CLIMATE 2020

New leaders, new approaches

UNA-UK

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Mobilising the world

Climate change is undeniable. Climate action is unstoppable. And climate solutions provide opportunities that are unmatchable

By **António Guterres**,
Secretary-General, United Nations

I have three granddaughters – the eldest is eight. I cannot imagine the world they will inhabit decades from now. But not knowing is no excuse for not acting to ensure that we do not undermine their future.

I want my grandchildren to inherit a healthy world, free of conflict and suffering – and a healthy planet, rooted in low-carbon sustainable solutions. That is my wish for everyone, everywhere. To get there, we have our work cut out for us.

Countries and communities everywhere are facing pressures that are being exacerbated by megatrends like population growth, urbanisation, food insecurity, water scarcity, massive movements of people – the list could go on. But one overriding megatrend is at the top of that list: climate change.

Last year was once again the hottest on record. The past decade has also been the hottest on record. Every geophysical system on which we depend is being affected, from mountains to oceans, from ice caps to forests, and across all the arable lands that provide our food.

The moral imperative for action is clear. The people hit first and worst by climate change are the poor, the vulnerable and the marginalised. Women and girls will suffer as they are always the most disproportionately affected by disasters.

The nations that will face the most profound consequences are the least responsible for climate change and the least equipped to deal with it. Droughts and floods mean poverty will worsen, famines will spread and people will die. As regions become unliveable, more and more people will be forced to move from degraded lands to cities and other nations. We see this already across North Africa and the Middle East. That is why there is also a compelling security case for climate action. Around the world, military strategists view climate change as a threat to global peace and security.

We are all aware of the political turmoil and societal tensions that have been generated by the mass movement of refugees. Imagine how many people are poised to become climate-displaced when their lands become unliveable. Last year, more than 24 million people in 118 countries and territories were displaced by natural disasters. That is three times as many as were displaced by conflict.

Climate change is also a menace to jobs, to property and to business. With wildfires, floods and other extreme weather events becoming more common, the economic costs

◀ António Guterres listens to a Nigerian refugee in Cameroon. The effects of climate change on the Sahel, increasing competition for water and food, have led to displacement and conflict across the breadth of Africa

are soaring. The insurance industry raised the alarm long ago. They have been joined by many others across the business community.

Climate action is gathering momentum not just because it is a necessity but also because it presents an opportunity – to forge a peaceful and sustainable future on a healthy planet. This is why governments adopted the Paris Agreement in 2015. Today, over 160 states representing more than 80 per cent of greenhouse gas emissions have ratified the Agreement. Every month, more countries are translating their pledges into national climate action plans.

Not everyone will move at the same pace or with equal vigour. But if any government doubts the global will and need for this accord that is reason for all others to unite even further and build ever-broader coalitions. Indeed, all around the world, cities, regions, states and territories are adopting their own ambitious targets and reporting mechanisms.

Some may seek to portray the response to climate change as a fundamental threat to the economy. Yet what we are witnessing in these early years of a systemic response is the opposite: new industries, new markets and more jobs.

The real danger is not the threat to one's economy that comes from acting. It is, instead, the risk to one's economy by failing to act. The message is simple: the sustainability train has left the station. Get on board or get left behind. Those who fail to bet on the green economy will be living in a grey future. Those who embrace green technologies will set the gold standard for economic leadership in the 21st century.

In the US and China, new renewable energy jobs now outstrip those created in the oil and gas industries. Major oil producers are also seeing the future and diversifying their economies – Saudi Arabia has announced plans to install 700 megawatts of solar and wind power. And industry experts predict India's solar capacity will double this year to 18 gigawatts.

The International Energy Agency has indicated that investing in energy efficiency could increase global economic output by $18 trillion dollars – more than the outputs of the US, Canada and Mexico combined. Future spending on energy infrastructure alone could total some $37 trillion dollars.

Now if that is the case, it is crucial for such massive investments to be sustainable and climate-friendly; otherwise, we will lock ourselves into bad practices for decades to come. Given the facts about youth unemployment, air pollution and climate change, surely it is common sense to put our investments where they will generate the most savings, create the most jobs, deliver the biggest health dividends and have the most impact against global warming.

That is why thousands of private corporations, including major oil and gas companies, are taking their own action. It is why some of the world's most successful business leaders, entrepreneurs and venture capitalists plan to invest in a fund called Breakthrough Energy Ventures, led by Bill Gates, to reduce greenhouse gas emissions with clean energy technology. It is why the market for securities designed to benefit the environment is on track to double again this year. And it is why 60 per cent of the world's 500 largest asset owners are taking steps to recognise the financial risks associated with climate change.

Science is speaking to us very clearly about what is happening. Innovation is showing us very clearly what can be done. If we want to protect forests and life on land, safeguard our oceans, create massive economic opportunities, prevent even more massive losses and improve the health and well-being of people and the planet, we have one simple option staring us in the face: climate action.

As UN Secretary-General, I am committed to mobilising the world to meet this challenge.

First, I will intensify high-level political engagement to raise the bar on climate action. Second, I will rally the full capacity of the UN development system behind climate action, especially at the country-level because that is where true change will be achieved. Third, I will use the convening power of the UN to work with all major actors to accelerate the necessary energy transition and promote the greening of investments in infrastructure and transport, as well as progress on carbon pricing, as more and more politicians, policy-makers and business actors are calling for a carbon price as the green economy's missing link.

Fourth, I will work with countries to mobilise national and international resources to support mitigation, adaptation, resilience and the implementation of their national climate action plans. I will focus on strengthening resilience of the small island states and encourage developed countries to fulfil the pledges they have made – including for the Green Climate Fund.

If any government doubts the global will and need for this accord that is reason for all others to unite even further and build ever-broader coalitions

And finally, I will encourage new and strengthened partnerships for implementing the Paris Agreement through North-South, South-South and triangular cooperation. I also intend to convene a climate summit in 2019 to make sure we reach the critical first review of Paris implementation with the strong wind of a green economy at our backs.

Climate change is an unprecedented and growing threat. The arguments for action are clear. So are the immense opportunities for peace and prosperity if we act quickly and decisively. All of us – governments, businesses, consumers – will have to make changes. This may not be easy at times. But for the sake of today's and future generations, it is the path we must pursue. ●

A version of this article was delivered as a speech at New York University's Stern School of Business on 30 May 2017.

Bringing everyone on board

The gateway to a low-emission, sustainable future must open wider

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

The pathways to a future free from the worst impacts of climate change exist. A future where all can rely on a sustainable life and livelihood and where humanity's treatment of our planetary home will not bring the roof down on our heads. Yet the gateway to that future must now open wider so that many more architects and builders of this sustainable, low-emissions world – across government, economy and society – can advance together, further and faster, down an open road.

So often, peace and security now seem difficult to reach. Population growth, food and water scarcity and chaotic urbanisation seem insurmountable to the citizen on the street or in the field.

We see growing threats and real impacts from climate change in both the developed and developing worlds.

Yet it is also a point in time when the nations of the world, most clearly through the Paris Agreement and the 2030 Agenda for Sustainable Development, have agreed that a sustainable, resilient and secure way of life is an essential and common goal.

This represents no less than a bold statement of determination by the international community to transform the way we generate power and produce and consume food and goods, and to invest in clean energy, manufacturing and farming which no longer pump out the greenhouse gases that create global warming and the pollution which destroys environments and public well-being.

It is a unique moment of optimism. It is also a moment when only the full participation, action and common understanding by all – governments, states, cities, business, investors and citizens – will achieve the future we want. So it is important to look concretely at why and how the Paris Agreement can work and how it dovetails across the 2030 Agenda.

Global strategy

The Paris Agreement is a global strategy from now into the longer term, defined by three key aims: limiting the average global temperature rise to well below 2ºC above pre-industrial levels and to make efforts to limit it to 1.5ºC; fostering and supporting resilient and sustainable low-emissions development; and ensuring global investment flows support these goals.

These three aims provide a clear, long-term direction of travel to all these state and non-state sectors because they link economic activity, emissions and the impacts of climate change.

The temperature goal reflects a vision of the type of future society we want, precisely because it does compel us to rethink the way we produce, use and consume energy, how we manufacture and build and how we manage our land and ecosystems.

To this end, policies need to be set in place now, technologies need to be developed, matured, commercialised and deployed at scale, and practices and behaviours of economic actors need to move ever faster towards low-emission and sustainable business and investment.

It is most important to underline, therefore, that the Paris Agreement includes an effective engine to raise global climate action over time, and in time to meet the temperature goal.

The Agreement both invites governments to communicate long-term, low-emission development strategies and also asks each country to submit national climate plans (known as NDCs) which they will update every five years, or more often as desired, towards increasingly higher ambition.

These are mutually reinforcing, because the long-term strategy provides a framework and direction to the subsequent national plans and, at the same time, the increasingly ambitious national plans deliver the results to achieve the long-term strategy.

The global response has been stunning. As of late-August, the UN Climate Change secretariat had already received 154 national climate plans from the 197 Parties to the agreement, with more expected all the time.

> ***We have unprecedented consensus on the path forward... and unprecedented political will to move forward together***

Meanwhile, action on climate change and action on sustainability also become mutually supporting goals.

Climate change is Goal 13 of the Sustainable Development Goals (SDGs), but as we look across all of the goals, it is quite evident that climate action contributes to the success of all 17 SDGs and vice-versa.

Look at SDG 1 to end poverty, SDG 8 related to decent work and economic opportunity and SDG 3 to improve health and well-being. For example, cheap, clean renewable energy in so many places that had no access or relied on expensive and dirty fossil fuels immediately improves health, provides new jobs and creates more self-sufficient local economies, boosting communities' economic

© Andres Martinez Casares/Reuters

◀ Repairing hurricane damage in Jérémie, Haiti. The most deprived are also the most threatened by climate change. Hence, climate action will contribute to the success of all 17 SDGs and vice versa

independence and empowering them to seek further solutions in other forms of climate action.

Renewable energy, meanwhile, is the critical path to affordable and clean energy for all – SDG 7. Newly installed renewable power capacity continues to set new records, most recently rising nine per cent in 2016 over 2015, according to the REN21 Network's latest report.

In fact, renewables are becoming central to the sustainable development plans of the developing world. China remains the single largest developer, but a solar revolution is taking off in India and 48 developing countries are now committed to futures of 100 per cent renewable energy.

Likewise, without goals such as quality education and gender equality – SDGs 4 and 5 – we would not develop the full capacity of human effort and ingenuity to make Paris and the 2030 Agenda a success.

UN Women has shown that women and children suffer the impacts of climate disasters in poorer countries at a rate four to five times that of men. The International Renewable Energy Agency reports that women account for no more than 25 per cent of the workforce in the modern renewable energy sector.

Yet, for example, in most developing countries, women are primary household energy managers and key actors in the food system and, once fully empowered, are powerful actors in climate action, including the transition to sustainable energy and climate-resilient agriculture.

In addition, it is important to note that the goals on healthy land and water ecosystems are essential to maintain the future balance of emissions.

Working together

With this understanding of the interconnected nature of all the SDGs and the climate change goals laid out in Paris, it becomes clearer not only why but also how all government, civic and business sectors can and must act together. And this is happening.

For example, from Nigeria's Delta and Ogun states to California, from Gujarat to Shenzhen to São Paulo, governors are building a host of climate-smart policies to cut emissions and protect their economies and societies from climate impacts.

From Chicago to Jakarta, from Durban to Oslo, mayors are leading the way, driven by the knowledge that cities account for over 70 per cent of global CO_2 emissions and 90 per cent of the world's urban areas situated on coastlines are at high risk from increasing storms and sea-level rise.

And from renewables technology to electric vehicles, from innovative insurance for the poorest and most vulnerable, to record green bonds issuance by major companies such as Apple and Goldman Sachs, the private sector is voluntarily following and sometimes even leading the objectives of these multilateral agreements.

We have, therefore, unprecedented agreement to move towards resilient and sustainable development powered by low-emission energy. We have unprecedented consensus on the path forward. And we have unprecedented political will to move forward together.

We have an agreed and robust foundation for action – in the United Nations and multilateral institutions, and in each country's national contribution to the Paris Agreement. But the gateway must open wider and we who are inspired by this must inspire others to understand and join this journey towards the only realistic future we have. ●

New winners, new losers?

As we push for the huge transitions that climate change requires, we must ensure that arguments of solidarity and cooperation prevail over those of self-interest and competition

By **Natalie Samarasinghe**, Executive Director, and **Fred Carver**, Head of Policy, United Nations Association – UK

It took eight years for the Kyoto Protocol to enter into force in 2005. The exclusion of major developing countries from binding emissions targets, followed by the US refusal to ratify it and later Canada's withdrawal, led many to doubt the efficacy of international climate treaties.

Fast forward a decade and the 2015 Paris Agreement on climate change seems to be gaining momentum. In this publication last year, we made the case that while the Agreement is far from perfect, lacking (for now at least) the ambition and robustness that we urgently need, it is nonetheless a crucial milestone, cementing the global consensus on climate change and committing – for the first time – all countries to action.

The Agreement took less than a year to enter into force. At the time of writing, it had 197 parties: every UN member state except Syria and Nicaragua, plus Palestine, Niue and the Cook Islands, as well as the European Union. 160 of them had ratified it, representing well over 80 per cent of the world's emissions. Over 150 have submitted national climate plans. There has also been movement on strengthening monitoring and transparency, with the first global stocktake due next year, alongside the adoption of a 'rulebook'.

Increased resolve

Perhaps most encouragingly, despite or – as some of our contributors argue – because of President Trump's decision to withdraw from it, the Agreement continues to be central to the climate conversation. Indeed, it appears to have increased resolve. China and India were among the countries to re-state their commitment to Paris in response. On the basis of the myriad actions announced by American states, cities, businesses, investors, tech firms and communities, the United States may even be on course to exceed the targets envisaged by Mr Trump's predecessor, a key actor in securing the Agreement.

Critics of Mr Trump's decision have – rightly – pointed out that shying away from climate action will harm the US economy and damage the country's reputation and influence. Many have argued that by choosing to marginalise its role in the defining issue of our time, the US is hastening the end of the American century. UNA-UK too commented at the time that in diplomatic terms the US will be a smaller country, and China a larger one as a consequence of the withdrawal.

As many of our contributors note, climate action is accentuating and accelerating the shift in global power relations as the centre of gravity continues to move eastwards, southwards and downwards. Eastwards towards China, India and a slew of middle-income states that are finding newer, greener ways to pursue development. Southwards towards Africa where countries such as Ethiopia, Ghana and Morocco are finding ways to leapfrog the carbon-dependent West and move straight to a post-carbon society.

Downwards as the power of civil society, the power of the private sector, and the power of individuals grows, to the point where government is no longer leading the fight to prevent climate change, but playing catch-up to non-state actors who have more rapidly embraced the cultural and business opportunities presented by the transition to a zero-carbon economy.

Solidarity and cooperation

Cause then, for optimism, but also for realism and caution. Realism because last

◀ Using a makeshift raft to get to safety in Kurigram District, Bangladesh. Exceptionally heavy monsoon rains in the country have caused extensive flooding, affecting an estimated 3.9 million people

Perhaps most important will be recognising the need for solidarity in protecting the most vulnerable countries and people from the fall-out from climate change

year, data from NASA and several climate institutions showed that the target of limiting global temperature rise to 1.5°C is probably no longer achievable. We also stayed above the symbolic red line of 400ppm CO_2 for the entire duration of 2016, and will likely stay above it for, at very least, the lifetimes of our readers. This puts us past the point of no return. It remains to be seen whether prompt action can limit the increase in global averages to within two degrees, and how well humanity will adapt to a two-degree warmer world. And caution because our response risks dividing the world into climate 'winners' and 'losers'. Our prevailing global system has left too many behind – and it is they who are already disproportionately affected by climate change.

Now we risk creating more categories of climate losers in our drive to increase ambition. By dialling up the self-interest argument for climate action – increased influence, economic gain and the competitive edge for countries, companies and communities – we may end up undermining what is most needed right now: solidarity and cooperation.

This means recognising the continued importance of the US and EU – key emitters, historically and going forward, and key actors in terms of innovation and finance – while embracing the need for a new, more equitable global system that sees African, Asian and Latin American countries in leading roles. It means recognising the continued utility of state-based action and agreements, even as a plethora of other actors become the lead implementers.

Perhaps most important – and challenging – will be recognising the need for solidarity in protecting the most vulnerable countries and people from the fall-out from climate change, especially more, and more intensive, conflicts, humanitarian disasters and refugee flows.

Which parts of the world are habitable and prosperous will change dramatically over the next decades. Ensuring the safe and orderly movement of many millions while maintaining their dignity and harnessing the opportunities that their arrival will bring will require the adoption of more modern and fluid definitions of identity and nationality. It will also require investment now – political and financial – in our international system.

If we don't, we will all be losers. That is UNA-UK's constant refrain to its partners in the UK and beyond. ●

The transition to a clean economy gains momentum

In a fluid political landscape, who is best placed to lead climate change action on the ground?

© Kevin Frayer/Getty Images

By **Emily Farnworth**, Head of Climate Change, World Economic Forum

Climate change has been described as the biggest risk to humanity. So what are we doing about it? The answer is: quite a lot, but not enough.

Even five years ago it would be impossible to imagine headlines like 'Exxon supports a global deal to address climate change', 'Investors call for low-carbon strategies to minimise financial exposure to climate risk' or 'China steps up to lead the global fight against climate change'.

But these headlines are exactly what have been appearing over the last few months. They are signs that key decision-makers are starting to understand the impact climate change will have on the stability of the global economy and the health of our society.

Access to electricity has been a driving factor in unlocking economic growth for many countries. And it has been fuelled by oil and coal – a significant factor in contributing to climate change. But now renewable energy generation has come of age and is competing with fossil fuels in many parts of the world. As storage and smart-grid technologies develop, the capability of renewables to compete – at any time of day or night, no matter what the load – will not be far away.

The future of transportation is also transitioning towards electrification. Solutions for electric road, rail, marine and even aviation transport are being developed at pace. This is a positive trend for climate change – provided that policy and infrastructure development can ensure electricity is being generated from clean sources.

As renewables offer the cheapest source of new power generation in many countries around the world, this should happen naturally. However, with the growth of electricity demand in fast-growing economies like China, India and many African countries, it is critical that the long-term impacts of power generation choices are considered, even when they may not be the cheapest, in the race to meet demand.

Investment decisions

One thing that might help considerably in the choice of new power generation is investor concern about the long-term viability of assets.

There is a growing awareness of the financial risks associated with using fossil fuels. The Financial Stability Board's Task Force on Climate-related Financial Disclosures recently released their recommendations – backed by investors, insurance companies and major corporations – that outline the need for better understanding of climate risk when making investment decisions.

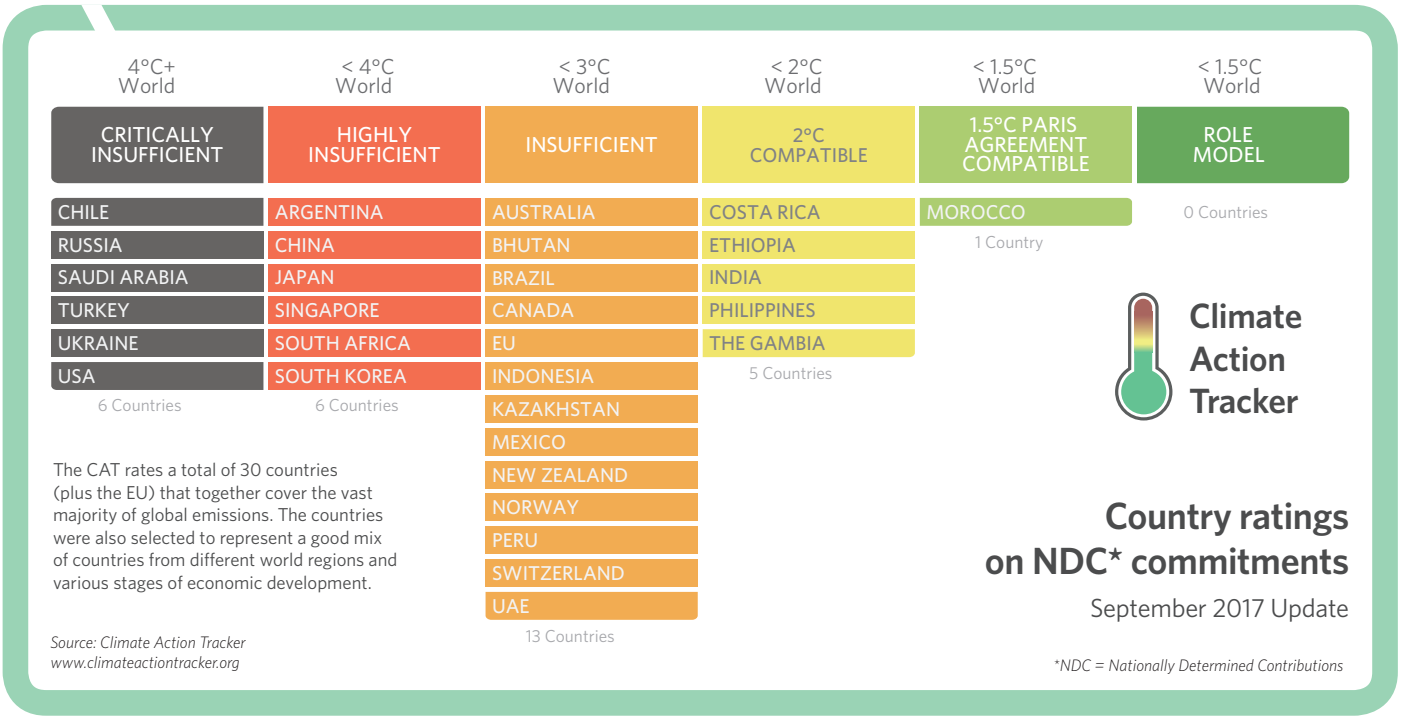
It is likely to drive a preference for clean energy and more resilient infrastructure investment, particularly in relation to new infrastructure developments in emerging economies.

This is also the message coming from China as part of their ambitious plans for the $900 billion infrastructure investment commitment behind their Belt and Road initiative. It is likely the future for curbing carbon emissions will be won or lost through the decisions in infrastructure investment. Lack of clarity around the

With the growth of electricity demand in fast-growing economies like China, India and many African countries, it is critical that the long-term impacts of power generation choices are considered in the race to meet demand

◀ An innovative approach to renewable power: a large floating solar farm under construction on a lake formed by a collapsed coal mine in Anhui province, China

Also in this section



true cost of energy projects is still masked by misunderstanding of energy incentives – whether they are for fossil fuels or renewables.

Additional complications of bringing renewables into grids at large scale still need to be addressed to fast track this solution. It will require a combination of digital infrastructure for demand-side management of power requirements alongside policy changes and the development of physical infrastructure capacity to make it work.

But, perhaps just as importantly, it will take changes in mindset. We need to recognise that new ways of managing electricity demand, use and storage are changing at an increased pace. Solutions not feasible just a year ago are becoming economically and technically viable.

Decentralised energy production and use are offering new ways for individuals, companies and communities to find local solutions that don't rely on traditional options. They offer 'bottom-up' approaches to delivering access to energy for those that don't have reliable grid connections.

Better micro-grid solutions and more energy-efficient technologies like LED lighting are also providing access to energy for many rural communities that have previously relied on kerosene. These options are not only safer and cleaner. They are often cheaper, too.

Price signals on carbon are similarly helping to drive investment decisions for clean energy and improved energy efficiency. China will launch a national carbon market at the end of the year, which will help drive emission cuts in some of the country's most carbon-intensive sectors while sending a clear signal to the rest of the world that China intends to continue its emissions-reduction push.

The country's new environmental regulations, set to come into force next year, will restrict a number of environmental pollutants, making clean energy options more appealing than coal.

Speed of transition

In addition, the Paris Agreement has helped to stimulate a groundswell of other actors driving change. Cities, states and regions are setting aggressive goals for carbon cuts, allowing for more localised solutions to deliver on pathways for reducing emissions. At the same time, these initiatives are developing more healthy and sustainable places for people to live and work.

A growing number of businesses are committed to reducing emissions across their operations and value chains. This is creating a market for energy-efficient technologies and renewable energy irrespective of local policies.

The voice of all these non-state actors is a welcome influence in the wake of the US President's decision to pull the country out of the Paris Agreement. It sends a signal to all national governments that the momentum behind the low-carbon transition is sufficient to continue to address climate change, irrespective of the decisions at the top of national governments.

This community will be keeping a close watch and it is inevitable the shift will continue from the climate action leaders that grow in numbers by the day.

The question is not whether the world will move to a low-carbon future. The question is how quickly the transition can occur to ensure those most vulnerable can be protected from the worst effects of climate change. ●

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Can China lead the way?

Infamous for its smog-filled cities and polluted groundwater, China is steadily acquiring a new reputation as a leader in green technology. What can China offer the world in the fight against climate change?

By **Jiang Kejun**, Director, and **Gao Xiang**, Associate Professor, Energy Research Institute, National Development and Reform Commission, China

In the early 1990s, as countries started to talk about international collaboration on climate change action, China's voice was weak and negative. China saw climate change as a political debate rather than a real global environmental problem. But with the involvement of experts from China in international research activities, the discussion about climate change within the Chinese government has since made significant strides.

Following the announcement in 2007 by then president Hu Jintao that China would make low-carbon economic development a national strategy, there has been a significant shift in the country's climate-change policymaking. China has been quick to establish clear policy signals promoting low-carbon development.

For the first time, China made a quantitative commitment to cut greenhouse gas emissions, in the Copenhagen Agreement in 2009. A year later, China launched a low-carbon city programme involving 13 pilot cities and provinces. In 2011, it designed and launched a pilot emissions trading system (ETS) in seven cities and provinces, the largest ETS in the world.

Many national policies were rewritten to factor in new targets on energy conservation, renewable energy development, urban planning, public consumption and behavioural change. Whereas climate change action in China pre-2005 was driven by international negotiations, since then it has been domestic policy leading the way.

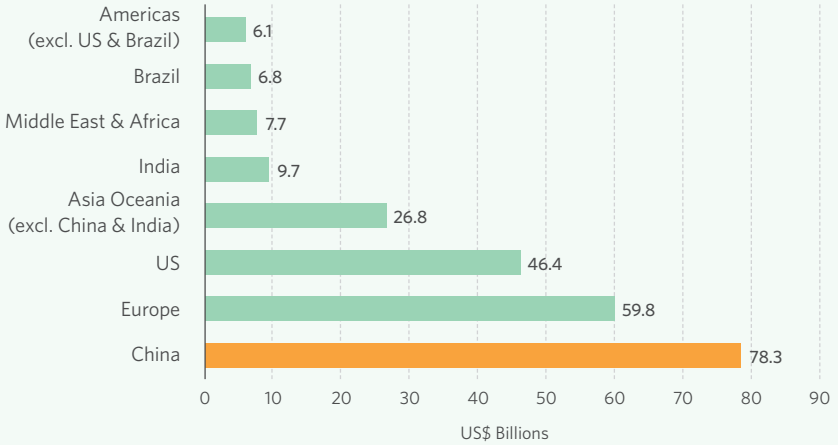
Over recent years, China has enjoyed rapid economic growth. Back in 2005, GDP stood at RMB 18.7 trillion ($2.8 trillion). By 2010 it had more than doubled to RMB 40.3 trillion ($6.03 trillion), and in 2016 stood at RMB 75 trillion ($11.2 trillion).

Today, it is low-carbon technology sectors that are driving the country's economic development. China's investment in and commitment to low-carbon technologies has helped bring costs down, benefiting users and producers around the world. In fact, according to the Integrated Energy and Environment Policy Assessment Model for China modeling team, China is now the world leader in most low-carbon technologies.

China has also suffered serious and widely publicised problems of poor air quality and related environmental damage. To improve air quality, China's government launched a national action plan in 2012. Most measures to fight air pollution are consistent with a low-carbon economy, such as capping demand for coal or developing renewable energy.

In 2016, China was responsible for more than 40 per cent of the newly installed capacity for renewable energy in the world. Analysis shows that China should be able to improve on its commitments under the Paris Agreement, by peaking on CO_2 emissions much earlier than 2030. By peaking on its coal consumption in 2014, China has contributed to limit global CO_2 emissions and help the world on its way towards meeting the 2°C target.

New investments in renewables 2016



Source: UN Environment, Bloomberg New Energy Finance

◀ **Rizhao, China. Poor air quality, which is responsible for over 700,000 deaths in China annually, is one of the factors behind the strong public support for climate action**

Socio-economic development

China now realises that it cannot achieve socio-economic development without also protecting the environment. "Green hills and clean waters are gold and silver mountains" is becoming mainstream philosophy in China's economic development. China is willing to put much more effort into improving environmental quality. Low-carbon technology is one of the key components of that effort.

With the onset of the 'new normal' of more moderate economic expansion, investment growth in traditional sectors will necessarily slow or even reverse. China will, of course, still need new investment. But that investment must be directed towards low-carbon technology-related sectors.

The public is increasingly concerned about the environment, and wants to see improvements. It is believed that global environmental issues may soon become the main concern of the Chinese public, overtaking worries about corruption. For decades, people's lives have been seriously impacted by worsening air quality, water pollution and other environmental problems. Studies show that more than 700,000 people in China die each year due to air pollution alone. Improving the environment could significantly boost people's quality of life. A healthy climate is also our golden mountain.

Leading by example

As a developing country, China's experience in transitioning to a low-carbon economy will hopefully provide a blueprint for many other developing countries to emulate. China has made comprehensive low-carbon policies, taken measures in energy conservation, and invested in renewable energy development, electric car promotion, green transport and environmental-friendly urban design and planning.

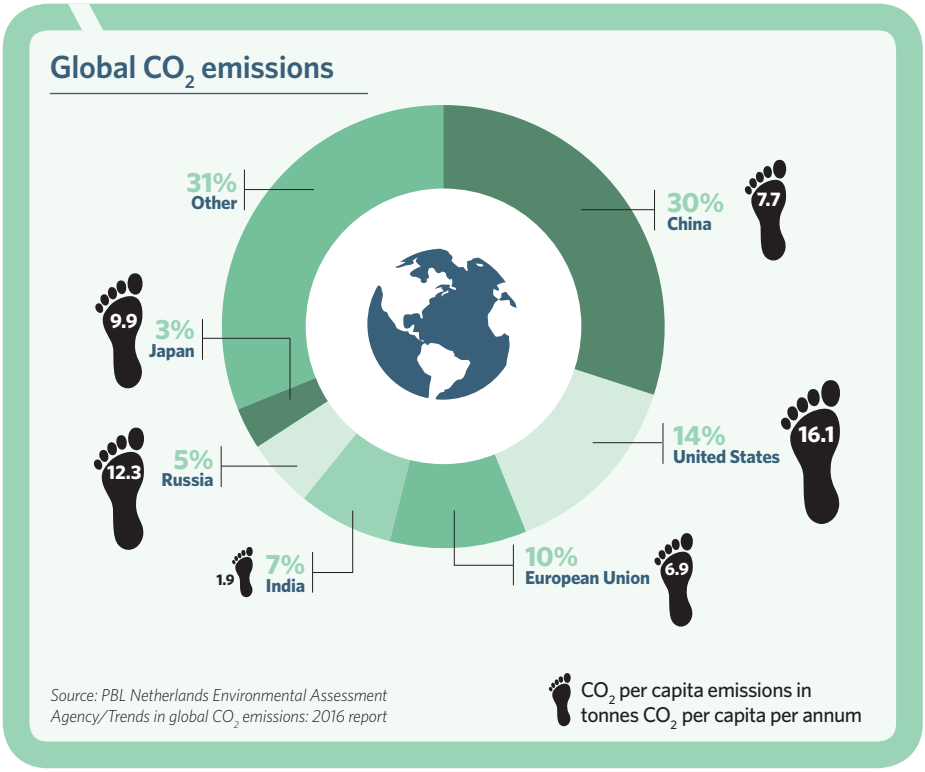
China has rich experience in designing and using subsidies, energy and environmental standards, emission charges and the ETS, as well as in generating public engagement. Its development of climate change-related policymaking over the last two decades, and its involvement in international collaboration, offers a clear template for other developing countries to follow. Over the last two decades, China learned almost everything on energy and climate change-related policy from developed countries. Likewise, developing countries that share similar circumstances could advise and share knowledge with each other as they make the transition to a low-carbon economy – though hopefully this won't take 20 years.

China's technological lead on low-carbon technologies could also well be utilised in other countries. With more low-carbon technologies now being manufactured, not only does the cost of the technology decrease – so too does the cost of the knowhow of utilising the technology in local conditions.

The country's momentum in transitioning to a low-carbon economy owes a lot to the strategy being linked with social development issues: promoting local economies, eliminating poverty, providing better access to energy, protecting biodiversity, increasing social inclusion, promoting gender equality, promoting the Sustainable Development Goals, and so on. China's good (and bad) practices in these areas would make good case studies for other countries to look at.

China is also leading in areas such as renewable and nuclear energy development, electric cars, carbon capture and storage, shared bikes, and urban design and planning. Here, there are opportunities for China to work with developed countries – particularly as there are strong interdependencies between many of these countries and China.

China's investment in research and development is increasing rapidly and is now second in the world. Historically, China's researchers benefited greatly by joining research programmes in other countries. In the future, China could fund researchers from other countries – especially developing nations – to take part in its own climate change-related research. ●



China's technological lead on low-carbon technologies could well be utilised in other countries

Prince Sultan Bin Abdulaziz
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Invitation for Nominations 8th Award (2018)

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Creativity Prize

Rita Colwell (University of Maryland) & Shafiqul Islam (Tufts University)
for using chlorophyll information from satellite data to predict cholera outbreaks at least three to six months in advance.


Dr. Rita Colwell


Dr. Shafiqul Islam

Creativity Prize

Peter J. Webster (Georgia Institute of Technology)
for using data on ocean-atmosphere interactions on monsoon strength to provide up to two-week lead time forecasts of monsoonal floods for highly populated coastal regions.


Dr. Peter J. Webster

Surface Water Prize

Gary Parker (University of Illinois Urbana-Champaign)
for contributing to our understanding of meandering rivers, the shapes they take, and how they change themselves and their floodplains as they migrate.


Dr. Gary Parker

Groundwater Prize

Tissa H. Illangasekare (Colorado School of Mines)
for improving the fundamental understanding of fluid flow and chemical transport in porous media, leading to the reliable prediction of the long-term fate of pollutants in groundwater systems.


Dr. Tissa H. Illangasekare

Alternative Water Resources Prize

Rong Wang & Anthony G. Fane (Nanyang Technological University, Singapore)
for developing hollow fibre membranes that combine forward and reverse osmosis with a previously undiscovered positively charged nanofiltration-like selective layer, greatly reducing the effects of scaling and flux losses.


Dr. R. Wang Dr. A. G. Fane

Water Management & Protection Prize

Daniel P. Loucks (Cornell University)
for the development and implementation of systems tools that provide an effective, dynamic, and successful framework for addressing practical water resources management problems worldwide.


Dr. Daniel P. Loucks

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EU – still a force for progress?

In a time of diplomatic dysfunction, can Europe advance climate action by example and collaboration?

By **Manuela Mattheß**, Junior Expert International Energy and Climate Policy, Friedrich-Ebert-Stiftung (FES)

The Paris Agreement can without a doubt be considered a historic breakthrough in international climate policy. For the first time, all member states of the United Nations Framework Convention on Climate Change (UNFCCC) agreed on joint efforts to tackle dangerous climate change, including limiting global warming to well below 2ºC (or even 1.5ºC). This will require – among other things - carbon neutrality as fast as possible.

After the historic success of Paris it became clear, however, that implementing the Paris Agreement would not be an easy task, as challenges such as raising ambition in national climate protection plans or addressing transparency and accountability remain. In addition, there have been severe changes within the global political framework that might pose a threat to a successful implementation process. The withdrawal of the US from the Paris Agreement, as announced on 1 June, will likely create a vacuum that needs to be filled, in terms of ambition and finances but also in terms of leadership.

Although, as an immediate response, many state and non-state actors publicly committed to implementing the Paris Agreement, it is generally viewed that there remains a need for global leadership to advance ambitious international climate policy efforts. If the European Union can manage to bridge the gap between international promises and domestic reality, and if it is able to establish strong and broad alliances with other climate champions, the prospect for its leadership are very high.

The EU has increasingly established itself as an international leader in global environmental governance in general, including, for example, with respect to the protection of the ozone layer and biodiversity. The EU's contribution to the Paris Agreement – the Nationally Determined Contributions (NDCs) of its member states – was submitted very early in the process and can be considered ambitious in comparison to other major players.

It includes a greenhouse gas (GHG) emission reduction of at least 40 per cent by 2030 in comparison to the level from 1990. This is in conjunction with its 2030 climate and energy framework, which incorporates increasing the share of renewable energy as well as increasing energy efficiency. However, the EU received a 'medium' rating on its NDC from the NGO Climate Action Tracker, meaning that its outlined efforts are not consistent with the temperature goal anchored in the Paris Agreement.

Even though the EU has already decreased its emissions by 24 per cent since 1990, more action is needed, particularly in terms of fulfilling its long-term 2050 emissions reduction goal of 80-95 per cent reduction. One of the important things to do is to reform the Emissions Trading Scheme (ETS), which can be seen as an essential instrument of EU climate policy but has been lacking efficiency in the past. Looking at mitigation efforts, it becomes very clear that the EU needs to close the existing gap in credibility between what it has been advocating (a sustainable and low-carbon future) and what it can currently reach.

A leadership role

In terms of resources and capacities the EU has the potential to play a leadership role. According to the World Economic Forum, its current member states Germany, the UK and France are among the world's biggest economies, supporting the union's significant economic potential. According to a statistic by the Green Climate Fund in July 2017, most of the member states of the EU have put forward pledges to provide climate finance to assist the countries most vulnerable to the disastrous effects of climate change.

Even though the EU has been increasingly challenged by centrifugal forces and the seemingly diverging interests of its member states, some of its leading economies (such as Germany and France) are willing to invest money and capacities to raise ambition with respect to climate action worldwide, underlining the fact that tackling climate change remains an important topic within the union.

Historically speaking, the European Union has been a driving force within the UN Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, using 'soft leadership' and 'leadership by example' as its strategy. Although some involvements have not succeeded, the EU can still be considered a master at coalition building.

In 2011 it supported the launch of the Durban Platform, which – among other things – helped pave the way towards Paris. The EU was very keen on bridging the gaps between different interests, functioning as an 'honest broker' that supported successful alliance building and convergence.

The Paris Climate Summit – which the EU helped to prepare in terms of content as well as with diplomatic efforts – was a big success for the EU. The EU strongly supported important aspects, such as the inclusion of mitigation commitments by all countries and a review mechanism that would allow increases in ambition.

The High Ambition Coalition, headed by the Marshall Islands and the EU – and including the US, developing countries and small island states – can be considered one of the EU's diplomatic masterpieces

▲ German Chancellor Angela Merkel welcoming French President Emmanuel Macron at the G20 summit in Hamburg, Germany. Germany and France have made it a priority to assist climate action worldwide

in international climate negotiations – building bridges and coalitions between diverging interests. This alliance proved very important in creating pressure to close an ambitious deal. The EU has also been taking an ambitious stand in G7 negotiations, raising the importance of fighting climate change and trying to intensify discussions on the necessity of low-carbon development pathways. Despite setbacks, it has utilised its diplomatic knowhow to advance international climate policy. Strong and resilient alliance building will be indispensable in the coming years of implementing the Paris Agreement goals, and it is hard to imagine building diplomatic bridges of interests without the EU at the frontline.

