opportunity to lock in higher energy taxes, while political opposition to reform may be weaker than in the past.

The stakes from energy price reform are huge. Now is the time to act. ●



Avoiding disasters by being prepared

In the ongoing battle to protect the world's most vulnerable communities from the devastating effects of climate change, risk management is a weapon that offers new hope

By **Stephen O'Brien**, UN Under-Secretary-General for Humanitarian Affairs and Emergency Relief Coordinator, United Nations Office for the Coordination of Humanitarian Affairs

As millions of people, from the Sahel to Central America, suffer the devastating impacts of climate-related natural disasters, it is clear that while climate change affects all of us, it has a disproportionately negative impact on the world's most vulnerable people. While institutions in the developed world can access the resources and technologies to mitigate the extreme effects of climate change, many developing countries cannot.

To make good on the promise of the 2030 Agenda for Sustainable Development to leave no one behind, and to implement the COP21 climate change agreement and the Sendai Framework for Disaster Risk Reduction, we must collectively shift our lens to put disaster risk management at the forefront of our efforts, working across sectors and institutional boundaries to do so.

Climate change is already increasing the frequency, intensity and longevity of natural hazards, evidenced by more chronic droughts, extreme storms, floods and deadly heatwaves. These hazards trigger water scarcity, plummeting crop yields and reduced pasture availability, causing food insecurity to spike. To use a current example, climate change has intensified

the effects of this year's El Niño, putting a staggering 60 million people at risk globally, the bulk of them in eastern and southern Africa, which are experiencing their worst droughts in decades.

Climate change intensifies the susceptibility to risk of already vulnerable people, particularly those living in poverty and the socially marginalised. This vulnerability is rising at a time when the international humanitarian system is already severely overstretched: a record 130 million people are currently in need of humanitarian assistance. The likelihood of being displaced by a natural disaster is 60 per cent higher than it was four decades ago, with 26.4 million people displaced by climate-related disasters each year since 2008.

Climate change also compounds conflict drivers, by exacerbating poverty, hunger and instability, and increasing competition over scarce resources. Many of the most intractable crises we currently confront are complex crises combining violent conflict, climate change and other factors. These characteristics apply to the conflict in South Sudan, the spreading violence in the Lake Chad Basin, and the humanitarian crisis linked to conflict and drought in Yemen.

Risk analysis

While we cannot anticipate all crises, sophisticated modelling and risk analysis means we can anticipate many of them. According to INFORM, the open-source risk assessment tool, 62 of the 64 countries that launched one or more UN humanitarian appeals over the past decade were ranked among the 100 countries

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◀ Displaced children take shelter in a damaged underground water tunnel in Sana'a, Yemen – a country ravaged by drought and conflict

most at risk of crises. To take the Sahel as an example: we can safely predict that, on average, six million children will be acutely malnourished and 20-25 million people will face severe food insecurity each year, much of it linked to climate change. However, such tools have yet to translate into better preparedness or early action at anywhere near the required scale.

We have a long way to go before risk management plays a central role in humanitarian action, but we are making progress. Several initiatives were launched at the World Humanitarian Summit in Istanbul in May 2016 on this front. Leaders committed to make better use of analysis to act early on risk, with over 50 organisations supporting the United Nations Development Programme-led risk analysis platform, which convenes risk experts from all fields to synthesise their analysis. Such approaches will underpin implementation of the Sendai framework, which focuses on multi-hazard risk management, moving away from reactive disaster management.

Preparedness

When it comes to preparedness, the World Humanitarian Summit saw the launch of an exciting initiative, the Global Partnership for Preparedness, by The Vulnerable Twenty Group of finance ministers, the UN and the World Bank, to help an initial set of 20 of the most at-risk countries achieve a minimum level of readiness for future shocks by 2020. Humanitarian organisations are well aware that preparedness is at the basis of effective response, and efforts to pre-position supplies, unleash prompt funding and set up partnerships in advance are growing in scale.

An interesting venture to watch on this front is the Connecting Business Initiative. This aims to strengthen national private-sector networks in high-risk locations to engage in risk reduction and preparedness, as well as response.

The summit also saw the launch of the Platform on Disaster Displacement, which recognises the growing threat of climate-induced displacement and the clear need for better protection for the millions who will be displaced by climate change-related hazards in years to come. The platform


130
million
in need of humanitarian assistance



60
million
at risk due to El Niño in 2016



26.4
million
displaced by climate-related disasters each year since 2008



builds on the Nansen Initiative, launched by Switzerland and Norway in 2012 to develop a better understanding of disaster-induced displacement. The findings of the Nansen Initiative were compiled into a Protection Agenda, which was endorsed by 109 states. The Platform on Disaster Displacement is now tasked with implementing the agenda, with regional champions leading the way.

As we move forward, three preconditions must underpin our efforts: collaboration, capacity-building and investment.

