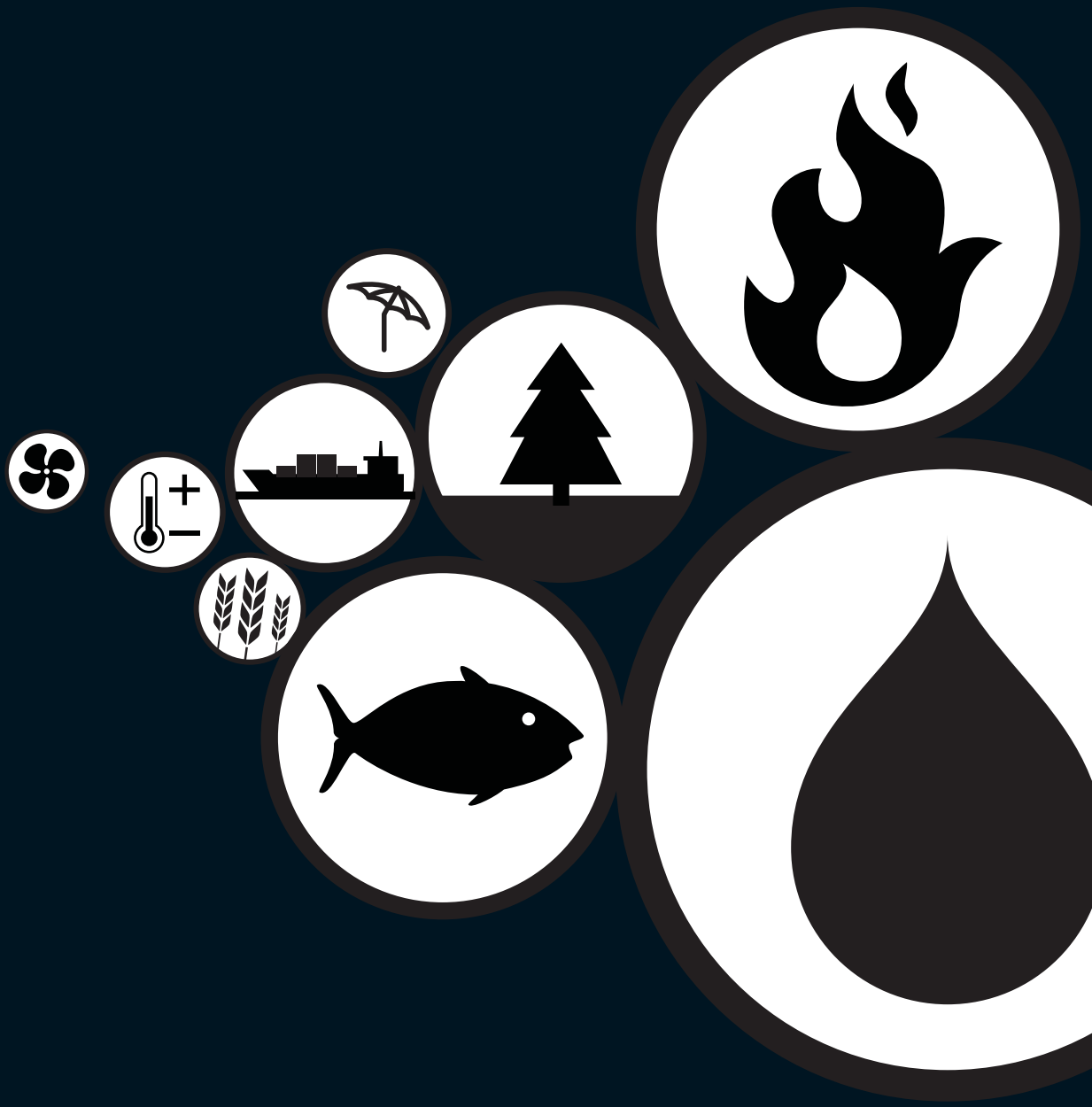
2ND EDITION CLIMATE VULNERABILITY MONITOR

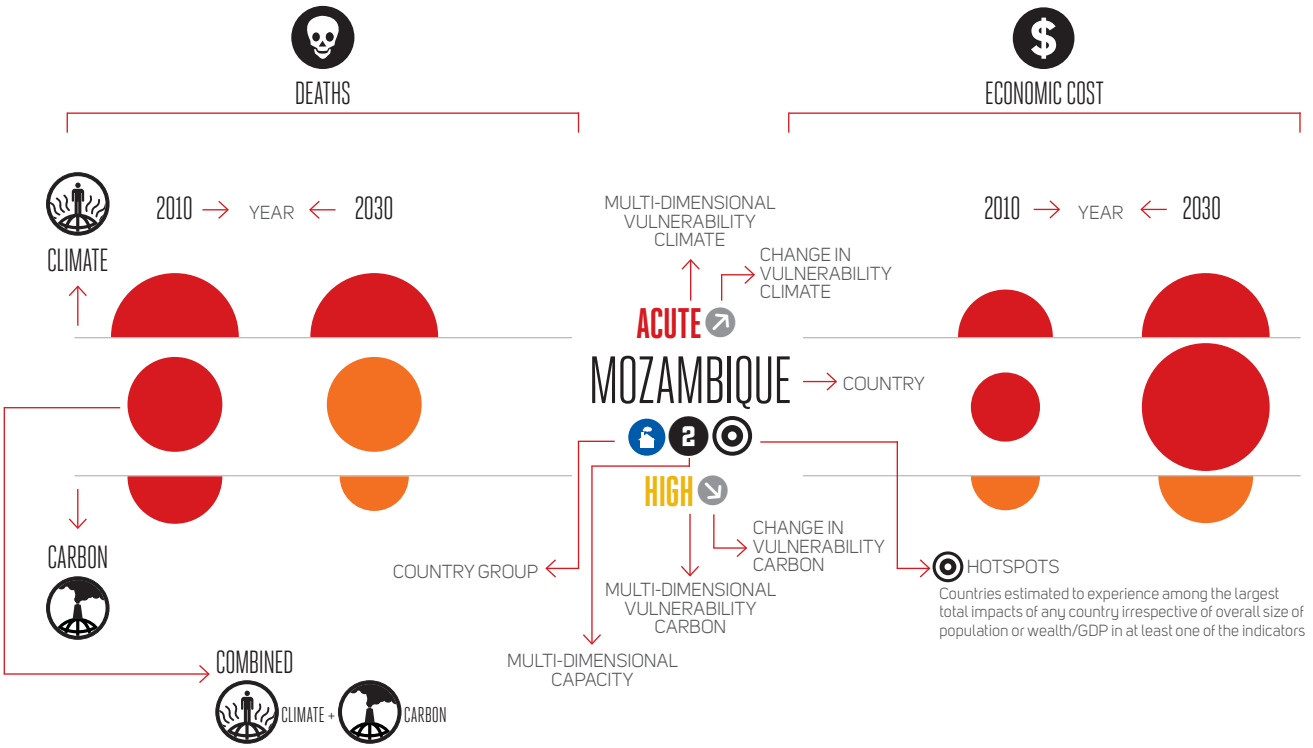
A GUIDE TO THE COLD CALCULUS OF A HOT PLANET

Climate Vulnerable Forum

DARA



KEY TO THE MONITOR



VULNERABILITY

- INCREASING
- STABLE
- DECREASING

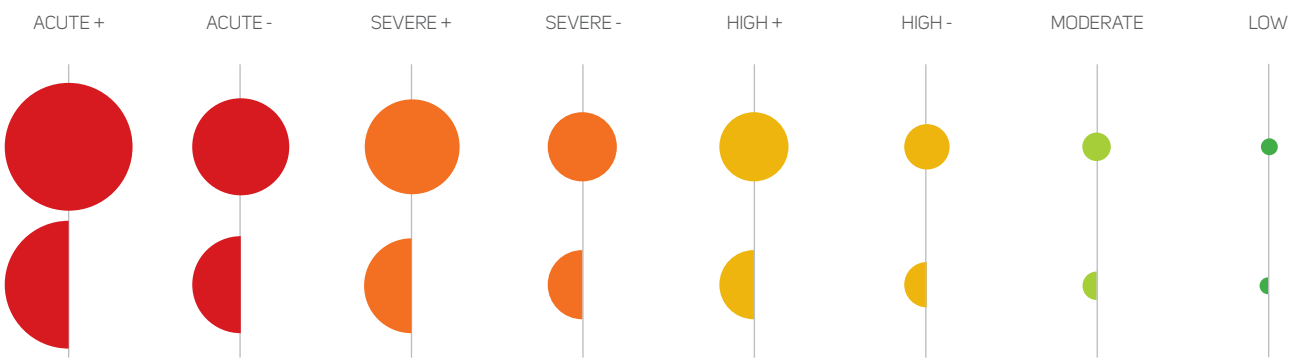
- ACUTE
- SEVERE
- HIGH
- MODERATE
- LOW

COUNTRY GROUPS

- DEVELOPED
- OTHER INDUSTRIALIZED
- DEVELOPING COUNTRY HIGH EMITTERS
- DEVELOPING COUNTRY LOW EMITTERS

MULTI-DIMENSIONAL CAPACITY

- 4 EXTENSIVE
- 3 INTERMEDIARY
- 2 RESTRICTED
- 1 HIGHLY RESTRICTED



COUNTRY GROUPS

List of countries by main Monitor country groups

DEVELOPED (ANNEX II)

Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States

OTHER INDUSTRIALIZED (ANNEX I OUTSIDE OF ANNEX II)

Belarus, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Russia, Slovakia, Slovenia, Turkey, Ukraine

DEVELOPING COUNTRY HIGH EMITTERS (NON-ANNEX I ABOVE 4 TONS CO_2E 2005)

Algeria, Antigua and Barbuda, Argentina, Azerbaijan, Bahamas, Bahrain, Belize, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei, Bulgaria, Cambodia, Central African Republic, Chile, China, Congo, Cyprus, DR Congo, Equatorial Guinea, Gabon, Grenanda, Guatemala, Guinea, Guyana, Indonesia, Iran, Iraq, Israel, Kazakhstan, Kuwait, Laos, Libya, Macedonia, Malaysia, Mexico, Mongolia, Myanmar, Namibia, North Korea, Oman, Papua New Guinea, Paraguay, Qatar, Saudi Arabia, Seychelles, Singapore, Solomon Islands, South Africa, South Korea, Suriname, Thailand, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Uruguay, Uzbekistan, Venezuela, Zambia

DEVELOPING COUNTRY LOW EMITTERS (NON-ANNEX I BELOW 4 TONS CO_2E 2005)

Afghanistan, Albania, Angola, Armenia, Bangladesh, Barbados, Benin, Bhutan, Burkina Faso, Burundi, Cape Verde, Chad, Colombia, Comoros, Costa Rica, Cuba, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Fiji, Gambia, Georgia, Ghana, Guinea, Guinea-Bissau, Haiti, Honduras, India, Jamaica, Jordan, Kenya, Kiribati, Kyrgyzstan, Lebanon, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Marshall Islands, Mauritania, Mauritius, Micronesia, Moldova, Morocco, Mozambique, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Palau, Panama, Peru, Philippines, Rwanda, Saint Lucia, Saint Vincent, Samoa, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, Sri Lanka, Sudan/South Sudan, Swaziland, Syria, Tajikistan, Tanzania, Timor-Leste, Togo, Tonga, Tunisia, Tuvalu, Uganda, Vanuatu, Vietnam, Yemen, Zimbabwe

2ND EDITION CLIMATE VULNERABILITY MONITOR

A GUIDE TO THE COLD CALCULUS OF A HOT PLANET

DARA and the Climate Vulnerable Forum

Climate Vulnerability Monitor 2nd Edition.
A Guide to the Cold Calculus of a Hot Planet

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DEDICATED TO THE INNOCENT VICTIMS OF CLIMATE CHANGE

"**A GREAT DEAL** has been written on the influence of the absorption of the atmosphere upon the climate.. Another side of the question that has long attracted the attention of physicists, is this: Is the mean temperature of the ground in any way influenced by the presence of heat-absorbing gases in the atmosphere? (..) If the quantity of carbonic acid [CO_2] decreases from 1 to 0.67, the fall of temperature is nearly the same as the increase in temperature if this quantity augments to 1.5. And to get a new increase of this order of magnitude (3-4°C), it will be necessary to alter the quantity of carbonic acid till it reaches a value nearly midway between 2 and 2.5."

SVANTE AUGUST ARRHENIUS
April 1896
The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science

"**FEW OF THOSE** familiar with the natural heat exchanges of the atmosphere, which go into the making of our climates and weather, would be prepared to admit that the activities of man could have any influence upon phenomena of so vast a scale.. I hope to show that such influence is not only possible, but it is actually occurring at the present time."

GUY STEWART CALLENDAR
April 1938
Quarterly Journal of the Royal Meteorological Society

"**IF AT THE END** of this century, measurements show that the carbon dioxide content of the atmosphere has risen appreciably and at the same time the temperature has continued to rise throughout the world, it will be firmly established that carbon dioxide is an important factor in causing climatic change."

GILBERT NORMAN PLASS
May 1956
American Journal of Physics

"**THE EARTH'S CLIMATE** system has demonstrably changed on both global and regional scales since the pre-industrial era.. The atmospheric concentrations of key anthropogenic greenhouse gases (i.e., carbon dioxide (CO_2)..) reached their highest recorded levels in the 1990s."

THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
September 2001

"**A HUNDRED YEARS** from now, looking back, the only question that will appear important about the historical moment in which we now live is the question of whether or not we did anything to arrest climate change."

THE ECONOMIST
December 2011

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PREFACE

THIS REPORT CHALLENGES A CONVENTIONAL VIEW: THAT GLOBAL ACTION ON CLIMATE CHANGE IS A COST TO SOCIETY. INSTEAD, IT ENLIGHTENS OUR UNDERSTANDING OF HOW TACKLING CLIMATE CHANGE THROUGH COORDINATED EFFORTS BETWEEN NATIONS WOULD ACTUALLY PRODUCE MUCH-NEEDED BENEFITS FOR ALL.

Climate change is already with us. It kills. It steals livelihoods. And it takes the most from those who have the least. But the costs are largely hidden from our understanding. Inaction on climate change actually takes from us all. Only together can we plot a different course: one of greater prosperity and well-being.

Technical barriers no longer hold back our transition to a low-carbon world, and technological solutions exist to manage risks. We struggle instead with other barriers.

There are political barriers: while some countries are committed to change and making progress, there is still a lack of conviction among the governments of too many industrialized and developing nations.

Social and cultural barriers also exist: lack of understanding causes popular indifference or even hostility to sensible change.

And financial barriers mean that only a fraction of the resources needed for low-carbon development and to support worst-hit communities are being made available.

To tackle all these barriers, 20 countries highly vulnerable to climate change came together to form the Climate Vulnerable Forum.

Our countries favour action on climate change. We are frustrated with the inadequacy of the global response and a world economy that continues to price carbon irresponsibly. We bear witness to the extremes at the climate frontlines of today. Despite having contributed the least to climate change, we are forced, almost unaided, to take costly measures to protect our people and our economies. We know the world is rapidly becoming more not less vulnerable, and that all our fates are tied.

"Many Forum governments are already embracing the call to action: Bangladesh has committed never to exceed the average per capita emissions of the developing countries. Costa Rica aims to be carbon neutral by 2021. But there are limits to what individual countries can achieve."

Farmers face more hot days as they set to work. Families are sleeping outside in mosquito-infested areas because their homes are unbearable in the heat of the night. Roads and buildings on permanently frozen land in the cooler regions are being damaged as melting sets in. Rivers are drying up, causing transport shocks, while unprecedented floods are devastating other areas. Salt from rising seas harms fertile land and fresh water supplies. Coastlines erode. Land is submerged. Populations fail to make a living. People move.

Pollution also kills. It acidifies lakes and oceans, poisons plants and animal life, corrodes infrastructure and contaminates the air we breathe.

We pay for each of these damages in lives, suffering and dollars. Yet the world has struggled to see how all these concerns are interlinked. That is why this report has sought to tackle our knowledge barriers.

With a better understanding of the full array of issues and the causes behind them, nobody should remain indifferent or inactive.

The Climate Vulnerable Forum commissioned this second Climate Vulnerability Monitor at its Ministerial Meeting at Dhaka in November 2011. The report was again mandated to DARA for independent development and was reviewed by an external Advisory Panel and Peer Review Committee comprised of international authorities on this subject.

Against a struggling world economy, its main findings offer sobering news: climate change is already lowering economic output globally and will increasingly hold back growth – unless strong action is urgently taken.

Its pages seek to move us to act by highlighting the human plight of an increasingly hotter and more polluted planet. Severe impacts on livelihoods, health and the world's poorest groups speak of fundamental injustices that simply cannot go unaddressed.

The report relies on the incredible wealth of some of the most recently published research and scientific knowledge, assimilating literally hundreds of studies and bodies of data into a common framework that makes its collective meaning clear. More research is plainly needed and will continuously enrich our understanding, but improving knowledge should not be a premise to refrain from acting when so much is at stake.

In the past, humanity has prevailed against recognized threats to our security and prosperity. Today there are two wars we must win: the continued fight against poverty, and the new challenge of climate change. Both can be tackled simultaneously with the same policy framework that would shift our development path to a low-carbon footing. Taking action, we can lessen the social, economic and environmental damages of a carbon-intensive economy.

We would create jobs, investment opportunities, new possibilities for international cooperation and technological deployment to the benefit of all.

Despite capacity constraints, many Forum governments are already embracing the call to action: Bangladesh has committed never to exceed the average per capita emissions of the developing countries. Costa Rica aims to be carbon neutral by 2021. But there are limits to what individual countries can achieve.

Solving the climate challenge requires broadest international cooperation. And yet countries still argue economic barriers to change. This report argues instead that strong measures on climate change would reap the most monetary benefits for society.

Indeed, building global partnerships where all nations can fully participate in the transition to a low-carbon economy will lessen costs and heighten the social, environmental and economic dividends for all. Just as supporting vulnerable communities will ultimately improve the well-being of society as a whole.

Divided, we face declining prosperity and immense suffering. Together, we have the chance to strengthen global welfare and safeguard the fate of the nations.

SHEIKH HASINA
Prime Minister of Bangladesh
JOSÉ MARÍA FIGUERES
Trustee of DARA, Former President of Costa Rica

ACKNOWLEDGEMENTS

This report was a project that took on a life – almost – of its own. Unrivalled is a word that comes to mind when describing the energy, interest and dedication of our core partners: donors, advisors, researchers, reviewers, the team within DARA, experts at Commons Consultants, or the celebrated graphic designers – wearebold.es – who made the "measles" you generally love (and less often disprove of) as readers.