Challenges ahead

There are a number of challenges, however, that continue to threaten the EU's position as a climate champion. Apart from the financial crisis, the Brexit negotiations and the massive task of refugee integration that will tie up resources, capacities and attention, the biggest challenge might be to ensure EU unity in the face of centrifugal and polarising forces. Those tendencies make it much harder to find majorities for ambitious climate action. It is therefore very important for the EU to find solutions to the diverging interests of its member states in energy and climate policy. Establishing better mechanisms to support policy coherence and paying attention to the burden-sharing principle could be important steps to take in order to bring those on board that tend to block climate ambition.

The European Union and all stakeholders in the international climate power game will be confronted with unpredictable political and economic dynamics (both internally and externally). The EU definitely has the means, the capacities and the diplomatic knowhow to be a leader in climate politics, but it has to raise ambition in its own climate goals. Only this way will it be able to continue working with a 'leadership by example' strategy that has been successful in the past.

Additionally, the EU should focus on being an initiator of and a mediator in ambitious, broad and strong climate alliances that engage themselves in implementing the Paris Agreement as well as the Sustainable Development Goals. Non-state actors such as civil society organisations, trade unions, cities and communities should be as much part of those coalitions of climate champions as states and businesses.

Forming alliances will also be important in strengthening multilateralism in a world that shows strong tendencies towards dangerous isolationism instead of increased cooperation. In this sense the world could use not one climate leader, but numerous ones that work together.

The EU has a strong talent for smart coalition building that should be used to establish bilateral and multilateral arrangements with other climate ambitious countries such as China. Even though the EU-China summit in June did not end with a joint agreement, it was an important first step in the right direction. The EU should also continue to expand climate cooperation with developing countries, which would raise its reputation and maintain its role as an honest broker. It also needs to increase its mitigation goals, more so as it can afford to move beyond its 2030 targets in terms of capacities and finances. This would be an important sign demonstrating to the world that the European Union is indeed a global climate champion. ●

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Investing in climate

The financial community is often criticised for seeking quick returns. How do we encourage private finance for climate action when the pay-off may be years – even decades – away?

By **Fiona Reynolds**, Managing Director, Principles for Responsible Investment (PRI)

According to the World Economic Forum *Global Risks Report 2017*, climate change is set to rank alongside income inequality and societal polarisation as a top trend for 2017. This year's report also noted that for the first time, all five environmental risks – which include extreme weather events, failure of climate change mitigation and adaptation, and water crises – feature among the most likely and most serious risks.

At the PRI, our signatories have indicated that climate is their most pressing concern in terms of posing material risks to their investment. Climate change is a cornerstone of our recently launched blueprint for responsible investment for the next 10 years. We plan to work with our investor base to ensure they keep engaging companies on this issue.

Climate change is just one of the many environmental, social and governance (ESG) issues that the PRI addresses. In just over the 10 years that the PRI has been in existence, we have seen consideration of ESG factors steadily move up the investor and corporate agenda as a way to realise better returns over the long term.

This mindset started to take shape post-financial crisis, when many investors began to question existing investment practices. The failure of traditional business

◀ Statoil's gas processing and CO_2 removal platform, Sleipner T, near Stavanger, Norway. Norway's Oil Fund, the national pension fund financed from surplus petroleum income, is a strong proponent of divestment from fossil-fuel assets

analysis to take into account a company's governance, compliance, basic corporate culture and leadership has produced a catalogue of poor business decisions. One has only to look at the recent example of Volkswagen to remind us that financial information in isolation might look appealing but it could be masking a host of unsavoury activities such as toxic waste dumping, use of child labour or overly aggressive tax practices.

We've also seen a confluence of factors, including high-profile policy-makers who are willing to publicly address the stark realities around issues such as climate change and the risks this presents for investors. For example, Mark Carney, Governor of the Bank of England, has referred to the "catastrophic risks" around climate change.

Research underway

Though data showing the correlation between ESG factors and returns has in the past been thin on the ground, research on this topic is finally catching up. Numerous studies from the University of Hamburg/Deutsche Asset Management, Oxford University/Arabesque Asset Management, Harvard, MSCI and others have highlighted how looking at ESG factors can improve returns over the long term.

According to research firm Cambridge Associates, over the past three years the MSCI Emerging Markets ESG Index has outperformed its parent index (the MSCI Emerging Markets Index) by 12 per cent on a total US dollar-based return. The company's analysts report that over half of this outperformance was based solely on ESG factors.

These factors comprise a wide variety of inputs, including carbon emissions, employee health and safety, and product sourcing.

Investors have a significant role when it comes to engaging with companies on ESG issues, particularly asset owners who are at the top of the investment chain. Many pension funds, for example, have for some time been looking at ESG across their own investments. As the Canadian Pension Plan stated in its 2014 annual report: "We consider responsible investing simply as intelligent long-term investing".

As the world moves inexorably towards a 2°C rise in global temperature, investors are understandably concerned about the risk of stranded assets at companies that derive the bulk of their income from energy production that utilises fossil fuels. Many companies faced with this risk are moving radically to alter their business models.

Perhaps one of the starkest indications of the growth of ESG thinking among the global investment community is the ongoing divestment from fossil-fuel assets. Major asset managers such as Norway's Oil Fund and France's AXA have engaged over the past few years in divestment from fossil-fuel assets.

Many other industry players are looking to follow suit. At the PRI, many of our signatories choose engagement over divestment because they feel that you can't influence behaviour unless you have a 'seat at the table'. However, for some, when engagement efforts fail, divestment may be the only option.

Governments and regulators are also taking heed of how ESG issues can build long-term value. Green finance initiatives – taking root from London to Beijing – are proving attractive as a way to take advantage of the falling costs of renewable energy and to reinvigorate economies through greater job creation.

With over 150 countries now committed to the Paris Agreement, and pledging to dramatically reduce their carbon footprint – mostly through the development of low-carbon energy and transportation infrastructure – it is vital that future infrastructure projects are both sustainable and climate resilient. Both the G20 and the Organisation for Economic Co-operation and Development are exploring how to direct more institutional investment into infrastructure, which can present an attractive opportunity for long-term capital.

Emerging markets in particular will require substantial investment in new green infrastructure to mitigate and adapt to climate change and support development objectives.

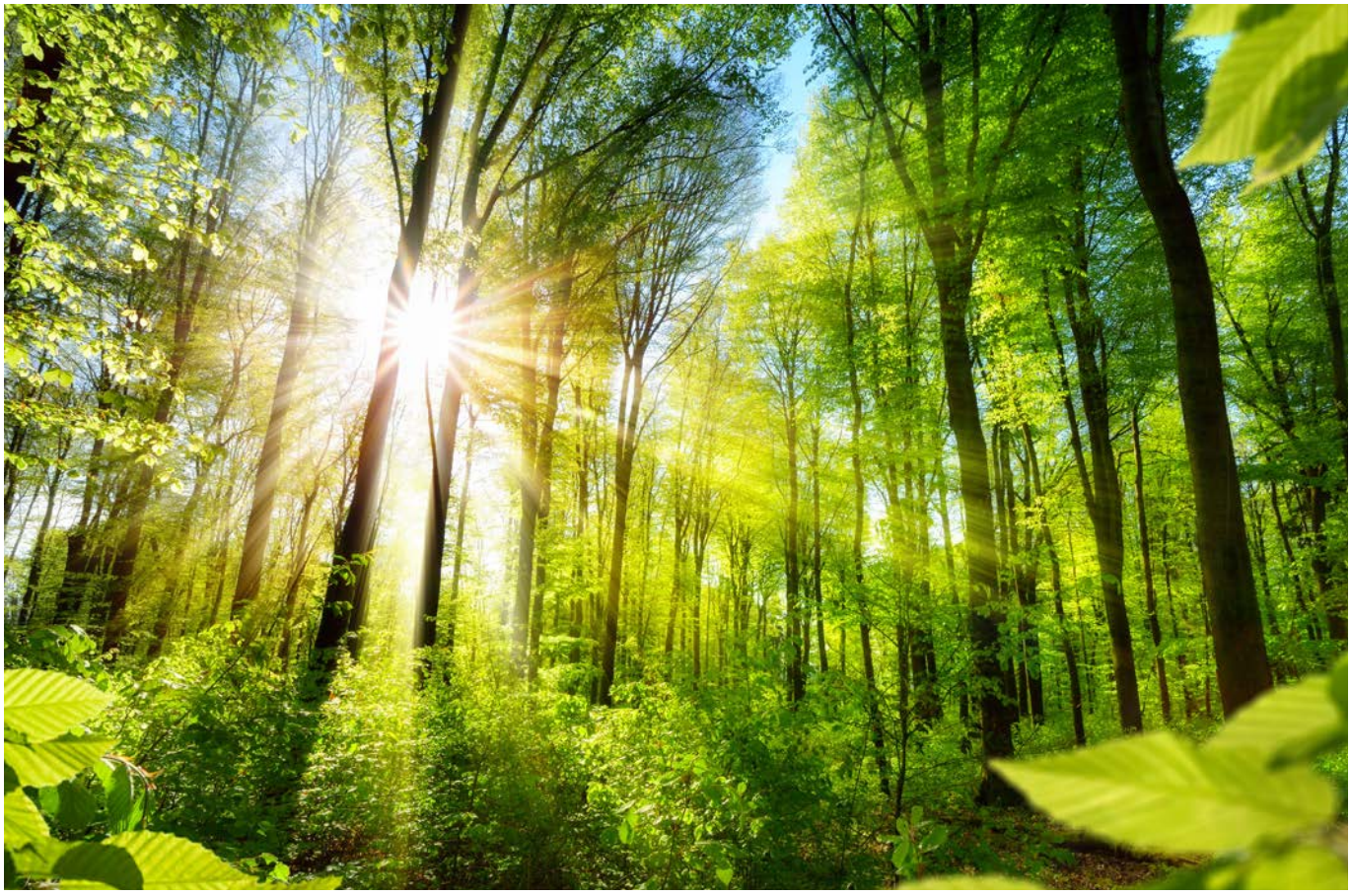
The new normal

The PRI recently developed a new infrastructure workstream, which will focus mainly on private debt and equity investments in infrastructure, both directly and via funds. It will also ensure consideration of material ESG factors in investment decision-making, and provide guidance on integrating responsible investment throughout the investment process, from origination to exit.

Perhaps one of the starkest indications of the growth of ESG thinking among the global investment community is the ongoing divestment from fossil-fuel assets

The commercial reality is that investors adapting to the 'new normal' of a low/no return environment are seeking opportunities for higher yields. Long-term investors with lots of patient capital need a home for those funds – infrastructure and long-term sustainable investing are like a marriage made in heaven.

While the US's decision to pull out of the Paris Agreement was disappointing, activity around climate is unlikely to be derailed. If anything, we have found that the US decision has actually galvanised investors and other stakeholders to ramp up their climate policies. The slow but steady turning of the global capital markets towards ESG is proof of how the mindset of the financial community is turning away from the pure profit motive to a more holistic and nuanced investment model. ●



Investing for the world you want to live in

As a leading global investor, we have a responsibility to manage, safeguard and help grow the value of our clients' assets

By Meryam Omi,
Head of Sustainability and Responsible Investing Strategy, Legal & General Investment Management

One way to do this is to ensure that the companies in which we invest are prepared for the future. Our independent Corporate Governance team uses Legal & General Investment Management's (LGIM's) scale and influence to encourage companies to develop resilient strategies, think longer term and consider all stakeholders. We work towards improving wider market standards, policies and regulations because we believe that good governance protects and enhances long-term prospects for our clients. We take our responsibility to act as good stewards and influence change seriously, devoting significant resources to this effort.

Climate change – a hot topic

A key focus area over the past year has been climate change. Investors are increasingly concerned about their investments being negatively impacted by changes in regulation, technology and consumer demand, as well as increasingly adverse weather patterns.

The Paris Agreement was adopted in December 2015, where we saw 195 countries all pledging their commitment toward the shared goal of keeping the global average temperature rise well below 2°C from pre-industrial levels.

Investors are also increasingly realising the need to address the long-term financial risks and opportunities

What is financed today drives the world we build for the future

associated with climate change and the shift away from traditional energy models.

All companies, whether they emit carbon or not, need financing. They require banks, pension funds and insurance companies to buy their shares and debt. How they invest and allocate capital holds the key to a world in which temperatures only rise by 2°C rather than 3 to 4°C. What is financed today drives the world we build for the future. That's where we come in.

LGIM tries to ensure that companies are addressing the transition to a low-carbon economy. Our mainstream index funds are required to hold all the companies in a benchmark index, and this scale gives us influence. We have for many years focused on using engagement, both with these companies as well as policymakers, to drive change and hold companies to account on the issue. Last year, for our clients that wanted to express a stronger stance, we evolved our approach to incorporate the twin powers of engagement and divestment.

Introducing the Future World Fund

In 2016, together with a major UK pension scheme, we launched the Future World Fund in order to help investors address the long-term financial risk of climate change, turning our existing approach into a real-world solution for our clients.

The fund is an index-based strategy which incorporates a climate 'tilt', giving investors greater exposure to companies that generate green revenues and that are more likely to benefit from the transition to a low-carbon economy. The tilt reduces exposure to companies with worse than average carbon emissions and fossil fuel assets, whilst maintaining broad sector exposures.

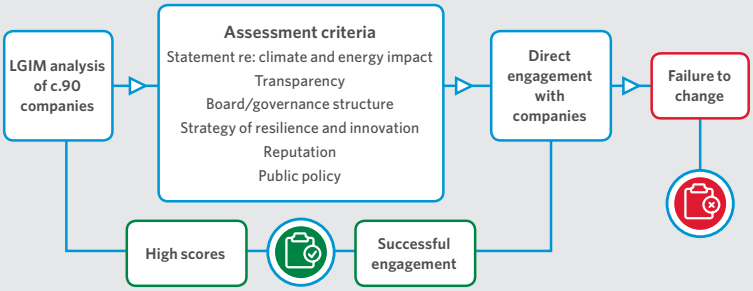
Evolving our approach – the Climate Impact Pledge

The Future World Fund takes our approach to climate change one step further by incorporating LGIM's Climate Impact Pledge. For the first time, we have gone beyond solely engaging with companies and we now have a vehicle to hold them to account on climate issues.

After one year of engagement, some of the companies that fail to meet our minimum standards will be removed from the portfolio. In funds where we are unable to contractually divest, we will vote against the Chair of the board of the same companies. This approach means that our Pledge has a direct link to all of the assets that LGIM manages globally.

How it works:

We believe that the combined approach of ranking, engaging, voting and divesting where possible can send a powerful message that investors are serious about tackling climate change. With over $1 trillion of assets under management on behalf of our clients, our collective voice can carry a lot of weight.



The time to act is now – a clear message to companies

Over time, the intention is to improve the standards and practices in these companies to make them more resilient to policy changes, more successful in providing low-carbon solutions and, ultimately, more prosperous as companies. In the long term, our clients who hold stakes in these companies should benefit from their financial success.

We hope to dispel the misconception that ESG-focused strategies must compromise returns in order to achieve their broader goals. As investors continue to re-evaluate the suitability of their investments in the context of their broader values and beliefs, LGIM is determined to play a key role in helping our clients invest for the future they want to live in. ■

UNA-UK thanks Legal & General Investment Management for its generous support for Climate 2020

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Model cities

Our planet demands fast action on climate change, yet the pace of national policymaking and implementation can be frustratingly slow. Can cities and their mayors show the way?

By **Mark Watts**, Executive Director, C40 Cities Climate Leadership Group

On 1 June 2017, President Donald Trump ended months of speculation and confirmed that his administration would seek to withdraw the United States from the Paris Agreement on Climate Change. The response from political leaders within America and around the globe has been remarkably swift and united in condemning the decision. Ban Ki-moon, the former UN Secretary-General, captured the mood of defiance, by saying that the Paris Agreement "once unthinkable, is now unstoppable".

Among the fiercest critics of Donald Trump's decision have been the mayors of American cities and the great cities of the world. C40's board president and 108th mayor of New York City, Michael Bloomberg, who also serves as the UN Secretary-General's Special Envoy for Cities and Climate Change, generously pledged to give $15 million to the UN climate change secretariat to compensate for the gap in funding that will result from the US withdrawal.

At the time of writing, more than 360 American mayors have committed to adopt, honour and uphold Paris Agreement goals.

Together, these cities joined hundreds of US states, universities and businesses to declare 'We Are Still In' and committed to "pursue ambitious climate goals, working together to take forceful action and to ensure that the US remains a global leader in reducing emissions".

Many of the same leaders are now working on the creation of the 'America's Pledge'. This is an unprecedented effort to aggregate carbon reductions by cities, regions, businesses and other social actors to ensure that the US achieves its Paris Agreement commitment.

Beyond the US, Anne Hidalgo, mayor of Paris and chair of the C40 network of cities that are committed to action on climate change, has said: "The next four years will be crucial in determining if the worst effects of climate change can be avoided… The great cities of the world, in particular the 12 American C40 cities, remain resolutely committed to doing what needs to be done to implement the Paris Agreement."

◀ **Potsdamer Platz, Berlin. Berlin, a C40 city, has committed to reducing its carbon emissions by 40 per cent in 2020, by 60 per cent in 2030 and by 85 per cent in 2050 from 1990 levels**

Binding commitments

In the hours following President Trump's announcement, more than 50 cities – from Paris to Montreal, from Auckland to Seoul – lit their city halls or their iconic monuments in green, as a sign of their commitment to the Paris Agreement.

This response is not surprising. C40 has been working with city leaders and mayors for more than a decade and has seen their determination to act on climate change for the benefit of their citizens.

Recent events mean that many of America's largest cities are now far more ambitious on climate action than the federal government. It is no longer clear whether the US will pursue national targets for reducing emissions or renewable energy. In contrast, many cities have made bold and binding commitments. Within hours of

President Trump's announcement, Portland and Pittsburgh committed to using 100 per cent renewable energy by 2050. Boston, Los Angeles, New York City, Washington DC, Chicago and many other cities have set targets of reducing their emissions by 80 per cent by 2050, consistent with the ambition set out at Paris.

This is not a new phenomenon, nor is it limited to US cities. Copenhagen aims to be carbon neutral by 2025, a far more ambitious goal than that of Denmark as a whole. Stockholm has plans to become fossil fuel free and cut its greenhouse gas (GHG) emissions by 100 per cent by 2040, five years ahead of Sweden's national target.

City leadership can be particularly important in nations where the national government is less committed to climate action. Australia is the world's largest exporter of coal, and coal power plants generate more than 80 per cent of electricity in the state of New South Wales. Yet, since 2004, when Clover Moore was first elected as lord mayor of the city, Sydney's emissions have fallen by 17 per cent while the city's economy has grown by 37 per cent.

Accelerating the agenda

So why have mayors made action on climate change such a priority? Primarily, it is because every day they can see the impact that climate change is already having on their cities and citizens. From hurricanes in New Orleans and New York, floods in Paris, Houston and Montreal, deadly heatwaves in Sydney, to toxic air pollution in Beijing, New Delhi and in all large cities, climate change is already causing major disruptions that mayors are compelled to deal with.

Yet, just as importantly, mayors recognise the benefits that action on climate change will bring to their citizens. Air pollution from diesel and petrol cars, lorries and buses is linked to millions of premature deaths each year in cities worldwide.

These same emissions are major contributors to climate change. Therefore, cities that act to increase public transport usage, disincentivise or even ban cars from parts of the city, and adopt electric vehicle technologies will improve the health of their citizens while also curbing emissions. New Climate Economy research has shown that creating compact and connected cities, built around mass public transport, would save more than $3 trillion in infrastructure investments over the next 15 years.

The cities that are able to deliver a sustainable, low-carbon future the quickest will also be the world's healthiest, wealthiest, most equal and most liveable. That is clearly what every mayor of the world's megacities wants to achieve for their citizens.

While national leaders have spent decades arguing and wrangling over the treaties and compromises needed for a global agreement on climate change, mayors have been getting on with the job

While national leaders have spent decades arguing and wrangling over the treaties and compromises needed for a global agreement on climate change, mayors have been getting on with the job. The urban philosopher, activist and visionary Benjamin Barber – who sadly died this year – was fond of quoting former New York mayor Fiorello La Guardia: "There is no Democratic or Republican way of fixing a sewer."

In mayors, Barber identified "a non-partisan and pragmatic style of governance that is lacking in national and international halls of power. Through these qualities of leadership mayors have retained the trust of citizens in their office, helped cities become beacons of good governance, and spearheaded city-to-city collaborations in order to better address shared problems."

Those decades of action and progress on tackling climate change are now proving invaluable for cities as they look to accelerate their sustainability agenda. The urgency of the climate crisis we face means cities need to share knowledge on what policies, projects and approaches work best, so other cities can learn from them and act without delay.

To give just one example, in 2007 Paris launched Vélib' – the world's first large-scale bike-sharing scheme in a major city. A decade later, 43 C40 cities have bike-sharing schemes. That represents hundreds of millions of bike journeys in cities each year, not generating any GHG emissions.

It is not just other mayors who are looking to cities for inspiration. Projects that have proved effective in major cities are already being adopted at the national level. In China, the central government has directed several of its cities to become pioneers in climate action. The vast fleets of electric buses rolling out in Wuhan, Nanjing and Shenzhen are testament to the enthusiasm with which mayors have embraced it.

Now the impacts of this approach are being seen. In June 2013, Shenzhen launched a carbon trading market, the first of its kind in China. By 2016 the city had established a national centre of excellence to inform other cities and regions about setting up their own markets. Shenzhen's officials are now advising on the establishment of China's national carbon trading market, expected to launch later this year.

Leading the way

There can be no doubt that nation states are crucial in delivering the reforms and action required to tackle climate change. Mayors cannot do it alone, but they are best placed to lead the way. C40 research found that mayors can deliver or influence just over half of the emissions savings needed to ensure their cities meet their obligations to the Paris Agreement.

Given the track record of cities in leading this agenda, we at C40 believe that more power should be devolved to city leaders, whether through increased access to finance, increased revenue-raising powers or authority over new areas such as energy generation.

This could just prove the fastest way for national leaders to help save the planet. Let mayors lead the way. ●

Sofidel innovates to lower carbon footprint in tissue production

In 2008, the Italian tissue company became the first in its industry to join the WWF's Climate Savers Programme. Since then Sofidel has been able to cut direct carbon emissions by 19.1% per ton of paper produced

"Less is more" can have multiple meanings: sobriety, responsible consumption, waste minimisation, but also higher operational efficiency. This is the philosophy that has led Sofidel's strategy in the last decade, a strategy deeply rooted in environmental and social sustainability, aiming at "building an inclusive, sustainable and resilient future for people and planet", in accordance with the UN Sustainable Development Goals.

Sofidel is an Italian tissue company with operations in 13 countries in Europe and the US, with a turnover of €1,842 million (2016).

To better achieve its sustainability goals, Sofidel was in 2008 the first tissue company to partner with WWF in the Climate Savers Programme, committing by 2020 to achieve ambitious objectives such as:

- reducing by 23% carbon direct emissions per ton of paper produced compared to 2009 values;
- cutting by 13% indirect CO_2 emissions caused by third parties in Sofidel's supply chain, compared to 2010 values per ton of paper produced;
- achieving 8% of annual fuel consumption covered by renewable sources, in a challenging scenario of an energy-intensive industry such as tissue production.

At the end of 2016, Sofidel was in line to reach the announced goals, with a carbon intensity reduction of 19.1%, due to increasing investments in energy efficiency, cogeneration and renewable energy use.

The in-depth data show that in the last three years the carbon intensity (kg CO_2/t paper) has decreased by 4.06%, despite a growing production capacity.

In 2016, cogeneration and energy efficiency have been the key to obtaining a lower company-wide environmental footprint, with six-digit investments in the group plants in Italy (Soffass Val Fegana, Soffass Monfalcone, Soffass Tassignano, Soffass Valdottavo), Spain (Sofidel Spain, Bunuel) and France (Sofidel France, Roanne).

Moreover, the company has pioneered an innovative technology that allows the recovery of energy through hydraulic turbines using water flows inside the tissue production system. This has been implemented in Poland's Ciechanow plant as well as in Italy (Soffass via Giuseppe Lazzareschi, Porcari).

Recent progress

Renewable energy has been another area of commitment in the last few years, mostly in biomass, PV and hydro power plants, allowing an overall annual production of 263 TJ.

Besides its efforts to reduce GHG emissions through the partnership with WWF, Sofidel's commitment to environmental sustainability is wider and embraces commodities' procurement and responsible water management.

In the former, Sofidel has achieved in 2016 the 100% of use of cellulose coming from independent third-party certified schemes (FSC®, FSC Controlled Wood, SFI®, PEFC™).

In the latter, the company's water usage performance is far better than the industry benchmark (7.0 l/kg compared to 15-25 l/kg), with investments for the use of waste and rainwater in production as well as biological depuration systems. ■

(Source: Sofidel 2016 Integrated Report)

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Making icebergs our business

On 12 July, the Larsen C ice shelf broke away from Antarctica, creating an iceberg the size of Brunei. This poses the question: if a one-trillion-ton chunk of ice crashes into the sea, does anyone hear it?

By **Lise Kingo**, CEO & Executive Director, United Nations Global Compact

Many in the global business community hear it – and they are working feverishly to develop climate solutions. These companies, large and small, understand that climate change represents unprecedented risk, and time is of the essence.

The recent *2020: The Climate Turning Point* report from Mission 2020 makes a forceful and science-based case that global emissions must peak by 2020. This effort demands more than any one group of stakeholders can deliver. Unless all players – business, government and non-profits – strive together to steer the planetary ship past this virtual precipice, it will be difficult or impossible to achieve the Sustainable Development Goals (SDGs) by 2030 or a net-zero emissions world by 2050.

The deadline is indeed vitally necessary, desirable and achievable. To that end, UN Global Compact members commit to deliver this outcome and keep the promises of the Paris Agreement through a heightened level of collective action between non-state players and government.

It is inspiring to see the business community stepping up to the climate challenge – identifying risk, driving innovation, creating solutions and improving both top and bottom lines in the process. The UN Global Compact is doing its part to facilitate such action by providing business leaders with peer networks, action platforms, guidelines and key performance indicators for measuring impact – a true and complete toolset. These capabilities are especially important given the urgent timeframe required. Our toolset, with its focus on responsible policy engagement, make it the partner of choice.

Since corporate efforts are not always aligned with the plans and targets of those companies' own national governments, however, their efforts and innovations are less scalable. Purposeful collective action will yield exponentially greater impact.

◀ A railway destroyed by floods in Rio Largo city, Brazil. There are investment opportunities in sustainable transportation in Argentina, Brazil, Colombia and Mexico, worth up to US$2.6 trillion

Partnering benefits business, society and the environment. It can even work to slow the melting of ice.

What opportunities does climate change present?

To define the potential of collective action, one need only look at why companies are making public commitments to climate action in ever-increasing numbers. Simply put, more and more businesses want to mitigate the risks and seize the opportunities presented by a very different future.

Setting science-based targets is a particularly effective way for companies to define opportunities aligned with their strategic priorities and with reality – and which are tangible and measureable. Science-based targets to reduce greenhouse gas (GHG) emissions, for example, or to limit global warming to less than 2°C, can be set using economic and/or physical activity measures that allocate GHG emission-reduction efforts among companies.

It is well documented that factoring climate change into business practices allows companies to reduce costs, develop innovative products and services, recruit and retain the best people, and build brand equity and competitive advantage. These are powerful objectives, and opportunities abound. According to the World Bank, climate investment opportunities will total $23 trillion in emerging markets by 2030. Examples include:

- green buildings, where China, Indonesia, the Philippines and Vietnam show a climate-smart investment potential of $16 trillion;
- sustainable transportation, where the potential for investment in Argentina, Brazil, Colombia and Mexico is $2.6 trillion;
- climate-resilient infrastructure, where $2.5 trillion of opportunities exist in India and Bangladesh.

The cost of solar has plummeted, making it more affordable than coal. Wind power, especially in Europe, has transformed the energy landscape. CEOs of many of the world's largest corporations, several of them oil and gas monoliths, personally petitioned the US White House to stay in the Paris Agreement. Why? Because they believe it is good for business.

How best to prepare?

As companies work to realise the opportunities that make the most sense for their business, they are striking out in new directions to protect against risk, tap new markets and enhance their brands. As they forge ahead, aligning with government targets and plans is not always at the top of their priority list. Consequently, they make less headway. It is also increasingly clear that a nation's ability to achieve the targets committed in Paris and see emissions capped by 2020 depends in substantial part on making sure its businesses succeed, and as rapidly as possible.

Businesses that operate in a favourable regulatory environment flourish. Responsible policy engagement should be a priority for any company, large or small. Companies play an important role in providing proactive, constructive input to help governments create effective climate policies. Making a commitment to sustainability is an important first step, but it is critical to connect the dots between this commitment and corporate policy positions.

Legislation and regulation are key ingredients in the climate effort. Emerging businesses need support to scale at pace. The explosive development and growth of the solar and electric vehicle industries are prime examples of the power of national and subnational customer incentives. This has been vividly demonstrated in Germany, China, India, the United States and, increasingly, all over the world. Across a wide range of sectors, many companies – such as Siemens, Natura Cosmetics, Tesla and Unilever – are generating tremendous excitement and hope for a better world.

How to facilitate collaboration

If the mutual benefits are so clear, how can we ensure the productive discussions, aligned planning and prioritisation, and shared data needed? Building on a decade's work with the Caring for Climate initiative, the UN Global Compact is uniquely positioned to help scale the progress already made by businesses on global climate action. Now, it can translate it into national action through its Global Compact Local Networks and UN partners.

The UN Global Compact announced its new Pathways to Low-Carbon and Resilient Development platform in Marrakech in November 2016. The platform, which went live in early 2017, is designed to mobilise the private sector to become a catalyst for enhancing country-level action to meet the ambitions of the Paris Agreement and the SDGs. It provides a collaborative space for companies and key stakeholders to share, learn and identify effective ways to contribute to intended nationally determined contribution and SDG implementation.

Together, companies and governments can make it happen

Even with the Paris Agreement pledges, ancient icebergs are calving and the world is heading for a temperature rise of 2.9-3.4°C this century. Our planet recorded yet another 'warmest global temperature' in 2016, at 1.1°C above the pre-industrial period. Faced with this reality, the need to help business and government work together to achieve these urgent goals has never been clearer or more critical. Communicating, planning, implementing and reporting on climate actions in a shared environment will have substantially more impact than isolated efforts – however successful those might be. Setting an effective price on carbon, such as the $100 per metric ton recommended by the UN Global Compact in 2016, is the most direct and effective way to reduce CO_2 emissions.

Together, let's help companies and governments at all levels develop responsible policy that benefits business, society and the environment. Effective policy and legislation make climate progress and business success synonymous. We must, and we can, do this – together. ●

Abandoning oil

How do countries whose wealth is built on fossil fuels transition to a low-carbon, sustainable future?

By **Eckart Woertz**, Research Coordinator and Senior Research Fellow, and **Luigi Carafa**, Co-chair, Climate Futures, Barcelona Centre for International Affairs (CIDOB)

If many saw peak oil as an imminent fact during the oil boom of the 2000s, it has now been replaced by expectations of ever-lasting abundance. The unconventional oil and gas revolution in the US has become a game changer. Rather than rising to the stratosphere, oil prices are set to fall to the bottom thanks to plentiful supply – so the story goes. Coal's position is even less enviable as it is crowded out by the improved economics of natural gas and renewables, and – in some countries – favourable legislation for these competing energy sources.

In the longer run, the transition to renewable energy might weigh on hydrocarbon prices, and not only in the power generation market. The transportation sector, for example, could also change considerably. Electric mobility and battery technology are being buoyed by falling prices and technological improvements. These and other energy storage solutions are helping to ease the integration of renewables in existing energy mixes.

Despite the US administration announcing its intention to withdraw from the Paris Agreement, political support for energy transitions still remains strong among the other signatories – but also within the US itself on a municipal and federal state level.

The UN's Sustainable Development Goals that were launched in 2015 are also supportive. To have a 66 per cent chance of meeting the Paris climate goals, the world needs to halve oil production and stop using coal for power generation. That means 80 per cent of current coal reserves, one third of oil and half of natural gas would have to be written off. Conflicts about who will bear the costs are starting to emerge.

Negative perceptions about the future of hydrocarbons have trickled down to the ranks of oil exporting countries. Low oil prices threaten their sociopolitical fabric. Oil revenues finance public sector jobs, welfare payments, armies and government agencies. Even the private sector depends on subcontracting from oil-financed states.

Whereas the chief economic benefit of commodity extraction is derived from owning the resource, the economics and value chains of renewable energy landscapes look very different. Sunlight and wind are free. Revenue generation in the energy world moves up the value chain, from commodities to technologies.

Countries that see their commodities fall in value but who do not have the capital and skills to master low-carbon technologies will lose out. Their revenue streams will decline. Unpaid bills, wages and contracts might lead to unrest and financial crisis.

> ***Diversification away from oil is declared government policy in all countries of the Gulf Cooperation Council***

Some oil exporters have started to reckon with this new reality. They have repatriated foreign assets to finance budget deficits that have emerged in recent years. Diversification away from oil is declared government policy in all countries of the Gulf Cooperation Council (GCC), especially in the United Arab Emirates (UAE) and Saudi Arabia. The latter launched Vision 2030 in 2016 with the goal of tripling non-oil revenue and balancing the budget by cutting subsidies and introducing a value-added tax. The UAE has a renewable energy programme and has managed to attract the International Renewal Energy Agency (IRENA) to Abu Dhabi against stiff competition from Bonn and Copenhagen. Saudi Arabia and Qatar trail behind, but have also launched initiatives to promote renewable energies on a large scale, especially solar. The former Saudi oil minister Ali Al-Naimi even suggested that one day Saudi Arabia could make a living from exporting solar-generated electricity instead of oil.

Some of the goals are not as ambitions as they may seem. The UAE's target of seven per cent power generation capacity from renewable sources by 2020 would only translate into a 2.5 per cent share of actual power generation, because of the intermittencies of such sources.

Some have suspected greenwashing and playing to the international gallery by a country that has one of the largest carbon footprints per capita in the world. GCC economies are heavily geared towards energy-intensive industries and lifestyles. Energy subsidies for such lavish consumption are part of the social contract and can only be cut back at a political cost.

Still, the GCC countries have had some success with economic diversification. They have moved up the value chain and are major players in heavy industries such as petrochemicals and aluminium. Logistics, tourism and services have developed into important sectors for the economy, not only in Dubai. Compared to countries such as Venezuela and Libya their starting position is more comfortable, thanks to their relative political stability. Yet their dependence on oil revenues is more pronounced than in Russia and even Iran, both of which have less dynamic and open economies.

Will the electric car be a major threat to future political stability in the Middle East? This is a distinct possibility. Yet

▲ **Dwellings of camel herders on the outskirts of Dubai, United Arab Emirates. The Gulf states that have used energy subsidies to fuel lavish consumption must urgently focus on economic diversification**

planes will still need kerosene, trucks diesel and ships fuel oil. About 30 per cent of oil consumption is used by the petrochemical industry and is unlikely to dwindle anytime soon. Production declines in ageing oil fields require reserves to be replenished, which is hampered by lagging investments.

The clock is ticking

Even in the case of a long-term renewable energy transition there might be a rebound of oil prices in the middle run. Yet oil exporters clearly do not count on it. The decision to float a five per cent share of the state-owned oil company Aramco at a time when oil prices have fallen indicates that the Saudi rulers do not expect sustainable higher prices in the future.

But when it comes to preparing for the future, the undisputed leader within the oil world is Norway. The Scandinavian country holds the largest sovereign wealth fund in the world, worth $959 billion, whose resources mainly come from the nation's oil and gas export revenues.

As Norway's Government Pension Fund Global website candidly explains: "[the fund] is saving for future generations in Norway. One day the oil will run out, but the return on the fund will continue to benefit the Norwegian population." Since 2014, the fund has proceeded with a risk-based divestment from fossil fuels (i.e. oil sands production and coal-fired power generation) and deforestation (i.e. palm oil production, pulp and paper), taking into consideration both financial and climate risks.

A truly transformational change is happening in Norwegian road transportation. Through the fund, the government is using oil money to heavily incentivise the purchase of electric vehicles. Electric cars are exempt from sales tax. Drivers can charge their vehicles for free, do not have to pay tolls and can use bus lanes to avoid traffic.

Electricity generation mostly comes from hydropower. The subsidies were introduced as far back as the 1990s, but the market only started to expand in 2012 when the Tesla Model S and Nissan LEAF arrived in the market. As a result, Norway is transitioning to electric cars faster than any other country in the world. About 37 per cent of all new cars are either fully electric or plug-in hybrids, and by 2025 the government expects that no more conventional cars will be sold in the country.

The G20 will have to play a crucial role in guiding the global transition to low-carbon energy systems. The world's wealthiest 20 countries consume 95 per cent of coal, more than 70 per cent of oil and gas, and are responsible for 85 per cent of global investment in renewables. Over the next decade, the infrastructure investment decisions of the G20 finance ministers will determine our climate future. The improved economics of renewables and natural gas increasingly weigh on coal and oil demand. Hydrocarbon exporters such as Norway and the GCC countries have started to factor in this new reality in their investment and diversification decisions. ●

FCA 4.0: smart manufacturing for smart product

Operators during the assembly stage have direct access to real time manufacturing data through wearable devices

Mobility is now at the centre of a highly disruptive technological revolution. Today, the ability to compete is the domain of those who are capable in the short and medium-term not just of reinventing their products to address new customer experience paradigms, but also of conceiving new ways of producing them.

Automakers need to innovate in ways that are both revolutionary and responsible. Being revolutionary means further accelerating the innovation process by opening it up to new contributors and agents of change such as employees, customers and external partners.

At the same time, that process must be responsible, guided by the concept of a circular economy where flexible manufacturing systems allow a more intelligent use of materials, resources can be tracked and re-used, rather than just consumed.

FCA is already creating the right conditions and environment for this new era of innovation, digitalisation and automation. The formula for the future is called industry 4.0 (i4.0), and FCA is already there with its company-specific 'combination of things'.

The ability to deliver innovative, high-quality cars depends on the ability to 'think premium' for customers while 'building premium' with workers across vehicle segments. Information technology plays a key role in this progressive transformation of work processes, by:

- optimising collaboration and integration between humans and technology;
- maximising the added value we can glean from data and information gathered through the many thousands of actions required to produce a complex product like a car;
- advancing the adoption of cybersecurity standards for connected systems;
- accelerating the paradigm shift in terms of worker skills and mindset.

FCA has recently implemented a new approach to manufacturing through the redesign of plants as 'digital factories' based on the integrated modular factory model. A completely new Information and Communication Technology (ICT) infrastructure, developed with different technological partners, known as the New Plant Landscape (NPL) has already been deployed at major FCA plants worldwide. NPL employs advanced ICT solutions to help achieve high standards of quality in manufacturing and assembly processes through rapid decision-making at all levels of the value chain.

The increased digitalisation of FCA plant workstations reinforces the concept that collaboration between humans and technology can unlock opportunities in terms of efficiencies, ergonomics, quality and the empowerment of employees.

For more than 10 years, FCA has leveraged these opportunities through the implementation of World Class Manufacturing (WCM) at FCA plants worldwide. WCM represents the foundation of this progressive transition to a smart modular factory model. It provides FCA-specific language for deployment of the i4.0 concepts of lean, smart and digital production.

The need for flexible manufacturing is addressed within the i4.0 approach through another technology that FCA uses to create on-demand parts for prototyping: industrial 3D printing, also referred to as Additive Manufacturing.

Compared with conventional manufacturing, where machining is subtractive, meaning that material is gradually removed in shaping a component, this technology shapes them by adding layers of material. 3D printing:

- permits much greater complexity when shaping, opening up new possibilities in areas such as aerodynamic design;
- improves time-to-market, by enhancing speed to production and prototyping;
- significantly reduces material use, waste generation and energy consumption associated with these activities.