First, actors across multiple sectors – from governments, regional bodies, humanitarian and development organisations, to scientists and the private sector – must set common vulnerability reduction outcomes and collaborate to meet them. The COP21 Paris Agreement unequivocally recognises that all countries must address the threat of climate change through the widest possible cooperation. A willingness to partner across sectors was also on display at the World Humanitarian Summit, where UN agencies agreed to a Commitment to Action, endorsed by the World Bank and International Organization for Migration,

to implement a “new way of working” that meets people’s immediate humanitarian needs, while at the same time reducing risk and vulnerability over the longer term.

This partnership and cooperation must never come at the cost of the humanitarian principles of independence, neutrality and impartiality, which form the bedrock of all humanitarian action.

Second, the emphasis must be on reinforcing the capacity of national and local actors to prepare for and mitigate disasters, heralding a shift towards more national and locally-led responses. Significant commitments were made at the summit to invest in community resilience and first-line response, to strengthen national and regional capacities and diversify partnerships.

Third, these efforts will require increased investment, not only from donors and the private sector but also from affected governments and international financial instruments. Only with funding can analysis turn into prompt action. There is overwhelming evidence that preparedness is one of the most effective ways to help prevent people from ending up in crisis, yet from 2006 to 2010, only three per cent of official humanitarian aid was spent on disaster prevention and preparedness. Both the proportion and the overall level of investment must increase as a matter of urgency.

UN agencies must lead the way in being prepared to respond to climate change-related hazards. In addition to supporting more effective coordination and communication, the Office for the Coordination of Humanitarian Affairs is investing in an emergency response preparedness approach to make sure the UN and our international partners understand and monitor risks and implement appropriate levels of preparedness to respond to them.

We must continue to build momentum on all of the above initiatives. Only through better anticipation, preparedness, risk mitigation and resilience can we ensure we leave no one behind, including the millions of people most at risk of life-threatening climate change. ●

Climate change, the biggest global threat to children



© Abate Damte/Save the Children



By *Andrés Conde*
CEO, *Save the Children Spain*

Climate change, that is to say, man-made global warming, is accepted as a scientific fact by near enough everyone – except those who want nothing to do with man's sustainable development.

Its direct consequences will have a devastating impact on children's lives: it is forecast that by 2050 it will have increased the number of children suffering from malnutrition to 24 million.

Preventable diseases like malaria and conditions like diarrhoea, which are among those that cause a high number of child deaths, will increase exponentially due to the deadly triad of drought-flood-heatwave.

At the moment, the El Niño climate phenomenon, one of the most destructive recorded to date, is putting the lives of 26.5 million children in eastern and southern Africa at risk. These children are at serious risk of suffering high levels of malnutrition, disease and water shortage. The effects of El Niño have also affected education: in Ethiopia, 1.2 million children have had to stop going to school because their schools are closed.

That's why at Save the Children we are working to curb the effects of climate change on children. We know that when two rainy seasons disappear in Ethiopia, the effect on children is catastrophic. With no harvest, there is no food for families or grain for livestock. Without livestock, without grain and without drinking water, life for almost 6 million Ethiopian children is an enormous challenge at the moment.

Another consequence of climate change that faces children are natural disasters. From 1990 to 2000, directly

due to disasters related to extreme, foreseeable weather conditions, around 300,000 children died.

The improvement of children's living conditions by 2030 (the year in which the 17 Sustainable Development Goal targets should be achieved) requires us to think in terms of climate change. It is the biggest real and direct threat to children that exists at the moment. It knows no borders and mainly affects children from the poorest areas of the planet, but also the children of developed and prosperous areas.

We know how to fight malnutrition, malaria and diarrhoea, but climate change is a much more complex task. The ozone layer, the frozen surface of the Arctic and the global average temperature are issues that generally lie outside the daily tasks of childrens' charity organisations. But, despite this, at Save the Children we are perfectly aware that, if we don't act immediately, in a coordinated, convincing manner, climate change will be responsible for, slowly but implacably, reversing the achievements of the last 30 years in the reduction of child mortality. ■

For more information, please visit: www.savethechildren.es or www.savethechildren.net



Save the Children

Fair access to scarce resources

Demographic changes and climate change are squeezing the availability of many natural resources, heightening the imperative to improve the quality of governance

By **Estherine Lisinge Fotabong**, Director of Programmes, Planning and Coordinating Agency, New Partnership for Africa's Development (NEPAD)

Current issues

Fair access to scarce resources has again emerged as a major issue in the current development discourse. A broad set of technical, ethical, social, ecological and economic considerations surrounds this debate. Throughout human history, people, communities, countries and even animals have fought over natural resources. When resources are scarce – be it water, land, energy or trees – competition becomes apparent. This exacerbates the stress on already fragile ecosystems and on the communities, groups and individuals who may be ill-equipped to cope with a sudden shortage. This, in turn, can lead to a breakdown of established codes of conduct, and even outright conflict. Even today, the need for these resources is a key element of geopolitical considerations.

The issue of natural resources and their growing scarcity has received considerable attention at all political levels, most significantly on the global stage, including in several UN conventions and agreements. Six of the 17 Sustainable Development Goals, which were adopted by the UN in September 2015, are closely related to the issue of resource scarcity.