We set out to "improve" the 2010 report and ended up with something that struggles to bear a passing resemblance to what we thought was a useful contribution back in 2010. Somehow four maps turned into fifty-nine, a methodology note of twenty-five pages became a tome of well over one hundred that we ultimately couldn't print in the book (the reader will find it online: www.daraint.org/cvm2). "Expert" workshops in Accra and Hanoi developed into fully-fledged policy exchanges, while delegates of the Climate Vulnerable Forum crowded Side Event rooms in Durban, Bonn and Rio. We hope you all appreciate the final result and cannot thank you enough for helping us to pull this unusual new work together.

Some much warranted apologies go to our close families and those of the core collaborators on this project. Thanks next to Lucía Fernández Suárez and the whole team and house in DARA, all of whom have helped make this report what it is – included of course are DARA's Board of Trustees, in particular our key benefactor Diego Hidalgo, and our Trustee José María Figueres.

May we also extend our utmost gratitude to friends and colleagues at King's College's Humanitarian Futures Programme at the helm of the FOREWARN project, of which this report is one part: Randolph Kent, Hugh Macleman, Jonathan Paz, Emma Visman and Okey Uzoechina.

We would like to thank the members of our Advisory Panel for their generous insight and contributions to this effort over many, many months: Mary Chinery-Hesse, Helen Clark, José María Figueres, Robert Glasser, Saleemul Huq, Yolanda Kakabadse, Ashok Khosla, Ricardo Lagos, Loren Legarda, Michael Marmot, Simon Maxwell, David Nabarro, Atiq Rahman, Teresa Ribera, Johan Rockström, Jeffrey Sachs, Hans Joachim Schellnhuber, Javier Solana, Andrew Steer, Margareta Wahlström, and Michael Zammit Cutajar. And also to Jan Eliasson, even though you had to take up a new role part way through the endeavour, we were and will continue to be most grateful for your encouragement and support.

The Peer Review Committee continually challenged us and suggested innovations, adjustments and corrections we never would have thought of ourselves. We certainly hope the final report meets your high expectations of it: Yasemin Aysan, Suruchi Bhadwal, Diarmid Campbell-Lendrum, Manuel Carballo, Ian Christoplos, Joshua Cooper, Mariane Diop Kane, Sean Doolan, Pierre Encontre, Hans-Martin Füssel, Tim Gore, Anne Hammil, Randolph Kent, Tord Kjellstrom, Isabel Kreisler, Juergen Kropp, Allan Lavell, Marc Levy, Filipe Lúcio, Urs Luterbacher, Andrew Maskrey, Benito Müller, Michele de Nevers, Martin Parry, James Roop, Ben Ramalingam, Carlo Scaramella, Matthias Schmale, Hansjoerg Strohmeyer, and Farhana Yamin.

The Government of Bangladesh as Chair of the Climate Vulnerable Forum has not ceased to drive forward the climate cause with energy and dynamism in a truly international spirit. Thank you for your openness to the research team's fresh ideas on this topic, and your willingness to explore where they might lead. Thanks goes in particular to Dr. Dipu Moni, The Honorable Foreign Minister of Bangladesh; Dr. Hasan Mahmud, The Honorable Minister of Environment and Forests of Bangladesh; Ambassador Mohamed Mijarul Quayes, Foreign Secretary of Bangladesh; Mr. Mesbah ul Alam, Secretary of Ministry of Environment and Forests; Ambassador Abdul Hannan, Permanent Representative to the United Nations Office at Geneva; Dr. S.M. Munjurul Khan, Deputy Secretary of Ministry of Environment and Forests; Deputy Permanent Representative to the United Nations, Mr. Rahman Mustafizur; and Mr Faiyaz Murshid Kazi of the Bangladesh Foreign Ministry. Finally, thanks so much to two of the leading doyens of international macro-economic diplomacy in South Asia: Mr. Md. Sufiur Rahman, Director General and Mr. Salahuddin Noman Chowdhury, Director, each of Economic Affairs Wing of Ministry of Foreign Affairs of Bangaldesh – may you continue to think and lead the way forward.

To our donors at AECID, AusAID and Fundación Biodiversidad: thank you for your many efforts to support this project and your helpful assistance in coordinating and realizing the wide-ranging activities involved. Thank you Juan Ovejero Dohn for looking after the team in Hanoi and Vietnam. To the Australian (and Italian) team in Accra, we hope you also enjoyed the experience of the country study: Sarah Willis and Azzurra Chiarini.

This report would not have been possible without the analytical expertise and dedicated work of Commons Consultants, the main research and production partner of DARA in this effort, a team led by Søren Peter Andreasen as Principal Advisor to the project and Peter Utzon Berg as the primary Technical Advisor to the endeavour. Your honed creativity and technical precision allowed this project to achieve its close to outlandish aims.
Mariano Sarmiento, lead designer and his dedicated and talented team are responsible for all of the extremely helpful or too complex graphics in this report, depending on your viewpoint. However, the complexity is all our fault and not Mariano's nor his team's – what you see is much, much better than anything we would have subjected you to without their help. Morwenna Marshall, thanks once again for being there even at the most inconvenient moments, and to Tim Morris, our copy editors who each receive a special vote of thanks.

We particularly owe our thanks to additional scientists and experts who provided strong guidance and assistance with model selection of which there are simply too many to list here. You may have just thought you were just doing our chief modeller, Cristian Conteduca, a favour (you were) but your assistance in helping us to track down the knowledge which forms the foundation of this work was absolutely fundamental to helping this report make what we hope is a meaningful contribution to the debate. Antonia Praetorius, Sebastian Strempel, YiWei Ng, we thank you.

Many thanks also to the governments of Ghana and Vietnam and to the UNDP country offices there, as well as UNDP headquarters in New York, for your most helpful support. In Vietnam, Live&Learn, Hang Nguyen and colleagues were tremendous in supporting our country research, and in Ghana, the Environmental Protection Agency-Ghana with expert support from Emmanuel Tachie-Obeng did a highly effective job of facilitating our trip and national and community activities and for which credit is deserved. Mary Chinery-Hesse, thank you so much for welcoming us and taking part.

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ROSS MOUNTAIN
DARA Director General

MATTHEW MCKINNON
Editor

CONTENTS

A GUIDE TO THE COLD CALCULUS OF A HOT PLANET

INTRO-DUCTION

TWO DECADES OF FAILURE TO ACT DECISIVELY ON CLIMATE CHANGE HAVE MADE THE EARTH HOTTER AND MORE POLLUTED.[1] There is still a window of opportunity, fast closing, to scale back pollution and tame the rising heat. But the world economy is locked onto a different course: fossil fuel consumption is expected to continue its rapid growth in the coming decades.[2] Major economies not committed to low-carbon development would need to enact policy changes to alter this fact. Current frontline stockpiles of hydrocarbons – of oil, coal, and gas – are multiples of what could possibly be consumed this century if the climate is to be kept under control, despite being valued as if all and more of these will be burnt.[3]

The cold calculus of a hot planet is that millions of people already suffer from the failure of the world economy to embark on a low-carbon transition. This report estimates that 5 million lives are lost each year today as a result of climate change and a carbon-based economy, with detailed explanations for why this is the case found in the relevant chapters that follow. In particular, effects are most severe for the world's poorest groups whose struggle against poverty is worsened.[4] Although no country is spared the impact: a depleted ozone layer for instance – also caused by potent greenhouse gases – has significantly increased the incidence of skin cancer, above all in the wealthiest of countries. The US will lose more than 2% of its GDP by 2030 according to this report's estimates.[5]

On the basis of this report's comprehensive reassessment of the incremental costs and benefits of a hotter, more polluted planet, a second cold calculus can also be made.

Climate change is found to have already set back global development by close to 1% of world GDP. This impact is felt, but rarely counted, in the bottom lines of companies, industries and major economies, and is already playing a role in determining the wealth or poverty of nations. Inaction on climate change cost Least Developed Countries an average of 7% of their GDP for the year 2010 – with losses that will greatly increase in the years ahead. Indeed, the explosive increase in heat expected over the coming decades will only lead to a corresponding escalation in these costs, increasingly holding back growth as emissions go unabated and efforts to support the worst-affected communities fail to meet the challenges at hand.

The losses incurred already exceed by a significant margin any costs of reducing emissions in line with a low-carbon transition.[6] Action on climate change would therefore already reap monetary benefits for the world, both globally and for major economies like the US, China and India.

So the second cold, bottom-line calculus of a hot planet is that tackling climate change is already sensible in economic terms today. The step will also minimize widespread illness and mortality that inaction causes. And it would bolster the fight against poverty while helping to safeguard a natural world in steep decline.[7]

The findings of this report differ from previous studies that largely understand climate change as a net benefit or minimal cost to society today (or prior to mid-century), and which inform current economic decision-making on climate change, making it easier for governments to avoid serious action.[8]

While the methods of this study resemble previous research, three key distinctions in the approach have led to fundamentally different results.

First, this report draws on the most recent science and research into different climate-related impacts, taking advantage of the incredible growth in understanding on this issue since the 1990s era research that provides the basis of almost all other studies of this kind.[9]

Second, building on freshly available research, a number of new effects are considered here. Chief among these is the impact that increasing heat has on labour productivity, or the fact that workers (especially outdoors) produce less in a given hour when it is very hot. Fractional increases in global temperature can translate into tens of additional hot days with each passing decade.[10] Labour productivity is estimated to result in the largest cost to the world economy of any effects analysed in this report. Other effects newly considered here include the thawing of permafrost in cold regions and the accelerated depreciation of infrastructure that results as frozen land shifts when it thaws.[11]

Finally, this report also considers a full range of the closely inter-linked costs and benefits of the carbon economy, independent of any climate change impacts. When accounting for the large-scale costs imposed by carbon-intensive hazards to human health, the environment and economic sectors, such as the fisheries industry, the full costs of inaction are laid bare.

Human society and the natural world, it turns out, are fundamentally susceptible to changes in ambient heat. Civilization itself emerged during an age subsequent to the last glacial era that was characterized by a uniquely stable and mild

THE CLIMATE VULNERABLE FORUM

The Climate Vulnerable Forum (CVF) is an international cooperation group for coordination, advocacy and knowledge-building among countries that face significant insecurity due to climate change. The Forum has distinguished itself through a determination to catalyze more effective and broad-based action for tackling the global climate challenge, internationally and nationally. Founded in 2009 by the Maldives, it now includes 20 governments and is a major foreign policy initiative of its current chair, Bangladesh. The Climate Vulnerability Monitor's second edition was commissioned at the November 2011 Ministerial Meeting of the Forum at Dhaka, Bangladesh.

climate. The balance is delicate: a few degrees cooler and much of the northern hemisphere freezes.[12] Several degrees hotter and parts of the planet exceed the thermal maximum at which human beings can exist outdoors.[13]

The world is just one degree Celsius (1.8° F) hotter than prior to industrialization – the principal cause of climate change.[14] But small changes count: Ghana for instance, a focus country in this report, has warmed faster than others. In just 50 years, the number of very hot days in Ghana has increased by 50 in number.[15] Inaction on climate change would see Ghana experience three to five times that increase in heat this century alone.[16]

It goes almost without saying that changes of this proportion have profound effects for human beings, the natural environment and the market economy. Releasing gigatonnes of carbon dioxide and other pollutants and gases into the atmosphere every year is neither a safe, sound nor healthy practice when cleaner, safer and more environmentally sound alternatives so readily exist. Low-carbon energy solutions –such as wind, solar, tidal or geothermal power – involve 10 to 100 times less negative externalities than carbon-intensive alternatives.[17]

Even for the sceptically minded, the argument for switching to safer, less damaging energy sources can be justified on account of the heavy costs of the prevailing carbon-intensive means.

The Climate Vulnerability Monitor (hereafter: "the Monitor") was commissioned by the Climate Vulnerable Forum, an international cooperation group of climate-insecure countries, and mandated to DARA as an independent global study into precisely these effects. As its name indicates, the report serves to monitor the evolution of changes related to the climate as they are already being felt around the world. Its role is to shed light on how society experiences inaction on the climate crisis today in order that the insight might assist in enhancing the contemporary global response to this most serious of societal concerns. The study has benefitted from the input of wide-ranging external advisory bodies and field research undertaken in Ghana and Vietnam.

Governments like those of the Climate Vulnerable Forum are already allocating significant taxpayer funds to deal with the local effects of climate change as they are taking hold. Governments worldwide are weighing macroeconomic energy and environmental policies, from infrastructure incentives to low-carbon regulation, nuclear energy reliance, or the exploitation of hazardous unconventional fuel reserves. In doing so, decisions are being made to allocate highly specific sums of money, human and intellectual capacities, and other resources of all kinds.

The Monitor helps to inform these decisions by presenting a snapshot of what current knowledge on climate change issues in their aggregate can reasonably be assumed to imply for the world. The analysis includes monetary, human and ecological estimations of the ramifications of inaction on climate change. These estimations are the result of this specific research effort and provide a reference of interest when considering what societal benefits might result from different policy strategies. The exercise enables the comparison of costs with benefits in order to judge the overall merits of different endeavours.

The report's structure has three main parts. The front matter of the report provides an executive summary, context to and details of this study, as well as an overview of key findings and a series of detailed recommendations targeted at specific groups. The Monitor itself is then presented, with the results of the assessment provided for every country and each of the different indicators used detailed one-by-one with key information provided each time at the country level, for different groups and overall. Finally, a number of special focus sections are also contained in this report, including independent chapters on the country-based research undertaken in Ghana and Vietnam.

It is the hope that this report will spur debate and awareness of the double-sided cold calculus of action versus inaction on climate change with which the world now desperately struggles.

The choice for society is critical but hardly difficult if the externalities of inaction on climate change have indeed been underestimated by the world economy. Business-as-usual impacts would for this century be multiples of any costs associated with a transition to a low-carbon economy and imply unthinkable human suffering.

All but the firmest responses leave the door wide open to catastrophic risks and threats to the planet's ability to support life, none of which even enter into the Monitor's assessment of costs.

According to the International Energy Agency, just five years remain for the world's major economies to enact structural economic transformations in order to break out of a dead end business-as-usual trap. If not, planned investments in high-carbon infrastructure would from 2017 rule out keeping the global temperature rise below the internationally agreed on level of 2° Celsius (3.6° F).[18]

Technological barriers no longer hold back the transition. Prolonging change only increases costs. Firm, urgent and internationally cooperative action heightens benefits for all. The best way forward is quite obviously clear.

DARA

Founded in 2003, DARA is an independent organisation headquartered in Madrid, Spain, committed to improving the quality and effectiveness of aid for vulnerable populations suffering from conflict, disasters and climate change. DARA was mandated by the Climate Vulnerable Forum as independent developer of the Climate Vulnerability Monitor in its first and second editions.

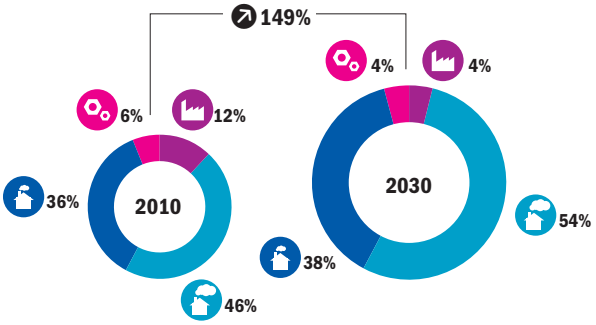
[1] The UN Framework Convention on Climate Change was signed in 1992 (UNFCCC, 1992)
[2] US EIA, 2011; IEA, 2011
[3] BP, 2011; US EIA, 2011; CTI, 2011
[4] UNDP, 2007
[5] Martens, 1998; UNEP, 2002
[6] For mitigation costs, see: Edenhofer et al., 2010 and IPCC, 2012b
[7] Butchart et al., 2010; Crutzen, 2010
[8] Tol, 2011; Nordhaus, 2011
[9] Tol, 2011; Exceptions include: Nordhaus, 2006; Rehdanz and Maddison, 2005
[10] Kjellstrom et al., 2009
[11] Nelson et al., 2002
[12] Petit et al., 1999
[13] Sherwood and Huber, 2010
[14] IPCC, 2007a
[15] McSweeney et al., 2012: "A 'Hot' day or 'hot' night is defined by the temperature exceeded on 10% of days or nights in the current climate of that region and season."
[16] Ibid
[17] IPCC, 2012a
[18] IAE, 2011

EXECUTIVE SUMMARY

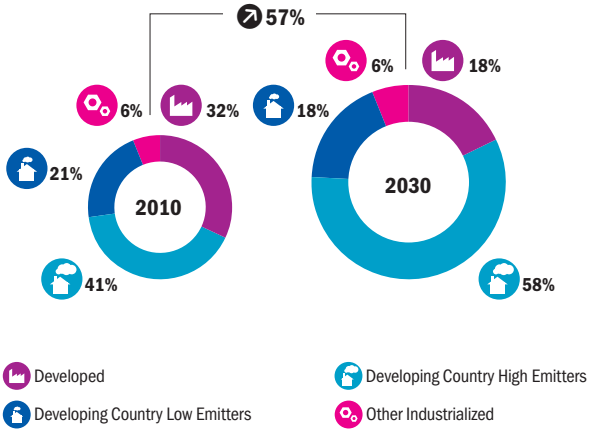
This report provides a reassessment of the human and economic costs of the climate crisis. The reassessment is based on a wealth of the latest research and scientific work on climate change and the carbon economy, research that is assimilated as a part of this report.

THE MAIN FINDING OF THIS REPORT IS THAT CLIMATE CHANGE HAS ALREADY HELD BACK GLOBAL DEVELOPMENT: IT IS ALREADY A SIGNIFICANT COST TO THE WORLD ECONOMY, WHILE INACTION ON CLIMATE CHANGE CAN BE CONSIDERED A LEADING GLOBAL CAUSE OF DEATH.

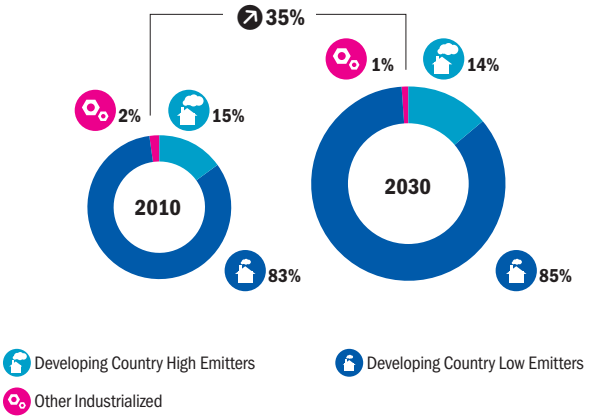
CLIMATE – TOTAL COSTS



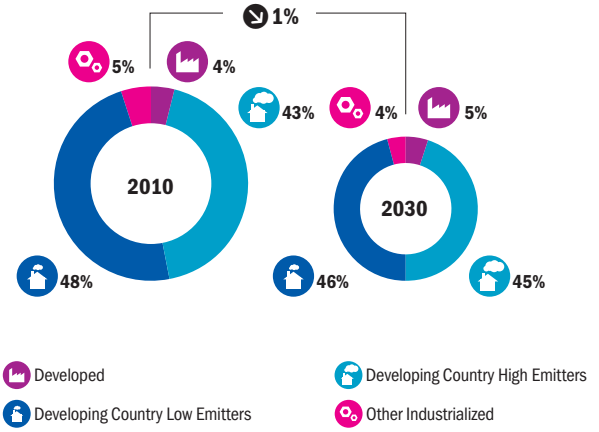
CARBON – TOTAL COSTS



CLIMATE – TOTAL DEATHS



CARBON – TOTAL DEATHS



This report estimates that climate change causes 400,000 deaths on average each year today, mainly due to hunger and communicable diseases that affect above all children in developing countries. Our present carbon-intensive energy system and related activities cause an estimated 4.5 million deaths each year linked to air pollution, hazardous occupations and cancer.