'Less is better' is not simply a lifestyle trend that is becoming increasingly relevant for customers – and millennials in particular. It is becoming the central paradigm for the hard manufacturing industry as well.

In recent years, FCA has continued to develop its know-how and technological

Alfa Romeo Stelvio 2017. Manufactured at the FCA plant in Cassino (Italy)

The Alfa Romeo Stelvio shows how FCA applies speed of change to processes and products

capabilities in this area. The Mirafiori plant in Turin, Italy, hosts the FCA Center of Competence for Additive Manufacturing that supports product development from design to testing, with a total of more than 14,000 components produced in 2016. The Center works closely with Italian and international universities and experts to spread the technical know-how globally across the Group.

The adoption of 3D printing is a clear example of an innovation that is revolutionary and sustainable at the same time. This technology was applied for the creation of a few thousand prototype parts during development of the Alfa Romeo Stelvio, manufactured at the Cassino plant, in Italy.

One of FCA's most advanced examples of i4.0 today is the Cassino assembly plant in Italy, where the Alfa Romeo Stelvio and Alfa Romeo Giulia are manufactured. The Cassino plant figures speak for themselves: over 11,000 part numbers, an automation level assured by more than 1,400 robots, and more than 6,000 connected devices, including smartphones and smartwatches that connect the worker to the interconnected experience of manufacturing a vehicle.

The plant offers high standards of efficiency, workforce ergonomics and eco-sustainability. It has sent zero industrial waste to landfill since 2000. It has a zero carbon footprint: 100% of electricity used in industrial processes comes from renewable sources, including on-site solar power generation. The plant also plans to be fully self-sufficient in terms of water usage; through innovations such as dry scrubbing technology, in the paint shop zero water is withdrawn from local resources for industrial purposes.

Supporting sustainable innovation

The Alfa Romeo Stelvio is the most recent example of how we design and build premium value for our customers. The Stelvio represents the positive impact that i4.0 can have on a product. It features a full array of cutting-edge technical solutions such as the world premiere Integrated Brake System (IBS), Autonomous Emergency Braking (AEB) with pedestrian recognition and a full carbon fibre crankshaft. The Stelvio features an outstanding power-to-weight ratio, thanks to the extensive use of ultra-lightweight materials: carbon fibre for the crankshaft and aluminium for hood, doors, fenders, lift gate, engine and suspension.

The Cassino plant and the Alfa Romeo Stelvio illustrate how FCA has conceived and built an i4.0 value chain combining – at the same time – speed of change with processes and products. FCA has transformed the rapid change in technology into an i4.0 business model that connects our plants, our suppliers and our dealers, up to the final customer.

This net of people, processes, products and services allows manufacturing data to be transformed into information, which then generates smart interactions within all elements of the FCA value chain.

We support sustainable innovation through a partnership of man and machine to develop and manufacture mobility solutions for our customers.

Looking toward the future, there are infinite technical connections that can be created and fostered between the people and machines that engineer and manufacture our vehicles, and the end driver. ■

FCA

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Technology: disruption needed

Can technology enable us to switch to sustainable energy in time to avoid global climate catastrophe? What can we do to ensure innovation and mass adoption happens before it's too late?

By **Varun Sivaram**, Philip D. Reed Fellow for Science and Technology, Council on Foreign Relations

The promise of the Paris Agreement, which was signed in 2015 and entered into force in 2016, lies in its premise that countries will periodically ratchet up their commitments to reducing their greenhouse gas emissions. So even though countries' existing commitments under Paris may not be strong enough to avert catastrophic climate change, future commitments might be.

New and improved clean energy technologies can entice countries to pledge much more stringent commitments. But whereas commercialising such technologies will require rising levels of investment in clean energy innovation, funding has been shaky over the last decade. Although there are some bright spots, most of the technologies needed to produce and use clean energy more cheaply and efficiently are progressing too slowly to transform the global energy system on the timescale needed to confront climate change.

Public policy can change that. At home, countries should invest in research, development and demonstration of new technologies – not only to stock new weapons in the world's arsenal to combat climate change but also to seize a share of the growing clean energy economic pie. And abroad, countries should cooperate on fostering innovation and setting standards to speed the introduction of new technologies.

Wanted: innovation

Trying to slash global carbon emissions just using existing clean energy technologies would be expensive, complicated and unpopular. That's because the options that are already commercially viable have serious limitations.

Thanks to falling costs, solar panels and wind turbines have attracted substantial investment in their deployment. But they only work when the sun shines or the wind blows. As batteries get cheaper, they can help store renewable energy for a few hours. But they will remain far too expensive to smooth out the variation of solar and wind over days, months and even seasons. All this means that claims of the cost-effectiveness of running the power grid off 100 per cent renewable energy are mostly hype. Recently, I co-authored an article with 20 leading energy researchers in the Proceedings of the National Academy of Sciences debunking one of those claims.

But a suite of new and improved clean energy technologies could mount a more realistic challenge to fossil-fuel dominance. Next-generation nuclear reactors could be meltdown-proof, cheaper and more efficient than today's reactors. Recently invented solar coatings have the potential to be as cheap as paint. More energy-dense batteries and other energy storage technologies could enable long-range electric vehicles and help grids cope with intermittent renewable energy. Much more efficient air conditioners could curb skyrocketing energy demand as the ranks of the middle class swell in the developing world. Technologies to capture and store carbon dioxide could make it possible to keep using a limited amount of fossil fuels without warming the planet.

Running out of time

The problem is that these technologies are not being developed and commercialised at nearly the pace necessary to arrest climate change. Urgent investments in innovation are needed today, because it can take decades for a new energy technology to achieve widespread adoption.

Noted energy historian Vaclav Smil observes that there have been three energy transitions over the last two centuries that we can learn from. From 1840 to 1900, coal rose from supplying five per cent of global energy demand to 50 per cent, dethroning wood as the largest energy source. Then from 1915 to 1965, oil beat out coal – rising from five per cent to 40 per cent. More recently, from 1930 to 1985, natural gas rose from five per cent to 25 per cent. Smil's point is that each of these transitions took over half a century, and in the most recent one, natural gas still has not knocked oil off the top spot.

Given how long these transitions take, it is disheartening that the development of new technologies in the private sector appears to be slowing down. We need to invent, develop, and market new

Technologies are not being developed at nearly the pace necessary to arrest climate change. Urgent investments in innovation are needed today... it can take decades for a new energy technology to achieve widespread adoption

▲ **The SwissTech Convention Center in Lausanne, Switzerland. The facade shown is made with panels containing organic dye-sensitised solar cells, a new generation of photovoltaics with great potential**

technologies quickly, to start them along the long road to mass adoption.

Recent research from Mark Muro at the Brookings Institution reports that since 2014 in the United States, the rate at which new patents for clean energy technologies have been granted has fallen after several years of growth. And my own research co-authored through the MIT Energy Initiative demonstrates that Silicon Valley venture capital investors walked away from funding many clean energy technologies, like new solar or battery materials, after losing over half of the $25 billion they invested from 2006 to 2011.

But it's not all bad news. Some clean energy technologies have defied the general trend and risen to mass adoption rapidly. The best example is the light-emitting diode (LED), a far more energy-efficient alternative to the incandescent lightbulb. Goldman Sachs predicts that by 2020, LEDs will account for over two thirds of lightbulb sales, up from one per cent a decade earlier.

Many other technologies that use energy more efficiently and intelligently are successfully raising private funding and

gaining market traction. Stephen Comello at Stanford University suggests that these technologies – including smart thermostats for the home or software to improve energy efficiency of buildings – represent a second wave of clean energy innovation.

This second wave, aimed at transforming the way energy is used, is succeeding at garnering private investment where the first wave, centred on technologies to clean up the way energy is produced, failed.

For a clean energy transition, we will need both energy supply and demand technologies. Still, noting the limited bright spots of clean energy technology adoption, Benjamin Sovacool at the University of Sussex has suggested that with the right conditions in place, like supportive public policy, a clean energy transition could happen in just a decade.

The role of public policy

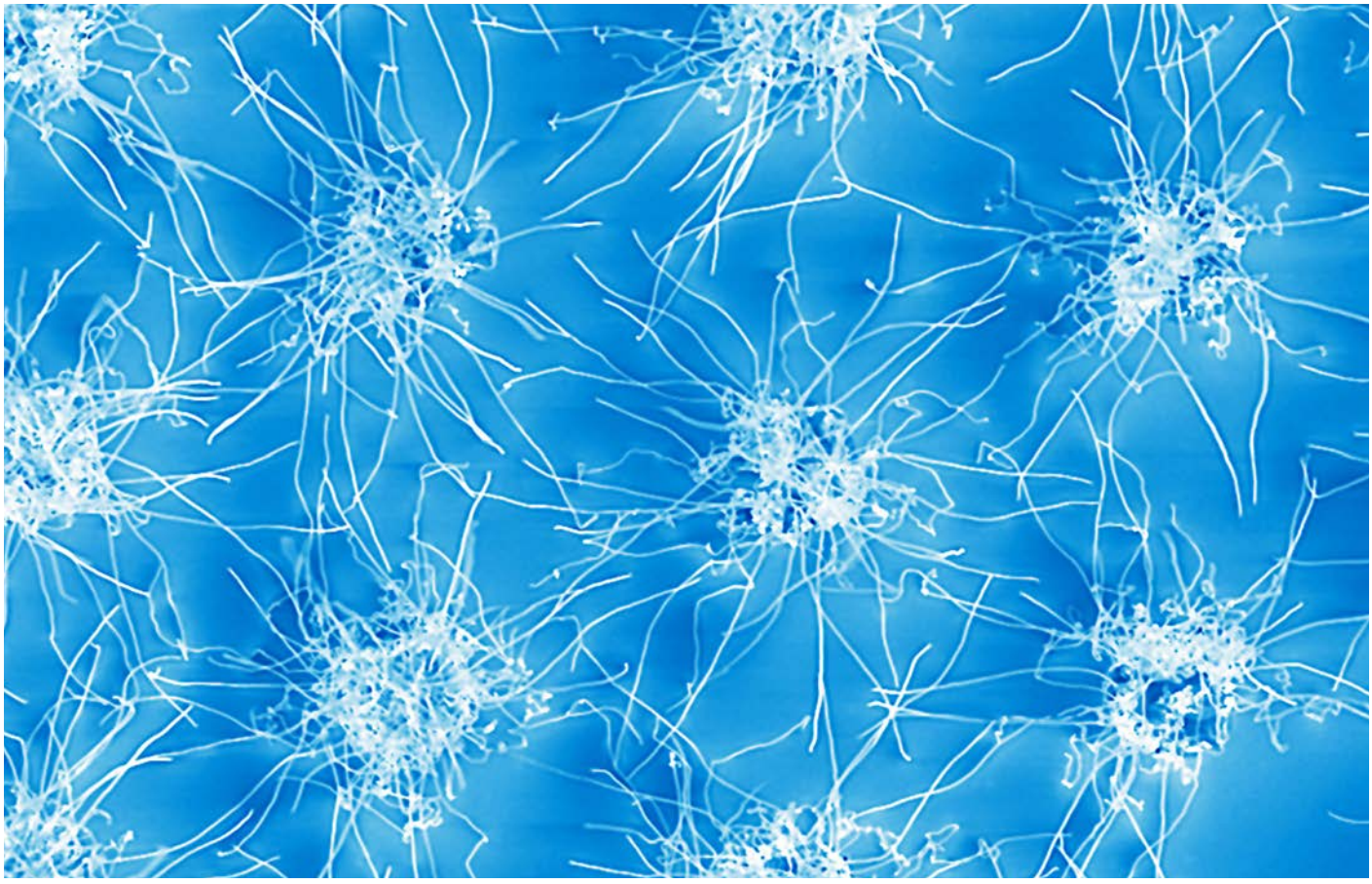
That's where governments can step in to accelerate clean energy innovation. Domestically, they should invest in research, development and demonstration of new technologies – a step that can mobilise further private investment. This would not be an altruistic move to help combat global climate change; it would bring tangible domestic economic benefits. Worldwide, the clean energy market is already worth around $300 billion annually. Countries that develop advanced technologies will be most competitive in this market.

An encouraging development on this front is the Mission Innovation pledge made by 22 countries and the European Union to double their public funding for clean energy innovation by 2021. Most countries appear on track to meet their commitments, though the US under President Trump is now considering slashing its funding rather than increasing it. Doing so would be a reckless mistake.

Internationally, countries can work together to advance innovation. In addition to holding one another to account on their Mission Innovation pledges, countries can also share insights into how best to promote innovation. For example, the US might share lessons from its exemplary government agency known as the Advanced Research Projects Agency-Energy (ARPA-E), which funds transformative energy technologies. Germany might similarly share insights gleaned from its successful network of Fraunhofer Institutes. Finally, countries can work together on issues like technology standards, which set out specifications for clean energy products that can speed their deployment.

Innovation is an imperative that should resonate around the world. And if countries come together to make the requisite investments in advancing it, they will be rewarded with prosperity and give the world a fighting chance to confront climate change. ●

▼ **Silicon nanowires grown on a patterned substrate – a model system that will be used as an advanced medium for photovoltaics and energy storage applications**



Refrigeration and harnessing the power of multinationals

Research now shows that within four years we will pass the point of no return for keeping the global average temperature of rising to no more than 1.5°C. Reductions of CO_2 through measures such as the phasing out of chemical refrigerants, like hydrofluorocarbons (HFCs), are necessary.

Per a recent United Nations Environment Programme report, 80% of current HFC-emissions originate from industrialised countries; despite this, the European Union is the only governmental body that has actively worked to reduce HFC emissions. Europe has made great strides.

And where Europe has led, other countries have followed – the US Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) programme has sanctioned the use of a wide range of natural refrigerants (NRs) and banned other high-GWP (global warming potential) refrigerants. The US EPA's GreenChill partnership and the North American Sustainable Refrigeration Council also help food retailers to reduce their refrigerant gas emissions and decrease their impact on the ozone layer.

However, this picture is not the same globally. Some regions, including emerging markets in East Asia, South Asia and South America, still have a long way to go in terms of their use of synthetic refrigerants.

Thankfully, however, governments are not the only ones driving positive change. We can see the threat that refrigerant gases pose to the environment has been firmly acknowledged by one influential group – the private sector.

In association with The Consumer Goods Forum (CGF), whose members include multinational consumer goods retailers and manufacturers, and other platforms such as Refrigerants, Naturally!, the member organisations recognise that given commercial refrigeration makes up around 40% of the world's HFC use, the opportunity for collective action and impact is huge.

There is significant scope for international companies to accelerate take-up of NRs in multiple territories by setting policies at a global level. For example, Coca-Cola, Heineken, Red Bull and Unilever have committed to eliminating HFCs from their vending and cooler machines across the globe, which has boosted take-up of NR equipment in places where progress might otherwise have been much slower. Similarly, European supermarket chains Tesco and Metro have introduced CO_2 refrigeration in their stores in China after first successfully employing the technology in their core market of Europe.

Back in 2010, the CGF's members made a commitment to tackle the growing impact of refrigeration systems and, in a move to sustain momentum, the CGF's Board announced a second Refrigeration Resolution in October 2016 to continue the phase-out of HFCs and call for the inclusion of HFCs in the Montreal Protocol. This proposed amendment was included in 2016: a huge step towards the global phase-out of harmful HFCs.

However, for all the industry's achievements, there is scope for companies to be more ambitious in phasing out harmful chemical refrigerants and moving to natural alternatives. The benefits of doing so are not just environmental but economic too. When implemented at scale, a HFC phase-down will have huge impact and could prevent warming of up to 0.1 °C by 2050 and 0.5 °C by 2100, offering one of the most cost effective climate mitigation strategies available in the world today.

In short, no matter what industry you are in, the case for switching to natural refrigerants has never been stronger, and the time to move is now! ■

See more: **www.theconsumergoodsforum.com**

◄ Heineken CEO Jean-François van Boxmeer promoting the phase-out of chemical refrigerants at the Consumer Goods Forum's Global Summit in Berlin

UNA-UK thanks the Consumer Goods Forum for its generous support for Climate 2020

Positive counteraction

Who defines Trump's impact on the Paris Agreement? You do

By **Raj Thamotheram**, Founder, Preventable Surprises

The US withdrawal from the Paris Agreement got the immediate media coverage the Trump team wanted, reassuring his core support base – climate change is a dog whistle issue in US politics today – while upsetting the 'liberal elite' the world over. Bull's eye!

But with each day and week that passes, evidence suggests his actions may have backfired. As Al Gore highlights, Donald Trump "has produced the largest upsurge in climate activism I've ever seen". This activism extends well beyond popular protests and covers all walks of society.

The one group that has not responded proactively is the big (and mainly US head-quartered) institutional investors. This article describes the changed context, highlights the comparatively weak response of these investors and identifies who can change this.

A major increase in activism

Global public opinion has been highly critical of the Trump team's decision to withdraw from the Paris Agreement, with popular protests in many countries. But the most important reaction has been in the US itself where many US states, cities and companies have now made their direct commitment to the Agreement.

In the battle of billionaires, Michael Bloomberg's response to personally pay the US's share of the United Nations Framework Convention on Climate Change budget is highly significant, not least because Bloomberg was the Mayor of New York.

As Mark Watts writes in this publication (see page 28), city and state legislators are particularly well placed to play a leadership role in this new context because "the cities that are able to deliver a sustainable, low-carbon future the quickest will also be the world's healthiest, wealthiest, most equal and most liveable". What Watts does not spell out is that it is harder for fossil fuel vested interests to capture city and state legislators.

The military could also play a stronger leadership role, even in countries where corporate capture of politics is marked. According to Admiral Chris Barrie, the former Head of the Australian Defence Force: "…we are approaching a time soon when there will be a serious possibility that no amount of effort in deploying the limited resources we have available will be able to ameliorate the national security problems and challenges we are confronting. We need to take decisive action now to head off the most unpalatable of climate change outcomes and this requires strong, determined leadership in government, in business and in our communities."

And actuaries, scientists and doctors are just some of the other professionals who are also helping to fill the climate leadership gap.

Invisible trillion-dollar gorillas

In this context of activist-type engagement by professionals, institutional investors have remained relatively passive.

Investors have enormous influence when it comes to corporate strategy and behaviour, arguably more than most national governments. To put this in perspective, the biggest fund managers have assets under their management equivalent to the GDPs of some major countries. BlackRock's assets under management are equivalent to the GDP of Japan, Vanguard's to the UK. Investors define the pay and the career prospects of corporate CEOs and there are myriad other connections that mediate this influence.

What could and should investors be doing? Investors need to act as forceful stewards and take shared responsibility for the long-term development of their investments by using their influence to shape public policy, to guide investee companies and to direct informational intermediaries. Let us take each in turn.

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▲ New York City Mayor Bill de Blasio on Wall Street. The strength of commitment to the Paris Agreement pledged by de Blasio and other mayors contrasts with the more muted support from the financial sector

First, let us consider forceful stewardship of climate-related public policy. What would this look like? Historically, the finance sector has been most effective when it is lobbying against something.

In the US, the already minimalist 'fiduciary duty rule' has now been kicked into the long grass. And in Europe – despite significant cross-party political support – the Financial Transaction Tax is still being delayed largely because of opposition from the finance sector. A coordinated approach to this kind of lobbying is required, but with a positive agenda. For example: to promote climate wellbeing.

One early example of good practice is how some major insurance companies came together to lobby against fossil fuel subsidies – how they will step up their activities to ensure policy change that means persuading others, notably US insurance companies, is yet to be seen.

The way investors responded to the final report of the Taskforce on Climate-related Financial Disclosure (TCFD) is another good example of the change that is needed.

A close comparison of the impressive list of companies that supported the Task

Also in this section

Force (notably, with considerable staff time), to the stellar roster of 103 companies whose CEOs signed a letter in support of its recommendations, reveals some curious discrepancies.

In the financial sector, for example, missing from the CEO signatories were BlackRock, Banco Bradesco, JP Morgan and Mercer. Yet all the organisations are said to have played very active roles in the TCFD; indeed Banco Bradesco provided two Deputy Chairs for the TCFD.

Some of the reasons for inaction cited include: "we don't sign on to group statements", "don't worry about the CEO signature – what matters is what the front-line investment staff do in the day-to-day interactions with companies" and "we are a complex organisation and we can't bulldoze this change through".

We have also heard there is a culture, especially in the US, of financial sector organisations being active in responsible investment projects with no expectation of visible or authentic CEO leadership. This is, of course, very different from other organisations, such as the Business Roundtable and the World Business Council for Sustainable Development, where CEOs take a personal leadership role.

Many of the big investors were also missing from the letter voicing support for the Paris Agreement. Also missing were the six major US banks who called for "cooperation among governments in reaching a global climate agreement" ahead of the Paris Agreement. Did the election of Donald Trump really invalidate their earlier judgment of risk?

The bottom line is that most of the 10 largest investment managers in the world have stood back from giving their full support to both TCFD and the Paris Agreement. These players – the vast majority of whom are US headquartered – therefore share responsibility with President Trump for missing this opportunity to contribute to a climate safe world, and in failing those who rely on their leadership.

The good news is that five investment firms have demonstrated their leadership at the CEO level, which shows us that investor leadership is possible.

The forceful stewardship approach

Second, we need forceful stewardship of investee companies. Equity but also debt, infrastructure and other investors must, if they are genuinely climate aware, be explicit about the risks involved in ignoring, or going slow on, the transition to a low-carbon world.

Schroders is a good example of an asset management company that speaks clearly to the mainstream press. The time has passed for private gentle discussions, company by company, about incremental change. What is now needed is sector-wide transformation, starting with the high-impact sectors, in particular energy utilities and automobiles.

The best way to do this is for investors to vote for AGM resolutions calling for the companies to publish net-zero-by-2050 transition plans. These two sectors, which are the biggest users of fossil fuels, are also already facing disruption so there is every reason for investors to want to know how the coming transition will be handled.

There is a very strong case for prudent investors – whatever they think of the science of climate change – to want this information and it is encouraging that in 2016, 40-60 per cent of shareowners voted for such disclosure.

And finally, investors should research and be forceful stewards of their own supply chain and thus the critical informational intermediaries, given the huge (but largely hidden) importance of sell-side and credit rating analysts, voting advisers and auditors.

In the last financial crash, credit rating agencies played a major role in facilitating market mispricings. It will be critical that these powerful but largely hidden intermediaries don't make the same mistake with the 'sub-clime' crisis.

Let me be crystal clear: this focus on stewardship is very different from what investors generally highlight when they are talking about climate change to the media or at UN events.

Some speak of divestment, which can challenge the legitimacy of the fossil fuel sector and can manage stock risk, and perhaps even sector risk if exposure to the sector is significantly reduced. Some speak of portfolio decarbonisation, which is a good strategy for delivering financial outperformance at low cost (such as 'smart beta' investments) and which also has a 'virtue signalling' effect when done by large numbers of big fund managers. Some highlight their investment in green equity funds or climate bonds – and these can provide good investment returns and could help trigger market change.

> ***When we choose to think of Donald Trump as the cause of the problem – and empower him in the process – we forget that we, individually and collectively, could be doing much more to walk our talk***

While these can all be good strategies for maximising risk-adjusted portfolio returns relative to peers, and creating a positive market narrative, none of these strategies are primarily designed to manage systemic risk. Only forceful stewardship can do that. This is an example of an 'inconvenient truth' close to home for responsible investors and needs to be acknowledged, at least in private, before investors can really be part of the solution to climate change.

Who can lead the way?

So who has to do what differently to get forceful stewardship adopted? Who are the stakeholders who could persuade investment firm leaders to lead?

The responsible investment professional bodies (such as CDP, the Ceres Investors Network on Climate Risk, and Principles for Responsible Investment) could usefully raise their membership bars. If they do not do so, they risk – inadvertently and unintentionally – masking the fact that

The 20 wealthiest countries and the 20 largest investment managers compared (US$ bn)

COUNTRY	GDP	INVESTOR	AUM	HQ
United States	17,348	BlackRock	4,675	US
China	10,357	Vanguard Asset Management	3,134	US
Japan	4,602	State Street Global Advisors	2,460	US/UK
Germany	3,874	Fidelity Investments	1,940	US
United Kingdom	2,950	BNY Mellon Investment Management EMEA	1,711	US
France	2,834	J.P. Morgan Asset Management	1,540	US
Brazil	2,347	Capital Group	1,419	US
Italy	2,148	PIMCO	1,413	US
India	2,051	Government Pension Investment Fund	1,255	Japan
Russia	1,861	Pramerica Investment Management	1,177	US
Canada	1,785	Amundi	1,052	France
Australia	1,443	Goldman Sachs Asset Management International	1,029	US
Korea	1,410	Norway Government Pension Fund Global	985	Norway
Spain	1,407	Northern Trust Asset Management	938	US
Mexico	1,291	Wellington Management	918	US
Indonesia	889	Natixis Global Asset Management	894	France
Netherlands	881	Franklin Templeton Investments	884	US
Turkey	798	Deutsche Asset & Wealth Management	877	Germany
Saudi Arabia	746	TIAA-CREF	855	US
Switzerland	704	Abu Dhabi Investment Authority	844	UAE

Source: Preventable Surprises/IMF. Figures based on 2014

the biggest investors – many of whom are also members – are failing to do what they should be doing.

These bodies could, for example, review the membership of those investors who abstained or voted against resolutions calling for scenario analysis aligned with Paris targets. These resolutions call simply for disclosure of scenario analysis and are fully consistent with the recommendations of the TCFD.

Thus, it is entirely reasonable that investors who do not support such resolutions should explain, in public, why they want to continue to be members of responsible investment bodies.

City mayors who are looking to punch above their weight could ensure their pension funds act as forceful stewards. Some have adopted the fossil free strategy and these cities could move to the next level: Fossil Free 2.0, in other words, also focusing on heavy demand sectors. And for cities that have rejected divestment, then clearly forceful stewardship is the way forward.

NGOs and philanthropic foundations concerned about the impact of climate change could make clear that they consider forceful stewardship of the sectors that are major fossil fuel users to be as important as divestment from fossil fuels. Any NGOs and foundations that have rejected divestment should be especially supportive of forceful stewardship.

Religious leaders like the Pope could also adopt this approach and so help end the stand-off between their pro- and anti-divestment advisers. The UN Joint Staff Pension Fund, which is active on several environmental, social and governance fronts, could also adopt a forceful stewardship approach.

All these examples have one thing in common. When we choose to think of Donald Trump as the cause of the problem – and empower him in the process – we forget that we, individually and collectively, could be doing much more to walk our talk, and this includes how we invest.

So let's stop asking what Trump's impact on the climate will be. Rather let's ask what we will do differently now. That's the only thing we have control over.

And if enough readers of this publication think big, this really could bend the curve of greenhouse gases by 2020 and so transform the world. ●

Bridge to a cleaner energy future

*By **Thomas Weber**, President, Jupiter Oxygen. Weber is on the Board of Directors of the US Business Council for Sustainable Energy and also represents Jupiter Oxygen at the Global CCS Institute and the Carbon Sequestration Leadership Forum*

When considering the options to cut CO_2 emissions and meet the targets of the Paris Agreement, one solution may have slipped below the radar: using CO_2 as a commercial commodity instead of treating it as waste. Technologies exist to do this today.

The solution is especially appealing to emerging economies, where the use of fossil fuels will continue, and likely increase, for decades – despite ambitious climate policies. One case in point is India. With 18% of the global population (1.3 billion people), India uses just 6% of the world's primary energy, and some 240 million people still have no access to electricity. Limited availability of energy is a major obstacle to India's development. The government's primary goal is to boost economic growth, which at the same time will increase energy consumption. The International Energy Agency (IEA) projects that India's energy demand will more than double by 2040 (IEA, 2015).

But while per capita CO_2 emissions are lower than those of China and significantly lower than the US, India is already the fourth largest carbon emitter. How to try to meet energy needs while keeping CO_2 in check? India plans to significantly increase renewable energy – for example, with the 100 GW solar power initiative by 2022, as announced at COP 21 in Paris (Government of India INDC 2015). However, the pace of economic change is too fast for renewables to take over an energy system where three quarters of energy demand is met by fossil fuels and where coal is the backbone of the Indian power sector, accounting for over 70% of generation. Coal is abundant in the country, and cheap; the government will necessarily keep investing in this resource and it is expected that the share of coal in the primary energy mix will even increase between now and 2040 (IEA, 2015). Any climate and energy policy will have to consider that reality. This is where Carbon Capture, Utilisation and Storage (CCUS), today – and the reuse of carbon (CCU) at scale in the near future – come into play.

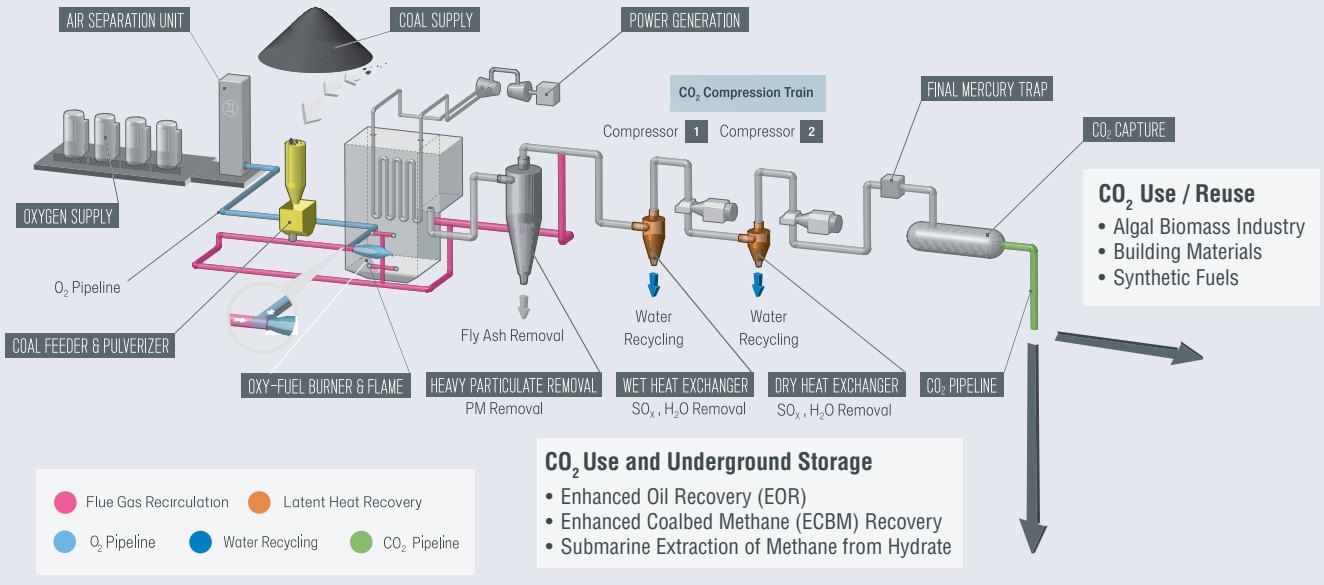
For example, one strategy has been developed to capture, utilise and store CO_2, using oxygen combustion to capture CO_2 from industrial facilities and power plants in order to inject it at high pressure into coal seams. This approach is a game-changer as it combines several attributes that support the effective and environmentally responsible use of fossil fuels (see schematic below ▼).

First, the use of high flame temperature oxy-combustion (burning fossil fuels in a boiler with nearly pure oxygen) maximises fuel efficiency and enables cost-effective carbon capture.

Second, this oxy-combustion process produces both CO_2 and nitrogen, which, when injected at high pressure (and permanently stored) in deep, unminable coal seams, significantly increases domestic gas production. The freed coal-bed methane (natural gas) is collected, sold and used, acting as an important bridge fuel in the transition to clean energy. (The process is referred to as Enhanced Coal-Bed

JUPITER OXYGEN'S CARBON CAPTURE PROCESS FOR COAL POWER PLANT RETROFITS

Oxy-combustion based carbon capture in conjunction with CO_2 utilisation offers economic solutions to substantially mitigate emissions



Schematic: JOC carbon capture technology developed in conjunction with National Energy Technology Laboratory of US Department of Energy

Methane "ECBM" recovery, and has been field tested in the USA, Canada and China).

Third, the synergy of oxy-combustion, carbon capture and utilisation creates significant additional revenue streams. The greatest obstacle to date for the implementation of carbon capture technology at power plants has been the added capital expenditures and reduced operating efficiency, leading to higher electricity costs. Having a viable CBM/ECBM market available, where the captured CO_2 as well as nitrogen can be sold to CBM/ECBM facilities, creates an immediate business case for oxy-combustion-based carbon capture at coal-fired power plants. Revenues from the sale of CO_2, nitrogen and other by-products will offset the higher costs of operating power plants with carbon capture. In addition, co-benefits of this advanced coal power plant operation are 95% reduction of CO_2 emissions, air pollutant control (SOx, NOx, particulate matter and mercury removal), as well as heat recovery (which increases the efficiency of the process) and water recovery (a particularly valuable scarce resource in India).

The value of carbon capture and storage via ECBM technology has been recognised by the Indian National Science Academy (see interview with Dr Vikram Vishal ▶).

Tapping the potential

Jupiter Oxygen Corporation (JOC), a pioneer in oxy-combustion technology, has commenced an initial commercial CCUS-ECBM project in Xinjiang Province (western China), which includes retrofitting coal-fired power plants with JOC's high flame temperature oxy-combustion and CO_2 capture technologies. In addition, JOC is pursuing demonstration project development in West Bengal, India, potentially including collaboration between JOC and the Indian Institute of Technology Bombay.

In India the potential for this technology is substantial. The country has large coal reserves, but not much natural gas. There are estimated to be 70 to 90 trillion cubic feet (2.0 to 2.6 trillion cubic metres) of coal bed methane in place, of which 20 trillion cubic feet (0.57 trillion cubic metres) are recoverable with conventional CBM. Almost the same volume again is potentially recoverable with ECBM (Kuuskraa, 2009). And exploiting the full potential of ECBM in India could deliver several billion metric tons of CO_2 storage capacity. As ECBM projects come into existence and expand, infrastructure and expertise will grow, enabling identification of the business opportunities that take advantage of proximity between the unminable coal seams and CO_2 'source' facilities. Some of these opportunities have already been identified for India in a recent study commissioned by JOC (ARI, 2015).

In essence, this is a sector where India can demonstrate leadership. India's Nationally Determined Contribution (NDC) to the Paris Agreement calls for technological solutions and international collaboration on clean coal. Furthermore, India is committed to reduce the carbon intensity of its GDP by 33-35% by 2030 from 2005 levels, a goal that is hard to reach without addressing fossil fuel emissions. But it's not just India. The IEA says that 70% of all carbon capture and storage in 2050 will need to be in non-OECD countries, where energy demand is growing and fossil fuels remain an important resource. Meanwhile, the fight against climate change is becoming a race against time. A recent report by the University of Washington shows that there is only a 5% chance of keeping global warming below 2°C by 2100.

As a complement to renewables and energy efficiency, CCUS and CCU offer an important bridge to a cleaner energy future, allowing us to be smarter about fossil fuels. ■

- ARI (2015) Advanced Resources International: Screening-Level Assessment of Enhanced Coalbed Methane and CO_2 Enhanced Oil Recovery Opportunities in India
- IEA (2015) International Energy Agency World Energy Outlook
- Government of India (2015): India's Intended Nationally Determined Contribution
- Kuuskraa VA, Stevens SH (2009) World gas shales and unconventional gas: a status report. Presented at United Nations Climate Change Conference, Copenhagen, Dec 2009

AN AWARD-WINNING TECHNIQUE

Dr Vikram Vishal, Assistant Professor from the Indian Institute of Technology Bombay, was awarded the Indian National Science Academy Medal for Young Scientist 2017 and the National Award 2017 by the Indian Ministry of Earth Sciences. He received the awards for his research on CO_2 capture and storage combined with methane recovery in coal beds.

What are the most innovative parts of your discovery?

I generated underground conditions in the laboratory and replicated the movement of liquefied CO_2 into the rocks. This enabled a significant advance in the understanding of carbon dioxide's phase change behaviour in deep-seated reservoirs. The results have been used to model the CO_2 storage capacity vis-à-vis enhanced gas recovery potential for selected Indian reservoirs. The models worked well to predict values of additional methane recovery. We are now ready for field-based trials in the prospective basins.

Where did your ideas come from?

I grew up in an industrial city in India and was intrigued by the fate of black smoke emitted from the chimneys. I chose to study the storage of CO_2, produced by large coal-fired power plants located in close proximity to the coal fields. I was primarily motivated to look for ways to improve our energy security, but was also looking to reduce the cost of CO_2 storage.

What is the biggest obstacle to the take-up of this technology?

The first is the need to build a more complete understanding of the geological uncertainties. Other challenges relate to training, better information on the capture and storage sites, the economics of the operation and improving social awareness. However, these challenges are all addressable. Site-specific studies and pilot projects should be explored. Support from the government, the involvement of the industry, international collaboration and more focused R&D will be instrumental to success. Encouragingly, India appears to be ready to work on these and is showing commitment to address climate change.

JUPITER 21

JUPITER OXYGEN

UNA-UK thanks Jupiter Oxygen for its generous support for Climate 2020

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Asia and the Pacific: climate change dilemma

In a region particularly vulnerable to climate change, the poorest are most exposed. Efforts to improve prosperity must not exacerbate the problem

By **Bambang Susantono**, Vice-President for Knowledge Management and Sustainable Development, Asian Development Bank

Asia and the Pacific continues to experience rapid economic development, with the region's economies posting 5.8 per cent growth in gross domestic product in 2016, representing 60 per cent of global growth.

For decades this growth has been facilitated by the consumption of fossil fuels. Continued economic expansion, widening access to electricity and rapid proliferation of the vehicle fleet are key contributors to Asia's growing share of global greenhouse gases, which could rise to 48 per cent by 2030 from approximately 40 per cent in 2016.

◀ Children living on the waterfront in Tondo, the Philippines, play amongst the rubbish washed ashore following a typhoon. The country has a disproportionate number of cities threatened by sea-level rises

Economies in the region need to rapidly decarbonise to alter this trend.

The region remains extremely vulnerable to the impacts of climate change. *A Region at Risk: The Human Dimensions of Climate Change in Asia and the Pacific*, a new publication from the Asian Development Bank (ADB) and the Potsdam Institute for Climate Impact Research (PIK), shows that under a business-as-usual scenario, expected temperature increase over the land area of Asia could reach as much as 6ºC by 2100.

Even if the Paris Agreement goal to limit global temperature rise to below 2ºC is met, Asia and the Pacific will still experience a greater frequency and intensity of heavy rainfall events, widespread coral bleaching and erratic precipitation patterns. In the high mountains of Asia, glaciers will recede, increasing water discharge in rivers and flooding land and communities, while causing water shortages due to the glaciers' diminished capacity for natural water storage. Sea-level rise will challenge the region's increasingly urbanised coastline: 19 of the 25 cities globally most exposed to a one-meter sea-level rise are in the region; seven are in the Philippines.

Climate change impacts on human systems, including food supply (agriculture and fisheries), human health (undernutrition and heat stroke) and security and migration will be unparalleled, according to the report. Rice yields in most Southeast Asian countries could decrease by as much as 50 per cent, which could lead to an additional 26,000 child deaths (deaths of those under five years old) annually by 2030, primarily due to undernutrition.