The goals on water; food security and sustainable agriculture; energy; climate; sustainable consumption and production; and biodiversity and ecosystems all give significant attention to this subject. Other UN conventions – including the Ramsar Convention (on wetlands), the Convention

on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on Biological Diversity – make references to the issue of scarce resources.

At the regional level, the African Convention on the Conservation of Nature and Natural Resources (the Algiers Convention) adopted by the African Union (AU), which aims at ensuring the conservation, utilisation and development of soil, water, flora and faunal resources, significantly addresses the issue of resource scarcity.

Additionally, the six programme areas of the New Partnership for Africa's Development (NEPAD) Environment Action Plan (also adopted by the AU Assembly in 2003) address the issue of resource scarcity and its governance. Certainly, the negative impacts of climate change and variability constitute a long-term driver that will likely aggravate resource scarcity and hinder access to and use of resources, resulting in mass migration and conflicts in resource-deficient communities.

Controversies

The overarching concept of resource scarcity is principally one of an increase in demand and shortage in supply. This is largely due to the resource being non-renewable or, where it is renewable, the rate of exploitation exceeding its replenishment. Resource scarcity has been, and will therefore continue to be, at the heart of the global development discourse.

► **Zam Zam refugee camp in North Darfur, Sudan.** Competition for water and pastures between farmers and herders is a factor in the Darfur conflict



In a recent survey by the World Economic Forum, resource scarcity was ranked fourth in terms of expected upcoming trends. Historically, the insatiable appetite for natural resources has been led by western and Organisation for Economic Co-operation and Development (OECD) countries, and in recent times by emerging economies such as China, Brazil and India. The increasing demand for scarce resources, particularly from Africa, has raised the

stakes for the governance of natural resources and their sustainable exploitation, fair use and equitable distribution of proceeds. The International Energy Agency's World Energy Outlook projects a rise in demand for oil of one per cent a year between now and 2030, with all of the growth in demand expected to come from non-OECD sources.

While there is strong correlation between resource scarcity and poverty, some

commentators argue that it is too simplistic and vague to say the former contributes to the latter. The contestations arise because resource scarcity is a "political (economy) issue that is much more about distributive issues and access to resources than it is about absolute resource shortages".¹ Another school of thought is that the problem may not be one of resource scarcity but rather resource misuse. Whatever the reality, it is undeniable that resource scarcity, whether



© Pool-UNAMID/Anadolu Agency/Getty Images

resulting from environmental degradation, overuse, inequitable access or politicisation of access, is a fertile ground for conflict, poverty and migration, as has been borne out in recent years.

In Africa, and as contained in the Algiers Convention, countries have a “sovereign right to exploit their own resources pursuant

to their environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment”. For Africa, the imperative is therefore to harness its natural resource base as a foundation to develop its society and meet its developmental aspirations.

CLIMATE IS WATER

The obvious links between water and climate have largely been ignored in international climate debates. COP21 changed that with water events organised by the French and Peruvian presidencies and in collaboration with non-state actors. Coordinated by the World Water Council, #ClimatelsWater played a key role in this process, forming an international collective of 24 organisations to speak with one voice for water.

Climate change manifests itself mainly through extreme weather events related to the water cycle, such as unpredictable rainfall, floods and droughts. Although water is ranked among the top global risks to society, ‘water’ remains invisible within the official UNFCCC negotiation, in particular the 2015 Paris Agreement. At the same time, water is mentioned in 93 per cent of the intended nationally determined contributions (INDCs), which correspond to each country’s public commitments for post-2020 climate actions under the new international agreement.

Water is, therefore, an intrinsic part of the solution to climate change, connecting policy areas, economic sectors and societies. Investment in water provides opportunities for improved access to energy and food and increases resilience to climate variability, while limiting potential costs related to water-related disasters. Moreover, actively involving the voices of women, youth and indigenous peoples, who are most often affected by climate change

impacts, is critical to ensure feasible solutions on the ground.

For continuity between COP21 and COP22, the French and Moroccan Governments and the World Water Council organised together the ‘Water Security for Climate Justice’ International Conference. This event launched a ‘Water for Africa’ call supported by over 20 ministerial delegations to elevate water politically during COP22.

Towards Marrakech and beyond, the #ClimatelsWater initiative invites you to join us to raise the profile for water within every aspect of climate discussions, since failure to address the relationship between water and climate puts our future in jeopardy.

#ClimatelsWater messages

- Climate change impacts water resources first and foremost.
- Water security is key to climate adaptation.
- Water underlies many low-carbon solutions.
- Urgent action is needed to incorporate water within UNFCCC processes.

For more information, please contact climateiswater@worldwatercouncil.org, www.climateiswater.org

#CLIMATE IS WATER

Rising competition

According to WWF, 14 countries in Africa are already experiencing water stress, with 11 more set to suffer a similar fate by 2025. That means within the next decade, nearly half of Africa’s projected 1.45 billion people will face water stress or scarcity.