OVERALL COSTS

	Losses 2010, Bln PPP corrected USD	Losses 2010, % of GDP	Net Losses, % of GDP 2010	Net Losses, % of GDP 2030
Climate	696	0.9%	0.8%	2.1%
Carbon	542	0.7%	0.7%	1.2%
World	**1,238**	**1.7%**	**1.6%**	**3.2%**

Climate change caused economic losses estimated close to 1% of global GDP for the year 2010, or 700 billion dollars (2010 PPP). The carbon-intensive economy cost the world another 0.7% of GDP in that year, independent of any climate change losses. Together, carbon economy- and climate change-related losses amounted to over 1.2 trillion dollars in 2010.

The world is already committed to a substantial increase in global temperatures – at least another 0.5° C (1° F) due to a combination of the inertia of the world's oceans, the slow response of the carbon cycle to reduced CO_2 emission and limitations on how fast emissions can actually be reduced.[1] The world economy therefore faces an increase in pressures that are estimated to lead to more than a doubling in the costs of climate change by 2030 to an estimated 2.5% of global GDP. Carbon economy costs also increase over this same period so that global GDP in 2030 is estimated to be well over 3% lower than it would have been in the absence of climate change and harmful carbon-intensive energy practices.

Continuing today's patterns of carbon-intensive energy use is estimated, together with climate change, to cause 6 million deaths per year by 2030, close to 700,000 of which would be due to climate change. This implies that a combined climate-carbon crisis is estimated to claim 100 million lives between now and the end of the next decade. A significant

NUMBER OF DEATHS

		2010	2030
Climate	Diarrheal Infections	85,000	150,000
	Heat & Cold Illnesses	35,000	35,000
	Hunger	225,000	380,000
	Malaria & Vector Borne Diseases	20,000	20,000
	Meningitis	30,000	40,000
	Environmental Disasters	5,000	7,000
Carbon	Air Pollution	1,400,000	2,100,000
	Indoor Smoke	3,100,000	3,100,000
	Occupational Hazards	55,000	80,000
	Skin Cancer	20,000	45,000
World		**4,975,000**	**5,957,000**

TECHNICAL SUMMARY

The Monitor presents a new and original analysis, synthesizing the latest research and scientific information on the global impact – including benefits and losses – of climate change and the carbon economy in economic, environmental and health terms. Climate change already causes 400,000 deaths each year on average. The present carbon-intensive economy moreover is linked to 4.5 million deaths worldwide each year. Climate change to date and the present carbon economy are estimated to have already lowered global output by 1.6% of world GDP or by around 1.2 trillion dollars (2010 PPP). Losses are expected to increase rapidly, reaching 6 million deaths and 3.2% of GDP in net average global losses by 2030. If emissions continue to increase unabated in a business-as-usual fashion (similar to the new IPCC RCP8.5 scenario), yearly average global losses to world output could exceed 10% of global GDP before the end of the century, with damages accelerating throughout the century. The costs of climate change and the carbon economy are already significantly higher than the estimated costs of shifting the world economy to a low-carbon footing – around 0.5% of GDP for the current decade, although increasing for subsequent decades.[1]

This report and scientific literature imply adaptation costs

share of the global population would be directly affected by inaction on climate change.

Global figures mask enormous costs that will, in particular, hit developing countries and above all the world's poorest groups. Least Developed Countries (LDCs) faced *on average* in excess of 7% of forgone GDP in 2010 due to climate change and the carbon economy, as all faced inequitable access to energy and sustainable development.

Over 90% of mortality assessed in this report occurs in developing countries only – more than 98% in the case of climate change.

Of all these losses, it is the world's poorest communities within lower and middle-income countries that are most exposed. Losses of income among these groups is already extreme. The world's principal objectives for poverty reduction, the Millennium Development Goals (MDGs), are therefore under comprehensive pressures, in particular as a result of climate change.

The impact for rural and coastal communities in the lowest-income settings implies serious threats for food security and extreme poverty (goal 1 of 8), child health and the ability of children to attend school (goals 2 and 4), maternal health and women's development (goals 3 and 5), the prevalence of infectious diseases (goal 6) and, through water, fisheries and biodiversity impacts, environmental sustainability (goal 7). Furthermore, in a difficult fiscal environment, the advent of climate change has pressured governments to divert Official Development Assistance (ODA) funds from other development commitments and activities in an attempt to provide support for climate change concerns, including to a marginal degree, for helping vulnerable communities adapt to climate change. The Green Climate Fund, agreed upon in incrementally greater detail at the successive international climate talks at Copenhagen, Cancún and Durban, faces an economic environment of declining ODA tied to acute fiscal crises across a host of the world's wealthiest economies (see: climate finance). These developments have ultimately compromised the global partnership for development (goal 8). Lag areas towards MDG achievement also align very closely with the most pronounced vulnerabilities resulting from climate change: sub-Saharan Africa, small island developing states, and South Asia in particular.

Poverty reduction efforts are in peril as the potential temperature increase the world is already committed to has only begun to be realized, and the world's major economies are in no way spared. The United States, China and India in particular are expected to incur enormous losses that in 2030 for these three countries alone will collectively total 2.5 trillion dollars in economic costs and over 3 million deaths per year, or half of all mortality – the majority in India and China.

The whole world is affected by these comprehensive concerns: 250 million people face the pressures of sea-level rise; 30 million people are affected by more extreme weather, especially flooding; 25 million people are affected by permafrost thawing; and 5 million people are pressured by desertification. The pressures that these combined stresses put on affected communities are immense and force or stimulate the movement of populations. As is highlighted in the Ghana country study in this report, they can also fuel violence and an erosion of the social and economic fabric of communities.

The impact of climate change on Labour Productivity is assessed here as the most substantial economic loss facing the world as a result of climate change. A large proportion of the global workforce is exposed to the incessant increase in heat, with the number of very hot days and nights increasing in many places by 10 days a decade.[2] Developing countries, and especially the lowest-income communities, are highly vulnerable to these effects because of geographical location – northern countries like Scandinavia, it is assumed, *benefit* from improved labour productivity due to warmer weather – but also because their labour forces have the highest proportion of non-climate controlled occupational environments.[3] Global productivity in labour is surging due to technological advances and a shift of emphasis from agricultural activities to an industrial and service sector focus for most developing countries, among other key developments.[4] Climate change, however, holds back the full extent of productivity gains the world would otherwise enjoy.[5] In this way, the

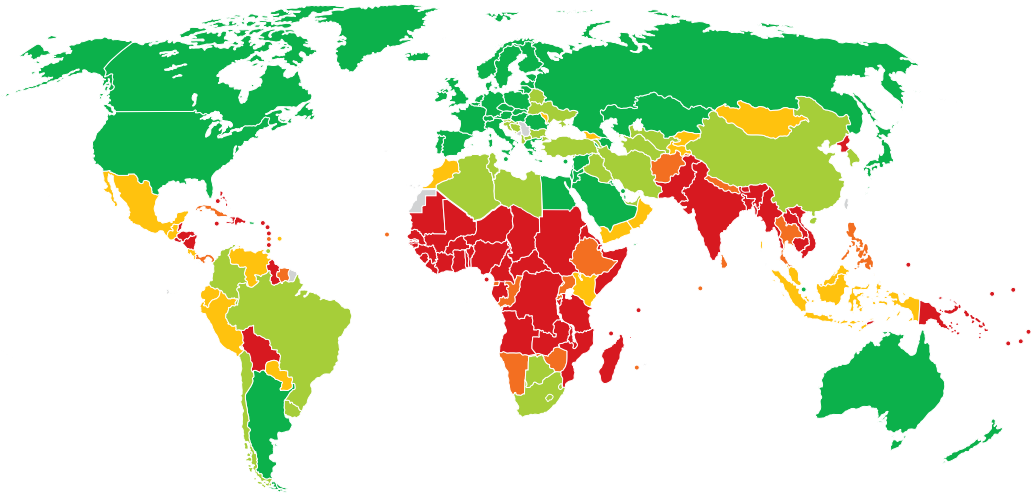
to be at least 150 billion dollars per year today for developing countries, rising to a minimum of more than 1 trillion dollars per year by 2030. These costs are, however, considerably lower than costs of damages to developing countries estimated here, so adapting to climate change is very likely a cost-effective investment in almost all cases and should be central to any climate change policy. Beyond adaptation, this report also emphasizes the urgency of mitigating key risks: tackling food security, indoor fires/ smoke, air pollution and other health issues such as diarrheal illnesses, malaria and meningitis that are all urgent priorities for lessening the extent of the human toll of this crisis.

With costs due both to unabated climate change and the carbon economy expected to rise rapidly over the course of this century, tackling climate change by reducing emissions yields net benefits to the world economy in monetary terms – amounting to around a 1% higher GDP for the entirety of the 21st century (net present value at a 3% discount rate). World net benefits from action on climate change are insensitive to discount rates from 0.1% to 20% (the highest tested). Even the most ambitious reductions in emissions aimed at holding warming below 2°C (e.g. 400ppm CO_2e/IPCC AR5 RCP2.6 scenario) generates economic benefits for the

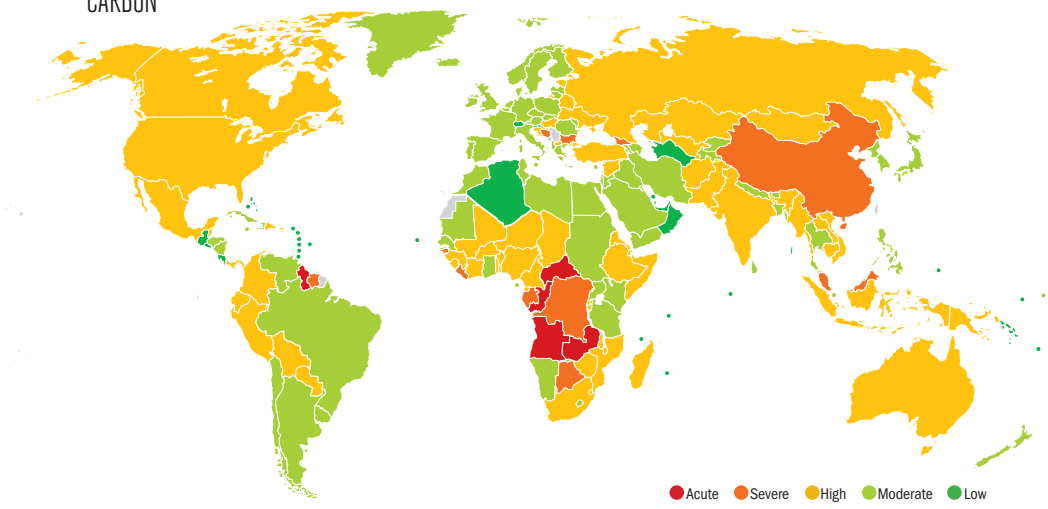
costs of climate change are hidden, which helps to explain in part how their full extent may have been missed. Even so, not all have benefitted from fast expanding labour productivity: labour productivity is a core indicator for MDG 1 (on extreme poverty and hunger), for instance, where little progress has been registered in many developing regions of the world, in particular for sub-Saharan Africa and the Pacific.[6] Not one country is *invulnerable* to the combined effects of climate change and the carbon economy. Inaction on climate change penalizes every country in the world, just as all are set to gain from action

MULTI-DIMENSIONAL VULNERABILITY

CLIMATE



CARBON



world economy after accounting for the costs of reducing emissions (mitigation costs). Limiting warming to this level would limit human, territorial and ecological damage as well as other concerns, such as climate-induced forced movement of human populations.

Over 98% of all climate change mortality and over 90% of all carbon economy related mortality is in developing countries: between 80% and 90% of all economic costs are projected to fall on developing countries. The most extreme effects of climate change are estimated to be felt by the Least Developed Countries, with average GDP losses of 8% in 2030. With respect to carbon economy effects, inequitable access to sustainable development sees Least Developed Countries again incurring the highest relative losses at over 3% of GDP, while between two thirds and three quarters of all carbon economy costs are borne by developing countries.

When the costs of climate change and the carbon economy estimated here are combined, not one country in the world is left unharmed. In terms of regional incentives to tackle climate change, every region is estimated to experience net economic benefits from action on climate change even for the highest levels of action.

The Monitor only analyses incremental impacts as a result of climate change, or changes in the frequency of well-known stochastic events, such as floods and landslides. Not assessed here in any way are potential catastrophic impacts that could occur due to more rapid climate change fuelled

on climate change. Moreover, the vulnerability of the world is shifting with every passing decade. Countries once resilient to marginal weather effects increasingly realize susceptibilities to a changed climate as the increase in heat and associated effects continue to reach new extremes.

Some quite serious damage is now unavoidable, but certain losses can still be reduced in the short term. In particular, human costs can be transferred to economic costs. This can be achieved through programmes aimed at reducing rural poverty – at the origin of hunger deaths and many communicable diseases afflicting the world's poorest groups, with risks that worsen with climate change. Or it can be achieved by ensuring clean air regulations, safer working conditions and modern energy options for people at risk due to carbon-intensive forms of energy. All these measures will save lives but cost money.

Economic losses themselves can also be lessened. A major recent review of humanitarian assistance work noted that Mozambique had requested 3 million dollars from the international community for flood preparations. That sum went unsecured, and 100 million dollars was subsequently spent on emergency flood response.[7] Investment in agriculture might also be cost-effective if the costs of supporting upgraded farming were to generate more benefits (in productivity, output) than the initial outlay.[8]

There are, however, limits to the ability of populations to adapt. The oceans can hardly be refrigerated against marine stresses.[9] Desert encroachment can be prevented but rarely reversed, and if so, generally at great expense.[10] It might be possible to protect a beach, but concrete polders could well be to the detriment of an area's authentic charm and so to the value of properties.

A low-carbon, renewable economy – of hydro, wind, solar, geothermal, tidal and other innovative sources of energy – now competes with the most carbon-intensive forms of power generation in the open market, where they constitute around 10% of the global energy mix today.[11] Shifting the balance in favour of low-carbon energy has been estimated to cost approximately 0.5% or less of GDP for the current decade.[12]

The carbon economy is largely responsible for the incredible growth in overall wealth society has amassed over the last 200 years, although, according to the World Bank, 1.3 billion people continue to remain trapped in dire poverty.[13] Regardless, an economic system developed to support a global population of 1 or 2 billion people in the 19th century is ill suited to a global population in excess of 7 billion and growing.[14]

The climate challenge runs in parallel to other key global developments: a growing world population, a major propensity to urbanization, and structural

by feedbacks such as a release of Arctic methane deposits, more rapid sea-level rise that could result from the disintegration of the West Antarctic Ice Sheet or large-scale climatic disruptions such as the collapse of ocean circulation mechanisms, all of which are understood to pose significantly larger human, economic and ecological risks than anything portrayed here. The possibilities of these events are by no means ruled out, with risks increasing substantially with warming.[2] Other economists have therefore factored such risks into their economic analysis to a degree.[3]

Only with the deep and sustained emissions reductions spelled out in the lowest of the new IPCC RCP 2.6 scenario is there a reasonable chance (comfortably over 50%) of not exceeding the internationally accepted "safety" temperature threshold of 2°C global mean warming above preindustrial.[4] Given the clear human, ecological and,

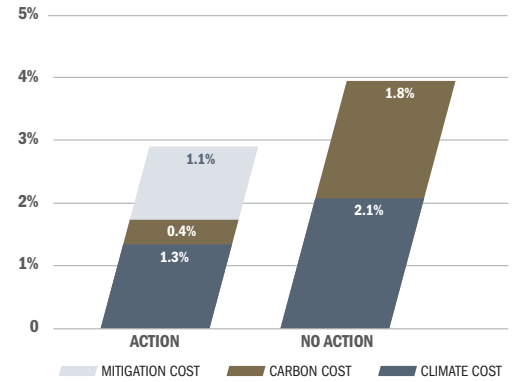
REGIONAL COST BENEFIT ANALYSIS, 2010-2100** PERCENTAGE OF GLOBAL GDP (NOMINAL), NET PRESENT VALUE AT 3% DISCOUNT RATE

	Climate + Carbon Costs				Highest Action		High Action		Moderate Action		Net Benefit		
Region	No Action	Highest action (400 ppm)	High action (450 ppm)	Moderate action (550 ppm)	Avoided costs*	Mitigation costs	Avoided costs*	Mitigation costs	Avoided costs*	Mitigation costs	Highest action	High Action	Moderate action
USA	3.0%	1.0%	1.0%	1.5%	2.0%	1.5%	2.0%	1.0%	1.5%	0.5%	0.5%	1.0%	1.0%
Japan	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.0%	0.0%	0.0%
Russia	4.5%	1.5%	1.5%	2.0%	3.0%	2.0%	3.0%	2.0%	2.5%	2.5%	1.0%	1.0%	0.0%
China	4.5%	2.0%	2.0%	2.5%	2.5%	2.0%	2.5%	1.5%	2.0%	1.0%	0.5%	1.0%	1.0%
India	11.0%	5.0%	5.5%	6.5%	6.0%	3.0%	5.5%	2.0%	4.5%	0.5%	3.0%	3.5%	4.0%
EU27	1.0%	0.5%	0.5%	0.5%	0.5%	1.0%	0.5%	0.5%	0.5%	0.5%	0.0%	0.0%	0.0%
ROW	8.5%	3.5%	3.5%	4.5%	5.5%	2.0%	5.0%	1.0%	4.5%	0.5%	3.5%	4.0%	3.5%
World***	4.0%	1.5%	1.5%	2.0%	2.5%	1.5%	2.0%	1.0%	2.0%	0.5%	1.0%	1.0%	1.0%

*Avoided costs: No action (A1B +8.5) minus reduced ppm scenario (400 ppm C02e: RCP2.6; 450 ppm: RCP2.9; 550 ppm: SRES B1)
** Discounted (3%) sum of costs and GDP – mitigation costs from Edenhofer et al., 2010 (regional: Remind + Poles)
*** Median value of all 5 scenarios (Edenhofer et al., 2010)

ACTION VERSUS INACTION OVER THE 21ST CENTURY

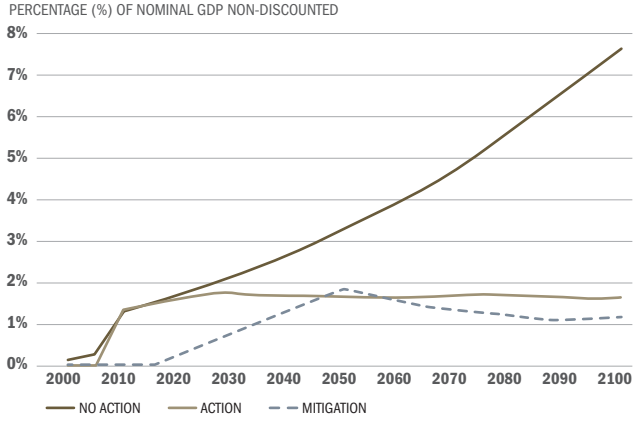
NPV OF GLOBAL CLIMATE/CARBON COSTS AND MITIGATION COSTS RELATIVE TO GDP (NOMINAL 2010-2100, 3% DISCOUNT RATE)



Action equals 450 ppm (RCP 2.9) No action equals mid-point of 2 non-stabilization scenarios (RCP 8.5 and SRES A1B)

21ST CENTURY COSTS OF CLIMATE CHANGE ACTION, INACTION AND MITIGATION

PERCENTAGE (%) OF NOMINAL GDP NON-DISCOUNTED



shifts occurring in economies around the world. All of these tendencies – most pronounced in developing countries, in particular the process of industrialization now spreading more and more widely[15] – can worsen or attenuate vulnerabilities to climate change or the carbon economy.