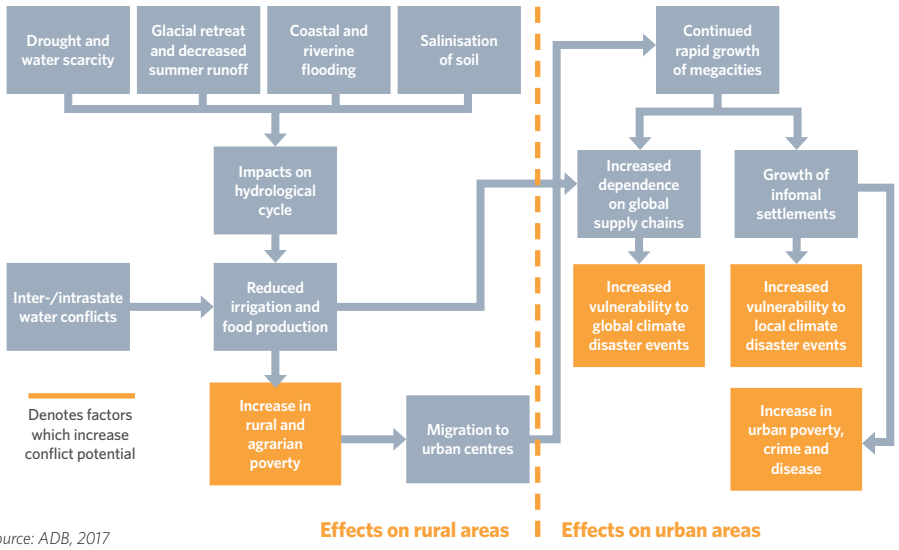
With natural resources at the brink, poverty in rural areas could become more prevalent and migration to cities could be inevitable, leading to a growth in informal settlements. As illustrated in Figure 1, climate change not only threatens energy, water, and food security, but also has the potential to destabilise local and national economies and generate conflicts in both rural and urban areas.

Mitigation opportunities to reduce risk

Transforming the response of cities and the energy sector are key to addressing the mitigation of greenhouse gases and reducing the impacts of climate change.

Cities have the greatest opportunity to mandate the use of renewable energy, build green infrastructure, promote sustainable transport and create flood-free environments. Designing green, sustainable and resilient urban plans is essential to slowing global warming and multiplying opportunities to effectively address the future impacts of climate change.

Figure 1. Possible impacts of climate change-related resource shortages on rural and urban populations



Source: ADB, 2017

While the region is already investing in clean energy, ADB's *Asian Development Outlook (ADO) 2016 Update: Meeting the Low-Carbon Growth Challenge* shows that much broader action is required.

Developing Asia needs to invest an additional $300 billion per year through 2050 in renewable power, carbon capture and storage, smart grids and energy storage to avoid locking itself into a high-carbon development path that would be costlier to reverse. The study also shows that a third of the region's emissions reductions by 2050 can come from better energy efficiency. Investment in energy efficiency is a key driver of low carbon growth.

Commitments to the reduction of greenhouse gas emissions are at the heart of nationally determined contributions (NDCs) under the Paris Agreement. Asia and the Pacific's NDCs show the potential for the region to substantially contribute to limiting earth's global warming, and there is leeway for bigger ambitions.

Under current NDC submissions, the People's Republic of China has committed to reduce greenhouse gas emissions by 60-65 per cent by 2030, India by 33-35 per cent and Indonesia by 29 per cent. Under a business-as-usual scenario, these three countries were projected to comprise 89 per cent of Asia and the Pacific's total emissions by 2030.

The ADO Update conducted various modelling scenarios for Asia's carbon future. Figure 2 compares two scenarios: 'INDC' which assumes implementation of the current intended NDCs (INDCs) up to 2030 and mitigation strengthening at a constant rate thereafter; and 'INDC to 2ºC scenario' which follows the INDC scenario to 2030 and then assumes strengthened mitigation to meet the Paris goal by 2100.

The figure represents cuts in emissions against a base case, business as usual scenario. Under the INDC scenario to 2050, emissions would be reduced by half by China, nearly 40 per cent by Indonesia and 20 per cent by India, with the rest of the region making more modest cuts. As can be seen by the scale of the gap between the INDC and INDC to 2°C scenarios, the region needs to adopt a greater urgency if it is to avert catastrophic climate change.

The pricing of carbon emissions and the removal of subsidies for fossil fuel based energy production and consumption will incentivise clean energy investments and facilitate decarbonisation.

The People's Republic of China is currently readying itself to implement a national emissions trading scheme building on 10 years of emissions trading experience, initially through the Clean Development Mechanism and seven carbon market pilots. Establishing enabling environments through effective regulatory mandates such as the use of renewable energy is critical to successful proliferation of low-carbon technology.

In a report published in 2015, the International Monetary Fund demonstrated that eliminating post-tax energy subsidies could not only cut global emissions of carbon dioxide by more than 20 per cent, but also raise government revenue by approximately $3 trillion.

cities globally most exposed to a **one-metre** sea-level rise are in **Asia and the Pacific; seven are in the Philippines**

Such funds could then partly be used in furthering mitigation and proving support to achieving the climate resilience of rural and urban communities. The private sector also plays a vital role in reducing risk and facilitating access to clean energy investments.

Role of financial risk management for technology deployment

In support of these key policy areas, ADB has recently established the High-Level Technology Fund, with a $40 million contribution from the Government of Japan to promote a broad range of technologies and innovative solutions in areas such as climate change, energy and transport.

ADB has also established the Asia Pacific Climate Finance Fund (ACliFF) with a $30 million contribution from the Government of Germany to support the development and implementation of financial risk management products to help unlock capital for climate investments including enhancing resilience of projects. These two funds help ADB enshrine its commitment for innovation in the region.

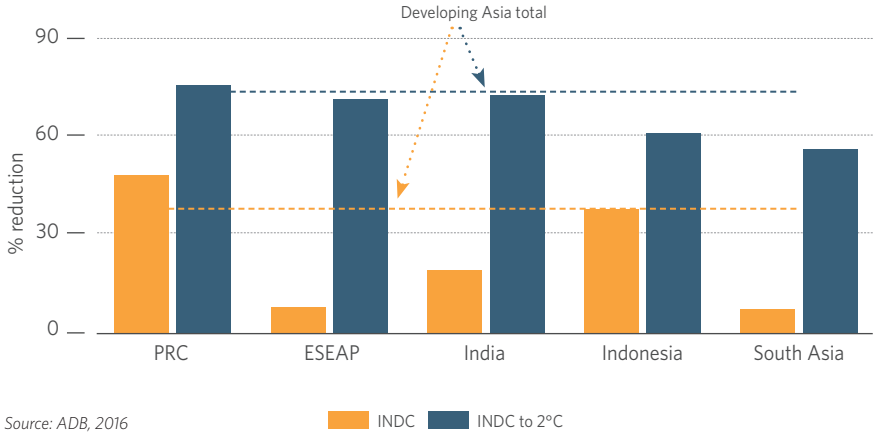
In 2016, ADB approved a record $3.7 billion in climate financing from its own resources and committed to scale up to $6 billion by 2020. ADB projects also mobilised an additional $701 million from external resources.

These actions are taken in recognition that Asia and the Pacific is the region where the battle against climate change will be won or lost. ADB will exert every effort to assist its developing member countries in addressing climate change through its commitments to scale up finance, enhance knowledge support and impart innovative technology.

The only way to meet the goals of the Paris Agreement and Sustainable Development Goal 13 (on climate action) is to pursue a low-carbon and climate resilient development pathway, and to do it with determination and urgency.

Solutions to both mitigate greenhouse gas emissions and adapt to the impacts of climate change will come at a cost. But the cost of not acting will be much larger and may include a reversal of the major development gains made over recent decades. ●

Figure 2. Emissions reductions by 2050 under the 'INDC' and 'INDC to 2°C' scenarios, compared to business as usual



Source: ADB, 2016

Notes: East and Southeast Asia and the Pacific (ESEAP) includes American Samoa, Brunei, Cambodia, Fiji, French Polynesia, Guam, Kiribati, the Lao People's Democratic Republic, Malaysia, the Marshall Islands, the Federated States of Micronesia, Mongolia, Myanmar, New Caledonia, the Northern Mariana Islands, Palau, Papua New Guinea, the Philippines, Samoa, Singapore, Solomon Islands, Thailand, Timor-Leste, Tonga, Vanuatu, Viet Nam, Taipei, and Hong Kong. South Asia includes Afghanistan, Bangladesh, Bhutan, the Maldives, Nepal, Pakistan and Sri Lanka.

Sources:
- ADB. 2017. A Region at Risk: The Human Dimensions of Climate Change in Asia and the Pacific
- ADB. 2016. Asian Development Outlook (ADO) 2016 Update: Meeting the Low-Carbon Growth Challenge
- ADB. 2016. The Economics of Greenhouse Gas Mitigation in Developing Asia
- Germanwatch. Global Climate Risk Index 2017
- Global Carbon Atlas. 2017. www.globalcarbonatlas.org/en/CO2-emissions
- IMF. 2015. How large are global energy subsidies? IMF Working Paper WP/15/105.

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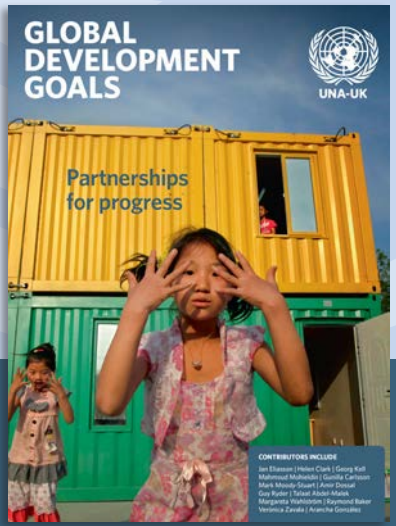

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For more information, email: claire.manuel@witanmedia.com

Energy storage and transmission

Switching our energy use from fossil fuels to renewables will require a fundamental upgrade to the infrastructure that distributes and stores power. How are countries making progress?

By **Kamel Ben Naceur**, Director of Sustainability, Technology and Outlooks, Research Division, IEA

The power sector is the largest emitter of CO_2 today, with emissions projected to increase rapidly unless we take swift action. In the International Energy Agency's (IEA's) base case scenario (which takes into account existing energy and climate commitments, including those in the Paris Agreement), electricity demand more than doubles between 2015 and 2060, with CO_2 emissions reaching 15 billion tons per year from power generation.

Another IEA scenario, compatible with the Paris COP21 (the 2015 UN climate conference) ambition of limiting the temperature increase to less than 2°C, sees the power sector reaching net-zero emissions by 2060.

The ingredients in reaching such an unprecedented transformation include: a profound change in the power generation primary mix (from fossil fuels to renewables and carbon capture and storage, or CCS); a similar shift in energy demand management; an expansion and upgrading of electricity grids; and an accelerated deployment of storage.

Since the beginning of the decade, political support and technological progress have combined to accelerate the pace of decarbonisation of power generation. This has led to some spectacular results. In 2016, generators across the globe set a new record, adding 161 GW of electrical capacity through new renewable sources.[1]

In Germany, on one day, the share of electricity supplied by renewable sources reached 87 per cent. A handful of countries – including Paraguay and Iceland – have already reached the holy grail of 100 per cent. But despite these encouraging examples, sadly most countries today do

◀ Votna, one of a series of man-made lakes feeding a hydroelectric power station in Hordaland county, Norway. Improved connectivity between countries will allow other parts of Europe to store energy in the Nordic reservoirs, mitigating the variability of their own renewable sources

not have such potential for renewable energy generation.

For most, the pace of transition is not rapid enough. The question, then, is whether 100 per cent low-carbon power generation is achievable in the near future. And, given the intermittent nature of renewable sources, what increasing role will energy storage have to play?

Today, worldwide energy storage stands at 150 GW of 'pumped hydro' (energy stored by pumping water uphill), and only about 1 GW of all other storage technologies combined. In the 2°C scenario, total storage needs to triple, and there are few expansion possibilities for hydro. The focus instead will be on smaller-scale, modular technologies like batteries that can be deployed anywhere in the power system.

Battery cost-cutting will be an essential factor, as today's cost ($300 per kWh) will need to decline by a factor of four by 2050 to make the scenario viable. The current generation of batteries uses lithium-ion chemistry. For electric vehicles, the most common type of battery uses nickel and manganese with cobalt or aluminium.

There are concerns about the short-term availability of lithium for such a fast-growth market. Other metals will also experience similar demand growth issues – cobalt, for example, for which two thirds of the current supply comes from a single country, the Democratic Republic of Congo.

To help ensure battery costs can indeed fall over the longer term, other technologies are being tested to potentially replace lithium, such as sodium sulphur and flow batteries. Another strategy is reusing end-of-life batteries, such as those from electric vehicles, to provide ancillary services to electricity networks.

The flow of power

Today, the installed infrastructure of electricity networks spans more than 50 million km. Traditionally, the flow of power has been monodirectional, from large production plants to consumers. With more and more end users now able to generate their own power (for example through solar panels), high and mid-voltage electricity networks are being transformed to include more distributed generation (where power is generated where it is used) and interconnectors.

Globally, electricity networks represent 40 per cent of the investment in electricity generation, transmission and distribution, at $280 billion per year. By 2060, the planet will need network size to increase by 75 per cent, with a much greater emphasis on flexibility and interconnection.

Network expansion

Another fundamental change that needs to occur is in the regional expansion of power networks. Until now, power grids have been viewed mostly as national investments, with little consideration for inter-country connections. This is now changing. In Europe, the European Commission has stepped up its regional interconnection ambitions, with plans to invest up to €140 billion by 2020 through so-called projects of common interest. These include high-voltage DC (HVDC) transmission or connection projects.

The worldwide capacity of HVDC transmission links and interconnectors amounts to about 250 GW (roughly the generation capacity of France and Italy combined). This capacity needs to expand by a third by 2020 – and double by 2025 – if we are to meet the 2°C scenario. The prime reason for this expansion is to accommodate an order of magnitude increase of variable renewable energy between now and 2060. That could represent a significant shift in power transmission technology.

Today, alternating current (AC) is the preferred global platform for homes and businesses. For medium to long-distance transmission (above 600 km), HVDC is preferred to HVAC transmission. For interconnection, synchronising different AC systems can be complex, due to the voltage and frequency requirements.

Therefore, HVDC is increasingly used to connect large AC systems, such as in South America and in Nordic/Baltic Europe.

Systems of the future

A final pillar of electricity infrastructure in a low-carbon energy system is active demand-side management, through the suite of digital technologies covered by smart grids. The architecture of the electricity system of the future requires interoperability and solutions such as adapted business models that make the system flexible.

Grids of tomorrow need to be able to cope with variable (solar, wind) and inflexible (nuclear, gas with CCS) supply, as well as flexibility on the demand side due to distributed generation. The renewable energy future won't just include new equipment – new types of storage, heat pumps, and so on – it must also factor in new behaviour from consumers.

The IEA has created a thematic network (IEA DSM Technology Collaboration Programme) with the purpose of developing and promoting tools and information on demand-side management and energy efficiency.

Among the 25 Tasks that have been defined by the IEA DSM, behavioural change occupies an important place. DSM policies and energy efficiency's uptake are not only dictated by technologies and policies, but also by behavioural and societal drivers and barriers.

The IEA DSM, starting with the consideration that the human need for the services derived from energy and behavioural interventions are both important, has developed a different behavioural change framework, including collective impact approach and storytelling as overarching methodologies.

Capturing the full benefits of energy storage require further development of market and regulatory frameworks. A particular focus should be made on the integration of storage systems with existing grid infrastructure or with on-site power generation. Demand side management, including behavioural aspects, data analytics and resiliency are all necessary ingredients for a successful implementation. ●

1 Renewable Energy Policy Network for the 21st Century. (2017). Advancing the Global Renewable Energy Transition. Paris.

Harnessing hydropower

Hydropower technology provider Voith is working towards a more effective renewable energy future

By **Uwe Wehnhardt**, President and CEO of Voith Hydro, member of the Voith Corporate Board of Management and Board member of the International Hydropower Association

Renewable energy is undoubtedly the most sustainable answer to rising energy demands. And hydropower plays a key role in environment-friendly power generation from regenerative energies. It is the leading renewable source of electricity generation globally, supplying 72 per cent of all renewable energy sources within the worldwide electricity mix.

In 2015, renewables accounted for more than half of all new electricity generation capacity globally for the first time. By 2040, power generation from renewable energies will increase to account for a third of today's total energy production. Hydropower will play a major role in this evolution, as worldwide hydropower generation will increase as well.

What is the secret of hydropower? It's the very efficient transformation of the mechanical energy stored naturally in water, firstly into the mechanical torque of the machine's shaft via the turbine, and secondly the conversion of shaft torque into electrical energy by the generator.

There are three types of hydropower stations which can be used to exploit the stored energy in water. First, there is the 'run-of-river' power station, where the electricity is generated from flowing water in a river. Second, there is the 'reservoir' energy source, where power is generated through the release of water stored in a naturally-fed reservoir behind a dam. A third model is the 'pumped storage' power plant, where stored water is recycled by pumping it back up to a higher reservoir in order to be released again when demand for power increases.

Major advantage: storage capability

In fact, pumped storage power plants are vital for the secure, sustainable and cost-effective supply of renewable energies. They represent the only system capable of storing energy on an industrial scale like a battery does. This enables them to complement weather-dependent wind and solar power, making them especially suitable for compensating fluctuations between power surpluses and shortages.

Indeed, pumped storage plants provide proven responsiveness to these fluctuations in demand, with modern systems needing only 30 seconds to start from a standstill. For this reason, they are able to contribute significantly to regulating and stabilising the power grid. Their special combination of storage system, reserve

The energy demand equivalent to

3.3 billion

households could be served by harnessing unutilised hydropower potential worldwide.

power and flexibility makes pumped storage plants true multi-functional power stations for ensuring system adequacy.

Preventing unnecessary emissions

These storage capabilities, in combination with low carbon dioxide emissions, make hydropower a valuable resource in achieving governmental targets aimed at reducing the impact of climate change. Current model calculations show that between 2015 and 2050, more than 120 billion tons of CO_2 emissions will be avoided by the use of hydropower globally. Moreover, the 2015 Hydropower Report revealed that World Energy Council countries – where the share of hydropower in electricity production is higher than average – generally have lower CO_2 emissions per kWh of electricity generated. For this reason, an ever increasing number of countries around the world are looking to maximise the potential of hydropower.

There are many opportunities for hydropower development throughout the world and although there is no clear consensus, estimates indicate the availability of more than 10,000 terawatt hours/year of unutilised hydropower potential worldwide. A household of three consumes 3,000 kilowatt hours of power on average every year. Hence the unused potential could serve the equivalent of 3.3 billion households.

Hydropower is renewable, reliable, affordable and good for economic and social development

Untapped potential is everywhere

The hydropower facilities installed today vary in terms of generation capacity from less than 100 kilowatts, to more than 18 gigawatts. Nevertheless, in most highly developed countries, the potential of technically usable hydropower is still far from exhausted.

At the end of 2015, the leading hydropower generating countries were China, the US, Brazil, Canada, India and Russia. China operates the world's largest hydropower plant, the Three Gorges Dam (18,200 megawatt), but also a series of other large-scale plants, including Xiluodu and Baihetan (approx. 12,000 megawatts). Power stations like these clearly demonstrate how hydropower has been able to reliably supply countless millions of people with power over decades. But the enormous potential for power generation in emerging countries and at smaller scales is still to be maximised.

Hydropower plants with an output of up to 30 megawatts can have immense impacts. In certain remote and mountainous regions small hydropower plants guarantee a local, stable power supply. They bring electricity to thousands of people. Rural societies running small-scale industries can immensely benefit from well-interlinked hydropower plant networks. They are thereby often a precursor for economic growth and social development and maintain their position as one of the most reliable and cost efficient renewable energy sources. This is also because tens of thousands of existing weirs, smaller dams and locks could be used for hydropower generation right away.

Conclusion

Hydropower is renewable, reliable, affordable and good for economic and social development. Its storage and base load capabilities, as well as low carbon dioxide emissions, make hydropower a valuable resource in achieving current climate change targets. It is versatile and offers significant unexploited potential in highly industrialised countries, as well as in emerging or developing regions. And, in particular, the demand for pumped storage power plants will continue to grow, as they enable countries around the world to maximise their use of other fluctuating renewable energy sources, even as overall demand for electricity increases.

About Voith

Voith has been a leading supplier of hydropower technology since its origins in 1870, and has been advancing the technology ever since. As a full-line supplier covering the entire lifecycle and every component of new and existing large and small hydropower plants, it is only logical that new products and solutions are also being developed for the digital hydropower plants of the future. Digital solutions will help energy suppliers run their hydropower plants even more efficiently or reduce operational costs. In addition, analysed and interpreted operational data will allow a much deeper understanding of hydropower machine behaviour. ■

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UNA-UK thanks Voith for its generous support for Climate 2020

Clean transport: where next for Europe?

What can Europe learn from its vehicle emissions scandal? Can it hope to lead the world again in developing the clean transportation systems essential to avoid climate catastrophe?

By **William Todts**, Executive Director, Transport & Environment

The defining challenge of our time is the fight against climate change. Indeed, if we fail, we will be making large parts of the world uninhabitable and causing enormous stress to the world order as we know it.

One of the major contributors to global warming is transport. Globally it accounts for 14 per cent of greenhouse gas emissions. In developed economies it is responsible for roughly a quarter of emissions. In recent decades transport emissions have increased steadily. To achieve the Paris Agreement's objectives, we will need to reverse this trend and cut emissions to near zero by the middle of the century.

This is a daunting challenge. Europe has traditionally been a frontrunner in the fight against climate change, including in the field of transportation. The EU's CO_2 standards for new cars, adopted in 2009, were the world's most ambitious and promised to cut new car CO_2 and fuel use by 40 per cent in 12 years. These regulations were adopted at a time when people around the world thought of European cars as the best in the world.

Europe's leading position was not just a reputational affair. Indeed, Europe's environmental standards were copied across the globe. The so-called Euro standards that measure vehicle exhaust pollution are still used in much of Asia, Africa and South America. These standards were followed by similar exercises in the US, Japan and Korea, leading to what some dubbed the global race for cleaner cars.

Two years after the outbreak of the 'Dieselgate' scandal, Europe's reputation for leadership in clean transportation lies in tatters. Volkswagen was the first to get caught and fined for cheating on emissions tests but it soon became clear that VW was just the tip of the iceberg. All of Europe's household brands were engaged in similar types of optimisation, creative testing and use of software to pass emission tests. Millions of cars have been recalled and millions more will likely follow in the coming months. The scandal was primarily related to NOx emissions but also extends to carbon emissions and fuel use.

And just when everyone thought things couldn't get any worse, VW and fellow German carmakers Mercedes and BMW became embroiled in a scandal regarding what may turn out to be the biggest cartel in EU history. The cartel is – you guessed it – related to diesel emissions.

Meanwhile, Europe's carmakers are being outcompeted left, right and centre when it comes to new technologies. California and China are where most car innovation happens today – be it the field of electrification or vehicle automation. The launch of Tesla's Model 3 has sent shivers down the spines of Europe's car executives. Here is a car that is faster, more comfortable, cheaper and, above all, cleaner than many of its premium brethren.

The days of European leadership on clean transportation seem long gone and Europe's unhealthy love affair with diesel is to blame. However, Europe is still very much the master of its own destiny. In fact, the diesel crisis may well turn out to be a blessing in disguise and could be the 'shock therapy' Europe needs to reclaim its already vanishing leadership on clean transportation.

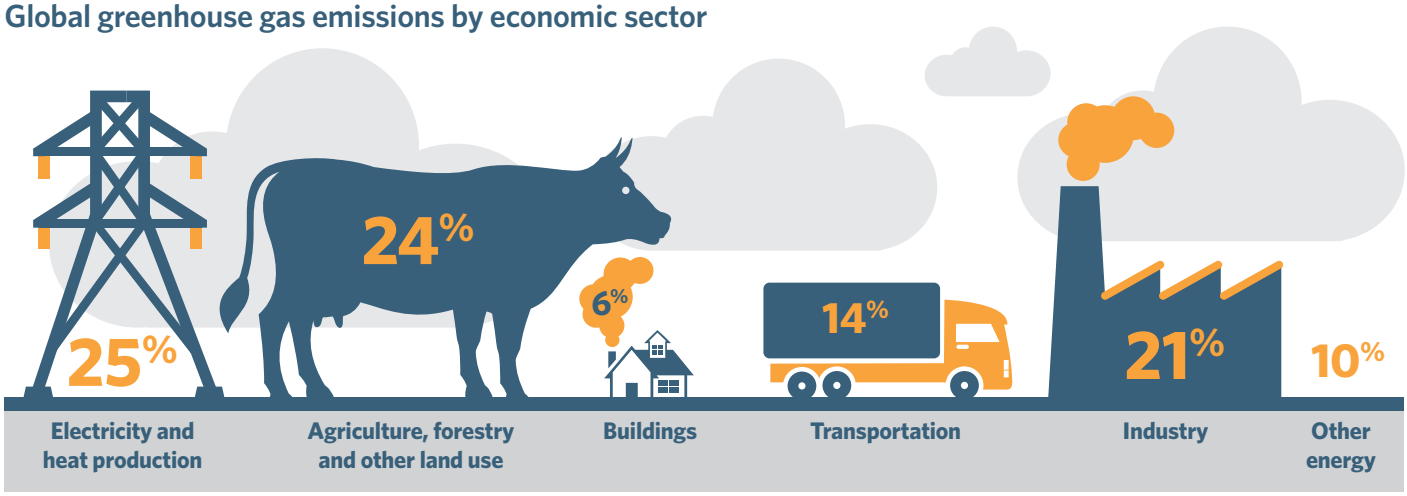
▲ **Work on Crossrail, Europe's biggest infrastructure project, which entails 26 miles of train tunnels under London and 10 new stations. Improved mass transit systems will need to accompany the clean car revolution if we are to achieve sustainable mobility**

The road ahead

One of the things to emerge after the signing of the Paris Agreement is a much greater understanding of the fact that we need to eliminate, rather than just reduce, carbon dioxide emissions. To reduce CO_2 emissions by, say, 20 per cent, improved diesel engines would do the trick. But cuts of 90-100 per cent require an altogether different technological solution. This explains environmentalists' excitement about the renewable energy and electric vehicle revolutions. Wind and solar energy are now the cheapest forms of new power generation – and this is why virtually all new power capacity in Europe is renewable. That means we can now imagine a future where electricity is not just clean but also plentiful and cheap.

Indeed, you could argue that today's defining question in transport is: "How do we get clean electricity to power vehicles, vessels and aircraft?" Recent developments in lithium-ion batteries mean battery vehicles are clearly the top contender to solve that problem. In 2010 a kWh of battery power cost around $1,175. Now we are headed for $117. It's this massive cost reduction that enables Tesla to sell a

Global greenhouse gas emissions by economic sector



Source: IPCC (2014); based on global emissions from 2010. Details about the sources included in these estimates can be found in the Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

65 kWh car with around a 400 km range for $35,000 – that's roughly the cost of a comparable BMW, Audi or Mercedes. By the early 2020s electric cars will be cost competitive with diesel and petrol – not just for premium vehicles but for family cars too. That's the reason why virtually all major carmakers are rushing to join the electric vehicle (EV) race.

It is true that Europe's industry isn't leading this race. Tesla is a Californian company and some of the biggest investments in electric cars are made in China. But the EV race has only just started and in many ways the Model 3 is merely the opening stage. From 2018–19 onwards, European carmakers will be presenting their own electric cars, with high ranges and competitive prices. They may well overtake Tesla and the Chinese manufacturers.

Does that mean it will all be smooth sailing from here onwards? Unfortunately not. The advent of electric cars is very much the result of sustained regulatory pressure. Air pollution limits and, above all, CO_2 standards for new cars have turned the screws on petrol and diesel cars. California's sales target for EVs – in place since the 1990s but ramped up in the late 2000s – has been a particularly effective policy, which is why China is now copying this approach.

Without these types of regulations, there is a high chance that carmakers would take the foot off the accelerator and postpone investments. Alternatively, they could sell new technologies elsewhere and keep selling diesel in Europe. After all, they have been selling diesel and petrol engines for a hundred years, so they could easily continue doing so for another few decades.

Oil companies and diesel engine parts suppliers will use their clout to postpone the rise of electric cars. For them it is a matter of survival. And this is where the Dieselgate scandal and the EV revolution come together. Societies do not implode in a big bang. They fail because they do not adapt to technological and societal change and become inert. The old continent is still a place of considerable dynamism. The question is whether this will be enough to overcome the vested interests that seek to hold it back in the clean vehicles race.

> ***With ambitious new standards, Europe would push its mighty car industry in the direction of zero emissions. This would truly be a game changer***

A mobility revolution

The answer to this question will come in November when the European Commission presents new car emission rules. The Commission is considering new targets for 2025 and 2030 and is, for the first time, looking at a specific sales target for zero-emission cars.

With ambitious new standards, Europe would push its mighty car industry in the direction of zero emissions. This would truly be a game changer and it would likely create a snowball effect that would make the clean car revolution unstoppable – not just in Europe but in the whole world.

Of course this wouldn't mean we could sit back. Trucks, planes and ships will need to undergo the same revolution if we want to win the fight against global warming.

Finally, we need to acknowledge that sustainable mobility is about much more than eliminating emissions. Our current mobility system uses vast amounts of raw materials (to build vehicles), space (parking and streets) and causes all manner of distress for people who are exposed to it (noise and accidents).

This is why the clean car revolution needs to be accompanied by a mobility revolution with more liveable cities built on improved mass transit systems, car sharing and, of course, walking and cycling. ●

Rail technology at the heart of economy and society

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

Ansaldo STS is active all over the world as a contractor and supplier of turnkey services and solutions, executing large global projects for passenger and freight railways and metro lines.

In addition to its turnkey projects for large metro lines, Ansaldo STS boasts significant long-term experience in the high-speed sector as a supplier and integrator of all sub-systems: interoperable signalling systems, telecommunications, electric power supply, on-board equipment and integration and electrification, and wayside equipment.

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.

Ansaldo STS combines experience with human, financial and technological resources to provide innovative solutions in the design and construction of equipment and systems for conventional and high-speed railway lines, mass transit rail network signalling and automation for passengers and freight.

Unique vision

The more we make sustainable long-term decisions, the better the interaction between our company, society and the environment will be, and this approach is part of our competitive edge.

Ansaldo STS's economic sustainability is its strategic answer to the macroeconomic context and transportation market trends. It is based on a business model that develops distinctive abilities and skills to boost the company's market competitiveness: its core is the growth of human and organisational capital.

The Ansaldo STS brand remains strong around the world, especially now it is within the Hitachi group. We can seize new opportunities by sharing the ethics and principles that have always characterised Ansaldo STS. Our unique vision combines social innovation with awareness of the impact our work has on the daily lives of millions, through their travel needs and the transport of essential goods.

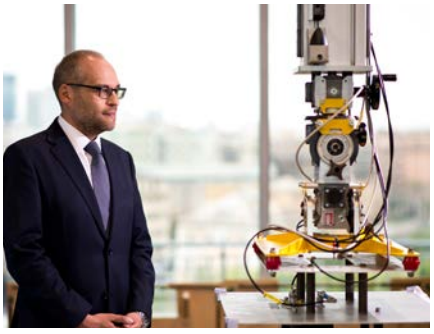
Creating innovative products

Our commitment continues to be focused on improving people's everyday lives, by connecting the passage of people and goods, business and pleasure. In doing this, we enable the creation of increasingly tangible and feasible social interaction and opportunities for economic development, through the use of technology applied to rail transport.

Ansaldo STS considers the social, economic, logistical, architectural, environmental and structural context of each project it handles, by planning, designing and building signalling and mass transit systems that provide the best possible combination of safety, efficiency and return on investment.

"We design and implement solutions and components for rail transport and mobility, creating value for our community," says Andrew Barr, Chief Executive Officer and General Manager of Ansaldo STS. "We are committed to creating innovative products that improve the quality of life and sustain responsibly the world in which we live.

"We consider sustainability in terms of social development, thus contributing to



security, efficiency, reliability and respect for the environment with solutions which are moving on daily millions of people and transporting goods needed to all; focusing on technological solutions in response to user needs in increasingly complex and diverse contexts and lifestyles." ■

We invite you to follow us and monitor our sustainable performances through www.ansaldo-sts.com/en/archive/2016-sustainability-report

Ansaldo STS A Hitachi Group Company

UNA-UK thanks Ansaldo STS for its generous support for Climate 2020

The UN's best allies are in the business sector

To tackle climate change, we need to reinvent our growth model and recognise that the UN and business need each other desperately

By **Veronica Lie**, Executive Vice President, Strategy and Systems, Xyntéo

The 1992 film *The Insider* recounts the true story of Jeffrey Wigand, a former head of R&D at tobacco company B&W, who tells the media that his colleagues not only knew that cigarettes were cancerous but were trying actively to make them even more addictive. Just as his interview was to be aired, B&W intervened.

But the truth will out and, today, the tobacco industry's deceit is common knowledge. The fall-out is now also wielded widely as a cautionary tale for companies that cling to business models, supply chains and products that harm the societies they are supposed to serve. As Paul Polman, CEO of Unilever and undoubtedly progressive business's most effective spokesperson, has said: "If you work at an insurance company that sells premiums you wouldn't even sell to your wife or mother, how happy would you feel to work there? …It certainly doesn't create the energy and engagement you need to be a long-term performing company."

Black spots remain. Just four years ago, a criminally flimsy textile factory in Dhaka District, Bangladesh collapsed, killing over 1,100 workers. Some oil and gas companies still continue to shirk responsibility for warming the climate and thus putting humanity at grave risk. And despite the exposure of cigarettes for what they are, tobacco still kills more than seven million people every year.

The biggest problems are the biggest markets

Yet, by and large, business leaders – the competent ones, anyway – recognise not only that they can't run successful businesses by screwing people over, but also that commercial success depends on being able to align business growth with human growth.

As Peter Diamandis of Singularity University says, "the biggest problems on the planet are the biggest market opportunities". Thus Unilever is making money by selling household cleaning products that improve sanitation. Mastercard is making money by increasing financial inclusion for the world's unbanked. Tesla is making money by driving the technological and commercial innovation that we need in batteries if we are to build an energy system in which renewables play a starring role, and not just a bit part.

Note: they are making money, not giving money. For those parties like the UN that are seeking to mobilise business as a partner in achieving social goals, this is a crucial distinction. Businesses need to see the upside of leading, not just the downside of lagging. They need to be aggressive and creative, not defensive and compliant. Initiatives like the UN Global Compact have been vital in building new business norms and in getting the private sector to accept their share of responsibility for the common good. But ultimately the full power of business will be unleashed by the push and pull of revenue, profit, demand, cost and returns on investment – in short: by the levers of growth.

Speaking in January in Davos, UN Secretary-General António Guterres noted that full implementation of the Sustainable Development Goals (SDGs) could yield something like $30 billion return on investment (ROI) per year. This is the right kind of narrative.

But there is a major caveat here. While appealing to the growth motive is surely the path to getting the private sector to throw its weight behind the Paris agreement, the SDGs and the like, we need also to recognise that the prevailing growth model is broken. So while the UN needs to learn how to speak more commercially, business needs to be prepared to redefine the terms of its success.

Our current growth model is literally eating itself. It is dependent on producing and consuming as much stuff as quickly as possible and rooted in metrics that do not reflect the true value or cost of activities.

Though received wisdom says that this system excels at allocating resources efficiently, we live in a world in which one per cent of the world's population holds 98 per cent of the wealth; in which only one per cent of materials remain in use six months after the point of purchase; in which income inequality has soared while wages have stagnated. Hershey, a 123-year-old American company that sells chocolate bars, attributed its poor performance in 2015 not to competition but to the fact that its customers could no longer afford its products.

Climate change is rightly considered one of the foremost challenges of our time. But finding a lasting solution depends on diagnosing the root problem. Climate change is actually a symptom of a much deeper ill – the fact that our growth model is not fit for the challenges of the 21st century.

So as the UN adjusts its narrative to hit the growth motive, it should also shift focus

▲ Planting the edible vine eru in the Cameroon forest. Iniatives like this, which protect forests and support their native communities, exemplify the new symbiosis needed between the UN and business

to the fact that we need to reinvent growth. We need growth but of a fundamentally different kind, that drives value creation for the many and not the few, across generations and not quarters.

An education in collaboration

We often talk about collaboration as if it is simply a function of being enlightened and 'decent'. But the truth is: collaboration is bloody, and it is hard. When times get tough, the barrier to exit is very low. Collaborations that stick require surgically structured partnerships based on mutual indispensability – where each party has a unique contribution to make and is incentivised to sustain that contribution.

Surely no one organisation has learned more about the hard reality of collaboration than the UN, with – in the words of former Secretary-General Ban Ki-moon – its 193 board members who all believe they are chair. As we move into a world demanding more and more complex forms of collaboration in order to deal with the systems-sized issues we face, this is an education we all sorely need.

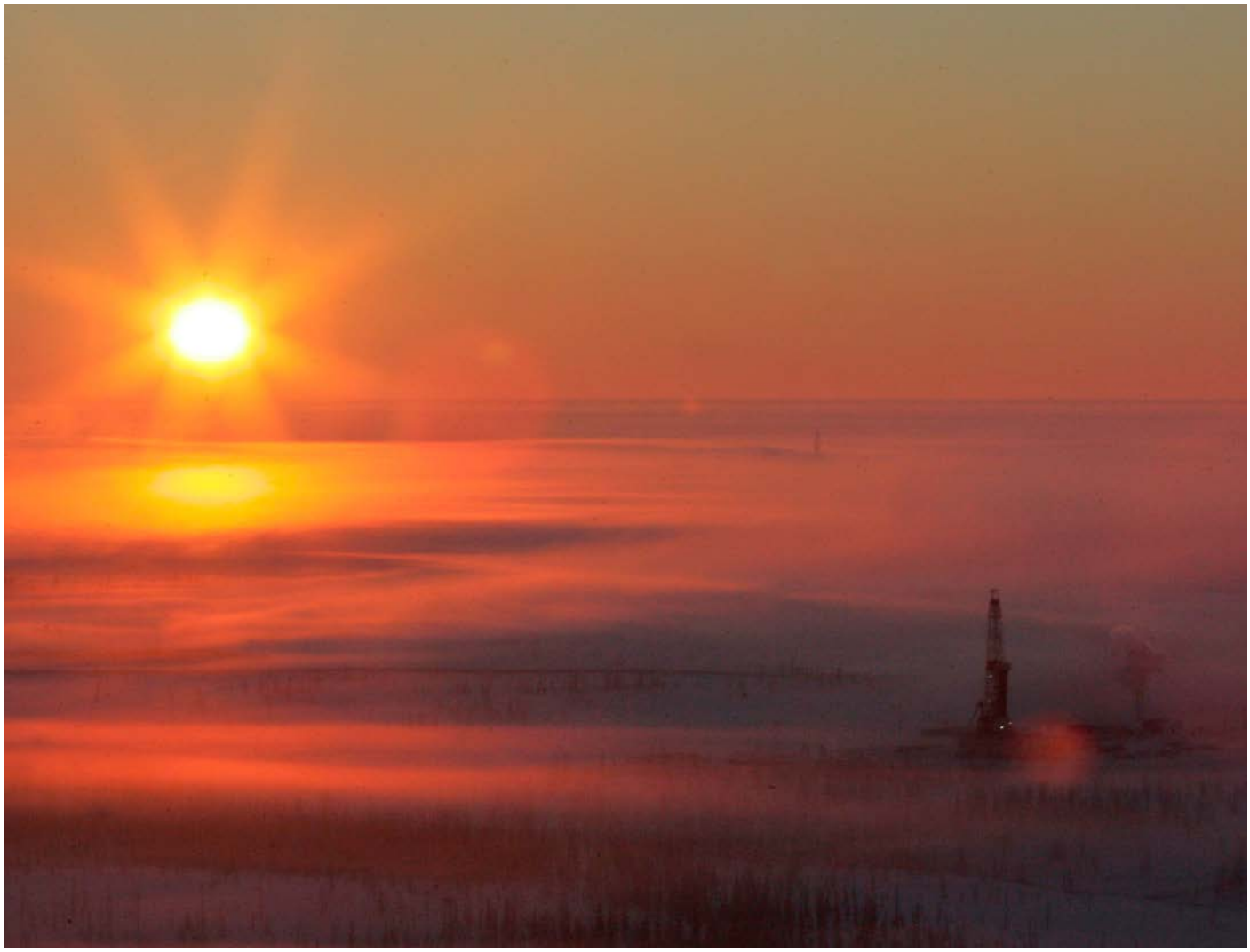
The UN needs business and vice versa

Without business the UN will not be able to reinvent our growth model. Conversely, without the UN and the work of the wide range of actors in its orbit, business would arguably be in danger of losing its raison d'être – sufficient numbers of people with the wherewithal to serve as its customers. So it seems that the defining feature of a successful collaboration – mutual indispensability – is in place.