A June 2007 report by the UN Environment Programme suggested that the ongoing conflict in Darfur has in part been driven by the pressures arising from climate change and environmental degradation. This has been aggravated by a 30 per cent reduction in rainfall in the region over the past 40 years, with the Sahara advancing by more than a mile every year. The resulting tension between farmers and herders over disappearing pasture and declining waterholes underpins the genesis of the Darfur conflict.

Rising rural population densities in parts of Africa are profoundly affecting farming systems and the region’s economies in ways

The challenge is to place more emphasis on implementation and concrete action

that are underappreciated in the current discourse on African development issues. Sub-Saharan Africa suffers from chronically overburdened water systems, which are under increasing stress from fast-growing urban areas.

Weak governments, corruption, mismanagement of resources, poor long-term investment, and a lack of environmental research and urban infrastructure only exacerbate the problem.

In some cases, the disruption or contamination of water supply in urban infrastructures and rural areas has incited domestic and cross-border violence. Incorporating water improvements into economic development is necessary to end the severe problems caused by water stress, to improve public health and to advance the economic stability of the region.

Regarding land, 90 per cent of Africa's surplus arable land is concentrated in a few countries, while its rural populations are highly clustered in relatively densely populated areas. In addition, median farm size is generally declining and land ownership concentration is rising, with more unsustainable forms of land intensification apparent in high-density farming areas. Meanwhile, land access remains important for absorbing youth into gainful employment.

Agricultural and rural development strategies in the region will need to anticipate more fully the implications of Africa's rapidly changing land and demographic situation. They will also need to factor in the immense challenges that mounting land pressures pose in the context of current evidence of unsustainable agricultural intensification, a rapidly rising labour force and limited non-farm job creation. These challenges are manageable but will require explicit policy actions to address the unique development challenges in densely populated rural areas.

Governance and risk

Good governance is most critical in situations where resource scarcity is not intentional but exists because of excessive demand or over-exploitation. The adverse effects of inequitable access to scarce resources risk polarising societies, marginalising communities and affecting agriculture and food security. These impacts can have implications for peace and security as well as social cohesion. A strong correlation can be made between fair access to resources and issues of human rights and national security, implying that more attention should be given to this challenge.

At the global level, the implementation of the Paris Agreement and other related instruments should ensure that practical measures (including technical and financial) are put in place to support equitable access and sustainable use of scarce resources. Across Africa, we have seen the alarming decline in national budgets for environment and other relevant ministries, weak institutional capacity of government institutions at all levels, and

the deteriorating state of national parks and countries' natural resource base.

Urgent systemic reforms are needed, smart policies that promote and ensure: the use of appropriate technologies; the empowerment of women; the participation of the private sector; and the involvement of youth and civil society. All of these will contribute to the sustainable use of scarce resources, ensuring that everyone has equitable access to them and can share the benefits of using them. After all, these resources are the engines of development for most African countries.

Resource governance structures have been dominated by exclusive management approaches and protectionist strategies. In most countries, national parks and other

By 2025, nearly

50%

of Africa's population could face water stress



wildlife reserves have become a major source of conflict due to the protection afforded them by the state. This governance approach has pitched the state – as managers of natural resources – against communities that have historically relied on these resources to support their livelihoods.

Unfair and unequal distribution of natural resources that sees them concentrated in the hands of a privileged few have thrown countries into conflict situations. In the last decade, the top eight oil producers in Africa (in order, Nigeria, Algeria, Angola, Egypt, Libya, Sudan, the Democratic Republic of Congo and Equatorial Guinea) were all afflicted in one way or another by violent conflict or low-intensity civil wars. The issue of land grabs

has also seen land taken from communities without appropriate consultations or compensation. The World Bank estimates that about 40 per cent of sub-Saharan Africa has no access to an improved source of drinking water. This is despite the fact that the continent of Africa is endowed with 63 cross-border river basins that cover about two thirds of its landmass, and further strengthens the case for equitable distribution of the resources.

Conclusion

The African continent has done reasonably well in developing policy frameworks to address the issue of fair access to scarce resources. Agenda 2063, the AU's aspirational vision for Africa's transformation, asserts the use of Africa's resources for its development. Like the NEPAD vision, it also recognises that only through inclusive governance can the continent truly achieve socio-economic transformation. Other continental strategies and programmes, including the African Mining Vision, the Environment Action Plan, Comprehensive Africa Agriculture Development Programme and the Rural Futures Programme, provide a solid framework and policy direction for Africa to maximise the use of its natural endowments.