In order to understand the fuller implications of this study and to make its findings comparable with previous works that take on longer-term perspectives, the costs of climate change and the carbon economy were also estimated for the period up until 2100. On this basis, business-as-usual development could see the costs of inaction exceeding 10% of global GDP in losses prior to 2100.

Reducing emissions results in net benefits for society in every case because the costs of a low-carbon transition are more than outweighed by averted losses due to climate change and the carbon economy.

In the global context, the highest level of emission reductions results in similar global benefits to lower levels of action. However, the highest action sees fewer negative impacts on society –from human health to biodiversity and for the world's oceans – but requires slightly greater investments in low-emission forms of energy. Less ambitious action means accepting larger scales of human and ecological impacts.

The regional analysis of costs and benefits differs little in fundamental terms from the global analysis: all regions benefit from climate action in economic terms. Most regions find optimal climate action in the high-action scenario. The highest action to reduce emissions also limits the risks of crossing tipping points leading to large-scale climate disruptions.[16] Less ambitious action on climate change does not: moderate action on climate change has a high chance of exceeding the accepted international temperature goal of holding warming below 2° C (3.6° F) above pre-industrial levels.[17] The most vulnerable countries have called for warming to be limited below 1.5° C above pre-industrial levels as they believe 2° C is far too damaging and a risk to their survival.

Neither should the risks of catastrophic impacts be discarded as heresy: new research has highlighted great risks associated with *heat*, as opposed to ocean-related immersion of countries, with heat risks concerning far greater shares of the world economy and its population. In particular, at certain levels of high-end warming, large areas of the planet would progressively begin to exceed the thermal maximum at which human beings are able to survive outdoors.[18] The possibilities of very rapid climate change are not implausible or ruled out by climate change models, especially as the planet warms beyond the 2 degrees Celsius temperature threshold

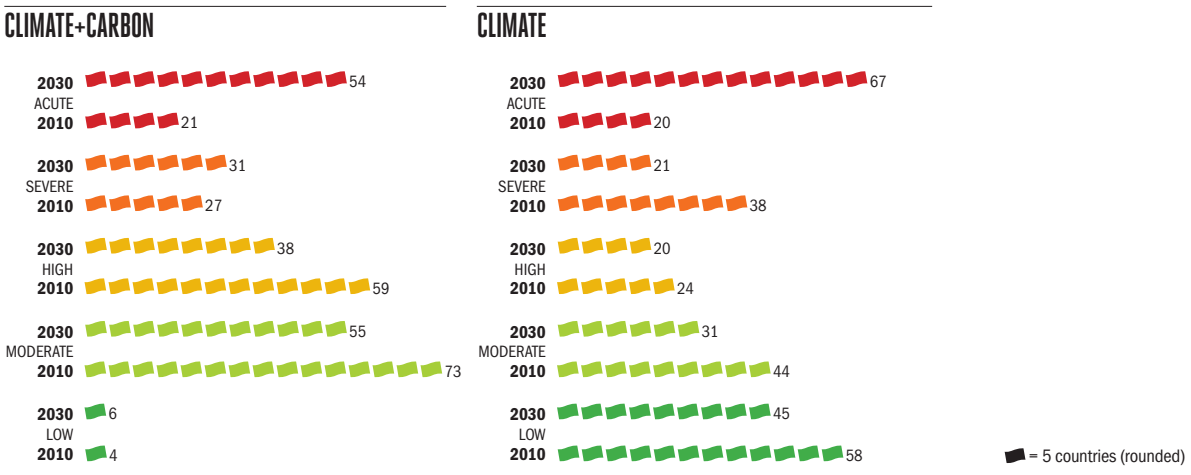
ultimately, economic advantages of aiming for a highest-action scenario, this report's findings imply that the highest action targets would reap the most benefits for the world. Therefore, the highest-action scenario is recommended to policy makers as the preferred target for enhancing and safeguarding global prosperity. Mainstream economic modelling shows that this transition is technologically and economically feasible but that action is needed now to get onto this pathway.[5] *International cooperation will clearly be central to ensuring that the costs of the transition are maintained at the lowest most efficient level and that the transition yields the highest co-benefits.*[6]

[1] See: Edenhofer et al., 2010; IPCC, 2012a
[2] Weitzman, 2007; Hare in Mastny, 2009
[3] For example: Hope, 2006; Stern, 2006
[4] Pope et al., 2010
[5] For an overview of some leading mitigation scenarios, see: Edenhofer et al., 2010; UNEP, 2011; IPCC, 2012a
[6] For example the economic benefits of cross-border emission reduction cooperation: De Cian and Tavoni, 2010

the international community has set for itself.[19] Of particular long-term concern are 1500 gigatonnes of CO_2 ($GtCO_2$) of methane stored in frozen sediments in the East-Siberian Sea at depths of less than 40 to 50 metres.[20] This represents three times the amount of CO_2 that could be released over much of this century if the 2 degrees target is to be kept.[21] As the Arctic sea warms due to climate change, these sediments are thawing and methane is already being visibly released at rates that currently exceed the total amount of methane emitted through natural processes over the entirety of the world's oceans.[22] While all policy pathways for reducing emissions have similar net benefits in economic terms, the highest-action route would clearly reap the greatest human, societal, economic and environmental benefits, since it would ensure the greatest chances of avoiding climate-triggered catastrophe and would minimize the human, social and environmental impacts of a hotter planet. Therefore, the cold calculus of a hot planet implies the most ambitious action on climate change is the savviest choice both in monetary, humanitarian and environmental terms. The highest-action approach is the pathway that the analysis in this report most supports.

The world risks carbon lock-in due to high-intensity carbon infrastructure plans still moving forward in the near term, so the shift in focus to a low-carbon transition should likely occur prior to 2017 and continue aggressively thereafter.[23] Several major economies will need to adjust and enact important domestic policy and legislative initiatives in order to make this a reality. Whatever the case, action on climate change that seeks out international partnership is most likely to further lessen the costs of a low-carbon transition and expand the benefits of this transition for all concerned. This report documents in part the potential benefits of avoided impacts of climate change in addition to the potential co-benefits of emission reductions that are targeted at key economic, health and environmental concerns.[24]

[1] Hansen et al., 2005
[2] Kjellstrom et al., 2009a; McSweeney et al., 2012
[3] ILO LABORSTA, 2012
[4] Storm and Naastepad, 2009; Wacker et al., 2006; Restuccia, et al., 2004; Storm and Naastepad, 2009; McMillan and Rodrik, 2012
[5] Kjellstrom et al., 2009a-b
[6] UN, 2012
[7] Ashdown et al., 2011
[8] Parry et al., 2009; EACC, 2010
[9] Cheung et al., 2010
[10] Puigdefaabregas, 1998
[11] US EIA, 2011
[12] Edenhofer et al., 2010; IPCC, 2012b
[13] Chen and Ravallion, 2012
[14] World Population Prospects/UN DESA, 2011
[15] OECD, 2012; IMF WEO, 2012; World Population Prospects/UN DESA, 2011
[16] Pope et al., 2010
[17] UNFCCC, 2009
[18] Sherwood and Huber, 2010
[19] Wietzman, 2007
[20] Shakhova et al., 2008
[21] Meinshausen et al., 2009
[22] Shakhova et al., 2008 and 2010
[23] IAE, 2011; UNEP, 2011
[24] De Cian and Tavoni, 2010



SUMMARY OF ECONOMIC IMPACT

		NET 2030	NET 2010	LOSSES 2010	GAINS 2010	2010				2030			
CLIMATE	DROUGHT	18	4	4	*	*	2	1	*	4	11	3	1
	FLOODS & LANDSLIDES	94	10	10	*	2	6	1	*	21	66	5	3
	STORMS	100	15	15	*	2	3	7	*	16	64	20	*
	WILDFIRES	*	*	*	*	*	*	*	*	*	*	*	*
	TOTAL	**213**	**29**	**29**	*	**5**	**14**	**10**	**1**	**40**	**142**	**28**	**4**
	BIODIVERSITY	389	78	78	*	8	26	36	9	56	299	80	54
	DESERTIFICATION	20	4	5	*	*	*	2	1	5	4	6	6
	HEATING & COOLING	-77	-33	5	-38	1	2	24	-8	30	7	-65	-49
	LABOUR PRODUCTIVITY	2,400	311	314	-3	135	162	16	-1	1,035	1,364	49	-12
	PERMAFROST	153	31	31	*	1	10	3	17	5	68	5	75
	SEA-LEVEL RISE	526	86	86	*	23	42	15	5	166	310	29	22
	WATER	13	14	44	-30	3	-3	13	7	-21	45	39	39
	TOTAL	**3,461**	**491**	**563**	**-71**	**166**	**235**	**60**	**30**	**1,276**	**1,908**	**144**	**135**
	TOTAL	**106**	**23**	**23**	*	**17**	**5**	*	**0.5**	**84**	**21**	*	**1**
	AGRICULTURE	367	50	51	*	27	17	3	2	208	144	8	10
	FISHERIES	168	13	16	-3	7	7	1	-1	97	80	-3	-6
	FORESTRY	44	6	7	-1	*	4	*	*	9	34	1	1
	HYDRO ENERGY	-24	-4	*	-4	*	-3	*	*	3	-20	-1	*
	TOURISM	*	*	5	-5	2	*	-1	*	19	-16	-2	-1
	TRANSPORT	7	1	1	*	*	*	1	*	*	1	6	*
	TOTAL	**565**	**66**	**80**	**-13**	**37**	**25**	**2**	**2**	**329**	**223**	**8**	**5**
	TOTAL GLOBAL RESULTS	**4,345**	**609**	**695**	**-84**	**225**	**279**	**72**	**33**	**1,730**	**2,294**	**179**	**144**
CARBON	OIL SANDS	24	7	7	*	*	*	7	*	2	1	20	0.5
	OIL SPILLS	38	13	13	*	1	6	6	0.5	3	24	9	2
	TOTAL	**61**	**20**	**20**	*	**1**	**6**	**13**	**0.5**	**5**	**25**	**29**	**3**
	BIODIVERSITY	1,734	291	291	*	32	128	114	17	236	1,034	349	115
	CORROSION	5	1.5	1.5	*	*	0.5	0.5	*	1	4	0.5	0.5
	WATER	10	4	4	*	*	*	3	1	*	2	4	4
	TOTAL	**1,749**	**296**	**296**	*	**32**	**129**	**117**	**18**	**238**	**1,038**	**353**	**120**
	TOTAL	**630**	**172**	**172**	*	**74**	**67**	**21**	**10**	**226**	**341**	**37**	**26**
	AGRICULTURE	-171	15	17	-2	1	2	9	4	-58	-121	4	4
	FISHERIES	77	9	9	*	1	7	0.5	*	5	70	2	0.5
	FORESTRY	83	28	28	*	3	9	14	1	13	48	18	4
	TOTAL	**-11**	**52**	**54**	**-2**	**4**	**18**	**24**	**5**	**-40**	**-3**	**24**	**8**
	TOTAL GLOBAL RESULTS	**2,429**	**540**	**542**	*	**112**	**220**	**174**	**34**	**429**	**1,401**	**444**	**156**

* Less than one billion dollars

Billions of dollars (2010 PPP) non-discounted. Totals do not correspond exactly due to rounding.

Environmental disasters · Habitat change · Health impact · Industry stress

Developing Country Low Emitters · Developing Country High Emitters · Developed · Other Industrialized

FINDINGS AND OBSERVATIONS

1.

THE MOST AMBITIOUS RESPONSE TO CLIMATE CHANGE IS THE MOST ADVANTAGEOUS POLICY IN HUMAN, ECONOMIC AND ENVIRONMENTAL TERMS

- Tackling climate change reaps significant net benefits for society in monetary terms, with monetary gains resulting from even the strongest action and far outweighing any associated expenses
- Climate change is estimated to have already cost the world close to 1% of GDP, the negative effects of the carbon economy add a further 0.7% of GDP to today's losses
- Both climate change and carbon economy costs grow as emissions expand and are lessened as they are cut
- Combined costs could double by 2030, lowering world GDP by well over 3% in absence of concerted action to reduce emissions and vulnerabilities globally
- This major revision of climate-related costs is based on an original research aggregation exercise of third-party scientific studies and data with more comprehensive and updated analysis than previously available including the full breadth of effects linked to the carbon economy, with overall conclusions notably unaffected by a differing of the discount rate applied
- The analysis excludes the willingness to pay to avoid long-term non-marginal catastrophic risks, often factored in by economists, which would further increase the costs of inaction and raise the benefits of ambitious responses, only strengthening the conclusion drawn here
- All collective actions aimed at stabilizing GHGs in the Earth's atmosphere generate net benefits to society: on the basis of available information the 400ppm CO_2 equivalent (RCP2.6) target results in the least human and environmental damages in addition to its monetary benefits
- Inaction would see a continuing escalation of the costs of the climate crisis and a diminishing ability for any policy action to bring it under control as humanity would be increasingly placed at the most extreme of risks

2.

THE HUMAN TOLL OF INACTION COULD EXCEED 100 MILLION DEATHS BETWEEN NOW AND 2030 ALONE

- Climate change and the carbon economy as estimated here are responsible for 5 million deaths each year today and cause illness in tens of million people globally comparable to the third leading cause of preventable death with a similar societal impact as tobacco use (see: Health Impact Climate/Carbon)
- The carbon economy claims the largest share of this impact, in particular due to toxic air pollution, at over 4.5 million deaths a year today
- Climate change is estimated to be responsible for 400,000 deaths each year, particularly due to hunger and communicable diseases in the lowest-income countries
- By 2030, the annual death toll is estimated to rise to 6 million, including close to 5.5 million deaths due to the carbon economy, and over 600,000 as a result of climate change
- Inaction on climate change could claim well over 100 million lives in the twenty year period to 2030
- Reducing emissions will rapidly diffuse risks to populations due to the carbon economy and generate co-benefits for human health, although the effect on the burden of disease will persist for decades
- Constraining climate change will have less of a beneficial effect on its near-term health impacts given that an additional half a degree of warming is now virtually inevitable in the decades immediately ahead
- Climate change linked health concerns are therefore an urgent priority for policies aimed at adapting to climate change, since the accelerating rate of change is outpacing the ability of expected large-scale gains in socio-economic development to lessen key health vulnerabilities in lower-income countries

3.

CLIMATE ACTION IS GOOD VALUE, BUT THE COST OF ADAPTING TO CLIMATE CHANGE HAS LIKELY BEEN UNDERESTIMATED

- Tackling the carbon economy alone is in many cases a sound proposition without even consideration of climate change – reducing the scale of future damages due to climate change are an added bonus to what can be a set of financially and environmentally sound policy measures in their own right
- Given the extent of near-future warming that decades of insufficient regulatory action have now unavoidably forced the world to experience, reducing emissions remains just half of the picture: parallel efforts to adapt to climate change are now essential to a safe and prosperous world
- While a full reassessment of the costs of adaptation is beyond the scope of this report, this Monitor's findings imply that it is very unlikely that the adaptation costs currently facing developing countries could be less than 150 billion US dollars per year today – double the highest of previous published estimates of around 75 billion US dollars per year – simply because a number of key climate change impacts assessed here, such as Heating and Cooling, or Water represent quasi adaptation costs by virtue of how they have been calculated – autonomous adaptation at cost (or gain) being assumed
- Moreover, provided the costs of adaptation rise at similar rates as the

costs of climate change, developing countries could be facing a minimum of over 1 trillion dollars of annual adaptation costs a year by 2030 (in 2010 dollars PPP) – an order of magnitude higher than any previous estimate

- While those figures represent minimum amounts, it is unlikely that the margin of error exceeds much more than double the minimums estimated here, whereas the impact of climate change is estimated to incur several times greater losses for developing countries: 500 billion dollars for 2010 and 4 trillion dollars for 2030 (2010 dollars PPP non-discounted)
- On the basis of existing literature on the subject, adaptation costs are therefore very likely to be less than the costs of the impacts of climate change – as a result adaptation represents a cost-effective investment across a broad range of sectors, meaning resources spent on adaptation are almost certain to reap net benefits for affected countries and for society as a whole
- An important qualification to any estimations of the costs of adaptation however is that climate-related uncertainty significantly increases costs, since planning is ideally robust to the full (or nearly) range of potential outcomes which may include opposites, such as more water, and inundation, or less water but drought

4.
CLIMATE INJUSTICE IS EXTREME

- Climate change takes the most from those who have the least: Least Developed Countries faced in excess of 10% GDP losses due to climate change and the carbon economy in 2010
- The Monitor uses four different country groups as broad geopolitical markers covering developed and industrialized countries as well as developing countries split between “high” and “low” emission categories – the latter group consists of 85 countries with less than 4 tons of CO_2e of GHG emissions (in 2005) or well below the safe per capita emissions level necessary for ensuring stabilized climate conditions in the near-term
- Low-emission countries have essentially contributed nothing to climate change –if all countries were polluting only to those levels, climate change would be marginal – although with a global carbon budget now all but exhausted even the lowest emitting countries can contribute or detract from the world’s ability to rise to the climate challenge
- Lacking any responsibility for climate change, the low-emission country group nevertheless experiences approximately 40% of all its economic losses, and over 80% of all climate change-related mortality
- In an intergenerational perspective, more than half of all climate change-related deaths are solely among young children in lower or middle income countries who have virtually no responsibility whatsoever for the problem – which adds further insult to the also serious implications of today’s inaction for the welfare of future generations