It was once common wisdom that the purpose of business was to maximise shareholder value, a notion that Jack Welch, the former CEO of General Electric, has since dubbed "the dumbest idea in the world". Though Welch's correction is welcome, the idea has created a false and pernicious trade-off between business and society, one which we are still trying to unravel. The purpose of business is to solve problems for its customers. The purpose of the UN is, more or less, the same.

The UN was born out of war. Though perhaps less easy to see, the challenges we are up against today are comparable in severity. In the face of such complexity and volatility, it's easy to feel outmanned. But the fact is, we live in an age of abundance, with an enormous store of talent, capital and ideas. Corporate balance sheets of American companies alone hold over $2 trillion, and at its peak last year, the global bond market included over $12 trillion in negative yields, demanding that investors actually pay to own them. Meanwhile, the planet has never been home to so many educated minds.

If we can make the alliance between the UN and business stick, we can unlock this abundance, creating a saner economic model that delivers genuine human return. ●



Tackling apathy and denial

Why do so many people switch off when it comes to climate change? How can psychology help to generate a more constructive response?

By **Renee Lertzman**, climate, energy and environment consultant

For those working on the front lines of climate action, it can be bewildering why more people are not taking action to protect themselves and their planet from the myriad threats posed by climate change. Despite what is currently known about these threats, humans continue to be slow in responding to the evidence.

Across governmental, private and public sectors, this conundrum is often addressed by focusing on the best means for communicating about climate change, and how to spark new behaviour in people – everything from political engagement to lifestyle changes. In recent years, we've seen a considerable proliferation of initiatives, studies, articles and projects dedicated to achieving this.

However, underlying many of these efforts are assumptions about the nature of engaging and mobilising, as well as the role of the individual in meeting these challenges. In light of increasing urgency and need, we now have the opportunity to

◀ The Vankor oil field in eastern Siberia, Russia. Dependence on fossil fuel income often goes hand-in-hand with climate denial. In the Pew Research Center's latest Global Attitudes Survey, Russia scored lowest out of 38 countries in its perception of climate change as a threat

carefully consider our approaches – and, importantly, review emerging research into the central role of 'affect', emotion and social interactions for climate change action.

Effective communication

Our thinking on effective communicating with individuals tends to fall into one of four dominant orientations: behaviour, framing, systems and emotions. This is also referred to as the 'quadrant of engagement'. This is a broad map, recognising that in the real world, these approaches often overlap. That said, more often than not, many of us become mired in one or two of these approaches.

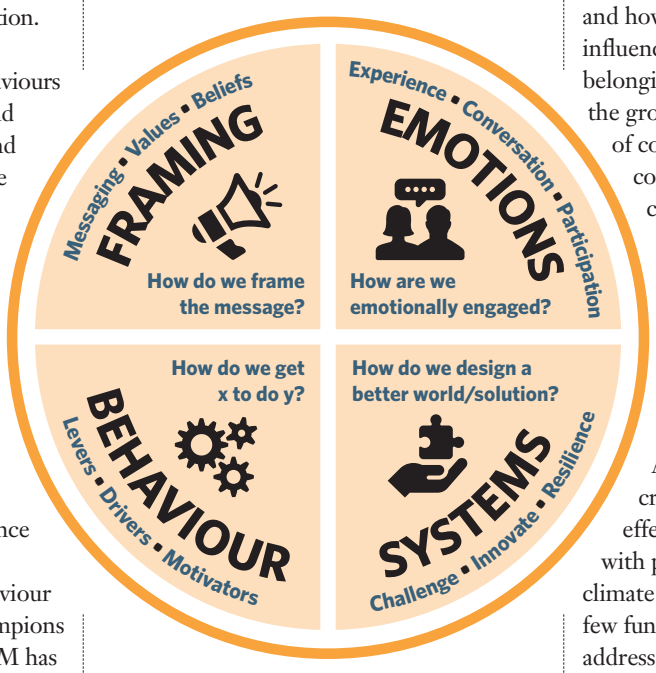
First, we have the behaviour orientation. This tends to emphasise the power of behavioural economics in shifting behaviours – from 'nudging' to using incentives and rewards to stimulate desired actions, and fees and penalties to punish undesirable ones. This way of thinking about engaging individuals has become deeply entrenched in many organisations. Yet research shows that individual behaviours are largely shaped by social contexts and underlying (largely unconscious) emotional drivers.

One example of how behavioural science has taken hold of climate communications has been the prevalence of community-based social marketing (CBSM), a protocol for sparking behaviour change through the use of teams, champions and ambassadors. In many ways, CBSM has become a stand-in for most approaches for behaviour change. When we speak about drivers, levers and motivation, we know we are usually in this quadrant, referencing behavioural economics, language and frameworks.

Next, we have a focus on framing. This approach is epitomised by using values-based framing to convey and persuade people to take climate action. The underlying thinking is that, given how climate and related issues concerning energy resources have become deeply ideologically charged, using the right kinds of 'frames' – phrases, language and words that resonate for specific communities, sectors and populations – can gain more traction.

Many research teams and centres around the world focus on framing and messaging as key levers for reaching individuals and sparking greater levels of engagement in climate issues. Often surveys are used to elicit the 'magic words' to use. This quadrant has been more recently influenced by the interest in storytelling, recognising how stories and narratives are powerful modes for conveying complex and potentially abstract information.

The quadrant of engagement



The third quadrant – systems – concentrates on systems-level change and, in particular, on solutions. This orientation is strongly influenced by the design sciences sectors, notably emerging from the work of Paul Hawken, who in the early 1990s in *The Ecology of Commerce* noted that sustainability is fundamentally a design problem.

This orientation is exemplified by the recent Project Drawdown – a research project that focuses explicitly on addressing climate change through the remarkable capacities we have as humans to innovate and solve design problems. This quadrant is also marked by the use of challenges (such as the Fuller Challenge) and competitions – whether among individuals, organisations, states or countries – to spark engagement and innovation.

The fourth quadrant – emotion – remains the most unexplored in the climate sectors. Yet it presents critical insights that can amplify and support all of the others. This orientation is grounded in the research about how 'affects' – such as desire, anxiety, security, anger, hope, inspiration – are what drive much of our behaviour.

The focus is less on identifying the right values, but on the conflicts or dilemmas that impede behavioural shifts, and how these conflicts are often socially influenced (identity, social norms, pressures, belonging). This quadrant also reflects the growing research into how the power of conversation – whether in-person conversations in groups, or taking conversational approaches to campaign strategies and education – can accelerate both behaviour change and overall engagement in the issues (take Carbon Conversations, for example).

From motivation to empowerment

All of these orientations offer critical insights into how we can effectively communicate and engage with populations at scale in addressing climate change issues. However, there are a few fundamental challenges that we need to address, as well as some gaps in our thinking to date.

First, we need to revise an underlying assumption that we need to motivate people to take action on climate change. This presumes there is a fundamental lack of care, concern or motivation that leads people to remain disengaged and inactive. This assumption directly conflicts with the deeply systemic nature of our challenges. It also presumes that people will act on

all of their most deeply held values, which may include wellbeing, safety, security and protection of nature. This is simply not the case.

In addition, we need to take heed of the lack of rationality when it comes to our behaviours. Issues represented by climate – whether they concern food, transportation, energy resources, industry or political action – can bring up tremendous conflicts for people, particularly between their values, aspirations and desires.

It is no longer as simple as raising awareness about the issues and expecting people to act accordingly. For example, in writing about the meat paradox, researchers Bastian and Loughnan discuss how connecting the act of eating meat with harm to animals can trigger intense cognitive dissonance. As a result, people will not only resist such awareness-raising, but will actually increase their consumption of meat as a way of reducing this dissonance.

is the increased focus on what it means to engage people. The challenge becomes less about how to motivate people to change, and more on how we can engage people to experience themselves as participants, stakeholders and co-creators of their future.

Taking into account the extensive research into the power of intrinsic motivation, we can frame engaging with climate change issues in terms of empowerment, purpose, meaning and mattering. We can design our communications efforts in terms of invitation and inclusion, rather than exhorting people to take steps to change their behaviour.

The science of engagement

We know more now than we ever have about the complexities and nuances of how humans learn new information – especially when that information stirs up confusion, a sense of being overwhelmed, powerlessness, conflict or unwanted emotions.

Understanding how humans manage psychological conflicts such as guilt, ambivalence, shame, anxiety and uncertainty has yet to fully enter into our work on engaging with people effectively about climate change

Understanding how humans manage psychological conflicts such as guilt, ambivalence, shame, anxiety and uncertainty has yet to fully enter into our work on communicating and engaging with people effectively about climate change. Rather, there is a tendency to focus on raising awareness of the problems, or an exclusive focus on the solutions.

There is a notion that if we can stimulate enough concern and fear, and then swiftly introduce solutions, we can get people to take action more quickly. However, this is not necessarily the case. Often, people need to reflect and process what this means for them, and to be assured that taking action will not threaten their fundamental sense of security and identity.

One of the most promising developments when it comes to empowering individuals

As Daniel Goleman has written: "The brain's basic design offers a prototype of how we handle pain of all sorts, including psychological distress and social anxieties."

Research across neuroscience, clinical psychology and public health offers profound insights for climate change efforts – specifically about how to address topics that may evoke difficult feelings. It is not a question about whether to be negative or positive, but what our work looks like if we take on board that climate change threats are arguably traumatic. If we apply what is known about how our minds process trauma, there are important implications for the ways we communicate.

As neuroscientist VS Ramachandran wrote in the late 1990s: "If confronted with new information that doesn't fit the model, [our mind] relies on defence mechanisms to deny, repress or confabulate – anything to preserve the status quo."

Although he wasn't talking about climate change, he very well could have been. The question is how we can navigate these defence mechanisms that seem to work against our best efforts. Do we focus on more positive stories and solutions, making engagement local and doable?

The answer is yes – and more. People need to know what they can do to make a meaningful difference, otherwise they will tune out and avoid engaging, out of self-protection. Powerlessness and helplessness are difficult things for people to experience.

That said, the most effective way to help motivate people is to acknowledge the extent to which something may seem overwhelming, insurmountable or hard to imagine. Our ability to empathise and connect with people is of utmost importance. All of the champions, ambassadors, social pledges and social media campaigns will never be sufficient unless we allow people to respond and react to the basic recognition of the current situation facing everyone on the planet. Paradoxically, the most effective way for doing so is by having conversations. The ability to reflect, think aloud and share stories is how we as humans are wired to learn, change and grow – not as individuals, but as communities.

The importance of empathy

As our work addressing climate change evolves to meet the pressing need for large-scale engagement, we would all be well served by tapping into the research and insights into how our minds work. This means going beyond a focus solely on behaviour, values, messaging and framing, solutions and storytelling. It requires building capacities for engagement that take into account the central role of 'affect' – how these issues make us feel, and how overwhelming they can be for many people.

Pushing solutions is itself not the only solution. Helping people see themselves as empowered actors in changing our world, framing the issue as an opportunity not a burden, is where we can find our greatest headwind. Empathy is a critical ingredient in this mix, if we are to be effective. ●

Holding emitters to account

What legal recourse can be brought to bear on those countries or organisations that flout the Paris Agreement?

By **Richard Lord QC**, Brick Court Chambers

In a civilised society, legal liability is one of the touchstones of when someone should be held to account. Greenhouse gas (GHG) emissions are to some extent both natural and inevitable, at least for the foreseeable future. Who are the emitters who should be held to account, given that every natural and legal person on the planet is an emitter?

This question becomes easier to answer following the Paris Agreement. Despite the lack of quantitative quotas at national level, the agreement sets the benchmark by global consensus in terms of achieving a planetary temperature rise of "well below" 2°C, with efforts to limit it to 1.5°C.

▲ **The Whanganui river, New Zealand has been granted 'legal personality' with the same legal rights to protection as a human being**

The fact that it is imposed collectively, however, means there is no answer to those whose activities are inconsistent with this benchmark.

The most obvious focus is on large corporate actors who might be said to be directly or indirectly responsible for emissions – whether as producers or consumers of fossil fuels or as 'facilitators' of their use. Research on the so-called 'carbon majors' shows that a relatively small number of corporate groups are 'responsible' for a relatively high share of emissions. But all corporations carry on business in one or more states, and in a defined industry sector. So accountability needs to be considered also at a national and sectoral level.

What might be termed climate change law has evolved rapidly in recent years. Some of it, concerned with adaptation (or the lack of it), is outside the scope of this article. What remains for consideration is fascinating and challenging in its diversity. There is only a small body of law that might properly be termed climate change law in the strict sense. But as the effect of climate change is cross-cutting, so the means of holding to account reflect both the diversity of adverse effects and the variety of legal doctrines relied upon.

It would be wrong to suggest litigation is an easy solution to climate change or a good substitute for effective international regulation

One unique feature of climate change for lawyers (apart from its enormity) is its true globalisation. Unlike traditional environmental issues where the effect of an action is felt in the locality where it occurs, problems on the coasts of Bangladesh or in the glaciers of the Andes are attributable to the sum total of emissions globally over past years.

What, therefore, are the legal bases on which emitters may be held to account? A few years ago, a number of lawsuits were brought, mainly in the US, seeking damage or injunctive relief against fossil fuel companies on the basis that their actions caused events (sea-level rise or extreme weather events) that damaged the claimants' property. None of these claims, largely based on common law tort actions, has succeeded, all foundering on issues such as standing or justiciability or causation. While it is not inconceivable that such actions will in future succeed, the focus has switched to other approaches. Three broad categories of legal action are outlined below: (a) those against states; (b) those against corporations; and (c) those against emission-intensive projects.

States

As observed above, Paris provides benchmarks but little scope for direct legal remedy for breach of its provisions. Importantly, however, it does not purport to be an exclusive or exhaustive code that precludes other legal actions. A very notable illustration of the scope for action comes in the Dutch decision (pre-Paris and still subject to appeal) in Urgenda Foundation v The Netherlands in June 2015. A group of concerned citizens obtained an order that, based on a science-driven assessment of necessary action, the Dutch government had to ensure emissions were 25 per cent below a 1990 baseline, based on a duty of the state to protect its citizens from imminent danger.

Many of the obstacles thought by more conservative lawyers to preclude such a ruling were swept aside by the court, including the argument that the country only accounted for a very small fraction (about 0.5 per cent) of global emissions. A similar if less dramatic result was achieved in the case of Leghari v Republic of Pakistan.

In addition, public law can be used to compel public bodies to comply with the law. Thus, where there are legal obligations in relation to reducing emissions (as with the UK Climate Change Act 2008), the government will be amenable to challenge if it fails to abide by those obligations. Where GHGs are classified in law as a pollutant, this may engage national environmental laws.

In other states, a constitutional right to a healthy environment, or similar rights, may ground a challenge to a government that is not doing enough to limit emissions. Such an approach may also be facilitated by the granting in some jurisdictions of 'legal personality', and the accompanying right to bring actions, to traditionally impersonal objects or concepts such as rivers (as has happened in New Zealand) or 'nature' (as in Bolivia and elsewhere).

The recognition that the effects of climate change engage numerous national and international human rights, such as those to life, livelihood and health, provides a further legal route for holding states that fail to take action to account.

Of great current interest is the invocation in a climate change context of an ancient doctrine of public trust, whereby the state holds, and is bound to manage and protect, natural resources (including the atmosphere) for public benefit. The 'Our Children's Trust' litigation in the US (Juliana v United States of America) has survived attempts to strike it out as legally unsustainable, and a trial date has been set for 2018.

Moreover, a number of fossil fuel trade organisations that initially pressed hard to be joined as parties have now withdrawn from the case, apparently fearing the consequences of the disclosure process. The case is of interest for many reasons, including its use of the concept of intergenerational equity, so that action today is taken for the benefit of future generations.

Corporations

Close attention has been focused not only on the actual activities of the fossil fuel industry but on its lobbying and statements on the validity/existence or otherwise, and effects of, anthropogenic climate change. One example is the current battle in the US between ExxonMobil and various state attorney generals seeking information for an investigation into whether Exxon misled investors, as well as civil law claims for conspiracy or fraud.

Although of less dramatic significance, claims for false advertising (about the environmental friendliness of products) may also attract civil or regulatory liability.

While many human rights laws are of direct relevance only to states, in the Philippines a petition has asked its Commission on Human Rights to investigate the allegations that actions of carbon majors have caused human rights breaches. Furthermore, the laws of some countries (possibly including South Africa, Brazil, India and Mexico) allow so-called horizontal actions against private actors responsible for human rights breaches.

Other tools have also been used to hold corporations to account, specifically by reference to their duties to report properly, including to regulators and shareholders, climate risks of various types. Particularly vulnerable are those whose business models are inconsistent with the Paris targets.

In addition, it is quite possible that businesses that use carbon-intensive processes to externalise and lower costs will fall foul of competition and trade laws.

Projects

Much action is directed at stopping specific high-emission projects, especially when no proper environmental impact assessment or consultation is involved. This may be by direct challenge to coal mines, power plants (as in a South African decision in March this year) and so on. Or it can be by seeking to prohibit external agencies from financing such projects (as in a submission by Greenpeace to Canadian security regulators to halt the fundraising for a pipeline in May this year).

There is no doubt that just as the physical climate is changing, so is the legal climate. As the world adapts to climate change so the courts are adapting to the new legal challenges thrown up by it. It would be wrong to suggest litigation is an easy solution to climate change or a good substitute for effective international regulation.

It would be equally wrong to ignore the counterbalancing litigation brought by (in particular) the fossil fuel industry to challenge regulation at national or local level.

But in this author's view, the direction of travel is clear, and the courts are increasingly willing to reflect the global consensus on the need for action on climate change. ●

▼ **The People's Climate March in Amsterdam, the Netherlands. In 2015, Urgenda Foundation won a court ruling compelling the Dutch government to adopt more ambitious climate policies on the grounds that the government had a duty to protect its citizens**

Political shifts

Many argue that non-state actors, not governments, will be the real drivers of climate action this century. How do you monitor, coordinate and maximise the potential of the diverse coalitions that now lead the fight against climate change?

By **Paula Caballero**, Global Director, Climate Program, World Resources Institute

The unprecedented momentum and commitment that the Paris Agreement has set in motion to tackle climate change reflects the power of multilateralism, channeling the interests of a broad range of actors. The Agreement was shaped by coalitions that emerged outside of both the confines of traditional political alignments and the negotiations themselves. Today, its implementation is being spurred by the increasing involvement of the private sector and civil society in advancing climate action. Indeed, for multilateralism to be fit for purpose in our globalised and connected world, it must actively engage many layers of government and society.

Powerful leadership by key countries was decisive in catapulting the negotiations forward to an outcome in Paris that far exceeded expectations. But one core reason for the extraordinary dynamism and resilience of the Paris Agreement since its adoption is that it resulted from an inclusive process that has generated unequalled and deep ownership.

In December 2015, the world converged in the French capital. Far-ranging coalitions came together – not just of new groupings of governments, but also of business, finance, civil society, philanthropists and

◀ French President Emmanuel Macron, German Chancellor Angela Merkel and US President Donald Trump at the G20 meeting in Hamburg. Tensions and leadership failures among world leaders has shifted the focus of climate action to non-state actors and coalitions

academic sectors. In Paris, climate change became everyone's business. Take, for example, Mission Innovation. This new partnership brings together both developed and developing countries, as well as private sector and business leadership, and has founded clear and tangible commitments to double clean energy research and development investment over five years. It is supported by the Breakthrough Energy Coalition, an initiative of high-powered investors and philanthropists committed to driving innovation.

Maintaining momentum

The foundations for this joint ownership of the climate crisis were laid throughout the tenure of the former Executive Secretary of the UN Framework Convention on Climate Change (UNFCCC), Christiana Figueres.

From the outset, she reached out to diverse constituencies, including in the private and finance sectors, academia and science, and faith groups. She opened the door to the private sector at global climate summits, both encouraging and recognising their participation. Figueres sought to catalyse the relationship between business and government because she understood that the private sector both delivers on climate action and can demand enhanced support and clear market signals from governments.

Within the UNFCCC, efforts to drive and maintain that momentum have been reflected in the Lima-Paris Action Agenda in 2014, the Global Climate Action Agenda in 2015 and the Marrakech Partnership for Global Climate Action in 2016. These initiatives, launched by successive UN climate conference hosts to engage "state and non-state" actors, seek to "boost cooperative action between governments, cities, business, investors and citizens to cut emissions rapidly and help vulnerable nations adapt to climate impacts". As Figueres told the *Nikkei-Asian Review*: "The private sector holds the key to [this] low-carbon future, with the Paris deal effectively acting as a global business plan for decarbonisation."

Her vision was shared by then-Secretary-General Ban Ki-moon, who hosted the UN Climate Summit in New York in 2014. It was a pivotal moment that further served to pull the global dialogue on climate change out of the narrow confines of conference negotiations by creating a platform for engagement by business and finance leaders, multilateral development banks, local authorities and civil society. Institutional investors and mayors announced coalitions, while actors from various sides came together around carbon pricing and deforestation, to name but two issues.

Most importantly, this momentum has been maintained. In late June 2017, for example, the industry-led Task Force on Climate-related Financial Disclosures recognised the systemic nature of climate risks, and the fact that the protection of investments and of the planet is synchronous. Moreover, the task force recommended that companies consider how different climate scenarios will impact on their businesses, including the 2°C target set in Paris. There is a growing expectation that the financial sector will align investment decisions with the long-term objective of the Paris Agreement.

New configurations of power and action are emerging that transcend the confines of national government

Indeed, as the understanding of the magnitude of the systemic risk posed by climate change is acknowledged across societies and economies, new configurations of power and action are emerging that transcend the confines of national government action. The decision by the Trump administration to withdraw from the Paris Agreement provoked remarkable

Also in this section

reactions at all levels. A group representing a broad cross-section of American society that now includes over 2,200 governors, mayors, businesses, investors and universities, signed up to the 'We Are Still In' initiative. The movement intends to ensure that "the US remains a global leader in reducing carbon emissions".

Just a few weeks later, Governor Jerry Brown of California announced he would host a global climate summit in 2018 and said to the *New York Times* that President Trump "doesn't speak for the rest of America" in pulling out of the Paris Agreement.

Tracking progress

However, there are complex issues around the assessment and aggregation of the mitigation efforts of non-state and subnational actors. In 2014 the Peruvian presidency launched the NAZCA portal, which enables these actors to register their climate efforts and commitments, thus providing visibility and recognition. But these commitments are not quantified. Different users employ different protocols and standards, which make aggregation daunting. Data collection, management and dissemination efforts remain uncoordinated.

There are many ongoing efforts to track, aggregate and quantify the contribution of these actors that can be built on, and progressively improved to help develop a set of principles and common approaches for data collection and assessment efforts. Events in 2018, which is shaping up to be a pivotal year for climate change, are driving efforts by the analytical community to lay the basis for a more rigorous and complete understanding of the contributions of these actors to closing the emissions gap.

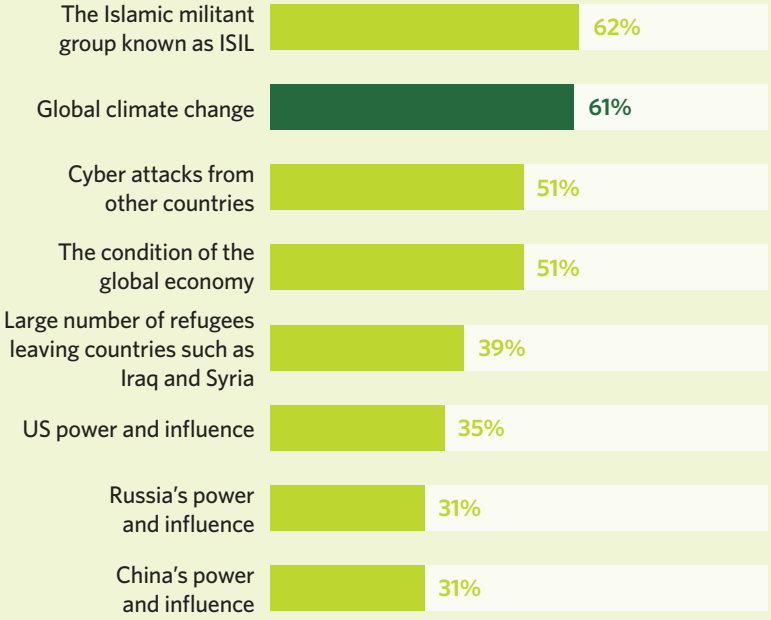
Tracking the progress of climate change action across constituencies and levels – to show progress to date, unlock further action, and forge coalitions to fast-track implementation – is a central objective. In addition to the California Global Climate Action Summit, the Intergovernmental Panel on Climate Change will produce a special report on the impacts of a global temperature rise of 1.5°C above pre-industrial levels. Meanwhile, under the UNFCCC, the Facilitative Dialogue – a key stocktaking exercise – will be held while the Paris Agreement 'rulebook' is slated for approval. The rulebook, which will measure, account for and review global climate action, is an important element in increasing transparency.

Nonetheless, many Parties to the UNFCCC are highly sensitive to non-state actor participation and activity in formal processes, and are reluctant to enable more substantive engagement. Efforts related to these non-state actor initiatives have therefore been framed in terms of collaboration that supports and contributes to government action. Increasingly, however, the UNFCCC will need to continue to evolve towards processes that are not based exclusively on state-centric models but also acknowledge action led by much broader cohorts of stakeholders.

Going forward, greater convergence needs to be facilitated between formal negotiating spheres and drivers of the real economy, where businesses and financial investors, mayors and subnational authorities, civil society and scientists hold sway.

As Paris made abundantly clear, today climate change is everyone's business. ●

Climate change is perceived globally as one of the leading threats to national security



Note: Figures represent global medians across 38 countries. ISIL not asked in Turkey and power and influence of country not asked in own country.

Source: Spring 2017 Global Attitudes Survey. Q17a-h. Pew Research Center

The long view

For centuries, humans have championed the democratic political system. But can it facilitate the radical change needed to stop the potentially annihilating effects of climate change?

By **AC Grayling**, Master of the New College of the Humanities, London, and its Professor of Philosophy

Although individual action to protect the environment – consuming less, recycling more, reducing one's carbon footprint – might be a contribution if enough people did it, the battle to minimise human-induced climate change has to be a worldwide endeavour among cooperating states. The outcome of the 2015 UN Climate Change Conference was one of the most optimistic and encouraging steps hitherto achieved in that battle – that is, until Donald Trump said he intended to withdraw the US, the biggest climate polluter in history, from the agreement.

The Paris Agreement and President Trump's decision illustrate the two ends of the spectrum of effort and concern. Our planet cannot be protected from a warming atmosphere – with melting ice caps, rising sea levels, droughts, floods, famines and migrations of desperate populations – without vigorous joint effort by the world's states.

It is thought that climate catastrophes caused turmoil in the past – perhaps at the beginning of the fourth millennium BCE, and in the early 12th century BCE when entire civilisations in the Mediterranean and Near East collapsed in rapid succession into centuries of dark ages. Only this time – today, in our present world, with a global population of over seven billion that is growing ever faster – any such catastrophe will be many orders of magnitude greater.

That is the situation that makes concerted international effort imperative. At the other

▲ **Donald Trump in Charleston, West Virginia. In the fallout of the financial crisis, populist leaders in most democratic countries have espoused cheap fossil-fuel energy as a remedy to falling living standards**

end of the spectrum, President Trump's announcement illustrates the fragility of international cooperation. It takes just one large rogue elephant in the herd to negate the endeavour. Any one of the US, China, India and the EU could undermine the sacrifice and determination demanded by the Paris Agreement.

It is a desperately sad move by any one large polluting economy if it refuses to cooperate. Such a decision condemns – actually condemns, not merely threatens to condemn – hundreds of millions of people to suffering, and almost certainly the whole planet to new dark ages.

Democracy is, as has been well said, the least bad of a lot of bad systems. But it pays a high price for the noble ideal of locating political authority in the consent of the people. Tyrants can make and act on quick decisions. Democracies debate and disagree, and move slowly. Tyrannies are efficient to the point of mercilessness. Democracies are inefficient to the point of ineffectiveness at times. The very nature of the political process in democracies means that leaders are reluctant to burden the populace with restrictions and sacrifices, lest they are voted out of office.

But saving the planet requires restrictions and sacrifices. Leaders are reluctant to burden business with extra costs on emissions and other good environmental practices, lest they damage the economy, and again in consequence lose office. Tyrants have no such anxieties: they worry only about the assassin or eventual rebellion.

Democracy, accordingly, is not a natural ally of the tough measures required to combat climate change. And yet populations of democracies will be the first to punish their political leaders when the disastrous effects of climate change start hitting home.

What is required for democracies to become fully engaged in the fight to save the planet is that their citizens should be informed and thoughtful, and willing participants in the required sacrifices. Given the realities, say cynics, is not this a vain hope?

Efforts to inform are manifold, but they are undermined by deniers and sceptics, among them Mr Trump. Efforts to encourage thoughtfulness and sacrifice among the people meet with the age-old reluctance on the part of too many people to attempt either.

Short-termism, self-interest, lack of real understanding, a head-in-the-sand attitude and several kinds of laziness and self-indulgence make us humans our own worst enemies: and in a democracy we all feel entitled to be all these things as a right.

If the world's people can be mobilised, then the short-termism and self-interest of the political classes in democracies will be addressed

There is nothing new in this. Plato two and a half millennia ago criticised democracy precisely because of this. But this is now a major life-threatening dilemma for our time.

Driving home the dangers

The international order is effectively an anarchy if any of its members – sovereign states – refuse to play ball with the rest, or refuse to adhere to agreements previously made. What is the sanction against, say, the US if indeed it does withdraw from the Paris Agreement? The international order is itself a loose form of democracy, and suffers the same deficits.

This fact illustrates where the nub of the problem lies: a lack of a sense of binding obligation to act for the benefit of others. Short-termism and self-interest are endemic weaknesses both of democracies and those who live in them. And these are precisely the things that have already wrought so much damage to the world's climate, and threaten the people of the world with ever-increasing danger.

Human survival is of course not the only, though it is the most obvious, point at issue in the climate emergency we are facing. Peace, stability, human rights, the welfare of children – these will all collapse before the survival issue becomes the only one left.

Now, not one of us should or would, I hope, seek to overturn democracy. But every one of us should, I hope, bend our thoughts vigorously to the problem of how to make the saving of our planet consistent with democracy. For surely, democracy and survival do not have to be in conflict. There have to be ways in which democracies can be full, compassionate, sensible partners with each other – indeed with everyone, no matter what the political system – in rescuing the planet from the peril that our historical self-indulgence and exploitation have already placed it in.

To ensure that the aims of the Paris Agreement are met, there therefore has to be another effort alongside the drive for far greater sustainability in industrial-commercial activity. This is an overwhelming, unceasing drive to educate and re-educate every single individual on the planet about climate change.

The real and imminent dangers to lives and societies have to be driven home. People have themselves to become the goads driving politicians and governments to act. If the world's people can be mobilised, then the short-termism and self-interest of the political classes in democracies will be addressed. Measures will be taken that people can understand are genuinely in their own real interests, as well as the interests of their fellows in the human story around the world.

Many are cynical about the potential of education to achieve anything like what is required here. Time and again dreamers and idealists have launched themselves into education to better the world. But in the face of how things are in both national and international politics, other than climate-induced civilisational collapse itself, education is the only thing that has a hope of changing minds. It is all we have. But with massive effort we can make a difference, and perhaps enough of one to save our lives. We have to teach ourselves into freedom from this danger: nothing less can or will do. ●

The fragility of cities

As climate change drives more people from rural to urban settings, how will already fragile cities cope? What must be done to ensure that all cities are safe, sustainable places to live?

By **Janani Vivekananda**, Senior Project Manager, adelphi

While research on climate change and urban violence are independently strong, few efforts have been made to understand the linkages between them. To date, there is little research or analysis on whether, where and how climate change adaptation and urban violence intersect and interact.

Why are the potential connections between climate change adaptation and urban violence important to understand? First, to ensure that adaptation efforts do not inadvertently increase the risk of urban violence. And second, where possible, so that these efforts can be designed to reduce the risk. This article identifies some of the gaps in the knowledge base and potential entry points for future research and action.

▲ **Residents in a slum on the banks of the Ciliwung river in Jakarta, Indonesia. The task of creating a safe living environment is compounded by the fact that the city is sinking, through a combination of subsidence and sea-level rises**

Why are cities so special when it comes to climate and fragility risks? From a climate perspective, the concentration of populations, infrastructure, economic activity and services means that the social, economic and political impacts of climate change in cities are exacerbated.

From a conflict perspective, cities put a spotlight on inequality through the sheer proximity of rich and poor – often with the most wealthy and poorest living side by side. OECD figures show that inequalities have increased in 75 per cent of the world's cities in the past 20 years.

An array of challenges

In a fragile context where inequality, poverty and marginalisation are drivers of grievance and conflict, climate impacts can make these inequalities even more apparent, fuelling grievances further. Often, it is the poorest who live in the most exposed areas, such as flood plains. In Karachi, floods in 2011 had a devastating impact on inhabitants of the city – but not all of them. Local business leaders received help to safeguard their assets through provision of sandbags. The inhabitants of slums, however, had no such assistance.

Urban populations are typically highly mobile and heterogeneous. These two traits characterise both urban resilience and vulnerability. City populations are cosmopolitan, perhaps more ethnically or religiously tolerant (often bringing knowledge of other contexts), and able to adapt and cope with shocks.

But urban living also means that ethnic differences are experienced at close range, with various, often hostile, ethnic groups living side by side. This can raise the risk of violence – such as that seen in the Nairobi slums during the 2007-08 election and again, though to a lesser degree, in August 2017. Governing transient populations that are frequently on the move presents an array of challenges – from tax collection and documentation to ensuring the sustainability of long-term interventions such as programmes to enhance livelihoods.

Three issues are of particular significance: weak governance; informal settlements and economies; and migration.

- **Weak governance:** Most urbanisation occurs in lower-income countries, many of which are classified as 'fragile states'. While, in principle, cities can absorb new entrants and provide them with employment, this is harder to ensure in fragile states where governance capacity is already weak or strained. Even relatively robust governments may struggle to provide jobs, housing and services to meet the needs of their rapidly growing urban populations. Governments that were designed to rule over cities of a certain size may be overwhelmed by in-migration. Where the government is absent or incompetent, local groups – from the benign (non-governmental organisations, labour unions, religious groups) to the malignant (organised crime cartels and terrorist organisations) – step into the void.

- **Informality (of shelter, communities, economies):** Inhabitants of informal settlements are often particularly exposed to climate impacts. Without adequate governance of in-migration to cities, the UN Department of Economic and Social Affairs predicts that the number of people living in slums will triple by 2050. Informal settlements, and informal economies that often thrive within them, can indeed be a source of resilience through the strong social capital and cohesion present within these communities. But the informal nature of those economies does not provide much in the way of governance, stability or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◀ Women carry firewood at a makeshift camp on the outskirts of Baidoa, Somalia. Catastrophic drought in Somalia has displaced nearly a million in recent months

predictability. Addressing the particular vulnerabilities and harnessing the dimensions of resilience of slum/shack dwellers is thus of particular importance in ensuring stability.

- **Migration** is another important trend that converges in cities. It overlaps with other pressures such as inequality and climate change in complex ways. For example, climate change may contribute to rural–urban migration. Migration can offer opportunities for fostering resilience, for example through remittances. But it can also pose a risk to migrants in urban settings since a disproportionate number of slum/shack dwellers are migrants, and are therefore exposed to greater climate vulnerability.

A more nuanced understanding of migration strategies is required to foster positive migration in the face of climate fragility risks.

Improving cities' resilience

Facing these challenges requires innovations in governance. At the moment, the international system is set up to act at the level of nation states. Meanwhile, city leaders are forging networks within and across international boundaries to address shared problems, including climate change.

But national governments and multilateral agencies such as the UN system are not organised to work with city-level governance mechanisms. Their continued focus on nation states limits the scope for devolved decision-making and consultative engagement at the city level.

We are also in an unprecedented era of global frameworks that offer real opportunities to promote resilience. However, the Sustainable Development Goals (SDGs), the New Urban Agenda and the UN Peacebuilding Commission's Sustaining Peace Agenda all have gaps when it comes to addressing this nexus of climate change, cities and fragility.

The SDGs include an urban goal (SDG 11) and a peace and security goal (SDG 16), while the New Urban Agenda makes reference to "conflict and post-conflict contexts". But the city is absent from the Sustaining Peace Agenda, and the New Urban Agenda provides no substantive guide on how to address urban violence and conflict. To ensure that policy responses genuinely address the complex risks posed to cities by climate change and fragility, we need to realise that climate change and conflict prevention activities do not operate in a vacuum in cities such as Karachi, Nairobi or Kabul.

Climate change and peace-building need to take account of city dynamics. Similarly, urban planning and development need to be 'climate and conflict sensitive'. That is to say, efforts to make cities resilient must take into account cities' complex dynamics.

This means understanding how potential conflicts arise in urban settings, the political economy, as well as knowing who holds power when land and resource rights are not clearly defined. It also means asking the right questions. How will urban planning interventions such as a slum-upgrading programme affect social dynamics and social cohesion? What can actually build resilience?

To answer these, the development community working to build resilient cities need only look to the peace-building and climate-adaptation sphere for existing tools to understand conflict and climate vulnerability.

There was consensus at the 2016 World Humanitarian Summit on the need for greater localisation. The gaps in the global frameworks illustrate that global and national development efforts must be transposed to the urban scale. This will require a transformation of the way in which the UN system and many donor agencies operate – for example recognising the role of urban authorities (which remain absent in many agreements) and building local urban capacity.

It will also need greater contextual knowledge of city actors – mayors, urban dwellers, municipalities and urban conflict dynamics – as well as engaging them in the implementation of global processes. ●

The development community working to build resilient cities need only look to the peace-building and climate-adaptation sphere for existing tools to understand conflict and climate vulnerability

Population and climate change

What is the relationship between population growth and human-made climate change? Must we necessarily limit the former to fix the latter?

By **Natalia Kanem**, Acting Executive Director, United Nations Population Fund (UNFPA)

Understanding the relationship between population and climate change is crucial to the design of policies that protect people's rights, particularly their reproductive choices, while preserving the planet. Yet, the social, economic and environmental consequences of population growth have been the subject of strong opinions, including in popular media, and a source of much controversy, conjecture and confusion over the years. Many fears about population growth are not borne out by the evidence, and the relationship between population growth and climate change is no exception.