The challenge is to place more emphasis on implementation and concrete action at all levels, with strengthening of stakeholder capacity a key requirement for success. Multilevel governance and dialogic policymaking is therefore essential in ensuring fair access and use of scarce resources. In many countries, particularly in Africa, the process of involving stakeholders is controlled by various legal and institutional structures, which invariably alienate resource communities from the management and sharing of resources. Information, knowledge-sharing and political and traditional leadership will create a conducive environment that would ensure that competition for scarce resources does not result in conflict. The time to act is now. ●

1 Daley, B. Resource scarcity and environment: Review of evidence and research gap analysis. Evidence on Demand, UK (2013) 26 pp. [DOI: http://dx.doi.org/10.12774/eod_hd062.jul2013.daley]

Forced to flee

While official figures downplay the role of climate change in mass migration, its catastrophic effect on displacing communities is undeniable. How can governments protect both the rights of migrants and the communities that give them refuge?

By **Walter Kälin**, Professor Emeritus, Faculty of Law, University of Bern; former Envoy of the Chairmanship of the Nansen Initiative; former member, UN Human Rights Committee

When heads of state and government meet on 19 September 2016 in New York for the United Nations Summit on Refugees and Migrants, some of the participants are likely to raise the fate of those who are forced to leave their homes in the aftermath of disasters such as windstorms or flooding. Others will no doubt seek to highlight the plight of those who, to cope with the adverse effects of climate change, decide to migrate from rural to urban areas or even to other countries in search of livelihoods and better living conditions.

Such interventions will be timely. On average, 26 million people are newly

the urban poor, after their land was washed away or salinisation of groundwater and soil made life too hard. In Kenya, Haiti and the Dominican Republic, the International Organization for Migration found that rural-urban migration is the predominant answer to slow-onset environmental degradation.

Other people try to find security and livelihood opportunities abroad. Almost 300,000 Somalis were accepted as refugees in the big refugee camps in Kenya, Ethiopia and Djibouti, when a prolonged period of drought turned into famine in 2011-12. When floods in Mozambique's river basins force people out of their homes and villages, displaced communities in border areas regularly find refuge in Malawi.

Overall, the number of people displaced across borders in the context of disasters and environmental degradation is unknown. These people are not counted

On average, 26 million people are newly displaced every year by disasters of various kinds

displaced every year by disasters of various kinds. Most flee when hit by weather and climate-related natural hazards. Others choose to migrate to cope with the slow-onset, adverse effects of climate change, such as rising sea levels, recurrent drought or desertification.

Most people move within their own country. In Bangladesh, for instance, almost every big city hosts significant numbers of families from vulnerable coastal areas. These people are struggling to find a living among

because the adverse effects of climate change are not recognised as a valid ground for receiving state protection from the country they are forced to move to. Thus, those arriving over the Mediterranean Sea from the Horn of Africa or the Sahel region, for instance, are unlikely to declare that they have left their homes for any reason other than to escape persecution.

Displacement and migration may be temporary, with people returning when the situation improves. In cases where affected



people have given up hope of rebuilding dignified lives in their country of origin, they may opt for permanent emigration.

Temporary migration can often have positive effects. It can allow people to work abroad during periods of instability, for instance when there is increased food insecurity. It can allow them to send money home to their family, or bring back new knowledge that enhances the resilience of their communities. However, pre-existing vulnerabilities are further heightened where migrants fall prey to trafficking, exploitation or marginalisation, or where particularly vulnerable families and communities are left behind with no support. In other situations, people in the most desperate circumstances



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may lack the resources to migrate, forcing them to remain in unsafe areas despite further massive deterioration of their lives.

Multi-causality

Natural hazards alone rarely force people to move. The 2011–12 famine in Somalia provides a good example of how natural and human-made factors combine when people are forced to flee. Affected communities in Somalia had to be protected abroad because after two decades of armed conflict, no authorities were able to assist them at home. Food aid could not reach them at their places of origin, primarily because of the prevailing insecurity, but also because the international community was not quick

enough to act, despite early warnings that famine was imminent.

Displacement takes place when people are exposed to a natural hazard and lack the resilience to withstand its impacts. Being exposed and lacking resilience are not ‘natural’ factors, but are consequences of human behaviour. Irregular settlements on steep slopes in urban areas or in flood-prone river plains and coastal areas clearly increase the risk of being displaced during heavy rainfall. People who are poor, have houses too weak to withstand a storm, experience food insecurity in rural areas or live in densely populated and poorly planned urban neighbourhoods (where corruption can contribute to weak

▲ Somalis wait to be registered at the Dagahaley refugee camp in Dadaab, Kenya in 2011. Almost 300,000 Somalis ended up in refugee camps in neighbouring countries due to prolonged drought then famine

enforcement of building codes) are less resilient than those who can profit from effective disaster risk reduction and climate change adaptation measures.

In a report for the 2015 Sendai World Conference on Disaster Risk Reduction, the Internal Displacement Monitoring Centre correctly stressed that compared to the impacts of the natural hazard itself, demographic, social, economic, institutional and political factors contribute as much – and sometimes even more – to whether affected people can stay or must flee.