5.
CLIMATE INACTION COMPROMISES GLOBAL DEVELOPMENT AND POVERTY REDUCTION EFFORTS

- With serious ramifications for agricultural and coastal communities in both economic, health and productivity terms, climate change almost surgically targets global poverty reduction efforts, in particular towards the eight internationally agreed Millennium Development Goals (MDGs), directly and manifestly compromising above all the targets for extreme poverty and hunger (goal 1), child health (goal 4) and environmental sustainability (goal 7), but with important repercussions also for gender equality (goal 3), maternal health (goal 5) and infectious disease (goal 6)
- Effects are most extreme for countries understood to have the lowest levels of capacity, where local efforts are less able to be relied upon for making headway in responding to these additional and growing pressures
- Regional lag towards the MDGs, particularly for Least Developed Countries, small island developing states and African countries also corresponds very precisely to those geographic groups worst affected by the impacts of climate change, where the relative scale of losses reach their most extreme values as assessed by the Monitor
- The net impact of climate change doubles as a share of global GDP between 2010 and 2030 with the growth in losses increasing rather than slowing over time regardless of an expected tripling of global wealth during this 20-year period
- So despite an extremely strong link between wealth and a capacity to withstand climate change, impacts still outstrip the ability of economic development to rid developing countries of heightened vulnerabilities to climate change - contrary therefore to the assertions of previous studies, investment in development is not a sufficient response to limit the impacts of climate change and should not be considered a substitute for a dual policy strategy on climate change encompassing early and strong reductions of emissions together with adaptation

6.
INTERNATIONAL CLIMATE FINANCE: A CLEAR DEFAULT ON COPENHAGEN/CANCUN COMMITMENTS

- Two important goals on “new and additional” finance for climate change were agreed in 2009 in Copenhagen at the major UN climate conference there (COP15) and adopted in more official form at subsequent talks

a year later in Cancún (COP16): 1) "Fast Start Finance" of 30 billion US dollars balanced between adaptation and mitigation to flow from developed to developing countries between 2010 and 2012; and, 2) a similar collective goal to mobilize 100 billion dollars a year of climate finance in support of developing countries

- Several possible definitions of "new" and "additional" are left open to interpretation, and include: a) resources that are over and above pre-existing (2009) flows of climate change finance; b) resources additional to commitments to deliver foreign aid of 0.7% GNI as Official Development Assistance (ODA) – a commitment widely unmet since it was adopted by the UN in the 1970s; c) additional to commitments or intentions for progressively increasing ODA to meet the 0.7% target as communicated by governments well prior to the new climate finance pledges; and d), additional to 2009 levels of ODA
- Climate change finance fails to meet any of the above criteria except the first: climate change finance has increased significantly, especially finance for mitigation of climate change
- Because the other definitions do not qualify however, it is clear that "Fast Start" climate change finance has been withdrawn from earlier parallel commitments to sustainable development and poverty reduction efforts – the annual new and additional share of climate change finance is actually in the realm of just 2-3 billion US dollars for 2010, and not 10 billion a year, which raises further serious concerns that long-term financial goals could result in still more and greater diversions
- Numerous developed countries did however face in precisely this period the most extreme of financial pressures of the recent historical era, with a number among them facing fiscal collapse as a result of serious domestic and transnational economic and credit crises during the years of 2008-2012
- The recently agreed Green Climate Fund faces a difficult initiation environment as a result, endangering effective and cost-efficient climate action, in particular there is still no clarity on the scale and sources of generation of funding above all for the interim period from 2013-2020
- Given that ODA fell in real terms in 2011 versus 2010, the new and additional proportion of climate finance for the second year of the three year commitment period can only be lower still, meaning around 20 billion dollars of new and additional climate change finance should flow in 2012 if Copenhagen/Cancún commitments are to be met
- The finance provided is also imbalanced: adaptation makes up a mere 14% of the committed 14 billion dollars of overall climate change finance in 2010, or around 2 billion dollars – indications of change since then are unclear due to delayed reporting cycles – the need for enhance Monitoring, Reporting and Verification (MRV) is critical, in particular because there are serious risks of double or inaccurate accounting for resources under current reporting regimes
- Worse still, "Fast Start" finance is very slow: disbursal rates for conventional ODA are much faster than for climate finance – 76% versus 48% – mainly due to the complex array of funding instruments involved, slowing the rate at which climate-related funds reach beneficiaries
- Adaptation finance is not responding to vulnerabilities: with just over 2 billion dollars of adaptation finance flowing annually from developed to developing countries, wholesale gaps remain for even the most severely affected front-line nations – these are often complicated by conditionalities and other barriers that lock-out some of the world's most vulnerable countries from support
- The Clean Development Mechanism – albeit under severe pressure since several developed countries discontinued forward association – is currently leveraging tens of billion dollars of annual investment in low-carbon initiatives in developing countries and has emerged as one of the most meaningful de facto technology transfer instruments currently operational with around half of all projects resulting in a technology transfer of one form or another – coverage however is extremely limited with almost 90% of all investment benefitting either China or India alone

7.
NOBODY IS SPARED
THE GLOBAL CLIMATE CRISIS

- In one respect or another, every country is experiencing negative impacts either resulting from the effects of climate change or as brought about by the carbon economy – not one country has Low vulnerability to the combined effects of climate change and the carbon economy, and just seven of the 184 assessed have Moderate vulnerability
- Even the largest and most advanced of the world's economies face serious losses, such as the United States, which is estimated to incur a 2.1% reduction in GDP by 2030
- That many wealthy countries exhibit low general vulnerability to climate change is more an indication of the extremity of effects taking hold on the climate frontlines, than of how inconsequential the effects of climate change are for the affluent
- Wealthy countries may have much lower thresholds of tolerance for climate-related impacts since wealth to a large extent insulates communities from suffering extreme societal risks: for example, the 75,000 additional deaths estimated to have been caused by the 2003 European Heat Wave that leading experts believe would almost certainly not have occurred in the absence of global warming is a major anomaly and point of concern for Europeans
- Advanced economies can also afford to part with much less of their economic growth than their developing counterparts – according to the International Monetary Fund, developing countries are growing more than four times as fast in real terms than advanced economies for whom

any marginal loss will have a disproportionate effect on what has been an average of just 1.5% in collective real economic growth over the last decade

- Furthermore, in the increasingly globalized world economy of the 21st century, the fortunes of all nations are more intimately tied, especially for highly networked developed countries that rely on foreign investments both domestically and abroad to sustain even marginal growth and retain high levels of prosperity – an unrestrained climate crisis can only become a major impediment to that prosperity whether or not its effects are felt locally or elsewhere
- The Monitor examines marginal short-term impacts and the implied evolution of these beyond the 2010-2030 scope of much of this report, but in the longer-term climate change implies rapidly growing risks of non-marginal and truly catastrophic impacts, such as a collapse in ocean circulation or of major ice sheets, or the breaching of thermal tolerance levels for humans – all of which would generate large-scale losses for any income group and none of which are accounted for in the Monitor

8.

OUTDATED ESTIMATES OF THE NEGATIVE EXTERNALITIES OF CLIMATE INACTION GUIDE TODAY'S REGULATORY DECISIONS

- Previous global estimates of the impact of climate change reveal less than 20 original studies developed by a much smaller range of authors, and with the exception of three, all are based on third-party research or data from the 1990s or earlier
- Previous studies routinely include the positive effects of carbon fertilization due to high levels of CO_2 without controlling for negative effects of an expanding carbon economy, such as ground-level ozone toxicity, ocean acidification, acid rain or the health hazards of pollution, among others
- No single study includes the impact of climate change on labour productivity, which the Monitor estimates as the most significant near-term impact of climate change in monetary terms
- Hundreds of estimates of the social cost of carbon are based on just nine studies of the negative externalities of climate change, all grounded in 1990s research and data, and which are actually integrated into and continue to guide the regulatory decisions of major countries
- In many cases these studies feed policy recommendations on emission reductions that would allow the rise in global temperatures to exceed the internationally agreed 2° Celsius (3.6°Fahrenheit) safety limit, since a common conclusion is that the costs of firm mitigation exceed any marginal benefits from reduced damages

RECOMMENDATIONS

FOR *ALL* NATIONAL POLICY MAKERS

COMMIT FIRMLY TO LOW-CARBON PROSPERITY

- Breaking free from the climate crisis will save lives, improve health and extend the lifespan and well-being of entire populations
- Tackling climate change results in net economic benefits and can reduce instability and system-level market volatility, restore domestic energy independence and jobs, while boosting business productivity and enhancing trade balances and economic competitiveness among major economies
- A low-carbon economy *will* reduce the stunning rate of contemporary environmental degradation, deforestation and irreversible biodiversity loss that is crippling the world's ecosystems with serious economic repercussions
- A global commitment to a low-carbon economy could strand half or more of all hydrocarbon reserves, rendering them unmarketable and potentially creating space for regulatory actions with very low costs not yet factored into economic modelling on low-carbon transition costing

PRIORITIZE PARALLEL MEASURES TO ADAPT TO CLIMATE CHANGE

- Adaptation cannot be a stand alone response to the climate challenge: treating only the symptoms but not the cause of the climate crisis would result in spectacular economic losses for the world economy – not all the effects of climate change can be adapted to; some come at a pure sunken cost, while uncertainty in many cases doubles the costs of adaptation since the possibility of random outcomes (e.g. more or less rain) require parallel measures in opposing directions
- Adapting to climate change is expensive, but not doing so is even more costly – on the whole, adaptation is cost effective and, if strategically programmed, may result in productivity boosts that more than compensate for any investment made – governments are accordingly advised to close the adaptation gap
- Not investing in convincing adaptation responses will increasingly hold back country-level business and investor confidence, especially for highly vulnerable countries where climate change is already one of the most significant economic challenges
- Climate change is radically more dangerous and damaging for the world's poorest populations than for any other groups. Not empowering marginalized communities to overcome the daunting new challenges only multiplies economic, social and political risks and instability, and will guarantee a steady erosion of longstanding poverty-reduction investments
- International funding and resources of all kinds need to be anchored both in the best possible understanding of the probable distribution and severity of vulnerabilities and impacts attributable to climate change and the highest co-benefits of supported mitigation actions in terms of human health and the environment

UNITE STRENGTHS IN INTERNATIONAL PARTNERSHIP

- A new international partnership is called for based not only on essential mutual trust and reassurances but also on pure common interest and shared economic, environmental and social benefits
- The climate crisis has emerged as one of the greatest common challenges of humankind: in a planet at risk, with death and damages in pandemic proportions and humanity and justice tested to the limits, not even half of the world's powers are capable of solving the problem alone
- Working in partnership, any costs associated with a low-carbon transition are minimized as the global comparative advantages of emission reduction and removal are fully leveraged, while the dividends of climate action for sustainable human development can be maximized in greater fulfillment of human rights
- That partnership can build on the significant energy already invested by the international community over the course of nearly two decades and 17 major UN climate conferences dealing with every conceivable technical aspect of the climate problematic in great detail and to the steady improvement of complex but vital institutional instruments such as the Clean Development Mechanism

FOR GOVERNMENT GROUPS

DEVELOPED COUNTRIES

1.1 Support the vulnerable *effectively*: Decades of investment in poverty-reduction efforts largely on the basis of public taxpayer resources have been seriously undermined by climate change and environmentally unsound development. Explosive climate stress and what are often termed its "risk multiplier" ramifications for health, social and political security, migration and global prosperity are also likely to indirectly endanger the already slow growth prospects of many developed countries. Act effectively by ensuring efforts are aligned with an evidence-based prioritization that places vulnerability up front, support promising local government initiatives, and reach for the last mile of impact.

1.2 Deliver fully on Copenhagen/Cancún commitments: Full delivery of climate finance is an essential component for meeting ambitious emission-reduction objectives. The prevailing financial climate is unfavourable, but climate finance has been largely transposed from parallel planned increases in Official Development Assistance committed or announced prior to and separately from international climate change agreements. Current flows are heavily imbalanced, with only marginal support for vulnerable countries to adapt to escalating damages. While mitigation actions can have very substantial benefits for sustainable human development, diverting resources intended for urgent poverty

reduction priorities penalizes the world's poorest groups as more than one billion people are still living with hunger on a daily basis. The global response to climate change cannot be taken out of the international community's commitment to eradicate extreme forms of poverty, a project now seriously endangered in large part precisely as a result of climate change. Despite the prevailing macro-economic difficulties, developed countries are urged to convene an extraordinary session of OECD Development Assistance Committee and to subsequently communicate a joint and time-bound action plan for delivering on the full set of collective climate finance and sustainable development commitments, much of which would otherwise go unmet by the end of 2012 and thereafter.

1.3 Rescue the MDGs: The Millennium Development Goals (MDGs) would have had significantly greater chances of being met globally in the absence of the climate crisis. The MDGs may not now be fully attained unless additional resources are devoted to the cause, targeting in particular progress specifically jeopardized by climate change impacts not accounted for when the MDGs were developed. With only a few years remaining before the foreseen conclusion timeframe, substantial emergency resources should be put into efforts to achieve the MDGs on the basis of goal specific, geographic and income-group lag. The evidence for seriously compromising effects for key MDGs and progress in priority regions as a result of climate change underscores the critical importance of mainstreaming climate change considerations into national-, provincial- and even town- or village-level development policies. An MDG rescue fund could constitute an early thematic funding window for the newly established Green Climate Fund set to be established within the framework of the UN Climate Change Convention (UNFCCC). While the international community is now busy designing the successor "Sustainable Development Goals" that will take over from the MDGs after 2015, this important process should nevertheless not detract from the vital importance of first ensuring success by 2015 on the original MDGs.

DEVELOPING COUNTRIES

2.1 Prioritize climate policy with highest co-benefits: Faced with limited capacities and resources, policy makers should deliberately target high-impact actions with multiple societal benefits in human, economic and environmental terms. One example is the promotion of efficient and clean-burning cooking stoves, which addresses indoor smoke-linked disease and deforestation, as well as supporting gender development and labour productivity. Promoting clean-burning stoves also limits potent particulate emissions which could help slow the aggressive short-term increase in temperatures. Dozens of other high-impact policy options abound. Pursuing low-carbon development strategies across the sectors of construction, forestry, water and agriculture in addition to the electricity-generation industry will broaden the possible development dividends yielded.

2.2 Pledge strong national action: Strong leadership can pay dividends. Above all, it is in the firm interests of developing countries to create a domestic environment of predictability as to the direction and intent of national climate change policies. More ambitious climate change policies will reassure foreign investors that climate risks are under control and that steps are being taken to ensure economic competitiveness and risk diversification with respect to energy usage and forward planning. With climate change already firmly embedded in the contemporary economic system, strong national action plans are an assertive starting point for reassuring key stakeholders in the economic and social prospects of an economy in the near term.

2.3 Invest in national risk analysis: Developing countries are overwhelmingly more vulnerable to climate-related impacts than industrialized nations. This is not only due to income inequalities and poverty but is also a product of heightened environmental vulnerabilities since the majority of developing countries are tropical or sub-tropical, where the implications of climate change are most severe. The high carbon intensity of economic activities common to many developing countries is a further disadvantage. As such, climate-related concerns are an important emerging factor for macroeconomic planning and the pursuit of optimal economic competitiveness. Effectively addressing climate-related risks requires sustained investment in local expertise, educational programmes, civil society groups and specialist technical networks. Ideally, reference climate change and emission scenarios, the backbone of climate change response planning, would be updated every 2-3 years and involve wide-ranging stakeholder groups in the development of each new iteration. National governments are best placed to foster the development of the most sophisticated country-specific climate-related analysis possible. Solid reference scenarios and analysis supports more accurate and efficient national policies and solidifies support for its implementation, including among development partners.

HIGHLY VULNERABLE COUNTRIES

3.1 Prioritize adaptation: Climate change is already a major determinant of the prosperity of economies most vulnerable to its effects. A highly robust climate change adaptation strategy and implementation plan is an essential safeguard for national development progress and economic growth prospects. As the knowledge base expands, country risk will increasingly factor in the diverse negative and positive effects of climate change to the economic prospects of nations, with direct

financial implications for investor confidence and foreign investment. Vulnerable countries need to learn from each other's successes and reassure the global economy that climate-related risks are well under control. Regional and localized knowledge tools, such as focused climate models, warrant serious investment in order to improve localized analysis as best as possible.

3.2 Boost domestic capacity: Considerable institutional competences are required to manage costly adaptation programmes necessary to limit damages and productivity losses due to climate change. If institutional arrangements are not in place, serious opportunities for participation in the global low-carbon transition may be foregone. Just one example relates to the Clean Development Mechanism (CDM). National authorities responsible for the registration of projects that could enable local environmentally sound energy-related projects to access financial resources from international carbon markets are still absent in a number of highly vulnerable countries. Capacity goes beyond the public sector too: no point in establishing a national CDM authority in the absence of any local entrepreneurial activity for developing low-carbon projects in the first place. Moreover, making the most of vibrant civil society interest on climate change will only add value and legitimacy to the climate change policy development process and is a valuable asset to governments that should be cultivated and strongly promoted.

3.3 Strengthen climate governance: The diffuse nature of climate change means its varied effects cut across the institutional divisions of policy both vertically, from national to provincial and district or municipal levels, as well as horizontally, encompassing government departments ranging from environment agencies to foreign, finance or planning ministries, resource management, civil defence, labour relations, agriculture, forestry, fisheries, commerce, science and education, health and safety, national meteorological services, to name just a few. Implementing meaningful policy requires extraordinary levels of coordination and stewardship. The most successful examples, such as the Philippines, thrive because of a deliberate high-level consolidation of national responsibility on climate issues in legislatively-mandated central authorities backed by direct executive involvement. The success of countries like the Philippines in implementing effective domestic climate change policies shows that improved climate change governance is a more significant determinant of climate policy success than the level of national domestic resources committed to climate policies.

FOR CIVIL SOCIETY AND THE PRIVATE SECTOR

COMMUNICATORS AND THE MEDIA

4.1 Question received wisdom: It has often been argued that green policies "curb economic growth", "increase gasoline prices" or "destroy jobs". Taxes on carbon do increase certain costs, namely by putting more of the burden of the negative effects of pollution back onto its sources. For most economies, an ambitious response to climate change would only attenuate dependency on costly and insecure imported fuel supplies in favour of locally developed energy solutions, such as energy efficiency upgrades to buildings. If the US was able to cut its trade deficit in half purely by shifting to domestic solutions for meeting and reducing energy requirements, would that not increase domestic prosperity, rather than curtail it? If half or more of the world's existing stocks of hydrocarbons, such as oil, were rendered obsolete, might not their market price just as well plummet not rise? If climate policy is only another ruse in support of "big" executive government, why in the US are individual states taking the legislative initiative and not the capital? When the local building and automobile industries actively lobby in favour of national legislation on climate change while hydrocarbon businesses with most of their operations offshore do the opposite, to what extent are policy outcomes being determined by vested influences as opposed to domestic economic interests?