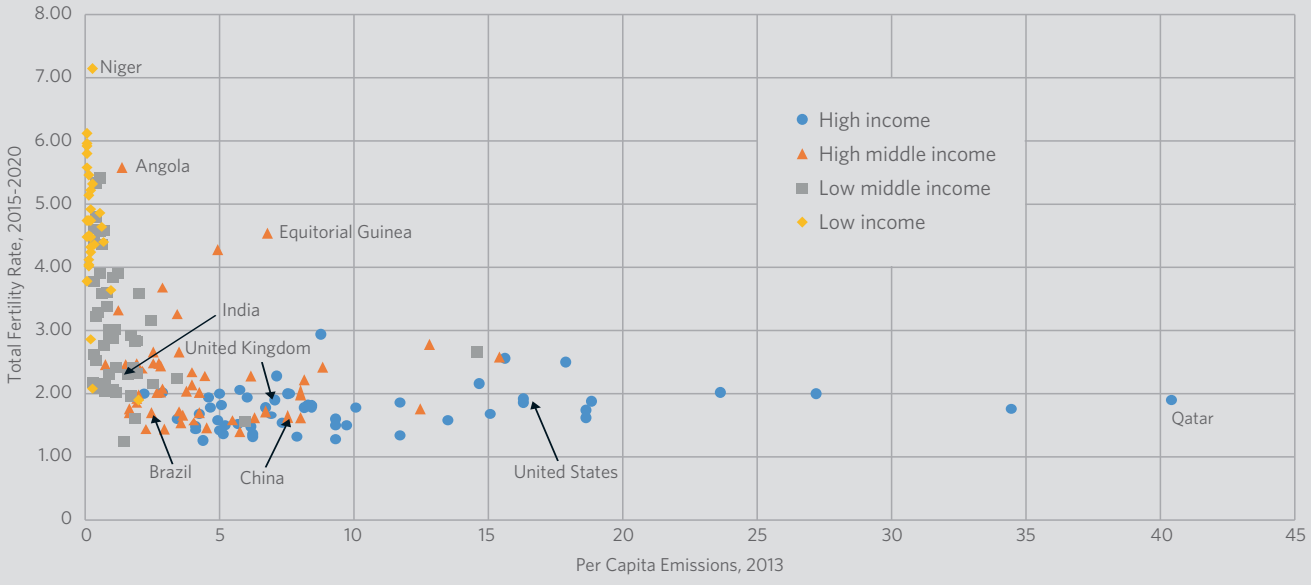
The Programme of Action of the International Conference on Population and Development (ICPD), held in Cairo in 1994, shifted the prevailing population discourse away from a focus on numbers and population targets. Instead, it moved the conversation towards actions to uphold universal principles of human rights and freedom of choice, particularly for women and girls to exercise decisions over their own bodies.

Basic misconceptions

When thinking about the greenhouse gas (GHG) emissions that drive climate change, it is far too common to either blame population growth and claim it as the most important driver of climate change, or to ignore population growth entirely, since historically it has been a highly politicised issue. These contradictory approaches are actually driven by the same basic misconception about the links between population and climate change.

This misconception is that more people automatically equals more emissions. From a climate change or natural resource perspective, there is a certain intuitive logic to it. More people is usually assumed to mean more eating and drinking, more driving or more energy use – all of which under our current model cause major emissions of GHGs. Yet emissions are not equally distributed across the world's population, any more than the consumption of food or cars, or the use of air conditioning.

Figure 1: Fertility and per capita emissions



Source: Total fertility rate from UN Population Division, World Population Prospects: the 2017 Revision
Per capita emissions from World Bank Open Data, data.worldbank.org

Figure 1 shows GHG emissions per capita by total fertility rate – the number of children born per woman over the course of their lives – a key factor in population growth.

High per capita emissions, occurring in the wealthiest countries, correlate with the lowest levels of fertility. The poorest countries generate the lowest per capita emissions – many close to zero.

While counter-intuitive to some, the poorest countries that have the highest fertility rates and the fastest rates of population growth also make the least contribution to GHG-generating phenomena. So, at present, a linear relationship between population growth and emissions cannot be established or defended.

Instead, income is the best proxy for emissions creation. Presently, only about 28 per cent of the people in the world make more than $10 per day, the income level at which consumption begins to significantly contribute to climate change emissions.

The alarming reality is that it has not taken very many high emitters to put the planet in significant danger. The claim that population growth, especially in the poorest countries, is a primary driver of climate change must be treated with major scepticism. And it should be noted that it is people living in the poorest countries, who have contributed the least to its occurrence, who will likely feel its impact most intensely.

Making better choices

The world is focused on helping the poorest countries and their populations emerge from poverty, including through the adoption of the Sustainable Development Goals with the ambition of ending extreme poverty by 2030.

Under our current model of economic growth, poverty reduction will bring an increase in emissions. And then – indeed – the population of the poorest countries will become increasingly important to emissions and to climate change. So, in the long term, population growth is certainly important to climate change.

Global experience has also shown that with better choices, we can structure our lives in ways that enhance wellbeing, while limiting emissions. There have been dramatic emissions reductions in some European countries and (for a period) in the United States, and a decline in intensity (or the emissions cost of GDP growth) in China and other emerging economies.

Figure 1 shows wide variations in the emissions per capita among high and middle-income countries. This suggests that, even now, we are not locked into a scenario in which growing wealth demands high emissions.

Reasons for optimism

As technology continues to improve, options for more sustainable, less carbon-dependent development will expand, allowing all countries and people the opportunity to develop while preventing climate change.

This is absolutely necessary. The data on population and emissions show that slowing population growth, even rapidly, is not a shortcut to preventing climate change. Indeed, it will have little or no effect if we cannot transition away from fossil fuels and other drivers of climate change and towards renewable and sustainable modes of living.

It is critical that we get smart about the relationship between population and climate change to make the best policy choices and avoid the pitfalls of the past. The Programme of Action of the ICPD was advanced to protect women and men from abuses of reproductive rights consequent to widespread concerns over population growth in the 1970s and 1980s.

In the Programme, the world's governments achieved consensus that widespread promotion of reproductive health and rights and women's empowerment offer a more effective means to advance development than a focus on population control. With better health, education and opportunity, most people choose smaller families – and population growth rates decline.

The 20-year review of the Programme, completed in 2014, affirmed this truth. Investments promoting the realisation of universal access to sexual and reproductive health and reproductive rights – including the education of women and girls, and a major expansion in sexual and reproductive health education, information and health services and more – result in people choosing smaller families, and fertility continues to decline.

The 2030 Agenda for Sustainable Development recognises the importance of this approach to population, including universal access to sexual and reproductive health and reproductive rights. The time has come to redouble our efforts to ensure these achievements.

Through implementing the Paris Agreement, which represents a generational awakening to tackle the challenge of climate change, we now have great reason for optimism. Namely, that we may simultaneously achieve a world of lower emissions while expanding women's and girls' rights, choice and wellbeing. ●

Let's get the facts right

The global rate of population growth is rapidly decelerating – from 2.05 per cent per year in the period 1965–70 to 1.52 per cent in 1990–95 and 1.09 per cent in 2015–20.

Nearly half of the projected population growth between now and 2100 will not be driven by high fertility. Instead it will be fuelled by 'population momentum', or large numbers of women of reproductive age – from high fertility in the past – having children.

Only 38 countries worldwide have total fertility rates higher than four children per woman, which drive the fastest rates of population growth. Together, these countries constitute only 13 per cent of the world's population.

Many people already want smaller families but struggle to achieve that aim. About 214 million women in developing regions who want to avoid pregnancy do not have access to modern methods of contraception.

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Turning the ship

Not everyone sees climate action as a force for good, and resistance to the Paris Agreement comes in many guises. What can be done to convince those who fear the switch to a low-carbon economy?

By **Manuel Pulgar-Vidal**, Head of Climate and Energy, WWF

Every revolution creates losers as well as winners. The economic and social revolution we must undertake to prevent dangerous climate change is no exception. However, while many of the winners do not yet exist – future employees of new industries, the generations to come who will enjoy a secure climate – the losers are here now, they are vocal, and they are powerful.

There are, of course, the vast economic, financial and political interests who stand to lose from the decarbonisation of the global economy: the companies that extract, refine, transport and burn coal, oil and natural gas; the investors who own their stock; and the countries whose entire fiscal position rests upon the revenues they earn from selling fossil fuels.

There are also many millions of workers whose livelihoods are threatened by decarbonisation. For them, a climate-secure future appears to be an economically insecure one. They are, understandably, anxious about campaigns to kill coal or move beyond oil – or, for that matter, to halt the deforestation that allows them to plant crops or graze cattle.

There are powerful forces, then, that consider climate action to be a threat to their interests, and who seek to undo global and national efforts to reduce emissions. While they have not entirely succeeded – as the landmark Paris Agreement shows – they have certainly slowed progress. And it is fair to say that with the election of

◀ CEOs of leading European utility companies, members of the Magritte Initiative, during a press conference at COP21. Such vested interests have the potential to be part of the solution, or part of the problem

Donald Trump in the US, and support for nationalist parties and causes in Europe, those prioritising immediate self-interest over addressing long-term collective problems like climate change have some momentum behind them.

How do those of us who remain deeply concerned about the problem of climate change seek to convince those who disagree? How do we continue to make progress, while respecting and supporting those for whom the change we need to see will come at a cost?

Presenting a clear message

Success in Paris in 2015, and the failure of previous climate conferences, has taught us important lessons about how to make progress based on international consensus. A crucial step forward was in allowing countries, through their intended nationally determined contributions, to volunteer their own emissions goals. This was vital in creating the confidence needed to reach agreement.

Another key element was the recognition that the climate process is a political one, in which decisions are made by politicians who need to see political outcomes for the time and resources they invest. Without their continued enthusiasm for the process, the political arguments will be won by those resisting change.

Science has, of course, had a critical role in underpinning the process and building political consensus for action. It was the impact of the first assessment report from the Intergovernmental Panel on Climate Change (IPCC) in 1990 that led directly to the 1992 Rio Declaration, and the creation of the UN Framework Convention on Climate Change. The IPCC's fifth assessment report – published in 2013 and with its recommendations for policy-makers – laid the foundations for agreement in Paris in 2015.

The fourth element is finance. Moving away from fossil fuels towards renewables will, over the medium term, reduce the costs of energy, while bringing enormous co-benefits regarding human health and employment. But, in the near term, this transition will create burdens that the poorer parts of the world are ill equipped to bear. The commitments for rich countries to provide $100 billion a year in climate finance did much to build consensus around a climate agreement.

How, then, is the progress made in Paris to be built upon and continued, especially in the face of vested interests and anxious electorates? The starting point has to be continuing to present a clear message based on the science behind climate action. We are already seeing impacts that threaten vulnerable ecosystems that are important in their own right, and relied upon by humans.

Climate change is threatening a mass extinction at a scale not seen for 65 million years. It is impossible for anyone concerned about conserving nature to be anything but horrified by that fact. It is time to better integrate into the climate agenda the urgent need to protect biodiversity, and to make explicit the links that exist between nature and human development.

It is time to better integrate into the climate agenda the urgent need to protect biodiversity, and to make explicit the links that exist between nature and human development

But we also need to better integrate the economic dimension of sustainability with our concerns for the social and environmental dimensions. A stable climate is as important for a healthy economy as it is for healthy ecosystems.

It is encouraging to see many of the world's largest investors recognise the threat posed to their investments from climate change. They have been encouraged by those bodies that regulate them, and which are concerned about the stability of financial markets, to analyse, disclose and better manage climate risks. Hopefully this increased scrutiny will persuade those parts of the financial system that continue to fund fossil-fuel development to reconsider the risks they are assuming.

This integration needs to reach the very top of government. A lesson from the climate talks is that responding to climate change is an endeavour that reaches beyond the resources of environment ministries. At Paris, it was taken up by the world's leading diplomats. Now, it is time for the world's ministers of economy and finance to meet to discuss climate change.

For it is the economic dimension where the battle to overcome vested interests and address climate change will be won or lost. For those of us who believe in international cooperation to address common threats to humanity, President Trump and his nationalist rhetoric, and rising support for isolationist and often xenophobic politicians seen around the world are deeply troubling. But it is important to recognise that they are democratic expressions of genuine concern about jobs and security.

Addressing climate change can provide answers to some of these concerns. Exploiting domestic sources of renewable energy can make countries more secure within their borders, and less dependent upon imports of fuel from potentially unfriendly or unstable countries. The low-carbon transition promises to create more jobs than it destroys. But this must be better communicated and, crucially, those whose jobs will disappear must not be left behind.

Putting a price on carbon, and eliminating what the Organisation for Economic Co-operation and Development estimates is $160 billion of annual subsidies on fossil fuels, would create ample revenues that could be directed towards helping the losers from the low-carbon revolution. Doing so would build support for climate action and undermine those vested interests that would seek to block it.

And let's be clear: should this revolution not succeed, none of us will be winners. ●

The path to a low-carbon economy

How can the world's economies, whose prosperity has been built on fossil fuels, transform themselves to avert catastrophic climate change?

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▲ **Inner Mongolia, China. A labourer loads coal into a furnace at an unauthorised steel factory. China has recently embraced climate action and positioned itself to be a world leader but, as in many countries, official efforts are challenged by illegal operations**

By **Adair Turner,** Chairman,
Institute for New Economic Thinking

The year 2015 was one of positive achievements for our collective future, with the adoption of both the Paris Agreement and the UN Sustainable Development Goals. The former committed to limit the rise in global temperature to well below 2°C, while the latter emphasised that social, economic and environmental progress are inextricably entwined.

The energy sector sits at the centre of those agendas. Energy systems across the world account for the vast majority of greenhouse gas emissions. Our economies – agriculture, industries and services – are powered by energy. Reliable energy access is essential to raise living standards for the estimated 767 million people still living in poverty today – and for the many more not yet enjoying the prosperity levels reached in developed economies.

The challenge is to build an energy system that can meet the needs of a growing world population expected to reach 11 billion

people by 2100. Such a system must allow the global economy to flourish while also achieving net-zero emissions before the end of the century.

Nothing short of a massive transformation in global energy systems can enable us to solve this twofold challenge. If instead we meet growing energy needs with increased hydrocarbon use, the world could be 4°C warmer than pre-industrial levels by the end of the century. The environmental consequences of that will be worst in developing countries and underprivileged communities.

Collective action required

Achieving this crucial energy transition requires action by governments, business and citizens across the world. The Energy Transitions Commission – a coalition of incumbent and disruptive energy players, energy-intensive industries, investors and environmental NGOs – was set up to argue for and ensure commitments to that action.

The Energy Transitions Commission's flagship report, *Better Energy, Greater Prosperity*, makes clear the scale of the challenge. But it also has two positive and optimistic messages: that it is technically and economically feasible to put the world on a well below 2°C trajectory; and that doing so will create major attractive investment opportunities.

Achieving a well below 2°C trajectory is technically and economically feasible. We can cut by half the carbon emissions from energy systems by 2040, while enhancing social and economic progress, if four parallel transition strategies are implemented.

First, we must decarbonise power systems by deploying renewable technologies. We must use this clean electricity to power an extended set of applications across the economy, with particular focus initially on the wider electrification of transport and housing. In the next 20 years, such clean electrification will be the single most important driver of the energy transition, delivering half of the carbon emissions reductions required by 2040.

This transformation is clearly economically feasible. In the last eight years, wind power costs have fallen by 65 per cent, solar costs by 85 per cent, and battery costs by 70 per cent. Within 15 years it will be possible not only to deliver renewable electricity at prices that are fully competitive with fossil fuel-based power, but also to provide the low-cost backup and storage required to make it possible to run power systems that are 80 to 90 per cent reliant on intermittent renewables.

Sophisticated grid control and demand management systems, with incentives to encourage power use and battery charging when supply is plentiful, will produce further significant cost reductions.

So, decarbonising power is vital and possible, but it is not sufficient to drive us towards net-zero emissions. To achieve that, we must also decarbonise sectors that are hard to electrify, especially in heavy industry and long-distance transport (trucking, shipping, aviation). The technologies to do that – bioenergy, hydrogen, carbon capture and sequestration – exist, but it is not yet clear which of these will be most economic in each sector. Crucially, these technologies are not achieving the cost reductions we are now seeing in renewable power and batteries, as they are not being deployed on the scale required to drive future rapid cost reduction.

Decarbonising energy supply could become a never-ending race if the amount of energy consumed in the world keeps growing rapidly

Over the next 20 years, we must therefore achieve that scale of deployment and cost reduction. To do that, we must use the same type of public research and development and deployment support that triggered the renewables success story.

However, decarbonising energy supply could become a never-ending race if the amount of energy consumed in the world keeps growing rapidly. Alongside decarbonisation efforts, we must therefore

Also in this section

restrain the growth in global energy demand by using energy more efficiently. Our objective should be to increase energy productivity (GDP per unit of energy consumed) by three per cent per annum, about twice the historic pace.

Analysis shows that this is technically feasible: by deploying the best technologies currently available, we could theoretically keep global energy demand flat by 2050. Reality is trickier, though, as this implies improving the energy efficiency of billions of buildings, home appliances, vehicles and industrial plants.

Increasing investment

That is why, in addition to energy efficiency improvements, we should pursue structural changes in the economy that enable GDP growth while using less energy-intensive goods and services. Efficient urban design, circular and sharing economy models, and the increased digitalisation of economic activities could be the most important drivers of this energy productivity revolution.

Second, we must develop multiple forms of carbon sequestration to absorb residual emissions. These include natural carbon sinks (for instance, through reforestation), carbon capture and storage in underground reservoirs, and carbon capture and conversion into CO_2-based products.

These possibilities must certainly not be treated as a 'get-out-of-jail-free card' that removes the need for rapid falls in fossil fuel use. But we should acknowledge that, without significant use of carbon sequestration, particularly to help decarbonise heavy industrial sectors, emission reduction numbers are unlikely to add up to what is required.

This four-dimensional strategy can meet both the climate change and development challenges. But isn't this plan a spending black hole?

The answer is no, because the second positive message of our report is that this energy transition does not represent a major macroeconomic challenge. On the contrary, it is an incredible investment opportunity,

The key challenge we face is to shift investment flows away from the fossil fuels sector towards renewables, clean technologies and energy-efficient infrastructure

Finally, we need to acknowledge that fossil fuel use won't disappear immediately. If the three transitions described above are implemented, demand for hydrocarbons will decrease significantly (by approximately one third) by 2040, but will still represent about half of global energy supply. The challenge is to make that compatible with the fact that we must limit CO_2 emissions from energy systems to 900 billion tonnes at most between now and 2100 if we are to limit warming to well below 2°C.

How can we do that? First, we have to optimise the remaining use of fossil fuels by prioritising the least polluting fuels – gas (striped of methane leakages) rather than oil, and anything rather than coal – and the applications where they are most difficult to substitute, such as heavy industry and long-distance transport.

and a potential driver of economic prosperity. We estimate that $300–$600 billion per annum of incremental investment is required to build low-carbon energy systems across the world. Given total global savings of around $20 trillion annually and global GDP of $78 trillion, this is significant but entirely manageable.

Indeed, in a period of slow global growth, with extremely low or even negative real interest rates signalling a dearth of investment opportunities relative to desired global savings, increased investment in a green, low-carbon economy could be a positive factor underpinning global demand and growth.

This is particularly true in developing countries, where almost 60 per cent of low-carbon investment needs are concentrated. Investment in green infrastructure and investment for social and economic development are very often two sides of the same coin. It is about providing reliable energy access to households and businesses; constructing affordable, comfortable and energy-efficient buildings; developing transport infrastructures that meet mobility needs while avoiding health-destroying air pollution; and strengthening the competitiveness of industries, through lower energy costs and greater innovation.

Developing countries have an opportunity to leapfrog to efficient, decentralised energy systems with high upfront capital costs but low operating costs. They can avoid investing in old fashioned, less efficient and centralised energy systems that can lock them into higher costs in the future.

Unlocking economic opportunities

Investors are increasingly aware that the low-carbon economy can provide attractive returns on investment, especially at a time of historically low interest rates. Green finance events and new energy departments within banks and asset management firms reveal this growing interest.

But many investors are still cautious, unsure about how costs and public policies will evolve. Often, they are also worried about the country risks associated with investment in emerging economies. The development of blended finance tools – through which development banks and other sources of public money de-risk green investments for private investors – is therefore likely to be crucial to unlock economic opportunities related to the energy transition.

The key challenge we face is to shift investment flows away from the fossil fuels sector towards renewables, clean technologies and energy-efficient infrastructure and equipment. Do that, and we can achieve the massive energy transition required to limit the rise in global temperatures to well below 2°C while also ensuring economic and social progress.

Collectively meeting this challenge is possible, but public policy-makers, investors and businesses must act now to accelerate the pace of change. ●

Sustainability at the core

Efacec's corporate vision sees the company strategically adapting to a new era in energy solutions

The future will be an era of new energy solutions, intense material circularity, new transportation systems, new economic models and new concepts of society. A future in which Efacec is fully committed to being an active partner, fostering the development of new energy solutions for a more sustainable world.

Committed to new environmental challenges

Due to the risk of an environmental collapse in the near future, society's ecosystem constantly requires new products, services and solutions. To tackle this impending threat, most companies need to adapt their portfolio to be successful.

As technological innovation is part of Efacec's DNA, we have long-established business initiatives in the fields of renewables, metro/light train systems and water treatment.

More recently we have started developing and commercialising smart grid components and electrical vehicle chargers, applying our extensive experience in energy automation systems and electronic power supply to address sustainability. Currently, we are launching new solutions in the areas of energy storage, micro grids, metering devices and energy integration systems.

Companies also need to review and improve the performance of their products throughout their entire life cycle. In addition, the imperative of creating a circular economy encourages them to review their business models to optimise the consumption and reuse of materials.

This is why our heavy material products, such as power transformers, are now the focus of intense design and innovation efforts to save materials. Customers are also being informed of the best ways to dispose of end-of-life equipment. And as a major contribution to the circular economy, Efacec offers entire rehabilitation services for transformers, switchgears and rotating machines, which enable us to save between 50% to 80% of the original materials' weight.

Leveraging innovation through people

The rapid pace of new product development also brings new challenges in terms of people management. A few years ago, the growing need for training and education led us to create Efacec's Academy, an internal entity dedicated exclusively to people's development. Simultaneously, Efacec has been aware of the need to create a favourable environment to speed up innovation and encourage employees' dedication and creativity. Throughout the year it runs multiple projects to foster this, both internal initiatives and ones open to R&D groups and academia.

> Society's ecosystem constantly requires new products, services and solutions

All these improvements have been organised under a holistic and integrated programme called Efacec 2020, which identifies our corporate strategic pillars and was developed in consultation with our people.

At the core of Efacec 2020 is our mission: to continuously create energy solutions for a more sustainable world. ■

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empowering the future

UNA-UK thanks Efacec for its generous support for Climate 2020

Local solutions

Is the current globalised economic model compatible with solving climate change?

By **Helena Norberg-Hodge**, Founder, Local Futures

Global collaboration and the free flow of ideas and solutions between people and governments around the world will be absolutely crucial as we face the climate challenge.

Economic globalisation, however, is something very different. With its goals of perpetual growth, carbon-intensive trade and deregulated corporate power, economic globalisation has fuelled enormous increases in inequality while rapidly accelerating the release of carbon into the atmosphere.

The destabilising impacts of corporate globalisation on local jobs and communities have created two separate counter-movements: one that is hopeful and one that is potentially dangerous.

On the one hand, a rise in xenophobia and nationalism is threatening the ability of the global community to enter into cooperative agreements to protect the climate. On the other hand, and far more hopeful for the climate, is the growing movement to return power from transnational corporations to people, communities and democratically elected governments – the movement for economic localisation.

To understand how economic localisation can help us implement the Paris Agreement, we need to question the assumptions that many well-intentioned people have about the ideas of growth, development and 'progress'. We need to look at the many benefits – for people, for food security, for ecosystems and the climate – of diverse, connected but economically localised communities.

Similarly, we must ensure that there is a genuine exchange of ideas and solutions between more and less developed countries. Vibrant, sustainable ways of life already in existence around the world must not be abandoned in favour of one culturally biased and technology-dependent definition of development.

Globalised inequality and the climate

It is often implied that poverty in the Global South can only be addressed by encouraging foreign investment and development on a globalised model. But in fact we see that corporate globalisation has enabled transnational companies to extract resources and labour from poor countries – those with the most lax labour and environmental regulations.

The result is that wealth is concentrated in fewer and fewer hands. As of last January, according to an Oxfam report, just eight men owned the same wealth as the 3.6 billion people who make up the poorest half of humanity. When we frame climate solutions only in terms of investment in large-scale corporate 'green' technology, we risk continuing to exacerbate this trend.

Localising our economies does not mean turning away from global cooperation or condemning societies to poverty. On the contrary, it means strengthening local economies

Trade agreements and the climate

Trade agreements that allow the desires of corporations to trump the needs of communities and ecosystems threaten the climate in multiple ways. The investor-state dispute settlement (ISDS) provisions written into most trade agreements allow foreign investors to sue governments if they regulate in ways that threaten their future profits.

Citing the North American Free Trade Agreement, US company Lone Pine Resources Inc. sued Canada for $250 million because the province of Quebec placed a moratorium on natural gas fracking. TransCanada Corporation sued the US for $15 billion for blocking the Keystone XL pipeline. This leads to a climate of 'regulatory chill' as countries – particularly poorer ones – become afraid to pass environmental legislation that would leave them open to ISDS suits.

Trade agreements and fossil-fuel subsidies have also led to dramatic increases in emissions from transport. Fish caught in North America are sent to China for filleting, and then back to the US for sale. At the same time, many countries import and export similar quantities of the same agricultural products, as tax incentives make food grown thousands of miles away cheaper than food grown down the street.

Such globalised production also lets countries dodge the true environmental costs of their consumption. In 2006, 21 per cent of air pollutants produced in China were created in the manufacture of goods for export to the US.[1] The raw materials that went into those goods may have already travelled from South Africa or Indonesia.

By outsourcing their production, wealthy nations are outsourcing their emissions as well. They are creating the impression of a shrinking ecological footprint – when in fact their footprint is simply being left on less developed parts of the world.

Climate and the globalised food system

Estimates of the food sector's contribution to greenhouse gas emissions range from 19

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◀ Harvesting soybean in Mato Grosso, Brazil. The global food industry's demand for beef and, more recently, soybean are the major causes of deforestation in Brazil

to 29 per cent. The industrial monocultures that make up the bulk of internationally traded food commodities rely heavily on agrochemicals and mechanised equipment – both of which result in significant emissions. They also degrade soil, depleting it of its ability to sequester carbon.

Monocultural farming for export is not only less climate-friendly, it leaves people vulnerable to fluctuating international markets and threatens local food security. As the UN Food and Agriculture Organization explains: "Family and small-scale farming are inextricably linked to world food security. Family farming preserves traditional food products, while contributing to a balanced diet and safeguarding the world's agro-biodiversity and the sustainable use of natural resources."

Many rural communities that are defined as among the poorest in the world in fact have significant resilience and ecological health from sustainable local food production. Statistics that measure poverty only in terms of per capita income may conceal the fact that when people move from rural smallholder farming into, say, sweatshop jobs in urban centres, their quality of life often goes down even as their cash income – and their carbon footprint – goes up.

What is progress?

The Paris Agreement takes the important step of encouraging more developed nations to shoulder a greater share of the climate burden. It is important to remember, however, that this does not mean all nations should follow the same pathway to development.

Western culture celebrates material consumption, technology and wealth in ways that are inherently unsustainable. The conventional economy measures, in Robert F. Kennedy's words, "everything except that which is worthwhile".

Shail Shrestha, a member of the delegation from Nepal to the UN climate conference in Paris, emphasises that, "responding to climate change requires a major change in value systems and calls into question the very meaning of 'prosperity'". He says: "Within the Paris framework there are predefined roles for nations – determined by their status as developed nations, developing nations, and LDCs [least developed countries] – that are based on culturally biased definitions of development.

"Those definitions essentially assume that industrialisation is fundamental to development. There is no acknowledgment of historic contributions by LDCs, through their traditional cultures, to the conservation of resources and natural areas…

"Technology transfer from the North to the South has long been regarded as the path to a better life in the less-developed regions of the world. But even the best and the most sustainable technology proposed in Paris would make Nepal less sustainable than it is today, thus leading us in the wrong direction. Indeed, cultural transfer from the South to the North would lead both in a more sustainable direction."

True interconnection

The global-to-local economic movement is uniting a wide range of existing campaigns. These include strong movements for local food, local business, decentralised renewable energy and cooperative community-owned banks. These movements enable people to link hands across many divides: North and South, left and right, economic and environmental, urban and rural.

Localising our economies does not mean turning away from global cooperation or condemning societies to poverty. On the contrary, it means strengthening local economies as we open a deeper global dialogue in our effort to meet the growing climate challenge. ●

1 Lin, J. et al. (2014). "China's international trade and air pollution in the United States". Proceedings of the National Academy of Sciences of the United States of America 111(5):1736–41.

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The world needs trillions

Tackling climate change will require huge amounts of investment, much of it in nascent technologies with as-yet unproven returns. How can the international community ensure that investors channel sufficient funds towards the most high-impact projects?

By **Barbara Buchner**, Executive Director, Climate Finance, Climate Policy Initiative (CPI)

Scaling up investment to the right projects, sectors and regions is arguably the key challenge to fulfilling the Paris Agreement and Sustainable Development Goals (SDGs).

The International Energy Agency estimates that just to get the energy sector on a low-carbon pathway, we need to invest $16.5 trillion in renewable energy and energy efficiency over the next 15 years. CPI's *Global Landscape of Climate Finance* shows that the world is making progress. In 2014, we invested $392 billion in low-carbon projects, up 15 per cent from the previous year, due in large part to record private

◀ The Salma Hydroelectric Dam in Afghanistan's Herat province, built under a development partnership with India. Most climate finance does not cross borders, but the world's poorest will require external assistance to improve access to clean energy

investment in renewable energy. However, investment still falls far short of the needs. In addition, earlier-stage technologies and markets face difficulty overcoming the 'valley of death' in attracting capital to scale at the levels needed.

Creating an enabling framework

How, then, can we overcome these challenges? Based on CPI's work to understand investment trends, accelerate effective use of available financial resources, and develop and scale solutions, we have identified several key lessons.

First, policy and public resources matter, playing a critical role in making the market. However, it is important to recognise that public investment alone cannot fill the gap. The private sector controls the vast majority of the world's assets, and can and will invest when risks and returns align. Given the urgency of the challenge, the goal of public investment and policy should be to create appropriate environments for private investment to flow to key areas.

Critical to this is the 'enabling framework' for investment. The majority of low-carbon finance is raised and spent in the same country. About 74 per cent of total climate finance flows never cross a border, and that share increases to 92 per cent when looking only at private finance. Because domestic investment dominates, it is vital to get domestic policy and support frameworks right.

Clear targets and stable policy frameworks mean less risk for private investors. In addition, targeted public policies – like feed-in tariffs, guarantees, tax incentives and concessional loans – can close gaps in risk and returns between dirty practices and clean ones, in many cases without placing major strains on public resources. Ensuring a level playing field is also key – for example, in many countries, fossil fuel subsidies still far outpace clean energy subsidies.

Unlocking investment in India through improved policy and financial innovation

CPI identified high financing costs as a major barrier to meeting the Indian government's ambitious renewable energy targets. In particular, it found that expensive, short-term domestic debt was adding 24 to 32 per cent to the cost of Indian renewable energy, compared with similar projects in the US.

CPI's analysis demonstrated that by providing low-cost, long-term debt via budgetary support, the government could make renewable energy cost-competitive with conventional power while also spending 28 to 78 per cent less than existing support policies. The provision of low-cost, long-term debt has become the main policy solution advocated by the Ministry of New and Renewable Energy.

As secretariat of the India Innovation Lab for Green Finance, CPI is working to support the development of further solutions. For instance, India's solar targets include 40 GW of rooftop solar power by 2022. But investors' lack of confidence in the sector and the small size of rooftop solar system deals mean that project developers cannot access debt finance at adequate terms.

The Rooftop Solar Private Sector Financing Facility addresses this by structuring small projects together to bring aggregate deals to a size and credit quality sufficient to attract investment. By demonstrating its commercial viability, these investments may enable the sector to issue asset-backed securities to institutional investors in the future, further reducing the cost of capital and expanding the investor base.

The second lesson is that knowledge is power. In recent years there has been considerable progress in understanding investment risks related to climate change. However, this information is not always available to investors – and certainly not in consistent and comparable formats that could best inform their decision-making on managing risks and returns.

There is a need to further integrate climate change considerations into daily decision-making and the financial system more generally, to enable investors to understand both the risks and opportunities related to climate change.

There is a window of opportunity right now to define strong, common standards for climate risk disclosure before approaches start to proliferate. Companies and investors will want to minimise the administrative burden by reporting according to one widely used set of standards. France's introduction of mandatory climate change-related reporting for institutional investors is a good example of actions that can help build on this momentum.

Endorsements of the recommendations of the Task Force on Climate-related Financial Disclosures from the G20, the Financial Stability Board and others would also help point the way forward.

The final lesson is that we need to think outside of the box. Scaling investment to the level required to meet the Paris Agreement and UN SDGs will require investment not just in sectors where there are established and compelling technologies and business models, such as renewable energy.

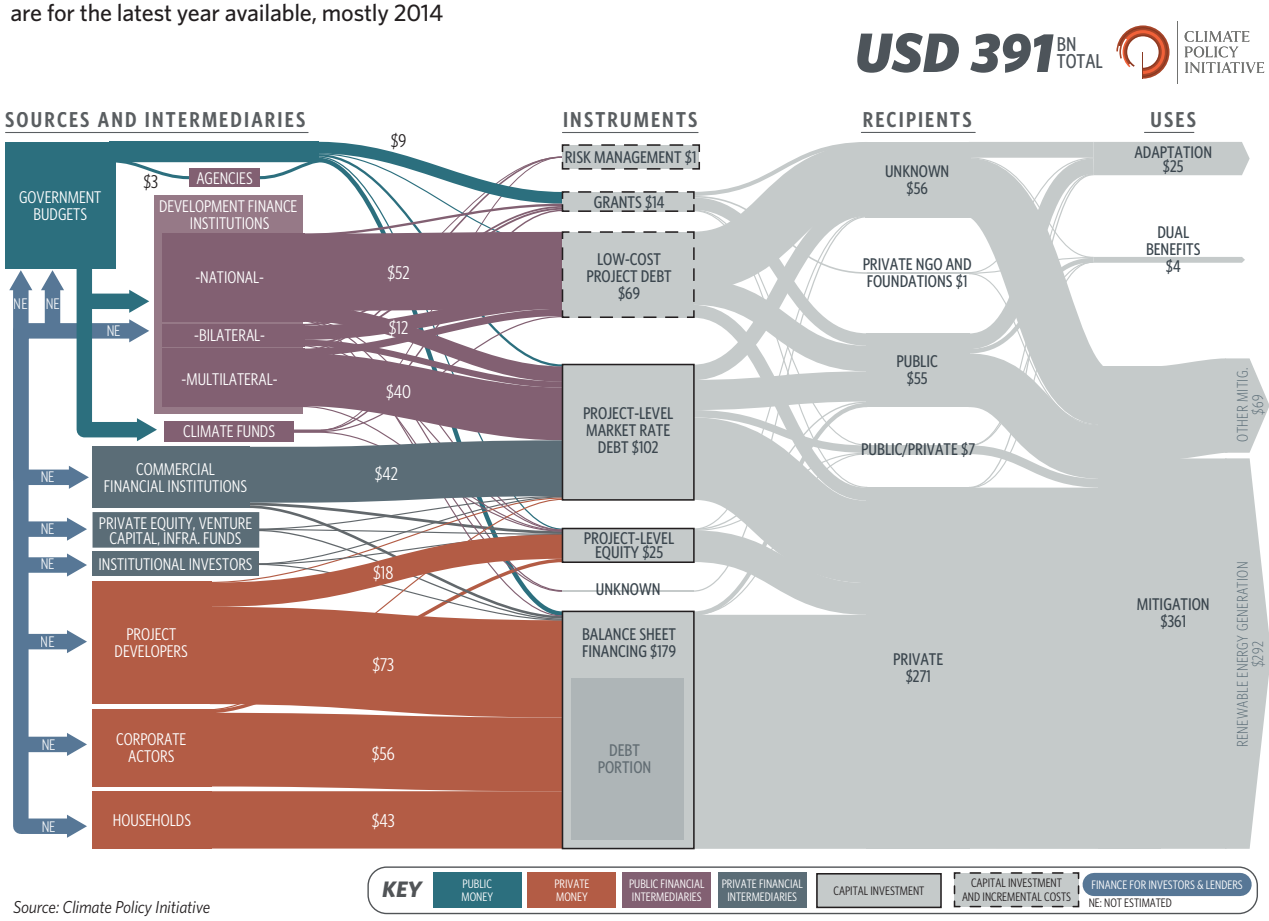
It will also need investment in more difficult sectors – such as energy efficiency, land use, adaptation and transit – where technologies are newer and access to capital is more constrained. There is a need to scale innovative, actionable financial solutions that can really make a difference.

Current innovations

The Global Innovation Lab for Climate Finance (the Lab) provides an example of how to drive investment in a number of sectors by developing and scaling innovative business models and financial instruments. The Lab is a partnership that brings together public and private actors to address persistent investment barriers.

The global landscape of climate finance

Climate finance flows along their life cycle. Figures are in USD billions and are for the latest year available, mostly 2014



Source: Climate Policy Initiative

It does this by identifying, developing, stress-testing and supporting the piloting of the next generation of climate finance instruments, with the goal of mobilising billions for climate action in developing countries. In just under three years, the Lab has helped raise over $600 million in seed capital for renewable energy, energy efficiency and climate adaptation projects – and received an endorsement from the G7.

These innovations include instruments such as Energy Savings Insurance, which guarantees savings from investments in proven energy efficiency technologies made by small and medium-sized enterprises. While these technologies are proven in some markets, a lack of confidence in, and experience of, their benefits in some developing countries has stalled investment. This instrument addresses those barriers and is being scaled by the Inter-American Development Bank to reach thousands of businesses in seven Latin American countries.

The Lab also develops instruments to unlock investment in sectors with less of a track record. For instance, the Climate-Smart Lending Platform brings together the tools, actors and finance necessary to reduce climate risk in lending portfolios and scale up climate-smart lending to smallholders globally.

Elsewhere, a new initiative currently in development called the Cloud Forest Blue Energy Mechanism creates a new business model to restore forests by partnering with hydropower plants that can benefit from such restoration in the form of improved water flow and reduced sedimentation. These types of financial structures can deliver environmental and investment returns.

To successfully transition to a low-carbon economy, the world needs trillions, not billions. Using public resources effectively to spur private investment and investing in innovation can help channel investment where it's needed most. ●

UK Export Finance: trade for good

How can UK financing and UK expertise support countries in achieving their Paris Agreement targets? By Richard Simon-Lewis, Head of Civil, Infrastructure and Energy, UK Export Finance

One of the most important discussions at COP21 was about financing the Paris Agreement, but given the scale of ambition, more than just development assistance will be needed. At the same time, there are important technological advances being made – for example in the UK's world-leading energy sector – but this expertise needs to be made available across borders.

That is where UK Export Finance (UKEF) comes in. As the UK's export credit agency, we provide finance and insurance to help UK firms export both their expertise and technology. Our financing can be the critical ingredient that makes a project happen, and we welcome any opportunity to play a role in projects that help realise the Paris Agreement.

Offshore Cape Three Points

Take, for example, the Offshore Cape Three Points project in Ghana. UKEF provided US$400 million in financing to make the project happen, supporting a GE Oil & Gas contract and working alongside the World Bank Group.

This transformative natural gas project will displace the use of heavy oil, reducing Ghana's carbon emissions by an estimated 1.6 million metric tons annually. The World Bank estimates that this is equivalent to taking 1.2 million cars off the road each year or planting 152 million trees – and most importantly it will help Ghana achieve its COP21 target of "doubling energy efficiency improvement to 20% in power plants."

It will also have a huge impact on Ghana's progress against the Sustainable Development Goals. The project will fuel up to 1,000MW of domestic power generation for more than 15 years – around 25% of total estimated thermal power generation capacity in 2020.

Energy security is a critical factor across development areas from nutrition to education to health, and will bring significant benefits to Ghana's 27 million citizens.