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▲ Refugees cross the Jordanian border. As of 16 August 2016, there were 656,198 registered Syrian refugees in Jordan, making up around 8% of the total population

This opens up ways to reduce displacement risks through a series of tools, as highlighted by the Nansen Initiative on cross-border induced disaster displacement in its 2015 Protection Agenda. These include, in particular, disaster risk reduction; climate change adaptation measures and other efforts to strengthen the resilience of communities at risk; planned relocation; and the facilitation of migration as a means to cope with the realities of disasters and the adverse effects of climate change.

The way ahead

Despite all these efforts, disaster and climate change-related displacement and migration will increase, as UN Secretary-General Ban Ki-moon highlights in his report to the UN Summit on Refugees and Migrants.

He notes that hazards related to climate change and environmental degradation will intensify and are, among others, likely “to drive people away from coastal areas and low-lying small-island states”.

This prospect calls for the development of policies to protect such people and allow them to integrate in host communities in ways that take into account the legitimate interests of both host and migrant. Such policies should be guided by the principle that no one shall be left behind. This is the strong message of the Sustainable Development Goals (SDGs). Together with human rights standards, many of the SDGs provide extensive guidance on how best to address disaster and climate change-related displacement and migration.

Who can take this challenge forward? While it is unlikely that the 19 September summit will address this issue in any depth, two processes are relevant. In December last year, COP21 in Paris agreed to create a

task force under the Warsaw International Mechanism for Loss and Damage “to develop recommendations for integrated approaches to avert, minimise and address displacement related to the adverse impacts of climate change”.

At the World Humanitarian Summit in May of this year, the Geneva-based Platform on Disaster Displacement, a process led by 18 states and chaired by Germany with Bangladesh as vice-chair, was launched as successor to the Nansen Initiative. Its purpose is to address the protection needs of people displaced across borders in the context of disasters and climate change, through promoting the implementation of the Nansen Initiative Protection Agenda.

Both processes are important steps towards the development of policies, rules and standards that will help to live up to the challenges of climate change-related human mobility. ●

Climate variability and its impact on water resources

Climate change has potentially devastating implications for the availability of one of humankind's most precious resources



Climate studies – and projections – show that water resources are vulnerable and can be severely affected by climate change, creating negative impacts on societies and ecosystems.

Climate, freshwater, biophysical and socio-economic systems are interconnected: a change in any one of these can impact any other. Climate change will exacerbate the impacts on the sustainable use and management of drinking water, causing shortages and droughts in some areas and floods in others, as well as excessive pollution.

Changes in water volume and quality, caused by climate variability, will affect food availability and accessibility. It will also impact on water management practices and the role and use of water infrastructure, such as structural flood protections, and drainage and irrigation systems.

One measure that can help countries address these issues is to establish sound institutions for implementing proper water resources management. The potential ramifications of successful water resources management spread far and wide across societies, impacting on areas such as energy, health, food safety and nature conservation, and involving the participation of multiple sectors.

The role of water has become more important since the creation of the High-Level Panel on Water in early 2016,

chaired by the presidents of Mexico and Mauritius. The panel's aims are to: mobilise and build alliances between governments, the private sector and civil society around water; encourage decision-making in global institutions specialised in the field; and, for the first time, establish a regulatory framework for water as a fundamental axis where resilience leads a new approach to disaster management worldwide. The overall goal is to meet Sustainable Development Goal 6: "Ensuring the availability and sustainable management of water and sanitation for all".

Although the effects of climate variability are not reversible in the short to medium term, they are predictable. This is why we must work together – governments and society – to design adaptation and mitigation strategies, both at the local and global level. ■



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Maintaining security

What can be done to prevent the pressures of climate change leading to conflict?

By **Elisabeth Gilmore**, Assistant Professor, School of Public Policy, University of Maryland; **Halvard Buhaug**, Research Professor, Peace Research Institute Oslo; and **Håvard Hegre**, Dag Hammarskjöld Professor of Peace and Conflict Research, Uppsala University.

As the frequency and severity of adverse impacts associated with climate change increase, there is a critical need to better understand how, when and where climatic changes may affect the likelihood of various forms of conflict

and political violence. With the exception of a few academic pieces that find a strong direct link between variability in weather patterns and conflict, most of the academic community have concluded that these associations are highly conditional, with some studies finding no relationship.

However, climate change, either through abrupt disasters or a slower shift in weather patterns, is projected to influence many known drivers of conflict. To the extent that limiting the end-of-century global mean temperature rise to 2°C or below will reduce the effects on these known stressors,

▲ Child soldiers at a disarmament and reintegration ceremony in South Sudan. Climate change is a factor in many conflicts in the Sahel and surrounding areas

the overall likelihood of conflict should also be reduced relative to high-end climate change scenarios. In the shorter term, however, peace-building is possibly the most effective policy to reduce climate-related risks by strengthening conflict-affected communities' coping capacity and resilience to environmental change.

In the absence of reductions in greenhouse gas (GHG) emissions, unabated

climate change is projected to affect almost all aspects of human wellbeing.

Causal pathways

Four indirect causal pathways emerge as having the potential to increase the number of outbreaks as well as alter the intensity and location of conflict: loss of livelihood; migration; food insecurity; and economic shocks and underperformance.