4.2 Promote awareness on risks as opportunities: Risks are opportunities. Serious environmental and health impacts of the carbon economy will abate as low carbon development progressively dominates economic activities. The same for climate change impacts. In almost every case, taking measures to limit damages due to the warming the world is already committed to will improve competitiveness and minimize any losses. The Monitor emphasizes that it is no longer credible that mitigation of climate change will lead to reduced economic growth. Indeed, the benefits of reducing the

carbon intensity of growth far outweigh any small and artificial premium in profit margins associated with carbon-based development strategies. The dividend of mitigation furthermore is most pronounced in fast-growing, newly industrialized developing countries.

4.3 Take a stand: Time is running out, and the stakes are tremendous, if not incalculable. If a low-carbon transition is not engineered within the decade, the consequences will be dire regardless of the ultimate magnitude, since they involve irreversible damage: the extinction of whole species, and thousands upon thousands of human lives lost. In worst cases, not solving climate change could render large areas of the planet unsuitable for human existence outdoors. The injustices, environmental irresponsibility and inhumanity involved are simply staggering. A nearly unparalleled body of scientific and observational evidence now amassed and plain for all to see with the steady disappearance of Arctic sea ice and glaciers. The dramatic weather-related adjustments and extremes repeated around the world are difficult to ignore. Despite the complexity of the topic, ignorance is no excuse for inaction, and indifference can be tied to complicity. With this report, there is now a comprehensive current-day economic justification for action in addition to the human, ethical, environmental and rights-based arguments already in wide circulation. Civil society groups, communicators and people of all kinds in positions of public influence or authority within their communities, whether in faith-based groups, municipal or educational establishments, should find no further obstacles to taking a stand in tackling climate change.

INVESTORS

5.1 Perform comprehensive risk analysis: Corporations reliant on business models based on carbon assets, such as reserves of oil, are taking a daily gamble that a low-carbon economy will never prevail and those assets will never be stranded unable to reach markets due to regulation. Certainly, the structural features of the global economy and every mainstream energy outlook analysis back the narrative of the low-carbon economy as a pipe dream. But only a very narrow window of legislative action in favour of a firm response to climate change would strand half or more of the world's existing stockpiles of carbon-based fuels as unmarketable. To what extent are investment portfolios exposed or not to that possibly marginal but phenomenal risk? Are those risks worth bearing? How might they be minimized?

5.2 Encourage diversification strategies: Hydrocarbon companies should be capable of presenting comprehensive diversification strategies into low-carbon alternatives. If no convincing diversification strategies have been developed, it is clear that corporate leadership are carrying investor resources along a risky political gamble. Detailed economic modelling by major pension funds has demonstrated that a diversified portfolio should reap more benefits for investors in the case of a low-carbon transition than under business-as-usual conditions. Few companies in the energy sector rival the omnipotence of hydrocarbon businesses, mainly state-owned as they are. Therefore, whether or not the future energy requirements of the planet are met through renewable sources or via point-supplied carbon intensive fuels, the leading global energy corporations of today are still the best equipped to service the world's energy requirements of a low-carbon economy. Not preparing the ground for a potential low-carbon transition only builds up risks that need not exist. Coal businesses, for instance, with strong investments in carbon capture and storage (CCS) and employee and environmental safety research and development, would most likely benefit from a low-carbon transition rather than suffer.

5.3 Foster transition stability: Legislative steps that entail irreversible change to the landscape of the world's energy industry are a systemic risk embedded in global markets, just like climate change is already an inescapable and growing determinant of market prosperity itself. The energy sector constitutes the primary or at least a major share of virtually every major stock exchange. Abrupt policy action that results in a stranding of a majority of carbon assets could cause serious instability. And yet changes are very specifically a contingent necessity to the constraining of climate change, which in spite of current business trends is nevertheless a widely ratified international priority. In a globalized economy, it is a sovereign regulatory concern for any party to the UNFCCC. Equity market regulators across the 194 parties involved should be monitoring and publicly reporting on the extent to which systemic carbon-linked risks might jeopardize national and global prosperity. This would enhance investor visibility to the risk profiles of entire indexes and encourage better carbon risk management. Regardless of the motivations, regulators unwilling to

publicize relevant information on such hazards might be suspected of purposely concealing inordinate risks, which may only compound exchange-specific risks and compromise investor confidence here.

RESEARCH COMMUNITY

6.1 Encourage attribution research: Imperfect data sets, confounding parallel effects, basic empirical limitations and otherwise, thwart the identification of climate change's role (or lack thereof) in any socio-economic or environmental phenomena. Yet the exercise is highly relevant and significant. Hundreds of billions of dollars of taxpayer resources virtually everywhere are already being diverted each year, consciously or not, to address the sprawling repercussions of a hotter planet. Knowing where these resources should or should not be deployed is of prime concern. Just one example serves to illustrate why. If climate change is assumed solely responsible for localized coastal degradation in a river delta due to a subjective rise in sea levels, a concrete wall along the foreshore might conceivably be built. However, equal or greater blame may well be attributable to upstream dams, hydro stations, irrigation, or localized ground-water pumping that would continue to cause land to sink further behind a prohibitively expensive, infrastructure-heavy coastal fortress aimed at containing sea-level rise. Furthermore, coastal defences in one area often accelerate degradation in adjacent coastal zones by inhibiting the natural dissipation qualities of tidal energy, spreading inadvertent losses further still.

6.2 Expand global analysis: Global estimates and models of the impact of climate change are so complex and subject to such a wide array of assumptions and proxies by the experts or research teams involved in their development as to be almost irreproducible by third parties, even when full transparency is provided on the methodological steps involved. And yet understanding the costs and benefits involved in addressing any serious policy concern is ordinarily an unavoidable imperative. Climate change proposes nonetheless perhaps the most ambitious policy agenda the modern world has had to decide on. The dearth of recent analysis on the question has no doubt lessened confidence in global policies capable of enabling a major macroeconomic restructuring crucial to the initiation of a low-carbon transition. The Monitor's reassessment of the costs of climate change would best be judged through comparison with other similarly updated studies. Where future studies include also carbon economy side effects, such as carbon fertilization, they should also include the full range of carbon economy side effects, including ozone toxicity, acid rain, pollution issues relating to health and other relevant impacts such as those assessed by the Monitor.

6.3 Avoid misrepresentation of risks: The level of confidence and agreement among academic specialists and their models is less important for vulnerable communities than the potential risks implied by science. Understating risks by stressing instead the uncertainties associated with attributional association to climate change is irresponsible because the implication is to displace concern, entailing potentially deadly and economically debilitating ramifications if policy makers fail to act on risks. While many risks cannot be affirmed as stemming from climate change with a high degree of confidence, neither can their causal association to climate change be discounted with any better degree of confidence. Future reference reports should aim to highlight first the range of risks, then the levels of confidence and uncertainty associated with them, and not the other way around. It is safer to risk being over prepared than under.

FOR THE INTERNATIONAL DEVELOPMENT AND HUMANITARIAN COMMUNITY

DEVELOPMENT ACTORS

7.1 Focus on economic development, education and environmental governance: Any strategy that boosts economic and human development will almost certainly also reduce climate vulnerability by some degree. This is highlighted by the very low levels of climate impacts assessed for the few high-income tropical countries that share environmental vulnerabilities with lower-income neighbours, such as Brunei, Saudi Arabia or Singapore. Education is also critical so that communities experiencing a growth of income are equally equipped with high degrees of awareness of the risks faced and the means available to mitigate these. Educating children, especially girls, may be the most cost-effective method to spread awareness, since the school system, as well as informal educational avenues, is a sustainable conduit to invest in, and children are

more likely to further pass on their knowledge to other groups, namely adults. Environmental governance is equally key, since the unsustainable exploitation of natural resources, above all fisheries, forests and water, might occur regardless of the level of education and may even intensify as incomes rise. But environmental governance should look beyond simple protection towards actually enhancing the public goods natural resources have to offer. This might include the construction of dams to trap water from heavy downpours for irrigation during drier spells, or the expansion of natural reserves or wetlands for pollination, waste water treatment or wind protection.

7.2 Raise the disposable income of farmers and fishermen: Support national efforts to establish appropriate national government policies and investments that yield for the lowest income groups. The groups most consistently and heavily exposed to climate-related impacts are small-scale or subsistence farmers and fishermen, and especially their children. The greatest challenge faced by the lowest income bracket of these groups is to reverse the vicious cycle of decline that climate-related risks are constantly feeding. In order to break out of decline, farmers and fishermen need to expand their incomes and profitability. If not, even the most cost-effective of opportunities to protect against damages may remain out of reach on purely financial grounds, such as higher quality seeds, clean burning stoves, irrigation equipment or crop insurance. Education and rural extension training has a role to play in helping farmers to boost productivity so that more can be achieved with the same resources available. Expanding market access for the raw or finished goods produced by this group is another option of growing interest as the world's markets continue to globalize. Providing financial stimulus and training to local entrepreneurs or cooperatives to establish light agro-fishery industries capable of packaging these goods for admission to global supply chains would allow local producers to appropriate a greater share of the value chain and maximize the commercial value of their goods.

7.3 Integrate climate strategies to revitalize development: Access to carbon markets via the reformed CDM, which allows the pooling of micro-level activities into one larger and therefore collectively financeable project, and the possibility of a global carbon market for forests, represent new sources of long-term income streams that could enable a host of fresh sustainable development initiatives to take hold in developing countries. Simple large-scale energy projects like hydro dams or extensive concrete sea defences may be attractive climate-related initiatives for administrative or other reasons, but energy-efficient cooking stoves and mangrove plantations would likely accomplish the same objectives – reduce emissions, protect against coastal degradation – but bring much higher co-benefits – for health, biodiversity, forests, carbon sinks, or wind protection, to name just some key advantages. Several successes in payment for ecosystem services systems, Costa Rica's scheme being a prime example, also provide templates for governments to regulate and incentivize the protection and growth of valuable environmental assets in an integrated and self-sustaining way. International policy makers should prioritize high co-benefit initiatives and integrated programmes that deal simultaneously with multiple issues in order to maximize the scarce resources available for tackling climate vulnerability while making the most out of the transition to a low-carbon economy in terms of sustainable human development at a global level. With far fewer resources available for adapting to climate change, prioritizing mitigation projects that also boost local adaptive capacity or directly result in adaptation dividends could double or more the possible extent of adaptation efforts. As an example, retrofitting buildings with thermal insulation would reduce cooling energy loads, and therefore emissions, but also safeguard health and labour productivity from rising temperatures.

THE HUMANITARIAN SYSTEM

8.1 Brace for change: Change is already underway. That change is also significant: as heat rises, parts of the world will experience climates with no analogue in human history. It is still extremely difficult to confidently attribute a specific extreme weather event in part or entirely to climate change, especially not close to the time of its occurrence. Certain types of events, such as extreme heat leading to drought or flooding triggered by heavy rains, nevertheless carry the classic hallmarks of disasters suspected to have been caused or aggravated by climate change. On the basis of the classical laws of physics, moreover, it is nearly impossible that, for example, more abundant, frequent and concentrated heavy rainfall or severe hot and dry spells would not result in a

general increase in flooding or drought. As such, the humanitarian sector needs to be capable not just of preparing for but also responding to weather-related emergencies on larger scales and at more frequent intervals. Likewise, all development and humanitarian partners should increasingly realize the value of building, together, the resilience of communities to avoid simply racing to respond to emergencies and maximize the effectiveness of development investments.

8.2 Establish a thematic funding window for climate-linked emergency response: The damage caused by the general increase in the extremity of certain types of weather already accounts for a significant and growing share of human and economic disaster losses. The concern falls squarely within the competence of the UNFCCC and is a legitimate target for climate change finance, especially for developing countries with marginal capacity that are penalized by current finance flows, which seek out strong "absorptive capacity". Persistent Horn of Africa and Sahel food security crises highlight the extent to which the international humanitarian community is not sufficiently equipped to cope with climate-related disasters. As climate stresses continue to mount, that capability will only be further eroded if action is not taken to ensure it is reinforced. The track record of humanitarian sector resource mobilization makes it unlikely that standard sources of funding will keep pace with costly additional burdens to emergency response. A climate finance-replenished thematic funding window should be established to finance a share of all emergency relief and rehabilitation costs associated with any extreme weather events, especially floods and drought – since such events can neither be attributed nor *dis-attributed* to climate change. The same window could also finance emergency preparedness activities in known high-risk hotspots. The UN's Central Emergency Response Fund (CERF) could establish a dedicated window for this purpose in conjunction (or not) with the Green Climate Fund.

8.3 Evolve thinking and partnerships: Even without today's clear resource constraints, it will take more than just additional financial resources to cope with the increases in risks expected as a result of heavier rain and more extreme heat. Strategic planning should question whether the past is an accurate basis for future situations given the highly dynamic conditions the world now finds itself dealing with as a result of climate change, economic and population growth, globalization, and otherwise. Extreme droughts are breaking new records today, but those records will only be re-broken again and again in the years to come. Organizations and institutional response structures will need to become more accustomed to dealing with highly uncertain and speculative information, find efficient ways to prepare for a range of different possible outcomes, including unprecedented multi-country crises that could be triggered by repeated extremes, such as heavy flooding followed by extreme and prolonged drought, and compounded by additional risks, such as energy price spikes. The interactions between climate change and other wide-ranging crises merits more focused examination: just as climate change outcomes are affected by wide-ranging issues, so too climate change will affect critical determinants of tomorrow's humanitarian crises, if not already, today's. Breaching conventional comfort zones in order to work more widely and effectively with non-traditional humanitarian actors like the private sector or the military, would also help to expand reach and impact.

RESEARCH PROCESS

INCEPTION AND DEVELOPMENT

The first edition of the Monitor was meant to serve as a departure point for discussions to refine understanding of climate vulnerability. As stated in that 2010 report, the goal has been to improve both the methodology and the accuracy of this tool going forward. A number of considerations raised during the development of the first report by external review bodies could not be adequately addressed at that time, but instead have fed into development of the second edition. So while this new report was only formally commissioned in November 2011, the second Monitor nevertheless has its origins well rooted in the first.

The original Monitor approached the problem of climate change in a non-technical but policy-relevant way. It established a conceptual framework that assessed vulnerability at the national level. But it allowed for an understanding of vulnerability as internationally fluid not static, with today's isolated vulnerabilities rapidly becoming tomorrow's shared vulnerabilities. Separating out some of the different components of vulnerability helped to show that nearly every country in the world faces some aspect of the problem to a high degree. Much of the architecture of the original report is retained in this Monitor.

Not unsurprisingly, a number of headline conclusions from the 2010 report still hold, such as an insufficient focus on the human health impacts affecting most vulnerable communities or the highly significant links between a country's level of vulnerability to climate change and its human development status. However, it became evident that not all original country-level results were satisfactory and that certain sections of the original report oversimplified the socio-economic effects of climate change. Nor did the original format provide sufficient granularity for sector-level effects (economic impacts were limited to "land" and "marine") or convey key nuances between different levels of certainty.

Much of the difficulty stemmed from a heavy reliance on third-party global or regional macro models that pooled information at those levels, leading to a certain degree of inaccuracy in the results for some countries, since the information wasn't designed for the Monitor's nation-by-nation analysis. This second edition continued to draw on other studies; however, it still did not solve the challenge of providing accurate national-level outputs. The difficulties of re-running climate impacts models developed by others is a recognised issue for the field (Nordhaus, 2011).

The second Monitor's now greatly expanded set of indicators is therefore primarily anchored in individual bodies of recent research pertaining to discrete effect areas, such as distinct economic sectors (agriculture, fisheries, forestry, etc.) and specific resource, health or environmental impacts (e.g. water, heat and cold illnesses and biodiversity). DARA has also worked with additional external advisory bodies in order to further the range of inputs. The new Monitor also includes a new thematic pillar.

While the original edition focused on the effect of "Climate", this edition focuses on both "Climate" and "Carbon". The new section on the socio-economic impacts of the carbon economy came from recognition that there is a distinct, symbiotic relationship between climate change concerns and the carbon economy. Viewing climate policy more holistically will help decision makers form parallel or combined responses to both the consequences of global warming and its root causes.

Another major adjustment to the second Monitor is the inclusion of in-depth country-level input, including field research and exchanges with local specialists. This input was viewed as a must for the effective development of an improved Monitor report, and the governments and experts of Ghana and Vietnam fully embraced and engaged with that process.

CONSULTATION & COUNTRY RESEARCH

EXTERNAL ADVISORY BODIES

Two external advisory bodies have provided critical input at various intervals during the course of the Monitor's development. A senior Advisory Panel provides strategic guidance on the Monitor's framing, analysis and recommendations. An open format Peer Review Committee provides specialist and technical input in particular on methodological and theoretical issues.

Participants in these two bodies serve in a non-remunerated personal capacity and represent a broad spectrum of expertise and viewpoints on the topic as well as a variety of stakeholder groups whose perspectives and involvement have helped enrich the Monitor's development, analysis and presentation. The research team responds to every question and critique from these groups and endeavours to reflect all input within the limitations of the overall project.

The expectations for the second Monitor were presented to the report advisory bodies at the beginning of 2012 in the form of an Inception Report to which DARA received a first round of substantive feedback.

The second Monitor then underwent two separate methodological and quantitative reviews by its Peer Review Committee, including a full-day workshop in Geneva in April 2012. A dialogue between Committee members and the Research Team was also organised with representatives of the Climate Vulnerable Forum on that occasion. A draft report was submitted for review to both bodies in August 2012 and adjusted prior to public release.

Individual members of the advisory bodies comment only on certain aspects of the project, not on its entirety, based on their expertise, availability and other considerations.

While the Monitor benefits from external advisory bodies and open peer review, the system and approach of this project is to be distinguished from academic peer-reviewed scientific literature. This report is designed primarily as a policy and communication tool that strives for technical accuracy in encapsulating the scientific work of third parties together with other forms of qualitative and quantitative information, including field-based research.

COUNTRY STUDIES

Country studies were undertaken in Vietnam and Ghana in March 2012. In each case, a half-day national workshop was convened to present conclusions of desk research conducted by DARA and to seek substantive input from key stakeholders and policy makers across public, private and civil society groups. Two representative territorial units were also identified in each country for field research, and dozens of extended interviews were conducted there with senior representatives of local government, civil society and business groups.

ADDITIONAL CONSULTATIONS

Climate Vulnerable Forum delegates were briefed on the Monitor's progress at an official open session of the group at the UN climate change talks in Bonn, Germany in May 2012. Additionally, some early results from the Monitor project were presented and discussed publicly at an official Climate Vulnerable Forum Side Event to the UN Conference on Sustainable Development (Rio+20) in Rio de Janeiro in June 2012.