Sustainable construction

Another notable example of UKEF supporting UK exports of carbon-reducing technology is the headquarters building of waste management company Bee'ah in the United Arab Emirates.

Bee'ah's headquarters will be the first building of its kind in Sharjah, UAE, to be powered entirely by renewable and recoverable energy sources. UKEF provided finance for its construction

The building, which was designed by Zaha Hadid Architects and is being built by Carillion, will be the first in the city of Sharjah to be powered entirely by renewable and recoverable energy sources, while utilising recycled materials in its construction.

Renewable energy

In 2016, we signed a Memorandum of Understanding with the Kenyan Government affirming our appetite to support renewable energy development in the country. We are also strengthening our renewables capability, and are working with sector associations to help smaller suppliers access opportunities with major projects and the finance they need to fulfil them.

Responsible trade

UKEF is also committed to encouraging responsible investment. In June, we were elected to the Steering Group of the Equator Principles Association – a global framework for managing environmental, social and human rights risks in projects.

Here, and as an active member of the OECD's export credit group's environmental, social and human rights practitioners, we are taking a leadership role to ensure that these risks are properly managed.

UKEF and the Paris Agreement

Realising the Paris Agreement will take an unprecedented mobilisation across nearly 200 countries. It will require governments, the private sector and international organisations to work together and, most critically, it will require significant investment.

We at UKEF stand ready to support more projects that will help realise the Paris Agreement – especially in the renewable sector. ■

To find out more about how UKEF can make this happen, visit: **www.gov.uk/uk-export-finance**

UK Export Finance

UNA-UK thanks UK Export Finance for its generous support for Climate 2020

Towards a green economy

The goals of the Paris Agreement are inexorably interwoven with the SDGs, and both require a transition to inclusive green economies

© Noel Celis/AFP/Getty Images

By **Achim Steiner**, Administrator, United Nations Development Programme (UNDP)

The impact of climate change and environmental degradation threatens our efforts to achieve the Sustainable Development Goals (SDGs) and, indeed, the very foundations of life on our shared planet.

Unless degradation is curtailed, poverty and instability will deepen, and growth cannot be lasting or inclusive. Healthy ecosystems bring benefits to all aspects of our lives by providing clean water, air, soil, food, fuel, medicine and resources for jobs and growth.

These benefits – known as 'ecosystem services' – underpin development, and must be safeguarded by fundamentally changing the way societies grow. And we must ensure this transition is just, so that we reduce inequalities and leave no one behind even as we make radical changes to our growth models.

Inclusive green economy approaches are central to this paradigm-changing process, and to successful implementation of the Paris Agreement. They provide us with the tools and flexibility to respond to the linked social, environmental and economic challenges we face. Moreover, these approaches provide new opportunities for sustained growth and societal progress.

We need to act now

The need for comprehensive climate action and the shift to a greener economy is urgent. Since the Paris Agreement was adopted – not even two years ago – new

◀ **Volunteers collect rubbish in Manila, Philippines. Greater social and environmental awareness, combined with a commitment to fairnesss and community action, will be instrumental to the success of both the Paris Agreement and the SDGs**

and more sobering milestones have been reached. Carbon dioxide levels in the atmosphere have breached 400 parts per million for the first time. The highest average global temperatures ever have been recorded. We have witnessed exceptionally low sea ice, and growing sea-level rise and ocean heat. There have been more extreme weather events, including storms, floods, droughts and fires, with devastating impacts on communities and commerce.

These trends and events are having, and will continue to have, a direct impact on the SDGs. By 2030 up to 100 million more people may be at risk of falling into poverty due to the changing climate (SDGs 1, 10); 120 million more children in sub-Saharan Africa and South Asia could suffer from malnourishment and stunting by 2050 (SDG 2); and approximately 250,000 additional deaths per year from malnutrition, malaria, diarrhoea and heat stress could occur between 2030 and 2050 (SDGs 3, 5).

The average global economic loss due to climate change could reach 3.2 per cent of global GDP by 2030 and as much as 10 per cent by 2100 (SDG 8). Tensions related to migration, food and water shortages are already exacerbated by climate change (SDG 16). Human-induced climate change and environmental degradation are also pushing us past other key planetary thresholds related to the health of our oceans (SDGs 6, 14), biodiversity loss (SDG 15) and unsustainable production and consumption (SDGs 9, 11, 12).

Each boundary we cross represents a tipping point, beyond which the risk to our societies, economies and collective security increases significantly – with potentially catastrophic consequences.

As we look towards 2030 and beyond, the resources needed by our growing world community will only increase. Over the next two decades, the global population will expand by more than 1.2 billion people; our urban footprint is expected to triple; demand for food will increase by 35 per cent, for water by 40 per cent, and for energy by 50 per cent. By 2050 we will need to generate over 1.5 billion new jobs for women and men.

These pressures are compounded by the impact of climate change. Until our development trajectory is less polluting, and more resource efficient and climate resilient it can no longer be sustained.

The challenges are formidable. But the solutions offer unprecedented opportunities for eliminating poverty and setting the world on a new path of prosperity, stability and growth that simultaneously protects our planet for future generations. And inclusive green economy approaches are key to advancing these solutions.

The notion of inclusive green economies is not empty idealism – a mere conceptualisation of the world as we would like to see it. The shift to green economies is already becoming a reality, one that continues to gain traction and influence.

Countries around the world are leading this shift – with governments and parliaments putting the policies in place that will allow us to achieve real transformations.

More than 190 countries have submitted national targets – or intended nationally determined contributions – on climate change. Over 175 countries have renewable energy targets in place, and more than 65 countries have created green economy plans. These commitments are supported at the global level by initiatives like the UN Partnership for Action on Green Economy (PAGE).

The private sector and climate finance

The private sector is fundamental to this process. We can no longer think of two separate and competing climate change and business agendas. As much as there is a normative and humanitarian case for addressing climate change and advancing the SDGs, there is also a formidable business case.

Investing in sustainable development makes sense for companies and entrepreneurs in developed and developing countries. It opens new markets, increases competitiveness and savings, protects long-term profits, allows companies to leapfrog technologically, and responds to evolving consumer demand and shareholder interests.

Each boundary we cross represents a tipping point, beyond which the risk to our societies, economies and collective security increases significantly – with potentially catastrophic consequences

And while public financing is critical, the much greater share of climate change finance and green investment will come from the private sector. For example, over the next 15 years tens of trillions of dollars will need to be invested – not just in traditional infrastructure but also in natural infrastructure such as forests, fisheries and coastal protection.

Countries need a mix of domestic, international, public and private resources, channelled through the likes of green bonds, conservation financing and impact investing. Better-targeted and more efficient use of public funds can help catalyse private climate financing with dividends across the SDGs.

Realising the opportunities

Historically, the climate change debate has encompassed the notion that there is a trade-off between growth and environmental and social sustainability. That trade-off is false.

As the 2030 Agenda makes clear, there is today an undeniable consensus on the urgent necessity and the compelling business case for pursuing green and inclusive development pathways.

The debate has moved on. Through initiatives like PAGE, our focus now is on how we can realise the many development opportunities afforded by inclusive green economy approaches to accelerate progress on the SDGs and Paris Agreement. ●

Shaking up business action on climate

Meeting the climate challenge will require radical and rapid transformation to business practices. How are companies responding, and what can be done to speed progress?

◀ Rosskopf mountain above Freiburg im Breisgau, Baden-Württemberg, Germany. The state government, putting transparency at the core of its climate action policy, is a good example of how sub-national government can spur business to greater climate action

By **Helen Clarkson**, CEO, The Climate Group

We live in an age of profound change, with technological developments at the centre of huge shifts in societies, economies and values. As the digital age unfolds and we move into the era of big data, there is a wide-scale disruption to business as usual, but one that could have a huge upside for the climate.

One large shift has been the emergence of social media as a check and balance on corporate action. In the last few years we've seen numerous businesses stumble as their communications teams have been caught short by scandals that they were ill-prepared to handle.

Radical transparency

But while the idea of online transparency can feel daunting to some, organisations are also finding out how they can build trust by sharing information and being open about their challenges and flaws. A new concept has emerged: 'radical transparency'.

Fashion brand Everlane is founded on the premise of radical transparency, and it urges its customers to, "Know your factories. Know your costs. Always ask why." The company profiles its factories on its website, and breaks down the garment cost into its component parts, including profit margin.

Similarly, Nudie Jeans, which has always manufactured with 100 per cent organic cotton, now has a goal of 100 per cent transparency. Global Forest Watch even uses interactive online tools to create a monitoring and alert system for the status of forests worldwide.

As we move into implementing the Paris Agreement, could radical transparency help to deliver radical decarbonisation?

At The Climate Group our mission is to accelerate climate action. We work to drive the pace, scale and ambition of climate initiatives to limit warming to well below 2°C and ensure a prosperous future for all. We do this by building networks of companies and sub-national governments that come together around common goals or commitments, and support them to turn these commitments into action.

As we move into implementing the Paris Agreement, could radical transparency help to deliver radical decarbonisation?

This is where transparency comes in. Working with our partner CDP, we check on how organisations are progressing those commitments, and showcase their work to demonstrate what is possible and drive further ambition.

Our ambitious "RE100" campaign brings together the world's most influential companies committed to 100

per cent renewable electricity. More than 100 leading corporates have signed up from different areas of the world, covering sectors as diverse as information technology (for example, Apple and Google), financial services (Wells Fargo and UBS), manufacturing (Tata Motors and Unilever) and retail (IKEA Group and Walmart).

Bringing together this large group of diverse companies sends a powerful market signal, showing the growing demand for renewable energy. The 100 per cent commitment is important: it shows not only that members are serious, but also that there's no room for compromise – there's no 'last slice' that isn't renewable. This ambition drives both internal decision-making and external interactions with the market.

Data reported to CDP for RE100 shows examples of significant leaps in renewable electricity uptake from these companies, some finding themselves going faster than they originally anticipated.

Goldman Sachs, for example, went from 14 per cent renewable electricity in 2014 to 86 per cent in 2015; Elopak went from 18 per cent to 86 per cent; and H&M from 27 per cent to 78 per cent in the same timeframe. Companies are progressing because they recognise the compelling business case for switching.

Reporting on climate risk

While campaigns such as RE100 are putting pressure on businesses to make commitments and follow up, at the same time the investment community is also driving change. While companies are used to making financial disclosures and having these pored over by investors, carbon disclosure is somewhat newer. But within a few years we could be seeing these sorts of disclosures on the same footing as the statutory report and accounts.

A recent report from the Task Force on Climate-related Financial Disclosures makes four recommendations on how companies should report on climate risk. Interestingly, the task force moved away from talking about an impact that a company has on the climate, and instead focuses on the risk that the climate poses for a company. By focusing squarely on these risks, this also makes the business case for corporate action on climate change, as a risk-mitigation activity. To that end, the report also lists a number of opportunity areas that companies should focus on, such as lower-emission forms of energy.

This is the reason that ShareAction, another partner of ours, has been championing the importance of corporate action on climate change as part of its responsible investment work. ShareAction has been highlighting investor interest in climate-change risk to businesses, as well as asking questions at AGMs about what action is being taken. For example, they challenged Burberry over going 100 per cent renewable at their 2016 AGM, and the company announced their RE100 membership last month.

Transparency is also a tool that we use in our work with sub-national governments through the Under2 Coalition, again in partnership with CDP. We first worked with CDP on a disclosure pilot for our state and regional partners in 2014. While there were 12 partners involved in that pilot, we've seen year-on-year growth, with 44 in 2015, 62 in 2016 and 100 looking likely to have disclosed by the time the reporting period closes later on this year. While governments are given the option to keep some of their disclosures private, increasingly we're seeing a willingness to disclose publicly.

Alongside this increase in disclosure, we've also seen a ratcheting up of ambition. Last year a number of governments moved to net-zero targets for the first time. We're also seeing moves such as the government of Chhattisgarh in India planning to develop a website on their climate action as a result of our engagement with them, and a bill in Massachusetts that proposes a biennial disclosure report of progress on their mitigation efforts.

We are clearly seeing our sub-national government partners embrace the transparency agenda. As Franz Untersteller, Minister of the Environment, Climate Protection and the Energy Sector for the Baden-Württemberg government in Germany has said: "Transparency lies at the heart of a successful climate action policy. This is the only way to prove we are on the right track towards our climate goals."

We're seeing that transparency coupled with communication drives more action. Knowing what others have done reinforces the business case for actions, and moves climate action into the mainstream

Spreading the word

A final critical tool for The Climate Group is communication to share success and drive more action. We share stories of climate action to show both that a world with under 2°C of warming is possible, but also action that is happening. That includes both our work with corporations as they set and then meet their targets, and case studies from governments that help inspire policy action elsewhere.

So, while it might be tempting to think of transparency as akin to benchmarking and fear that companies will only aim to stay marginally ahead of their peers, instead we're seeing that transparency coupled with communication drives more action. Knowing what others have done reinforces the business case for actions, and moves climate action into the mainstream.

Our work on a campaign such as RE100 will be done when a commitment to 100 per cent renewable electricity is the business norm, not the exception. While we've recently welcomed our 102nd member, and are excited for more to join the fold, we're also looking forward to the day when such a commitment is entirely unremarkable. ●

Case study: communal approach to forest conservation

Golden Agri-Resources is engaging the community to commit to forest conservation

Conservation planning and management is a key priority for Golden Agri-Resources (GAR) since establishing the first Forest Conservation Policy in the palm oil sector in 2011, which outlined how GAR intended to decouple palm oil production from deforestation. GAR subsequently identified and is managing 72,000 hectares of high carbon stock (HCS) forests and high conservation value (HCV) areas for conservation within our concessions.

Implementing zero deforestation commitments and achieving long-term conservation is as much a human matter as it is an operational one. Companies manage concession leases temporarily assigned to them by governments, ideally granted with the agreement of local communities. While these leases can run for decades, government reserves the right to reclaim concession areas not fully developed.

Meanwhile, local communities have their own needs to meet within their customary village boundaries – e.g., food security or income generation – and will not automatically protect land earmarked for conservation. Companies must undergo intensive negotiation with them while mediating with local governments on acceptable land use, on land whose boundaries and customary rights are often poorly defined and overlapping.

Halting encroachment or the degradation of conservation land requires community buy-in to the concept of long-term conservation. For GAR, this depends on an extensive and intensive investment in a Participatory Conservation Planning (PCP) process. 'Production-protection partnerships' describes how companies, communities and governments must jointly cooperate to achieve food security, livelihood improvements and conservation within a landscape.

GAR worked with four villages in West Kalimantan, Indonesia to conserve HCS areas. The villages rejected our conservation proposal outright, unaware of its importance while of the belief they would not be allowed to use alternative land for their subsistence.

Intensive engagement educated the community on the significance of HCS forests and the long-term benefits of conservation. GAR also demonstrated controlled ways to utilise the forest for their subsistence while still maintaining its integrity. Convinced, this community accepted the proposal and issued village regulations to manage their forest, formalising the agreement at a public consultation event held in August.

Next, GAR will facilitate the launching of village regulation as a legal basis for communities to manage forests that are agreed upon by them to be protected sustainably. These villages will also start to run an Alternative Livelihood programme with GAR support, reducing pressure on their HCS forest area.

Results and achievements

To date, we have rolled out Participatory Mapping (PM) in 67 villages across 13 concessions and carried out PCP in 10 villages across West Kalimantan, securing community agreement to set aside over 7,000 hectares of HCS forests for conservation. Keeping in mind the timeframe and resource requirements for the entire process, GAR is committing to engage another 10 villages for PM in 2017. Furthermore, we are using this model of community partnership to rehabilitate 2,600 hectares of peat land in West Kalimantan, and halt future encroachment into peat areas through implementation of Alternative Livelihood programmes. Scaled up, this protection-production model helps ensure economic growth in tandem with forest conservation as we launch similar partnerships across our concessions. The model goes well beyond economic growth to support UN SDGs such as ending poverty; good health and wellbeing; quality education; and reducing inequalities.

Palm oil companies can play an important role in securing the future of the forests in our own concessions, but have little control on the land outside of them. Effecting conservation at the level of the landscape will require firm commitments – including financing – from government, civil society and the global private sector. ■

UNA-UK thanks Golden Agri-Resources for its generous support for Climate 2020

What does Participatory Conservation Planning (PCP) involve?

1 GAR visits the area to understand more about the landscape and village(s) living in the area

2 Participatory Mapping – GAR works with villages to map critical areas for food security

3 Joint discussion with local community to identify areas for conservation according to GAR's Social & Environmental Policy

4 A core element of PCP involves designing Alternative Livelihood programmes such as organic vegetable farming using spare communal land, allowing communities to earn additional income without disturbing forests

5 Where communities reject the idea of conservation altogether and clear HCS land for farming, GAR's stand is not to buy from them

6 Final map combining areas for conservation, development and food security, together with management plan is presented to key stakeholders

© Jonathan Bachman/Reuters

Knowing what to do

Making better use of the vast amounts of data at our disposal will be critical to taking the evidence-based actions needed to tackle climate change

By **Claire Melamed**, Executive Director, and **Aditya Agrawal**, Director, Data Ecosystems Development, Global Partnership for Sustainable Development Data

Professor Stephen Hawking marked his 75th birthday with a stark warning on climate change, saying that he fears "evolution has inbuilt greed and aggression to the human genome".

Tackling climate change requires two things: a political decision to take action, and the information to know what actions to take. Both require new forms of cooperation. If selfishness is the greatest threat to our planet and people, then cooperation is its saviour.

The Global Partnership for Sustainable Development Data (GPSDD) exists to

◀ Residents of Houston, USA, seek safety from the floods caused by Tropical Storm Harvey. Often data on risk exists but either goes unanalysed or unheeded. In most countries, insurance companies have a better knowledge of flood risk than government

foster the cooperation to drive better information. We live in a world that produces more data than ever before. But this does not mean that it is available – at the right time and in the right format – to solve the critical challenges of our time. Focusing on data might seem a diversion, a distraction from the real business of policy and politics. But data is part of the critical infrastructure for policymaking, without which change is less likely.

Data coordination leaves nowhere to hide

A common understanding of the facts is the basis for political coalition and popular support, which are prerequisites for action. This is painfully evident in the area of climate change – where the basic facts, uncontested by an overwhelming majority of the world's experts, are still being challenged by an ideological few.

Despite an overwhelming amount of evidence from scientists and researchers around the world agreeing on the role of humans in increasing the effects of climate change, this topic still remains highly political. Better data alone cannot overcome ideological divisions. But a better understanding of the data and the story it is telling the world will help to build the political momentum for change. It will also reduce the hiding places for those who would deny what is happening to our planet.

Data is also essential for defining priorities for action. Governments have to know what industries and activities are the major sources of emissions in their countries to decide how to design the right combination of regulations, tax and subsidy policies to reduce them. They have to know how climate change is affecting rainfall and soil quality in different parts of the country to decide how to support those who are already feeling the effects. And they have to know if the policies they implement are working, or if a change of course is needed. Too many governments lack too much of the essential information, and too many of the skills to analyse that information, that is the basis for good policy-making.

Climate change and extreme weather events do not respect manmade borders, so a unified response remains vital. The contribution of carbon into the atmosphere varies dramatically from developed to developing countries, where the impact will affect the poor and marginalised first. To better account for these variations, as well as the effects, impact and responsiveness of potential solutions, we need data to inform action and decision-making. Also essential are broad education and outreach programmes to engage citizens on what they can do to help mitigate against climate change.

Until information is improved, we will be fighting climate change with blindfolds on.

There is unprecedented information about the world – will we use it?

The world of data has been transformed over the last two decades. It used to be mainly public bodies and a few academic institutions that were chiefly responsible for the collection, curation and use of data. Every department of every government around the world is still collecting and using data. In many cases, they are doing this more than ever before, as the ambitions of governments to provide universal services and to reach their far-flung populations have grown over time.

Now, they have been joined by many others. Thanks to dramatic technological changes with which we are all familiar, vast quantities of data are created and held by institutions of all types and sizes. Companies hold millions of data points created by the phones we all carry in our pockets every day and by the hundreds of satellites that fly over us, photographing the world as they go. Grassroots organisations in every corner of the world hold unique records of how people live and how they are responding to the challenges of climate change.

Yet this highly useful information is not readily available to the people tasked with fighting climate change. Imagine being a policy-maker of a nation seeking to address climate change and knowing that the

Also in this section

owners of the most popular phone network know more about your fellow citizens than you do. Satellites that are positioned over your country are capturing minute-by-minute information on deforestation, shifting seasons, urbanisation – but you do not have access to that info. Insurance companies operating in your country have better flood maps than your ministry. Unlocking this information for the public good would facilitate huge leaps in countries' capacities for resilience-planning and climate responses.

The data system needs coordination and efficiency

The GPSDD is a growing network of over 250 organisations around the world working to harness the data revolution for sustainable development and climate action. Our member organisations include governments, companies, civil-society groups, international organisations, academic institutions, foundations, statistics agencies and other data communities.

To succeed in the fight against climate change, government agencies need to be working together through a multi-stakeholder approach inclusive of civil society and the private sector.

The GPSDD is currently working with a number of governments – including Colombia, the Philippines, Ghana, Sierra Leone, Kenya, Senegal, Tanzania and the US – on 'data roadmaps' that adopt this inclusive approach. Countries can broker partnerships to access data that is relevant to climate and resilience planning – such as earth observation data, including satellite data on weather and sensors on soil and plants.

However, having a clear understanding of the data ecosystem – in terms of what data exists where, who is doing what, and key roles and responsibilities on data production and use – is often lacking, or fragmented at best.

Aligning frameworks that have a data-reporting requirement – whether this be international, national development priorities, or existing data programmes such as open data, spatial data infrastructure, e-governance or official statistics – offers an approach for better coordination and efficiency, as well as reducing redundancy. In return, a better understanding of the data ecosystem can be gained, including understanding where the gaps exist.

Once this data ecosystem is better understood, the distinct roles and responsibilities across government agencies, and how civil society and private sector can better engage, become clearer. This understanding will also help to identify what actions are needed to fill these gaps and how to partner with regional and international organisations that can support political, technical, capacity and financial challenges.

For example, in Ghana, a Sustainable Development Goals (SDGs) Implementation Coordination Committee has been established to develop a multi-stakeholder approach to putting the SDGs into practice. This includes key government institutions, civil society and the private sector.

In Sierra Leone, the same approach is being applied but through a pre-existing body, the Open Data Council. In each case, a data ecosystem mapping effort is being undertaken to better understand what data exists and where. More specifically, it will reveal gaps, which can then be prioritised for investment and partnerships.

Opening data sets can help countries meet the Paris Agreement

The Paris Agreement aims to strengthen

From eco-warriors to data ecosystem warriors

Of the two elements needed to fight climate change – political action and information (to know what actions to take) – the former understandably dominates the headlines. The Trump administration's formal notification to the United Nations of its intention to pull out of the Paris Agreement has been a galvanising moment for many. Yet the threat of climate fatigue persists, even as the stories about bushfires and bleached coral pile up.

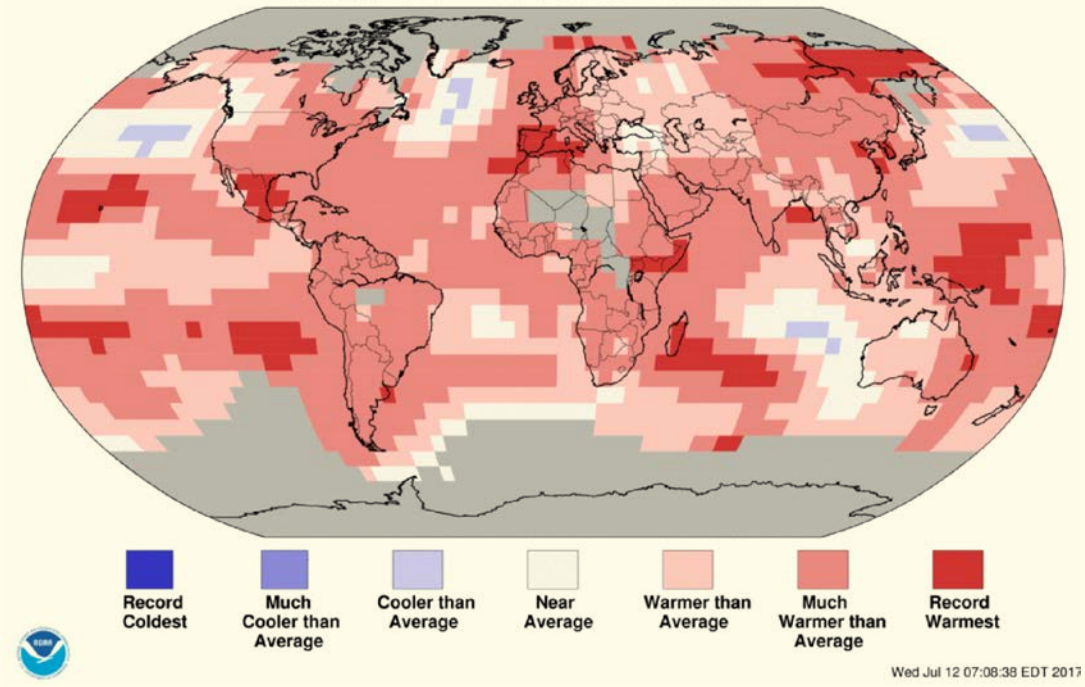
Readers of these stories can contribute to political action by lobbying, protesting and advocating for climate action. They can also call for a climate movement underpinned by the best and most recent information available on our planet and its people.

Admittedly, one's first thought upon reading about the melting permafrost may not be: "How can I contribute to a better climate data ecosystem?" But addressing climate data gaps will maximise the impact of work to combat climate change.

The following can help make data available to guide climate action:

- **Being an advocate for facts-based climate information:** Every region is experiencing rapid transformations as a result of climate change. We need to track and respond to emerging realities. This needs investment in data and a commitment to opening data up – it will not happen without public pressure.
- **Sharing more information:** Many of us working in government, think tanks, UN agencies and elsewhere don't think to share the data we have collated. Often this is because no one has yet asked us to share it – or perhaps because cleaning it up and putting it out there seems somewhat daunting. Yet by pushing our organisations to be more open we can support the data revolution at a grassroots level.
- **Encouraging the public sector and NGOs to harness the creativity of data scientists:** Some of the greatest minds of our generation are spending their days teaching fridges to obey human requests to restock milk and orange juice. Engaging talented technicians and data scientists to help deliver solutions to the greatest challenge humankind has ever faced requires investment in capacity – as well as breaking down bureaucratic silos between agencies and sectors.
- **Talking to each other:** If selfishness threatens humanity, cooperation can save it. There are hundreds of communities of practice that tend to operate fairly independently. Let's share and overcome common challenges. We need to connect with each other, convene the best minds and catalyse solutions to all our problems from the ground up.

Land and ocean temperature percentiles Jan-Jun 2017



NOAA's National Centers for Environmental Information. Data source: GHCN-M version 3.3.0 & ERSST version 4.0.0

the global response to the threat of climate change. It seeks to keep global temperature rise this century to under 2°C above pre-industrial levels and to limit temperature increases even further where possible.

Coupled with the SDGs, launched in 2015, and the intended nationally determined contributions under the UN Framework Convention on Climate Change, there are plenty of instruments in place to support how governments, civil-society organisations and the private sector can reduce their impact on climate change.

However, climate data is often incomplete, fragmented across agencies, or not made openly accessible or available in interoperable formats. These factors limit how data can be applied, and therefore how policy and decision-making can be better informed.

The Paris Agreement depends on international cooperation and mutual trust, in that member countries will prioritise global needs over national self-interest. It also requires countries to monitor, report and verify climate actions, most significantly around greenhouse gas emissions.

Transparency is inherent in the Paris Agreement. This guiding principle of transparency is designed to make data publicly available – allowing any organisation to examine the data, analyse it and advocate for change as necessary. As a result, the absence of comprehensive open climate data will make it difficult for countries to meet their commitments under the Paris Agreement.

Governments likely either do not understand the demand for climate data, or may not be able to make the data openly accessible due to weak mandates or incentives, political issues or lack of capacity. On the demand side, other organisations, private-sector bodies and citizens – who may want to hold their governments accountable or use the data to further innovate and determine more local actions – likely do not know where the data exists and how it can be accessed, if at all.

Given current political trends and the increased rate at which climate change is occurring, it has never been more important to make climate data more available in useful formats. This would allow a range of actors across sectors to better understand climate trends, and develop solutions and policies that work.

The Open Government Partnership, International Open Data Charter and national and sub-national open-data programmes offer an opportunity to implement solutions based on international commitments and allow new platforms and technology to rapidly disseminate climate data. ●

Case study: climate observation from space

Data gathered from space provides invaluable insight into the causes and impacts of climate change

Ice is one of the many wonders of our Earth. If you have ever trekked on a stunning glacier in the Alps or Alaska, you will have had the feeling of walking on an immense reservoir. But glaciers also act as ancient and precious mines of information, allowing us to understand their evolution over millions of years.

Thanks to the SAR (synthetic aperture radar) technology of the COSMO-SkyMed satellite programme, we can see the extraordinary patterns that glaciers form. Fragmented with brilliant and unnatural colours, they resemble Cubist landscapes conjured from the brushes of a Braque or Picasso.

The polar regions are extremely important in terms of their global impact on weather, climate and the circulation of the atmosphere and oceans. Using Earth observation technology in the battle against climate change is very important to Italy. We are proud that the Italian COSMO-SkyMed constellation is now celebrating its 10th anniversary.

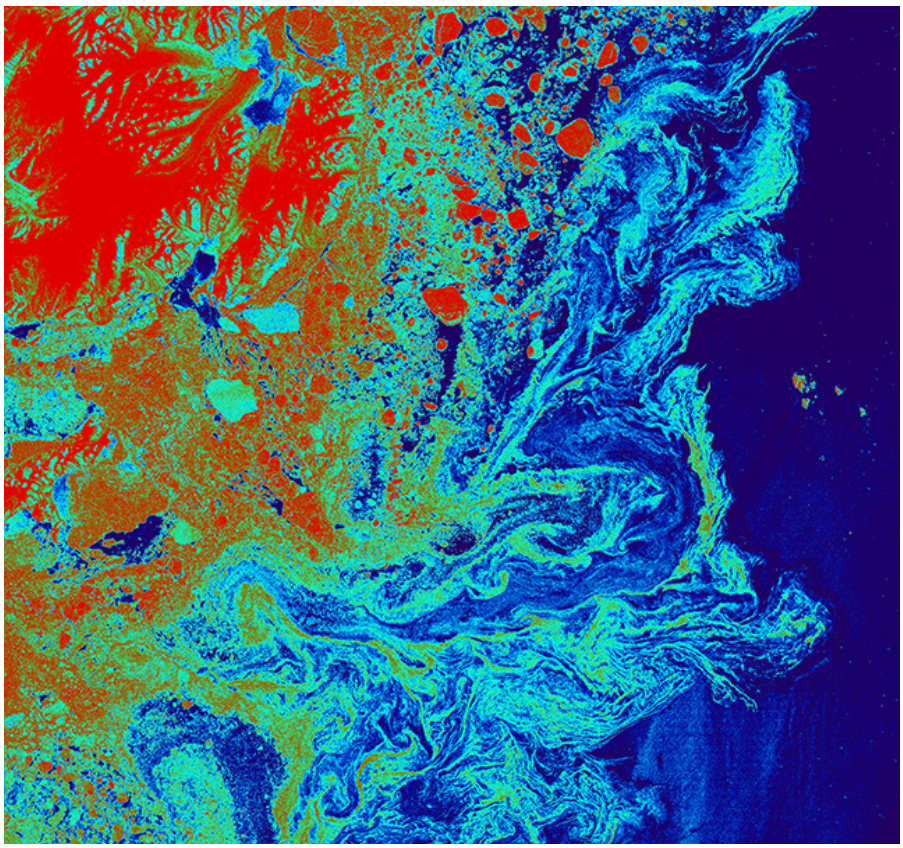
The constellation represents truly cutting-edge technology. Funded by the Italian Space Agency (ASI) in partnership with the Ministry of Defence, COSMO-SkyMed is built and run by the Italian space industry – namely, Leonardo and its joint ventures with Thales, Thales Alenia Space and Telespazio.

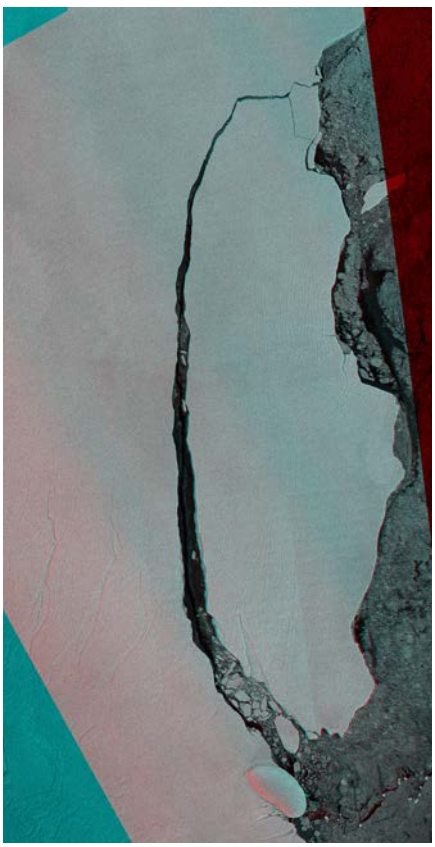
It is the first system of its kind designed for both civil and military use. Its many applications include: land and sea security; prevention and management of natural or man-made disasters; providing data on climate change, coastal monitoring, polar ice and agricultural and forestry resources; and urban control of buildings.

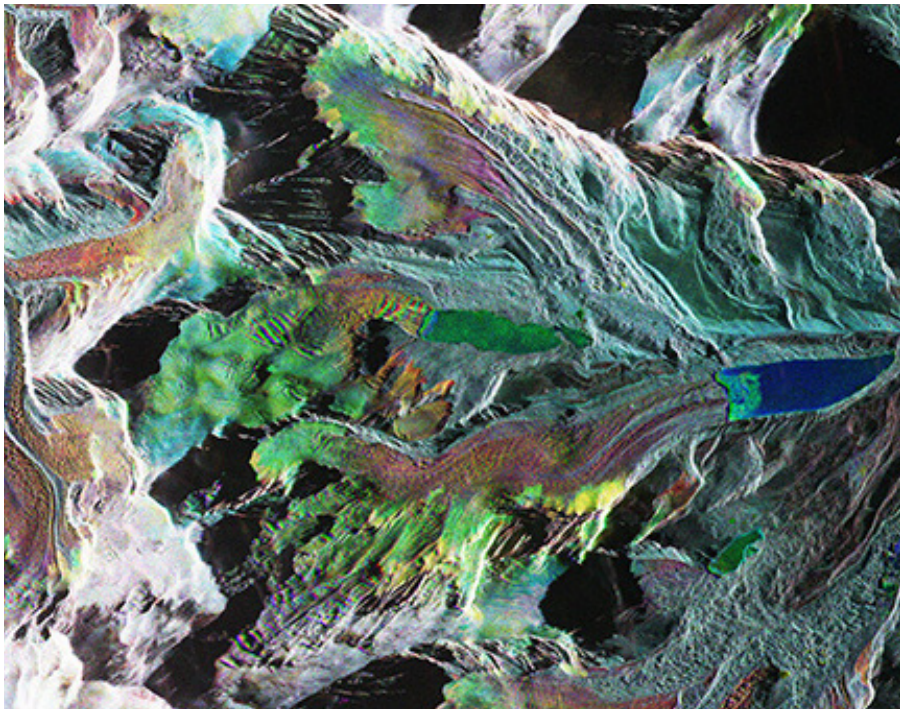
In recent months, international political debate on environmental policies has become more uncertain and complicated. This is despite the ever-increasing danger signs about the fragile status of our planet.

Tipping points

In 2016 scientists warned that the increasingly rapid melting of the ice cap risks triggering 19 'tipping points' in the Arctic that could have disastrous consequences around the world. These tipping points occur when a natural system, such as a polar ice cap, undergoes sudden or overwhelming change that has







26 of the 50 fundamental variables for climate analysis are observable by satellites

Left: Lhonak glacier in the Himalayas. The lake formed from its melt waters is very vulnerable, with a high potential to cause devastating floods
Right: icebergs formed from the Pine Island glacier, Antarctica. Different colours show the movement of icebergs over an eight-day period

profound – and often irreversible – effects on surrounding ecosystems.

In political debate it is important to keep in mind the scientific data that must guide us in analysing problems and choosing solutions. The good news is that 26 of the 50 fundamental variables for climate analysis are observable by satellites.

For several years, COSMO-SkyMed data – processed by e-GEOS, an ASI (20%)/ Telespazio (80%) company – has been widely used to provide in-depth analysis of the polar regions, the most important 'climate controllers' of the Earth. However, Arctic regions also offer opportunities for those seeking to commercially exploit the Earth's natural resources. The melting of ice has inevitably made this easier.

Real-time information on sea-ice conditions is essential for all operations in ice-covered areas. The safety and efficiency of sea transportation, offshore operations, fisheries and other activities in these regions require high-resolution ice forecasts.

Earth observation (and in particular SAR technology) is a reliable tool for monitoring icy surfaces, complementing the most accurate aerial and on-site observations. It can provide critical information about the extension of the icy surface, and of the shape and movements of the ice cap. COSMO-SkyMed is also a powerful tool for measuring glacier motion, as it can perform multiple observations over a short time frame and from different visual angles.

Two recent examples illustrate the potential of the technology. The European Commission's Earth observation programme, Copernicus – which includes the COSMO-SkyMed and Sentinel satellites – has taken images of two large icebergs that have detached from the Nansen Antarctic ice platform.

Combining different types of images gathered from satellites Sentinel-2A (optical imaging), Sentinel-1A (radar imaging) and COSMO-SkyMed, the National Committee for Research has been able to study the phenomenon since 2013.

Marine drift

Another study concerns the monitoring of the drift of marine ice across the western Fram Strait, located between the Svalbard islands and Greenland. Here the East Greenland Current carries more than 90 per cent of the marine ice that flows south from the Arctic. The current therefore serves as the main freshwater reservoir for the Arctic Ocean, and has a potential impact on the entire Atlantic Ocean. Measuring this important current is done through a boom system and through the observations made by the COSMO-SkyMed satellites. Analysing the data is critical to predicting climatic and meteorological dynamics and to understanding changes to some of the Earth's fundamental equilibria.

Responding to the data requests of polar scientists and from the Polar Space Task Group, ASI will continue to promote polar research and development through an open call process, based on the needs of users. But whatever the needs are, scientific or commercial, the information we are gathering will be crucial to defining the next environmental policies, and to achieving a greater understanding of our precious planet. ■

Opposite, far left: the coast of Greenland, artificially coloured to highlight ice floes on the sea
Left: July 2017, a trillion-tonne iceberg, twice the size of Luxembourg, breaks off the Larsen ice shelf in Antarctica

UNA-UK thanks Agenzia Spaziale Italiana for its generous support for Climate 2020

The impact on life on Earth

How is climate change disrupting our planet's ecosystems and human societies?

By **Hans-Otto Pörtner**, Co-Chair, Working Group II, Intergovernmental Panel on Climate Change (IPCC)

The world's climate is changing. The mean surface temperature of the globe has already warmed, on average, by about 1°C when compared to the estimated pre-industrial average. Examples of climate change range from shifts in weather patterns and climate characteristics (such as patterns of rainfall or snowfall) to the increasing intensity of droughts, heatwaves and storms – on top of the rise in mean temperature.

In several parts of the world, particularly over land masses and in polar regions, the degree of warming exceeds the global average. Warming is especially strong in the Arctic and is also developing in the Antarctic. Melting glaciers and polar ice sheets are causing sea levels to rise.