Both extreme flooding and prolonged drought can result in loss of livelihood, especially in areas that rely on rain-fed agriculture, which could sow conditions for increased violence by lowering the economic costs of participating in violent activities. There is empirical evidence supporting this pathway in some contexts. However, these results are not uniform across all regions, suggesting that pre-existing adaptive capacity and resilience may play a moderating role.

Loss of livelihood may also be the proximate cause of migration, often referred to as 'environmental' or 'distress' migration. For example, year-upon-year drought can result in the migration of entire communities, often to urban centres. Large numbers of new migrants can put a strain on services in cities, especially where authorities are already struggling to provide for existing residents. This could

with low institutional capacity and a high incidence of poverty. While climatic variability, such as drought, is one of many factors that influence prices, sound domestic policies can buffer these effects.

Finally, economic growth is strongly correlated with a decreased likelihood of armed conflict. Climate change may affect economic growth through natural disasters as well as prolonged shifts, especially in agricultural-based economies. Ongoing underperformance can also slow societal gains, such as educational attainment, as well as undermine the stability of political regimes, which would further increase the propensity for conflict.

Indirect effects

While the unprecedented nature of climate change may limit the degree to which the recent past can provide a guide for projections of future conflict, it is clear that the effect of climate change on conflict will vary according to the affected societies' level of development.

As the impacts of climate change can hinder socioeconomic development, climate change may constitute a significant 'threat multiplier' to stability in already vulnerable societies, such that regions that are conflict-prone will face an increased likelihood of conflict.

increased GHG emissions and increased costs of mitigation policies.

As the effect of climate change on conflict is indirect, policies for mitigation and adaptation to climate change can both play a role in containing the security concerns it raises. According to the Intergovernmental Panel on Climate Change, staying below a 2°C rise in the end-of-century global mean temperature will avert the most serious impacts that would accompany extreme climate change.

This temperature target has been incorporated into the UN Framework Convention on Climate Change and was renewed in the Paris Agreement, which was accompanied by intended nationally determined contributions that outline each country's mitigation and adaptation plans.

Pathways with strong climate mitigation may reduce aggregate long-term risks of climate change on conflict; however, they may not necessarily lessen conflict risk in the absence of development and peace-building.

Further, climate mitigation policies should be sensitive to unintended consequences for development. For example, climate mitigation policies that rely on land through bioenergy and afforestation to meet mitigation goals may put pressure on agriculture and may, under some scenarios, worsen food availability.

Additionally, the 2°C target does not preclude all climate damages: adaptation will be required to offset the unavoidable risks. Measures to help regions that are negatively affected adapt to these changes will be important to minimise any political violence indirectly emerging from the adverse changes.

While the global incidence of armed conflict has declined markedly in recent decades, the last few years have seen an increase in unrest, with new and entrenched civil wars such as that in Syria. It is essential to continue to develop efforts to prevent a further reversal of the overall trend. International assistance in the form of effective development aid and peace-building assistance is likely the most effective means to simultaneously reduce climate and conflict risks. ●

Many of the factors that make countries prone to violence increase their vulnerability to climate change


then foster anti-government riots and social unrest.

Further, an increase in fragmentation along ethnic lines may present an additional stressor for unrest. On the other hand, migration may also be an adaptive measure that lessens exposure and reduces damages. More systematic research is needed on the causes and outcomes of environmental migration.

Separately, food price spikes and food insecurity are associated with instability. Riots in response to price spikes, however, are most frequently seen in countries

The indirect effects may further amplify over time and potentially lead to 'conflict trap' type dynamics, especially in poor countries, as many of the factors that make countries prone to violence increase their vulnerability to the impacts of climate change.

However, some pathways for future socioeconomic development that facilitate peace may not necessarily facilitate mitigation and adaptation to climate change. For example, while economic growth lowers the risk of armed conflict, this growth is generally associated with



"Our small, dense, interconnected world continues to stand thanks to the lessons learned by the women and men who survived the Second World War; and if we neglect or dismantle the dykes that they built against such disaster, we will place ourselves and our children in terrible danger"

ZEID RA'AD AL HUSSEIN

*UN High Commissioner for Human Rights
UNA-UK's keynote speaker, 70th anniversary celebrations
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Common purpose, shared planet

The UN climate deal was an important diplomatic victory. But its implementation, like its origins, will be fuelled by people driving change through everyday political, social and economic actions

By **Liza Henshaw**, Chief Operating Officer, Global Citizen

The Paris Agreement was negotiated by a handful of individuals. The next stage of climate action, however, will be driven by tens of millions of people across the planet who believe that by coming together they can change the world.

These 'Global Citizens' will not just sit around and wait for their leaders to solve the world's biggest problems. Global

Citizens identify as exactly that – as citizens of the world and they see themselves as collectively responsible for all human prosperity and the stewardship of our precious planet.