RESEARCH PROCESS

4
DURBAN
UNFCCC COP17
Official Forum Side Event
Presentation of the
Dhaka Declaration
December 2011

5
INCEPTION REPORT
Monitor 2nd Ed.
February 2012

6
YEN BAI, VIETNAM
Field Research
March 2012

7
HANOI
National Workshop
March 2012

8
BEN TRE, VIETNAM
Field Research
March 2012

9
SOUTH-EAST COAST, GHANA
Field Research
March 2012

10
ACCRA
National Workshop
March 2012

11
BOLGATANGA, GHANA
Field Research
March 2012

12
1ST METHODOLOGICAL/ QUANTITATIVE REVIEW
Monitor 2nd Ed.
April 2012

13

GENEVA

Peer Review Committee Workshop
April 2012

14

BONN

UNFCCC Intercessional Negotiations Official Forum Side Event
May 2012

15

RIO DE JANEIRO

UN Conference on Sustainable Development Official Forum Side Event
June 2012

16

2ND METHODOLOGICAL / QUANTITATIVE REVIEW

Monitor 2nd Ed.
July 2012

17

DRAFT REPORT REVIEW

Monitor 2nd Ed.
August 2012

CLIMATE VULNERABILITY MONITOR 2ND EDITION

PEER REVIEW COMMITTEE

EDITORIAL/RESEARCH TEAM

18

NEW YORK

Launch of Monitor 2nd Ed.
September 2012

19

WASHINGTON, D.C.

Expert Discussion
October 2012

3

DHAKA

Climate Vulnerable Forum Ministerial Meeting
November 2011

2

CANCÚN

UNFCCC COP16 Launch of Monitor 1st Ed.
December 2010

1

LONDON

Launch of Monitor 1st Ed.
December 2010

20

DOHA

UNFCCC COP18 Official Forum Side Event
November 2012

KEY ISSUES

ADDITIONAL DEATHS

Floods & landslides
2010 · 2,750
2030 · 3,500

Storms
2010 · 2,500
2030 · 3,500

Diarrheal infections
2010 · 20,000
2030 · 45,000

Heat & cold illnesses
2010 · 35,000
2030 · 35,000

Hunger
2010 · 225,000
2030 · 380,000

Malaria & vector-borne
2010 · 20,000
2030 · 20,000

Meningitis
2010 · 85,000
2030 · 150,000

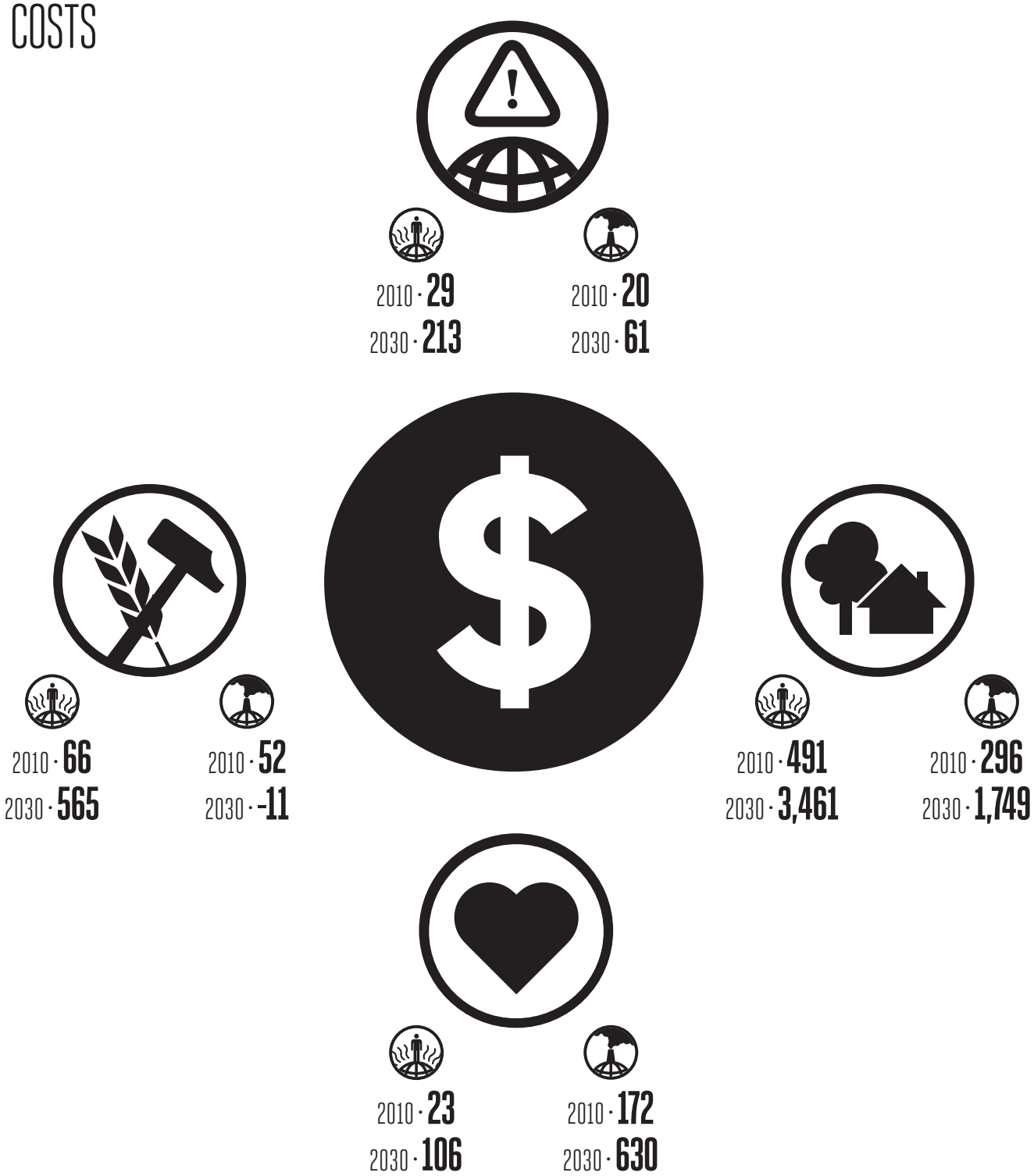
Air pollution
2010 · 3.1 MILLION
2030 · 3.1 MILLION

Indoor smoke
2010 · 1.4 MILLION
2030 · 2.1 MILLION

Occupational hazards
2010 · 30,000
2030 · 40,000

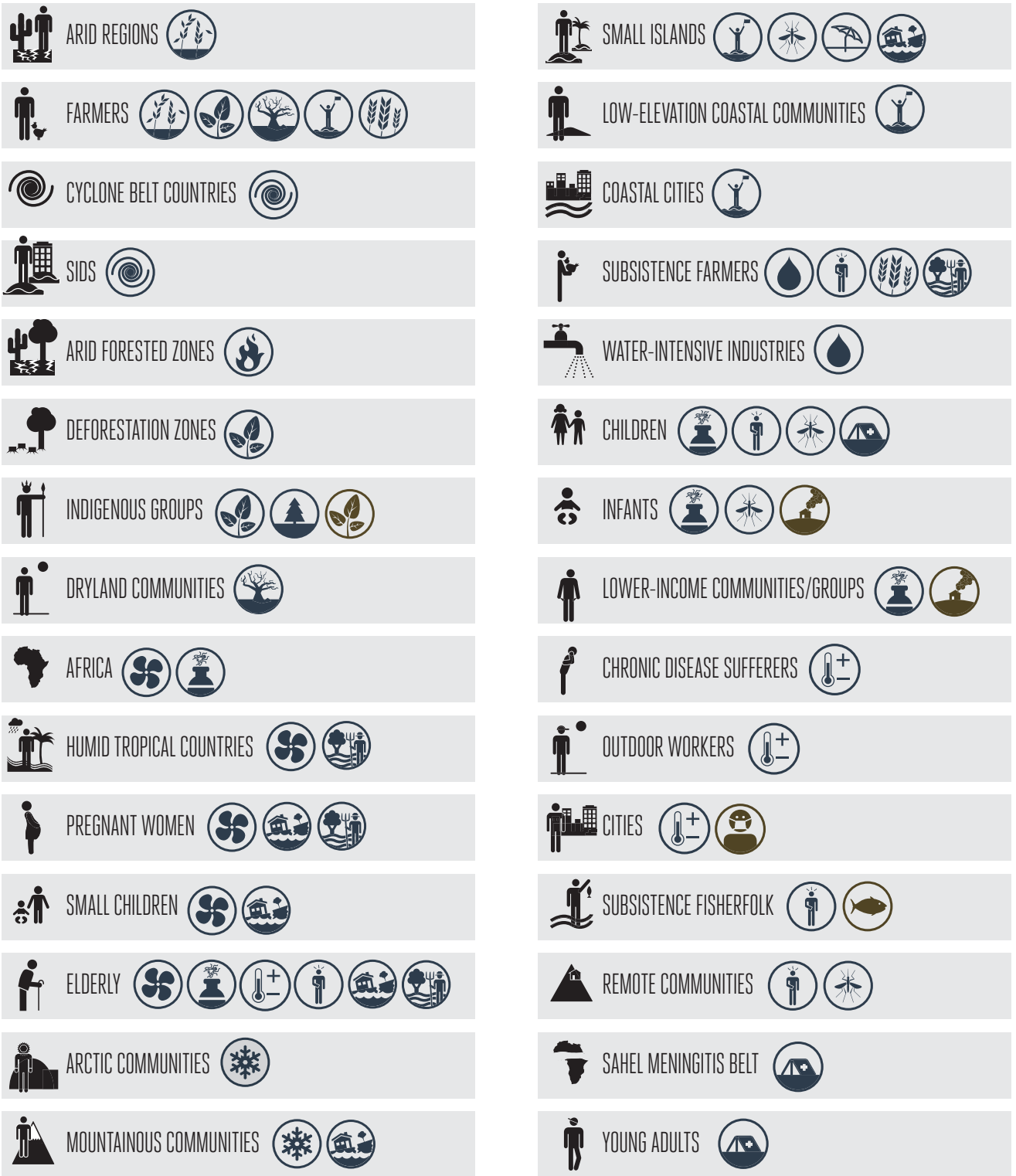
Skin cancer
2010 · 55,000
2030 · 80,000

ADDITIONAL COSTS



Climate · Carbon · Enviromental disasters · Habitat change · Health · Industry stress · = Billion USD PPP (2010 non-discounted) - negative values show gains

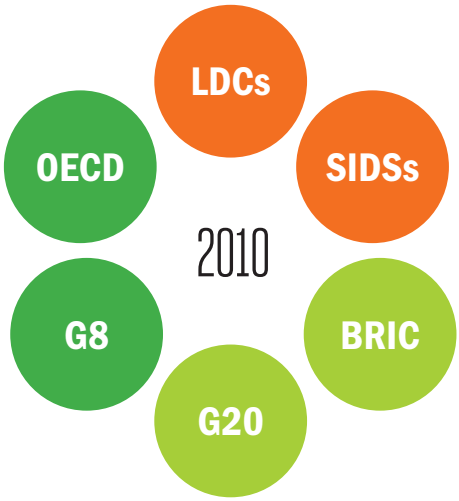
AFFECTED GROUPS

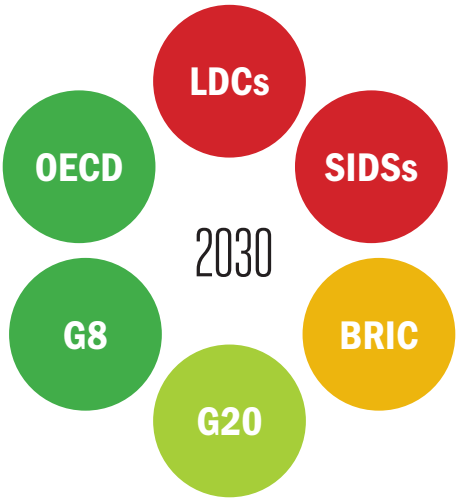



TROPICAL COUNTRIES
LIVELIHOODS DERIVED FROM FISHING
ENERGY COMPANIES
BEACH RESORTS
LOW-ELEVATION WINTER RESORTS
DENSELY POPULATED RIVER WAYS
OIL SAND HOST COMMUNITIES
COASTAL COMMUNITIES
TROPICAL FOREST COMMUNITIES/ZONES
NEWLY-INDUSTRIALIZED COUNTRIES
TRANSITION ECONOMIES
INDUSTRIALIZED COUNTRIES
WOMEN
RURAL POPULATIONS WITH POOR ENERGY ACCESS
COAL MINERS
VEHICLE DRIVERS
COAL AND GAS POWER PLANT WORKERS
FAIR SKINNED
DEVELOPED COUNTRIES
CHINA
RIVER BASINS
OUTDOOR OCCUPATIONS
MIDDLE INCOME COUNTRIES
HEAVILY LABOURING WORKERS
LOWER INCOME COMMUNITIES
FISHERMEN
Drought
Floods & landslides
Storms
Wildfires
Biodiversity
Diarrheal infections
Heat & cold illnesses
Hunger
Malaria & vector-borne
Meningitis
Desertification
Heating and Cooling
Labour productivity
Sea level rise
Agriculture
Fisheries
Tourism
Water
Forestry
Hydro Energy
Transport
Permafrost
Biodiversity
Fisheries
Oil sands
Air pollution
Indoor smoke
OIL Spills
Water
Skin cancer
Agriculture
Forestry
Corrosion
Occupational hazards