Given the present observations and rates of change, and comparisons to similarly warm palaeo periods, it is becoming increasingly likely that the global average sea level will rise beyond that previously projected for 2100.

Climate change is causing increasingly severe and pervasive impacts. These have become evident in human societies and ecosystems on all continents, as well as in all oceans. A prominent example is the progressive demise of warm water coral reefs due to repeated exposure to temperatures which are too high, combined with other human-induced stressors. Ecosystem impacts are largely characterised by the displacement of organisms through exposure to temperatures outside of their thermal range. As a consequence, the distributions of organisms in both aquatic and terrestrial realms follow the shifts in their preferred temperatures – mostly from lower to higher latitudes, leading to the mixing of ecosystems and a projected loss in biodiversity.

In parallel, some areas previously available for growing certain crops will become unsuitable in the future. Depending on the degree of global warming that will occur, crop productivity – as well as fisheries, aquaculture productivity and food security for humankind overall – is projected to decline.

Such pressures exist for all organisms: not only for animals, plants and their ecosystems, but also for humans and their societies, despite humans' wider scope for behavioural and technical adaptability. Temperature extremes – such as the increasing frequency of heatwaves – are threatening plants and animals (including humans). They are already having an impact on various regions and causing an increase in mortality.

> ***It is becoming increasingly likely that the global average sea level will rise beyond that previously projected for 2100***

Like all organisms, humans have limits to the temperatures they can tolerate and function in. Limits are lowest at high humidity, which hampers the temperature regulation of the human body. Particularly at low latitudes, humid heat makes some places increasingly unpleasant, if not uninhabitable. Here, humans increasingly rely on technical solutions such as air conditioning to provide comfort zones where they can live and work, albeit by becoming isolated from the outdoors. The capacity for outdoor work in hot and humid climates, therefore, becomes increasingly constrained.

© Gideon Mendel For Action Aid/In Pictures/Corbis via Getty Images

▲ Building an earth barrier to protect Jhanghara village, Pakistan, from floods that affected 20 million people across the country in 2010, destroying some 1.8 million homes

Human life and livelihoods, as well as the ecosystems on which they depend, are also vulnerable to other environmental extremes such as drought or floods. Among humans, the very young and elderly are the most vulnerable, while poverty increases the direct exposure of humans to environmental extremes and risks. Nonetheless, extremes such as heatwaves are causing an increase in human mortality in both developed and developing countries. What's more, climate change also creates human exposure to redistributed disease vectors and associated illnesses in formerly unaffected areas.

Evolutionary crises

Carbon dioxide (CO_2), as a key driver of climate change, accumulates in both the oceans and the atmosphere. In the oceans, it undergoes a chemical reaction that acidifies the water. Ocean acidification is progressing in parallel to rising atmospheric CO_2 concentrations. The acidification dissolves calcium carbonate shells and structures built by sensitive marine calcifiers such as bivalves, echinoderms or corals, and hampers their ability to repair or build new ones. The accumulating CO_2 penetrates the organism's body and can result in disturbances of life-sustaining processes, and can elicit behavioural changes in animals.

There are other effects, too. Rising CO_2 levels can lead to more vigorous growth in plant life in the oceans (as well as on land). Warming can cause oceans to become stratified, preventing the mixing of water between upper and lower layers, and can stimulate the oxygen demand of organisms. At low latitudes both processes can combine to create an expansion of isolated water bodies at intermediate depths that are naturally characterised by low oxygen levels. The result is that these waters can increasingly lose animal life.

These findings illustrate that life on Earth – especially complex, 'higher' life forms such as plants and animals (including humans and their societies) – relies on ambient temperatures being maintained at low-enough atmospheric CO_2 levels. Further, the evolution of life, especially of higher life forms, could only occur because microbial life on our planet has generated and is supporting high-enough oxygen levels in the atmosphere and water.

The fact that our planet has provided the 'right' temperatures and high-enough oxygen levels has, in fact, enabled the evolution of complex animals and plants. Conversely, temperature extremes, oxygen losses and high CO_2 levels have contributed to evolutionary crises during Earth's history and have shaped the direction of evolutionary changes.

Major implications

Over the last 10,000 years or so of stable climate conditions, human civilisation has progressed to make humans – the most successful mammalian species – capable of sustaining high population densities on most continents. At the same time, the building of human infrastructure has predominantly occurred in coastal and low-lying areas, leading to the prevalence of megacities (cities of more than 10 million people) in coastal regions, which are now challenged by progressive sea-level rises.

Human history also shows us how climate-related events – such as droughts, crop failure and pest infestation – can lead to population displacement and conflict. As climate-induced human migration has been projected (and may already have started), the low availability of uncolonised territory and associated resources may increase conflict and make human civilisation more vulnerable to climatic changes and associated economic losses.

The oceans have an important role in maintaining temperatures within a tolerable range on land. Oceans absorb more than 90 per cent of the heat accumulated by the planet and minimise temperature shifts and variability. For example, the Gulf Stream – a crucial driver of the gigantic conveyor belt of global ocean currents – may be seen as part of this climate conditioning system and as a thermostat for the North Atlantic and Europe predominantly. Temperatures are maintained in a pleasant range: temperature extremes are alleviated.

The Gulf Stream has not only shaped climatic zones in Europe and neighbouring seas, but also the associated communities of plants and animals that are specialised for these zones. This includes the marine ecosystems of the Atlantic as well as their fisheries' productivity. On land, mild temperatures and the balanced distribution of precipitation support green landscapes and high yields in agriculture. The Gulf Stream circulation has also shaped the history and cultural evolution of humankind in Africa and Europe.

While the Gulf Stream appears as a given, it is responsive to small changes in environmental conditions – for example, the changing heat budget of the oceans under conditions of climatic change. The apparent instability and projected weakening of the Gulf Stream given climate change is a concern: the Gulf Stream is a crucial driver of global ocean circulation, supports the health of sustainable ecosystems, and human wellbeing. The loss of the stable climate that our planet has enjoyed for the last 10,000 years will have major implications for all life on Earth.

Many insights provided by the natural sciences have shaped human civilisation and technologies. In similar ways, climate change and its impacts have become part of our reality everywhere. A puzzling development is that some high-level policymakers appear to believe that they can choose to ignore unequivocal scientific evidence about climate change. While ignoring reality is not without precedent in human history, the available evidence tells us that the global climate system is changing and that the planet is warming. What's more, the evidence shows that it is humankind causing these changes and the associated impacts, through emissions of CO_2 and other greenhouse gases to the atmosphere.

We can say with very high certainty that the various measurements, observations and projections provide a factual and realistic picture of both the present and the future. Denying climate change is thus equivalent to ignoring reality. As much as voters cannot vote on climate change, policymakers cannot make the reality of climate change subject to their approval. They also cannot choose to ignore the fact that human livelihoods and ecosystems are being harmed, or that human lives are being lost due to climate change. We need collective action, even if some might consider such action to be precautionary.

The sixth assessment cycle of the IPCC will assess our growing knowledge base further. But what is already very clear is that only by keeping climate change within narrow limits – such as those agreed in Paris in 2015 – will we be able to build a better and more prosperous and sustainable future for humankind and the world's ecosystems, as outlined in the UN Sustainable Development Goals. ●

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Will there be enough?

Water is essential for human life – but it's also critical for economic stability, global security, and climate change mitigation and adaptation

By **Sofia Widforss**, former Programme Manager, International Policy, Stockholm International Water Institute

Reports from the UN Refugee Agency (UNHCR) show how communities are already suffering from the consequences of climate change. Families are being forced to migrate as their homes are destroyed and already scarce drinking water sources become limited and contaminated. Natural disasters often hit the most vulnerable and poor.


© Tony Karumba/AFP/Getty Images

◀ Drying fish on the shores of Lake Turkana, northern Kenya. The lake has receded in recent years leading to diminished fish stocks and forcing its dependent communities into territorial conflict

In the past decade, an annual average of 21.5 million people have been forcibly displaced by weather-related hazards – floods, storms, wildfires and extreme temperature. Both slow and rapid-onset disasters – such as the droughts in Somalia in 2011 and 2012, and floods in Pakistan between 2010 and 2012 – left huge numbers of people without clean water, shelter and basic supplies.

Globally, according to the International Organization for Migration, an estimated 200 million are at risk of becoming environmental or climate refugees by 2050. According to the UN Office for Disaster Risk Reduction (UNISDR), water and climate disasters account for nearly 95 per cent of people affected by disasters, and have caused over 60 per cent of all damage worldwide.

In recent years, water crises have been ranked as high risks for societies by experts and global decision-makers, both in terms of likelihood and impact (as presented in the World Economic Forum *Global Risks* reports).

Global warming increases stress on already scarce water sources. Increased temperatures have altered rainfall patterns, caused rivers and lakes to dry up and glaciers to melt, creating the risk of flooding. Sea-level rise does not only pose a physical threat to coastal communities, but also leads to increasing risks for salt water intrusion of coastal aquifers, putting further strain on vulnerable freshwater resources. Himalayan glaciers feed great Asian rivers such as the Yangtze, Ganges, Mekong and Indus. Over a billion people rely on these glaciers for drinking water, sanitation, agriculture and hydroelectric power.

Water scarcity, aggravated by climate change, also poses a threat to food security. Crops and livestock are unlikely to survive in certain locations if weather conditions alter too much. As so often, women are disproportionately affected. Women are the primary producers of food globally and make up most agricultural workers in many countries. This means they are hit harder by irregularities in precipitation due to climate change as they rely on rain-fed agriculture.

The combination of food insecurity, shortage of and reduced access to water resources, and existing gender inequalities, such as limited ability to own land, increases women's burden of climate change-induced consequences.

Rising water scarcity and variability does not only pose risks to our lives and livelihoods but also to global security. The 2016 World Bank report *High and Dry: Climate Change, Water, and the Economy* warns that water scarcity, intensified by climate change, might "hinder economic growth, spur migration, and spark conflict".

Climate change is believed to have added fuel to the fire in many conflicts, from Darfur to Somalia, and Iraq to Syria. Given the urgency and gravity of the risks associated with climate and water change, we must improve disaster prevention and ensure that responses are aligned with needs.

In the aftermath of the triumphant signing of the UN Sustainable Development Goals (SDGs) and the Paris Agreement, we need to acknowledge what delivering on these ambitions will entail. With manifold complex challenges, there is a risk that the ambitions illustrated in Agenda 2030, in the Sendai Framework for Disaster Risk Reduction, and the Paris Agreement end up as paper tigers – instead of being implemented through much-needed, coordinated programmes and projects.

Rising water scarcity and variability does not only pose risks to our lives and livelihoods but also to global security

For example, the SDG target to achieve universal and equitable access to safe and affordable drinking water for all by 2030 requires committed action. Today, 663 million people lack access to drinking water from an 'improved' source.

UNICEF figures suggest that only two thirds of the world's population have access to 'improved' sanitation. Without sanitation, there is no alternative but to defecate in the open. Access to safe water and sanitation is a question of human dignity. It also has implications for gender equality. When girls do not attend school

because their personal hygiene cannot be maintained or they need to stay home to fetch water, their potential as productive members of society is jeopardised. This directly hinders sustainable development.

Competing demands between water users call for smart water management and governance to ensure that resources are allocated in a fair way. Approximately 70 per cent of all water abstracted from rivers, lakes and aquifers is used for irrigation. Valuing irrigation in times of drought will require trade-offs between food production and other societal water-demanding needs.

Unfortunately, waste is often found at the end of the chain of water-intensive production. Therefore, on top of allocation and distribution challenges, resource efficiency and reuse are key factors to achieving sustainability.

Interdependent objectives

Everything is connected. Recognising the interdependence of different objectives will allow us to identify co-benefits when implementing climate or development policies and plans. Water is critical for climate change mitigation by reducing greenhouse gas emissions, since many fossil-free energy sources rely on dependable access to water.

For instance, hydropower needs stable flows; biofuel production requires water; and carbon capture and storage is water-intensive and risks groundwater contamination. In parallel, the means to regulate water scarcity, including desalination, are very energy intensive. To transport larger volumes of water across longer distances will increase the energy intensity in water provision as the hydraulic infrastructure requires energy input. Thus, if we understand the underlying water–climate logic, the risk of fragmented and thus failed interventions and investments will be avoided.

Moreover, through the vital role that ecosystems often play in improving freshwater storage for flood and drought control, safeguarding water resources is, together with sustainable forestry, perhaps the most promising of adaptation measures. Replenishing groundwater storage and refilling reservoirs enhances the resilience of the surrounding ecosystems, thereby reducing the vulnerability to populations facing climate change-related risks.

The known and still unknown negative impacts that a changing climate combined with water scarcity and variability bring on humanity are too destructive to not be prioritised. Freshwater is our most precious resource. Despite this, we do not protect it. Properly valuing water and other ecosystem services will contribute to accuracy and fairness in allocating existing resources. Proactively requiring compliance and resource efficiency throughout the entire supply chain, instead of waiting for consumer-driven demand, will bring benefits – including potential economic advantages.

We, as global citizens, are the patrons of our societies. We are the agents of change in shaping our vision and making the future bright, blue and green. It is up to us to adapt our behaviours, production and consumption patterns to support liveable societies.

The global agreements have encouraged novel approaches, illustrating the major challenges ahead to set inclusive and sustainable development trajectories. But they also carry a basket of carrots with opportunities for governments, authorities, city and business leaders, regulators and practitioners to wisely execute the needed responses. ●

FACING WATER ISSUES IN MANUFACTURING

Water consumption is one of the main challenges facing environmentally friendly industrial manufacturing.

Sofidel – the second largest tissue company in Europe and the sixth worldwide – has made water issues one of the crucial pillars in its own environmental sustainability strategy. It is committed to responsibly managing the resource, highlighting its relevance in terms of hygiene and well-being and raising awareness among the company's stakeholders.

The aim of reducing water consumption is pursued both through management measures and specific investments. Moreover, the use of water at Sofidel paper mills is monitored in real time through a dedicated dashboard – the efficiency of water flow is a significant parameter in the company's worker incentive system.

As a whole, this commitment has led Sofidel to achieve significant results, with an average use of water per kilogramme of paper produced of 7.0 l/kg, compared to the industry's benchmark of 15-25 l/kg.

Sofidel's responsibility goes beyond production impacts, aiming at "building an inclusive, sustainable and resilient future for people and planet", in accordance with the United Nations Sustainable Development Goals.

The pledge to improve hygiene and sanitation in developing countries led to a three-year partnership with WaterAid, an NGO whose mission is to ensure safe water and sanitation to everyone, everywhere by 2030. This contributes to UN SDG 6 on clean water and sanitation.

As of today, the issue is particularly relevant in less developed countries, with 663 million people that still don't have access to safe water, and 2.4 billion people that have no place to go to the toilet. This means that otherwise-preventable diseases can spread: according to WHO and UNICEF, a child under five dies every two minutes because of this lack of clean water, sanitation and hygiene.

www.sofidel.com

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Increasing resilience to climate variability and change

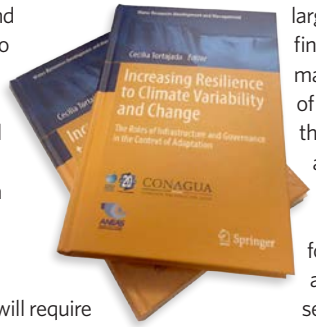
Mexico, through the National Water Commission (Conagua) and the National Association of Water and Sanitation Utilities of Mexico (ANEAS), in cooperation with the World Water Council (WWC), has developed a programme called: "Increasing resilience to climate variability and change: the roles of infrastructure and governance in the context of adaptation". A scientific book with the same title has also been published.

The book presents 11 case studies that document successful adaptation efforts in projects, basins and regions around the world. These analyse how the water sector can provide valuable solutions to the challenges posed by climate variability and change through sound water infrastructure and adaptive water management.

Among the key messages emerging from these studies is the need to close the scientific knowledge gap in this particular field, since these studies show that infrastructure can significantly contribute to building resilience to climate change.

Improved governance

However, infrastructure alone is not enough to increase resilience, as it must be coupled with appropriate management and governance approaches aligned to local contexts in order to be effective. These approaches need to be planned and managed within a governance framework that takes into account long-term perspectives and multi-sector and multi-level actor needs and perspectives.



Resilience to flood disasters will require properly maintained infrastructure through coordinated management, crisis prevention capacity, as well as coordinated actions and a pragmatic approach to future uncertainties such as climate change. Finally, governance will need to be improved in order to implement fundamental changes and help for post-disaster recovery.

The studies show that water infrastructure must have a multipurpose use to meet growing water demands for agricultural, industrial, energy and domestic use. However, multipurpose water infrastructure raises specific financing problems, in addition to those generic to water.

The figures involved are typically large, some components are not financially profitable under strict market conditions, a large number of different actors are affected, there are many competing users, and conflicts often arise about priorities between them.

It also points out that for a long time water has been a neglected and marginalised sector in the discussion of public policies for sustainable growth and development.

This lack of attention is most pronounced and dangerous in infrastructure, where there is inadequate resilience to climate change. ■

Much of this collection is freely available on the WWC website: **www.worldwatercouncil.org**

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UNA-UK thanks ANEAS for its generous support for Climate 2020

As the Sahel becomes Sahara

What happens when habitable land is lost? What can be done to alleviate the consequences?

By **Fred Carver**, Head of Policy, United Nations Association – UK

The UN deploys peacekeepers to 15 locations around the world. Eight of those missions, including the five largest ones, exist in a belt across northern sub-Saharan Africa: in Western Sahara, in Liberia, in Mali, in the Central African Republic (CAR), in the Democratic Republic of Congo, in Darfur, in Abyei and in South Sudan.

Collectively these missions represent over 80 per cent of the UN's budget and personnel for peacekeeping and, as a consequence, the lion's share of the UN's

© Marco Dormino/UN Photo

◀ UN peacekeepers from Rwanda patrol the city of Gao in northern Mali. The presence of peacekeepers in the country has probably prevented genocide

overall investment in peace and security Why? What makes this particular crescent of the world so particularly in need of the UN's resources and attention?

There are, of course, a multitude of reasons in each case and in no single instance was climate change the primary cause. However, it is certainly a contributory factor common to every single situation.

In recent years drought, desertification and soil loss have seen the Sahara creep south into the Sahel, and the Sahel in turn creep south into the Sudanian Savanna. Scarcity has followed, exacerbating existing power imbalances and providing an incentive to act upon longstanding grievances, as inequality shifts from being a matter of justice to one of future security, and potentially one of existence. States' confidence in economic growth and stability falters, and they seek out the plunder and insider unity that conflict brings.

Meanwhile apocalyptic cults (in Congo and Mali) and secessionist groups (in CAR and the Sudans) alike become more appealing, as the disincentives to instability become less readily apparent. Young men (and increasingly women too) with less to lose and less to farm see fewer reasons not to take up arms. Much as Bambang Susantono has argued in his article on Asia (see page 48), in northern sub-Saharan Africa global warming hasn't yet directly caused wars, but it has provided a more hospitable climate for them.

It is a phenomenon that could well creep yet further south. Northern Nigeria and the greater Lake Chad basin, Eritrea and Kenya have all demonstrated the existence of risk factors identified in the UN's framework of analysis for atrocity crimes. It seems likely therefore that the stresses on the UN's peace and security apparatus are only going to increase, particularly in this region. Yet at the same time powerful forces, led by but not limited to the United States, are keen to reduce the size, scope and, notably, costs associated with UN peacekeeping.

Peacebuilding initiatives

Thus far the Secretary-General has been looking for the solution 'upstream'. By investing in mediation and pre-emptive peacebuilding initiatives, such as enhanced and strengthened political missions, he is hoping to reduce the need for future expensive peacekeeping missions. This logic is sound, and were the situation static such an approach would doubtless be effective. But as the Sahel turns into the Sahara he may find these efforts going against a tide of sand.

Additionally, mediation and political missions are not a like-for-like replacement to peacekeeping. The approaches serve subtly different purposes. Political missions may be able to substitute for peacekeeping when it comes to preventing a return to war, but that is increasingly a secondary purpose of modern missions.

Lessons learned

When it comes to 'peacebuilding' – the reconstruction of sustainable mechanisms and infrastructure for a long-term reduction in violence – and the prevention of atrocities, there is no obvious substitute for UN peacekeeping missions.

The record of UN peacekeepers on both fronts is mixed but improving. A recent study by the Rand Corporation, The UN's Role in Nation-Building, found that UN peacekeepers outperform unilateral and/or military interventions when it comes to state-building.

As for preventing atrocities, peacekeeping has learned the lessons of Rwanda and Srebrenica rather better than its political masters. Modern missions have the mandate and resources those missions lacked. What they don't always have is a Security Council with the foresight to deploy them ahead of the outbreak of violence.

Granted, the record is far from flawless. Too often, Member States fail to provide the UN with sufficiently trained and equipped troops. The UN internal investigation into violence in Juba in 2016 found that a force of some 19,000 peacekeepers were unable to protect civilians from atrocity crimes that took place just one mile from their base, yet a small handful of private security contractors were.

A few hundred willing and capable troops could perform a more useful function than many thousands of peacekeepers who lack the skills or motivation, and would also be a good deal cheaper. However, elite troops with the skillset required to perform this role are in short supply. Many hail from nations who have not been enthusiastic about volunteering them for UN duty.

Nevertheless, UN peacekeepers have, in all probability, prevented genocide in CAR and Mali, and significantly reduced the number and nature of atrocity crimes in many other countries. Few missions have come in for as much criticism as UNAMID

– the joint African Union and UN mission to Darfur – and yet even in Darfur the value of the mission is clear. As a teacher in North Darfur told Waging Peace in a report UNA-UK co-authored: "The bottom line is that the force can still manage to save some lives and protect some of the population from rape and torture, as well as report atrocities." Another Darfuri, in conversation with the International Refugee Rights Initiative, was even more succinct and gave them the title for their report: "No one on the Earth cares if we survive except God and sometimes UNAMID."

Peacekeeping should therefore continue to play a role in the region for some time to come, and we would do well to maintain a sense of perspective about the cost. Around $7 billion a year may seem like a lot, but it represents just 0.5 per cent of total military spending globally. It pales into insignificance when compared to the other costs of what broadly should be considered climate change adaptation and mitigation.

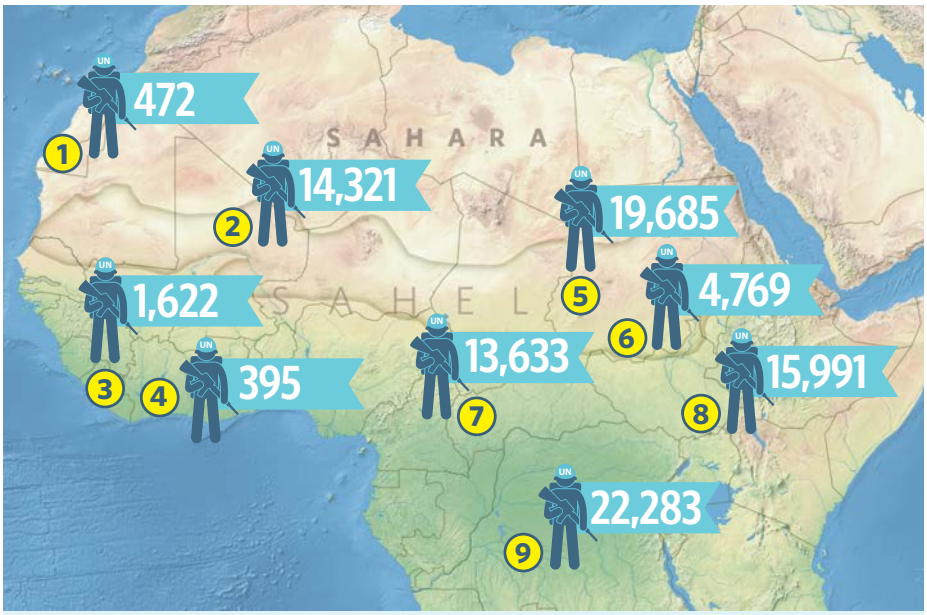
Smoothing the transition?

But is peacekeeping a tool for adaptation? Partly it depends on what we need to adapt to. If the Paris Agreement is successful then temperatures will rise by about 2°C over the next 80 years and then hold steady. In the short term that would see desertification continue and increase, and both the Sahara and Sahel move southwards.

In the long term there is no consensus: the situation could stabilise with new southern boundaries; or feedback effects could see the region rendered a largely uninhabitable extreme desert; or warming temperatures could see a reversal of the monsoon cycle and the region actually becoming more fertile. If warming cannot be held to 2°C then the region is much less likely to remain habitable.

The UN therefore needs to support the region to go through – at the very least – decades of relative resource scarcity and a permanent shift in geographic resource allocation (which will lead to political, social and cultural tensions, which are likely to spill over into multiple conflicts) and – at most – the organised evacuation of most of the region (and other parts of the planet to boot).

United Nations Peacekeeping operations in Africa



1 MINURSO Western Sahara
2 MINUSMA Mali
3 UNMIL Liberia
4 UNOCI Côte D'Ivoire
5 UNAMID Darfur
6 UNISFA Abyei
7 MINUSCA Central African Republic
8 UNMISS South Sudan
9 MONUSCO Democratic Rep. of Congo

Figures show total personnel, civilian, police and military for June 2017. UNAMID is an African Union-UN hybrid operation.

Source: United Nations Department of Public Information, in consultation with the Department of Peacekeeping Operations, Department of Field Support and Department of Management

While the latter would require a completely new global politics of migration and asylum, and Herculean work by the already overstretched UN High Commission for Refugees, peacekeeping could provide part of the answer to smoothing out the bumps and tensions of a less radical transition.

This cannot happen in isolation. Conceptually, peacekeepers don't end conflict. They impose order but, as Stathis Kalyvas has argued, order is not the opposite of violence but simply a form of formalised violence. Thus, peacekeeping provides a mechanism for de-escalation by formalising conflict and so legitimises and cements post-conflict power relations. But if those power relations remain exploitative, unjust and unequal then the ingredients for future conflict remain.

Peacekeeping is not peacemaking, and while it can smooth the transition that climate change will bring it will not, by itself, provide a just post-warming settlement for the region.

An (expensive) ongoing peacekeeping presence or investment in robust institutions may keep the lid on hostilities for a while. But as the Sahara grows ever larger, pressure will build and tensions will climb ever higher, eventually reaching bursting point along familiar fault lines. This is unless a process of development and, crucially, a more equitable politics enables the creation of a sustainable regional society better able to adapt to a warmer, dustier, future.

Peacekeeping can buy time, and curb the worst excesses of human behaviour. But, in the long term, if desertification is not brought to a halt, and if existing resources are not allocated more equitably, then the Sahara will push a wave of conflict before it as it marches southwards. ●

Fleeing for survival

© Sasha Nichol/Save the Children

By Andrés Conde
CEO, Save the Children Spain

Violence, war and poverty are the usual things that spring to mind when we think about the reasons behind the current migration crisis in Europe. These are reasons why someone would leave everything behind and flee their country to seek refuge in another. But the impact of climate change is another cause for children and their families to abandon their homes. We should not forget that climate change directly impacts on poverty, the lack of economic opportunities and armed conflict in many countries.

Severe droughts brought about by phenomena such as El Niño are depriving many households of the basics, while their crops are wilting and their livestock perishing. Whole families are forced to sell their only assets when scarcity of food and water is the desperate reality. According to the UN, there will be between 250 million and 1 billion people who will be forced to abandon their region or country in the coming 50 years due to climate change, many of them children.

For many refugees and forced migrants, the European coasts hold the key to their future and that of their children. Far from being a safe path, the Mediterranean has now become a cemetery for people drowned by desperation and the interests of traffickers.

In 2016, the most deadly year so far recorded in the Mediterranean, more than 5,000 refugees and migrants lost their lives trying to reach Europe. In the same year, more than 4,500 children reached Italy from Libyan coasts, over 4,000 of them made the whole journey completely alone. This route is considered to be the most dangerous, children are ten times more likely to die than those crossing from Turkey's coasts to Greece.

So far this year, more than 1,250 people have lost their lives attempting to cross this stretch of water. This tragedy highlights the real need for search and rescue operations. For this reason, at Save the Children, we decided to extend our response with our search and rescue ship, the *Vos Hestia*, to avoid more drownings.

Since the start of our operations, we have rescued more than 4,000 people, over 500 of them children

Since the start of our operations, we have rescued more than 4,000 people, over 500 of them children. The *Vos Hestia* is the only ship devoted to protecting unaccompanied children. Many of those rescued are traumatised and need help and support as they are extremely vulnerable to trafficking, abuse and exploitation.

Whatever the motive for their flight, whether it is war, poverty or climate change, our response remains firm: we cannot allow the most vulnerable children to drown in the sea. As a humanitarian organisation we are obliged to protect and save their lives, whether here in Europe or on their dangerous journey to safety. ■

Save the Children

UNA-UK thanks Save the Children for its generous support for Climate 2020

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Feeding a growing population

How can agriculture address this challenge while simultaneously adapting to – and not exacerbating – climate change?

By **José Graziano da Silva**, Director-General, UN Food & Agriculture Organization (FAO)

I am convinced that we can end hunger and poverty in our lifetime. We have the tools and we have the know-how. However, the goals and aspirations of the 2030 Agenda for Sustainable Development to eliminate hunger and rural poverty cannot be achieved if urgent action to combat climate change and its impacts is not taken now.

Climate change and food security

Climate change threatens to reverse the progress made so far in the fight against hunger and malnutrition. As highlighted by the Intergovernmental Panel on Climate Change in its *Climate Change 2014 Synthesis Report*, climate change increases and intensifies risks to food security and nutrition. The most affected are vulnerable populations in arid and semi-arid areas, landlocked countries and small island developing states.

Climate change threatens all dimensions of food security: availability, access, stability and utilisation. It affects food availability by reducing the productivity of crops, livestock and fisheries. It hinders access to food by disrupting the livelihoods of millions of rural people who rely on agriculture for their incomes. Farmers, pastoralists, fisherfolk and community foresters who depend on activities that are directly linked to climate are the ones most affected.

◀ The Green Dam near Hassi Bahbah, Algeria, a reforestation project started in the 1970s and designed to combat desertification. It spans the full east-west length of the country

Agriculture will bear the brunt of climate change impacts. It will be affected directly by changes in temperature levels and rainfall distribution, and indirectly through changes to other species such as pollinators, pests, disease vectors and invasive species.

In our report *The impact of disasters on agriculture: Addressing the information gap*, the FAO estimates that between 2006 and 2016, agricultural sectors accounted for 26 per cent of total damage and loss caused by climate-related extremes in developing countries. These extremes included more severe and frequent weather events, heat waves, droughts and sea-level rise.

Climate change impacts seriously compromise food production in countries and regions that are already highly food-insecure. Such findings are evidenced in the latest edition of FAO's flagship report *The state of food and agriculture: Climate change, agriculture and food security*. Climate change will also have broader impacts through effects on trade flows, food markets and price volatility, and could introduce new risks for human health.

Migration challenges and opportunities

Today, as per FAO's report *The future of food and agriculture – Trends and challenges*, the total number of international migrants, including those displaced by climate-related natural disasters, is 41 per cent higher than in 2000. By 2050, the number is expected to reach more than 400 million. However, the large majority of migrants worldwide, about 740 million, move within their own countries rather than abroad. They move from one rural area to another or from rural to urban areas.

Although conflicts, violence and natural disasters are among the major causes of migration and displacement, many migrants are also compelled to move because of socio-economic factors. These include poverty, food insecurity, lack of employment opportunities, limited access to social

IRELAND'S COMMITMENT AND COLLABORATION

By **Michael Creed TD**,
Minister of the Department of Agriculture, Fisheries and Marine

Ireland sets a global standard for sustainable agriculture and food production

The provision of food security for the world's growing population in a way that is environmentally sustainable is one of the great challenges for agriculture and society. Our natural assets face increased pressure that requires a commitment to sustainable production. Critical to this is also the security of the environment that protects our natural resources and reduces our emissions and waste.

The agri-food sector is the largest indigenous industry in Ireland. It operates in rural communities to provide sources of income and employment and also makes use of the natural capital and resources.

The awareness of these core factors in Irish agriculture has positioned sustainability at the centre of the sector's long-term vision Food Wise 2025, which states that: "Environmental sustainability and economic sustainability are equal and complementary – one cannot be achieved at the expense of the other."

Ireland is already one of the world's most efficient food producers through continued action to drive down the emission intensity of Ireland's livestock production. Most notably this has been achieved through the world's first national sustainability programme, Origin Green, which commits its current 500+ participating companies and farms to improvements and measurement of their sustainability performance.

A larger network of agri-environmental initiatives coupled with our focus on scientific research ensures and encourages farming practices that underpin our sustainability credentials.

Our ambition to be a leader in sustainable food production requires a sustained collaborative effort. This aim is shared by the government, farmers and the food industry in Ireland. In Food Wise 2025, we embrace collaboration to meet the complex challenges and deliver the opportunities for environmental and economic sustainability for all our stakeholders.

The ambition that we can do more to advance our goals, such as the expansion of Origin Green, is firmly embedded in our strategy. I believe in Ireland's long-term commitment and collaborative approach to improving the environmental footprint of the agri-food sector. It is an important global example of sustainable action in agriculture, food production and environmental protection.

protection and the depletion of natural resources.

In the coming decades, climate change is likely to increase migration pressures both within and across countries, posing challenges but also potential opportunities for food security, sustainable agriculture and rural development.

Sustainable agriculture

Hunger, poverty and climate change need to be tackled together. This is a development imperative, but also a moral one, as those who are now suffering most from food insecurity have contributed least to the changing climate. International agreements such as the Paris Agreement, the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction and the Agenda for Humanity provide opportunities for concrete actions to tackle climate change.

As the impacts of climate change become more and more severe, a global transformation towards sustainable agriculture must begin immediately. Smallholders must be supported to adapt to climate change. The integration of the agricultural sector perspectives in 94 per cent of countries' climate commitments – their intended nationally determined contributions or INDCs – is a clear indicator that countries know this already.

Such strong demand for climate action also underlines the fact that FAO has a fundamental contribution to make. More coherent strategies, financing, data and information are needed to better inform transformative policies and institutions that can overcome barriers to implementation of actions at scale.

Adaptation and resilience

Concrete adaptation actions to face climate change should take place urgently at scale to make agriculture more sustainable, productive and resilient. Diversification and better integration of food production systems into ecological processes can create synergies with the natural habitat instead of depleting natural resources.

Agroecology and sustainable intensification are examples of approaches that improve yields and build resilience through practices such as green manuring, nitrogen-fixing cover crops and sustainable soil and water management, as well as integration with agroforestry and animal production.

More resilient agriculture and investments into smallholder and family farmers can deliver transformative change and enhance the prospects and incomes of the world's poorest while buffering them against the impacts of climate change. Livelihood diversification can also help rural households manage climate risks by combining on-farm activities with seasonal work – in both agriculture and other sectors.

In all cases, social protection programmes will need to play an important role in helping smallholders better manage risk, reducing vulnerability to food price volatility. Investment in smallholder agriculture and family farming, social protection, and climate risk management and risk transfer tools such as insurance are far below the levels needed to manage climate risks.

Prioritising mitigation

To keep the increase in global temperature below 2°C, emissions will need to drop by as much as 70 per cent by 2050. Keeping climate change within manageable levels is possible with the contribution of the agriculture sectors.

The challenge will be to reduce emissions while meeting unprecedented demand for food. In the forestry sector, avoiding deforestation, increasing forested areas and adopting sustained-yield management in timber production can store large amounts of carbon. Appropriate land use and soil management lead to improved soil quality and fertility and can help mitigate climate change.

Options for achieving mitigation benefits from agricultural sectors are available, but these options should be viewed in the broader context of providing food for all and must be prioritised without threatening food security.

Leaving no one behind

Smallholders and poor people in rural areas often lack access to support services. They will require far greater access to technologies, markets, information and credit for investment to adjust their production systems and practices to climate change.

To allow for the transformation towards sustainable and more equitable agriculture to happen, access to adequate extension advice and markets must improve. Insecurity of tenure, high transaction costs, and lower access to resources, especially among rural women, are barriers that will need to be overcome. Access to weather and climate information in agriculture and food security, disaster risk reduction, water and health are equally important to ensure food for all.

Hunger, poverty and climate change need to be tackled together. This is a development imperative, but also a moral one, as those who are now suffering most from food insecurity have contributed least to the changing climate

International and South–South cooperation

The international community needs to act to address climate change today, by adopting climate-friendly practices in agriculture, forestry and fisheries. International cooperation, particularly South–South cooperation, through the sharing and exchange of technologies and good practices, should be geared towards supporting smallholder and family farmers adapt to climate change.

This will determine whether humanity succeeds in eradicating hunger and poverty by 2030. Business as usual is no longer an option to ensure food for all. ●

Crops for a changing climate

Plant breeders are already adapting crops to the world's changing climate, but the clock is ticking. To help us grow more and faster, we need a policy environment where innovation can flourish

Farmers around the world already suffer from the instability and uncertainty caused by climate change. Erratic and extreme weather conditions are wreaking havoc on harvests and livelihoods by increasing drought, soil salinity, plant pests and diseases.

Crop improvement is key to stabilising and increasing harvests in such challenging growing conditions. Yield stability is the basis of farmers' livelihoods and local food security. In pursuit of this, plant breeders are constantly seeking new ways to adapt crops to local climates. But we need to recognise that the lack of incentives for innovation in both the public and private sectors is compromising the world's ability to combat hunger.

Thanks to advances in plant science and breeding methods, today's breeders have developed climate-resilient varieties, such as drought-tolerant maize. They are developing crops with resistances to fungi, bacteria and insects whose detrimental impact can be exacerbated by climate change.

Resistances to rust in wheat, blast in rice and bacterial blight in barley can all be found when breeders can use a wide variety of natural genetic diversity.

Plant breeding takes time – up to 10 years, depending on the crop. However, with the current pace of climate change and rate of population growth, plant breeders are struggling to keep up with demand.

Clarity and reassurance needed

Better understanding of biological mechanisms in plants have brought us new tools that can significantly speed up the breeding process and target the necessary improvements more precisely.

However, not all tools are equally accepted everywhere in the world, which creates a patchwork of policy and regulatory environments for such plant breeding innovations, despite their relative accessibility and affordability.

This leads to uncertainty for the world's plant breeders who are developing crops adapted to local conditions. Ultimately, this state of confusion can limit innovation.

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Investment in plant research can yield tools with great societal benefits

Plant breeders, both in public institutes and private breeding companies, need more clarity about the national policies that govern access to genetic resources for food and agriculture, and reassurance about the acceptance and regulation of the breeding methods that can be used. Plant breeding has shown that investment in plant research can yield tools with great societal benefits – and public investment in research is badly needed. In order for farmers to benefit from these new developments, policies should be consistent and science-based across countries and regions.

Time is not on our side. Action needs to be taken now to provide an enabling policy environment that stimulates plant breeding to bring stability for farmers, product quality for consumers and food security for the world. Let's make sure that future generations will not ask why more was not done to deploy the full range of plant breeding tools available. ■

ISF International Seed Federation
Seed is Life

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Climate 2020: sustainability

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About us

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The United Nations Association – UK (UNA-UK) is the only UK charity devoted to building support for an effective UN, and a vibrant grassroots movement campaigning for a safer, fairer and more sustainable world

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 on the 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.

Over the last two years, the UN has demonstrated its ability to forge global solutions through two landmark agreements: the Paris Agreement on climate change and the 2030 Agenda for Sustainable Development. Making these commitments count – for the world's most vulnerable people and for the future of our planet – will require a wholesale transformation of our economies and societies. This, in turn, will need global cooperation and public buy-in on a scale that has never been seen before.

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. ●

UNA-UK

To make a donation, find out more or get in touch, please visit www.una.org.uk

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