Global Citizens are taking, and will continue to take, small and large actions to improve the lives of all people, regardless of racial or religious lines and geographical borders. We understand to lift people out of poverty, to provide access to clean water, to provide education and gender equality

and to curb climate change, will require the actions of all of us.

This unity of purpose is a generational change. We have lost faith that politicians and policymakers will be able to change the world. We question whether they even want to improve the world for all people as we watch them devote their energies to

▲ London the day before COP21 began in Paris. Citizens of the world cannot stand back, hoping that politicians will solve the big issues – they must drive the change

► March 2016, collecting water from shallow wells dug in the river bed in Somalia's drought-afflicted Shabelle region. Eradicating poverty will require action from us all

re-election and self-preservation. It is our job, our responsibility as Global Citizens to take action to lift people out of poverty while protecting the planet and preserving its natural resources.

We never bought into the so-called climate change debate – for us the science was always settled. Global average temperatures have risen almost every year of our lives and this is due to human activity. Reliance on fossil fuels must be reduced, renewables are our future, technology is part of the solution and individual choice matters.

A life with purpose

Individual action has become the cornerstone of living a life with purpose. We all know that bringing our own shopping bags to the supermarket will not save the planet, but we do it anyway because each small action is part of a larger commitment to respecting the finite resources available. We eat less or in some cases no meat; we care if the fish on our plate is sustainably caught; we buy fairtrade goods – we actually care about our purchases.

How our goods and services are created and sourced means more to us than just the accumulation of stuff. We reject the 'keep up with the Joneses' consumerism of the 1980s and 1990s and instead value



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fuel investments. One can argue whether or not this had any impact on climate change, and whether or not this is an effective method to bring about social change. But what does seem very evident is that our actions demonstrated our power to demand – and get – a response.

tweets, I hear you and I will make good on my promises for global education, poverty alleviation and emissions reductions”, we know we have made an impact on the world’s most pressing problems.

We see these seemingly insurmountable problems as new challenges to solve. The idea that climate change is too big to tackle is ridiculous. We hold in our back pocket more technology than the first astronauts had on Apollo 11. Each day we see more solar panels, more wind turbines, more fuel-efficient cars, more energy financing, longer battery storage, and more energy-efficient products. Progress is being made in all corners of the world: complacency is the enemy; collective actions are the solution.

Our movement has generated 7.2 million actions from Global Citizens over the last four years, which are set to affect over 656 million lives. We did this one small action at a time. We have achieved much, but there is still much to do. And it is people – those Global Citizens around the world – who have the power to create this change. ●

The idea that climate change is too big to tackle is ridiculous. We hold in our back pocket more technology than the first astronauts had on Apollo 11

experiences, relationships and connections. In the ultimate gesture of eschewing the ownership culture, we created the shared economy so that everyone could have temporary access to a car, a vacation home and even a new dress for a night.

Along the way, our society started to see the impact we are having. On college campuses we were able to get huge endowment managers to divest of fossil-

We created petitions and have flooded government offices with phone calls, tweets and social media postings. Using Facebook, Instagram and Snapchat we have shown that everyone can be a publisher, that humour goes viral, and that small calls to action can garner huge followings.

Our actions have become a force to be reckoned with. When the Prime Minister of Norway or Italy says, “stop sending me

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In 1945, the creation of the UN reflected the hope for a better future. Since then, UNA-UK has enabled ordinary people to engage with that promise, by connecting people from all walks of life to the UN and influencing decision-makers to support its goals.

Today, the need for the UN has never been greater. Thanks to the organisation, millions of people now live longer, safer and healthier lives. But many have been left behind. Far too many people still die each year from violence, disasters and deprivation. Human rights violations persist in all corners of the globe, and humanitarian emergencies are set to increase. War and persecution have forced more people to flee their homes than at any other time since records began.

These problems are not confined to one country. Nor can they be tackled in isolation. The UN is the only organisation with the reach, remit and legitimacy to address the challenges we face.

Last year, the UN demonstrated its ability to forge global solutions through two landmark agreements on sustainable development and climate change. Making these commitments count – for the world's most vulnerable people and for the future of our planet – will require global cooperation and public buy-in on a scale that transcends the buzzwords of “partnerships” and “engagement”.

UNA-UK serves as a bridge between governments, the UN and the public. We lobby for joined-up thinking on peace, development and human rights, and for strong action on climate change. We work with experts and practitioners to find new ways to tackle the challenges we face. Through education and training, we equip young people to play a role in international affairs. And by demonstrating why the UN matters, we encourage people to act on their responsibilities as global citizens. Our members and supporters multiply these efforts at the local level, and our sister UNAs around the world do so internationally. Together, we form a critical mass of support for a strong, credible and effective United Nations. ●

To find out more and to join our growing movement, visit www.una.org.uk. If you are interested in working with us, please contact us on: +44 20 7766 3454 or info@una.org.uk



Front cover: Dam to defend against monsoon floods in Gaibandha, northern Bangladesh, August 2016. Bangladesh has been suffering from devastating floods since the middle of July. © KM Asad/LightRocket via Getty Images.

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