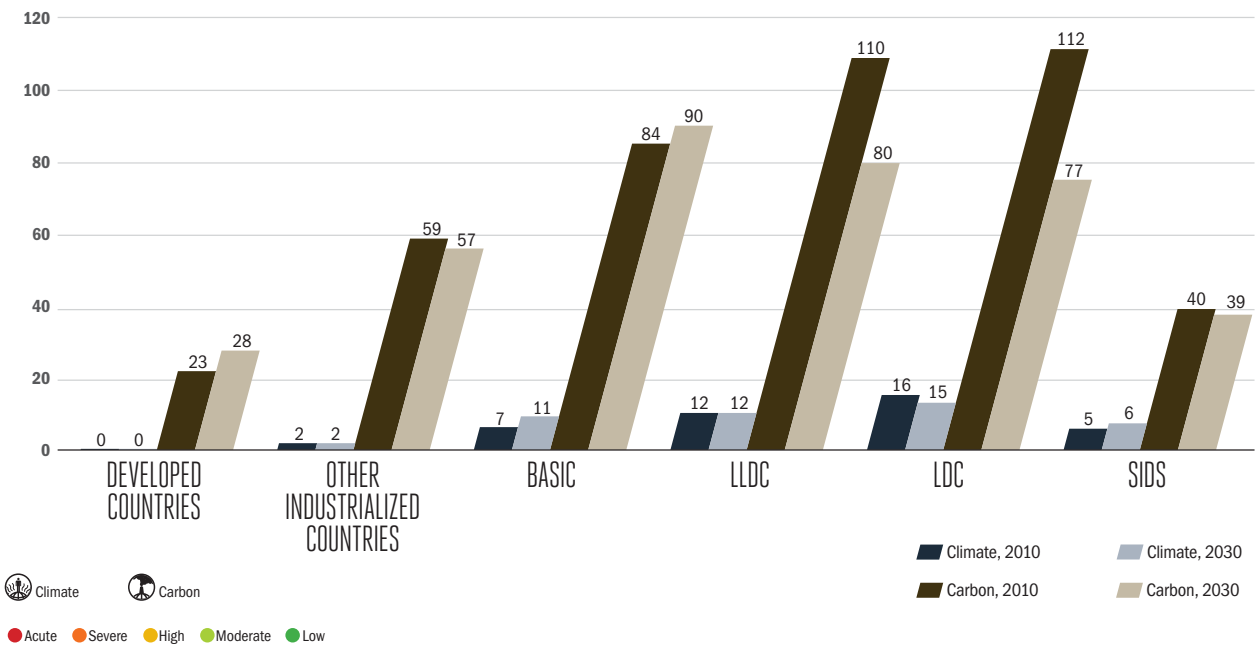
GEOPOLITICS

CLIMATE

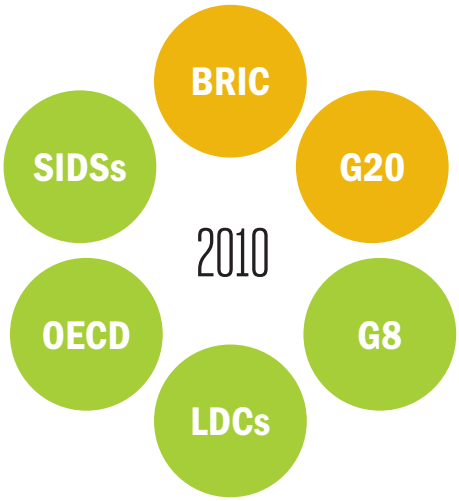


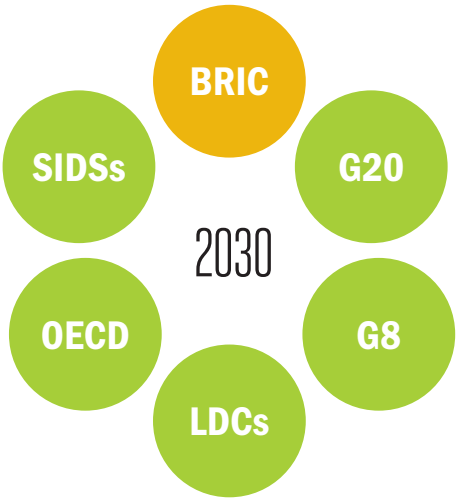


DEATHS DUE TO CLIMATE AND CARBON PER 100,000

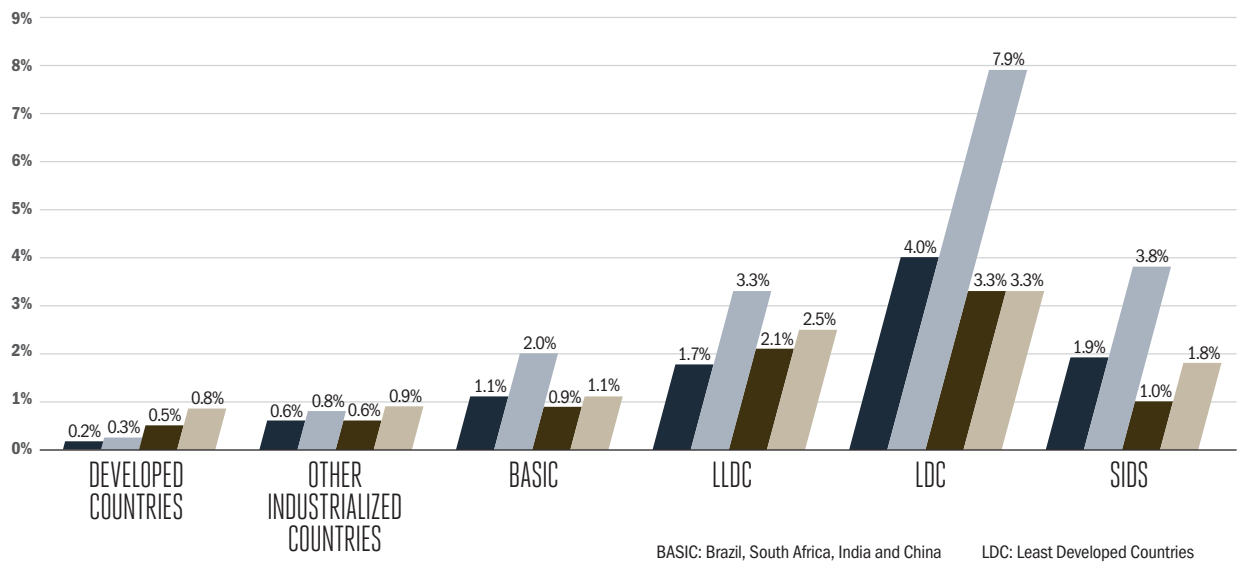


CARBON





COSTS DUE TO CLIMATE AND CARBON, % OF GDP



BASIC: Brazil, South Africa, India and China

LDC: Least Developed Countries

LLDC: Land Locked Developing Countries

SIDS: Small Island Developing States

HOTSPOTS

CLIMATE

2010 2030

182,000 **INDIA** 333,000

17,000 **PAKISTAN** 37,000

26,000 **NIGERIA** 31,000

17,000 **DR CONGO** 25,000

15,000 **BANGLADESH** 21,000

10,000 **ETHIOPIA** 16,000

9,000 **INDONESIA** 13,000

8,000 **AFGHANISTAN** 13,000

7,000 **MYANMAR** 11,000

6,000 **SUDAN/SOUTH SUDAN** 8,000

6,000 **TANZANIA** 8,000

5,000 **UGANDA** 7,000

4,000 **MOZAMBIQUE** 6,000

4,000 **ANGOLA** 5,000

3,000 **BRAZIL** 5,000

3,000 **COTE D'IVOIRE** 5,000

3,000 **NIGER** 4,000

4,000 **CAMERON** 4,000

3,000 **BURKINA FASO** 4,000

3,000 **CHAD** 4,000

2010 2030

72 **CHINA** 727

89 **INDIA** 680

48 **MEXICO** 368

36 **INDONESIA** 282

21 **THAILAND** 166

14 **VIETNAM** 159

15 **MALAYSIA** 119

16 **BRAZIL** 118

45 **UNITED STATES** 116

13 **PHILIPPINES** 102

15 **NIGERIA** 94

11 **COLOMBIA** 87

11 **VENEZUELA** 84

11 **PAKISTAN** 81

7 **BANGLADESH** 69

17 **RUSSIA** 61

7 **IRAN** 50

5 **MYANMAR** 39

7 **ARGENTINA** 38

5 **SOUTH AFRICA** 32

Climate Carbon Economic Cost (billion PPP USD)

CARBON

2010		2030
1,379,000	CHINA	1,643,000
923,000	INDIA	1,059,000
148,000	PAKISTAN	234,000
123,000	INDONESIA	184,000
177,000	NIGERIA	168,000
99,000	BANGLADESH	118,000
84,000	AFGHANISTAN	114,000
81,000	UNITED STATES	112,000
107,000	ETHIOPIA	94,000
84,000	DR CONGO	91,000
98,000	RUSSIA	77,000
55,000	VIETNAM	65,000
50,000	BRAZIL	64,000
34,000	TURKEY	49,000
25,000	IRAN	48,000
32,000	PHILIPPINES	46,000
40,000	MYANMAR	45,000
34,000	JAPAN	41,000
39,000	ANGOLA	40,000
42,000	UKRAINE	39,000

2010		2030
71	CHINA	451
114	UNITED STATES	305
42	BRAZIL	298
39	INDIA	129
19	INDONESIA	121
22	RUSSIA	119
11	MEXICO	73
10	ARGENTINA	71
9	MALAYSIA	67
8	PERU	58
19	CANADA	53
6	COLOMBIA	46
10	ANGOLA	40
5	GABON	33
4	VENEZUELA	33
4	BOLIVIA	31
10	AUSTRALIA	26
4	THAILAND	19
9	JAPAN	18
5	PAKISTAN	18

MILLENNIUM DEVELOPMENT GOALS

END EXTREME POVERTY & HUNGER

UNIVERSAL EDUCATION

GENDER EQUALITY

CHILD MORTALITY

Floods & landslides · Storms · Diarrheal infections · Heat & cold illnesses · Hunger · Malaria & vector-borne · Meningitis · Drought · Biodiversity

Desertification · Heating and Cooling · Labour productivity · Sea-level rise · Agriculture · Fisheries · Tourism · Water · Forestry · Hydro Energy

Biodiversity · Fisheries · Oil sands · Air pollution · Indoor smoke · Oil Spills · Water

MATERNAL HEALTH

COMBAT HIV/AIDS & INFECTIOUS DISEASES

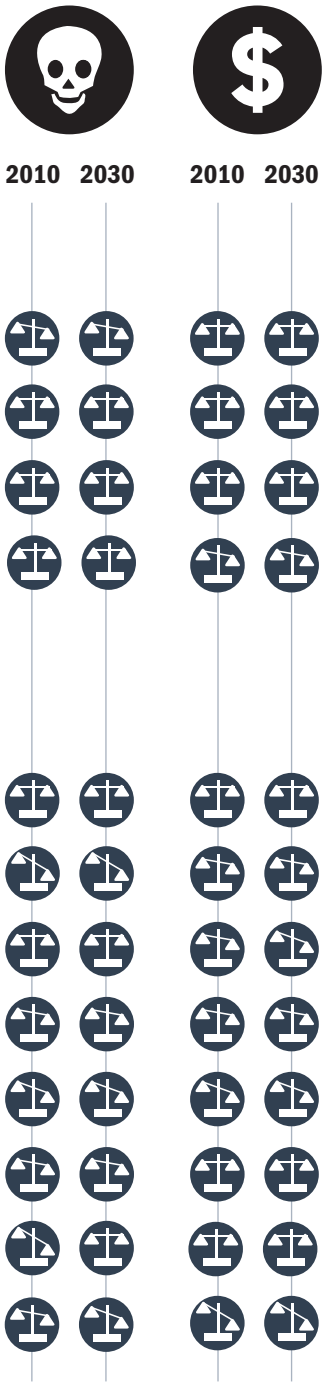
ENVIRONMENTAL SUSTAINABILITY

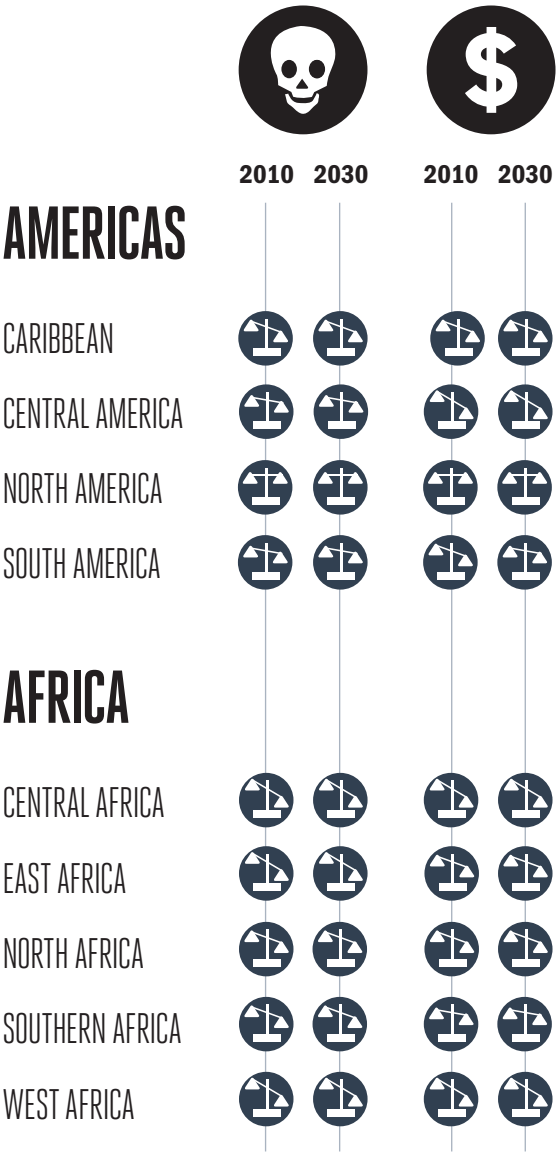
INJUSTICE

Floods & landslides · Storms · Diarrheal infections · Heat & cold illnesses · Hunger · Malaria & vector-borne · Meningitis · Wildfires

Permafrost · Forestry · Tourism · Desertification · Fisheries · Sea-level rise · Hydro Energy · Transport · Biodiversity

Heating & Cooling · Drought · Labour Productivity · Water · Agriculture


2010
2030
2010
2030
EUROPE
EASTERN EUROPE
NORTHERN EUROPE
WESTERN EUROPE
SOUTHERN EUROPE
ASIA-PACIFIC
AUSTRALASIA
CENTRAL ASIA
EAST ASIA
MIDDLE EAST
PACIFIC
RUSSIA/NORTH ASIA
SOUTH ASIA
SOUTHEAST ASIA


2010
2030
2010
2030
AMERICAS
CARIBBEAN
CENTRAL AMERICA
NORTH AMERICA
SOUTH AMERICA
AFRICA
CENTRAL AFRICA
EAST AFRICA
NORTH AFRICA
SOUTHERN AFRICA
WEST AFRICA

CLIMATE FINANCE

PRIORITY

Climate

Floods & landslides · Storms · Diarrheal infections · Heat & cold illnesses · Hunger · Malaria & vector-borne · Meningitis · Wildfires

Permafrost · Forestry · Tourism · Desertification · Fisheries · Sea-Level Rise · Hydro Energy · Transport · Biodiversity

Heating & Cooling · Drought · Labour Productivity · Water · Agriculture

In 2010, developed countries provided 14 billion dollars of their Official Development Assistance (ODA) as climate finance, a significant increase from around 7 billion in 2009. However, the degree to which these resources are "new and additional" as agreed at the international climate change talks at Copenhagen and Cancún is seriously in question. The Fast Start Finance target of 30 billion dollars over the three years from 2010 to 2012 would imply approximately 10 billion dollars' worth of new climate finance per year. While collectively climate finance for 2010 was a respectable 7 billion dollars higher than in 2009, only 5 billion is derived from increases in donors' ODA volumes – i.e. approximately 2 billion dollars of those resources have been either diverted or reclassified from existing ODA flows.

If, however, other commitments related to ODA are taken into account, the level of "additionality" and new finance diminishes considerably. In the 1970s, a collective commitment to provide 0.7% of the Gross National Income (GNI) of developed countries as ODA to developing countries was agreed to in the UN General Assembly. That commitment has been consistently met by a handful of developed country donors since the mid-1970s and has been reconfirmed in numerous official international contexts. The 2005 G8 summit at Gleneagles and the UN 2005 World Summit, which launched the Millennium Development Goals for 2015, saw a spate of new ODA commitments – including countries far behind the 0.7% target – all attempts to reach 0.7% by 2015, with interim ODA volume goals for 2010.

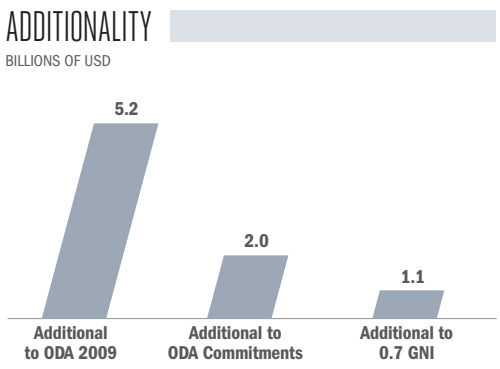
Only 2 billion dollars of new climate finance for 2010 is actually additional to these targets for progressing towards 0.7% of GNI or flows above that – commitments that had already been made by the same group of countries in order to support the achievement of the Millennium Development Goals, among other sustainable development priorities, such as Agenda 21. Given that today still only a fraction of countries have actually provided in excess of 0.7% GNI as ODA, just 1 billion dollars of new climate finance alone can be considered additional to this particular commitment.

To the degree, therefore, that commitments on climate finance are delivering, they are also unquestionably at the expense of previous commitments to related sustainable development priorities. Neither is the picture for 2011 likely to be substantively different, since under preliminary reporting, overall ODA has increased by just 3.9%, broadly enough to keep up with one year of global inflation over this period as reported by the International Monetary Fund. Furthermore, almost 90% of this finance was targeted towards mitigation activities, with 14% committed to adaptation – a clear discrimination versus the agreements made at Copenhagen and Cancún, whereby it was firmly agreed that there would be a balance of resources for the two purposes.

Financial flows in the form of aid or climate finance have been central to policy debate and intergovernmental negotiations for responses to sustainable development challenges and climate change. But ODA-related flows are only a fraction of the picture. Investment linked to projects of the UNFCCC's Clean Development Mechanism, for instance, are now several times the level of climate finance through ODA. More than half of ODA is, in any case, concessional debt – and a possible liability. More than half of all CDM projects, on the other hand, are estimated to result in a technology transfer of one form or another – a further bonus. Despite this, the CDM arguably absorbs much less of the attention of policy makers than finance. This is partly ascribed to the faltering political support currently enjoyed by the Kyoto Protocol mechanism. But the fact that China to-date accounts for almost 80% of all CDM investments by volume, and India for another 15%, does mean all other developing countries capture just over 5% of any investment flows. Many countries have no CDM projects at all and no national capacity to register CDM projects.

In an ongoing financial and economic crisis that runs parallel to time-restricted policy windows for addressing core global concerns such as climate change, a heavy reliance on further delivery through ODA finance is clearly a restrictive avenue of action. The example of the CDM also demonstrates the large-scale impact possible through policy frameworks with a bearing in the private sector, as opposed to ODA finance efforts, even when these are only moderately effective (given CDM coverage limitations alone). Effective policies for technology development and transfer, capacity building and regulatory mechanisms have the potential to yield significant impact in terms of implementation of sustainable development visions, including in the climate agenda, the Rio agenda and otherwise.

Climate change finance from developed countries to developing countries is reported by all donors as a part of their Official Development Assistance (ODA). This analysis was based on the Organization for Economic Co-operation and Development's (OECD) CRS database – the only truly comprehensive and comparable source of financial tracking available, although it is exclusively a donor reporting mechanism. Research focused on the latest data accessible, which is for the year 2010. 2010 is also the first year of so-called Fast Start Finance – additional commitments to climate change finance agreed at the UN Climate Summit at Copenhagen (COP15) and further confirmed at the next Summit in Cancún (COP16). The analysis has benefitted from the Rio markers for climate change used by donor governments and the OECD. Only finance to projects reported to have climate change as a principal objective were included in the analysis so as to retain comparability with sector-based development finance analysis, where partially related funding is ignored. That focus also partly addresses further concerns over the misrepresentation and double-counting of a share of climate finance as reported by other recent independent research into the topic. The approach used here represents just one perspective on monitoring international climate finance flows; other methodologies could have been chosen and would have likely yielded different results and conclusions.



INDICATOR OVERVIEW

	Impact Areas	Indicators	Confidence	Severity	Surge	Injustice	Priority	Gender Bias	Affected Country Group A	Affected Country Group R
CLIMATE		DROUGHT								
		FLOODS & LANDSLIDES								
		STORMS								
		WILDFIRES								
		BIODIVERSITY								
		DESERTIFICATION								
		HEATING & COOLING								
		LABOUR PRODUCTIVITY								
		PERMAFROST								
		SEA-LEVEL RISE								
		WATER								
		DIARRHEAL INFECTIONS								
		HEAT & COOL ILLNESSES								
		HUNGER								
		MALARIA & VECTOR BORNE								
		MENINGITIS								
		AGRICULTURE								
		FISHERIES								
		FORESTRY								
		HYDRO ENERGY								
		TOURISM								
		TRANSPORT								
	WORLD									
CARBON		OIL SANDS								
		OIL SPILLS								
		BIODIVERSITY								
		CORROSION								
		WATER								
		AIR POLLUTION								
		INDOOR SMOKE								
		OCCUPATIONAL HAZARDS								
		SKIN CANCER								
		AGRICULTURE								
		FISHERIES								
		FORESTRY								
	WORLD									

A Absolute (largest overall share of total negative impact) R Relative (highest share of total losses vs. GDP/per capita) Mo Model ES Emission scenario Additional mortality – yearly average

Info		Change		Impact					
Mo	ES		$	#	2010	2030	2010 $	2030 $	
Corti et al., 2009; Hoekstra et al., 2010; Rubel and Kottek, 2010; Sheffield and Wood, 2007	SRES A1B (IPCC, 2007)		↗71%	10			5,000	20,000	
Kharin et al., 2007	SRES A1B (IPCC, 2007)	↗4%	↗231%	8	2,750	3,500	10,000	95,000	
Donat et al, 2011; Mendelsohn et al., 2011	IPCC SRES A1B (IPCC, 2000)	↗24%	↗129%	7	2,500	3,500	15,000	100,000	
Krawchuk et al., 2009	IPCC SRES A2 (IPCC, 2000)		↗106%	14			-15	-90	
Baumgartner et al., 2012; Thomas et al., 2004	IPCC SRES A1B (IPCC, 2000)		↗74%	3			80,000	400,000	
Hansen et al., 2007	IPCC SRES A1B (IPCC, 2000)		↗56%	11			5,000	20,000	
Isaac et al., 2008	TIMER/IMAGE reference scenario for the ADAM project (Isaac et al. 2008)		↘19%	22			-35,000	-75,000	
Euskirchen, 2006; Kjellstrom et al., 2009	SRES A2 (IPCC, 2000)		↗174%	1			300,000	2,500,000	
Hoekstra et al., 2010; Nelson et al., 2001	UKTR GCM-based scenario (Nelson et al., 2001)		↗71%	5			30,000	150,000	
DIVA, 2003	A1F1 (IPCC, 2000)		↗115%	2			85,000	550,000	
Hoekstra et al., 2010; McKinsey and Company, 2009; Nohara, 2006; Portmann et al., 2010; Rosengrant et al., 2002	IPCC SRES A1B (IPCC, 2000)		↘68%	12			15,000	15,000	
McMichael et al., 2004	S750 (IPCC, 2007)	↗56%		15	85,000	150,000			
Curriero et al., 2002; Knutti et al., 2008; Toulemon and Barbieri, 2006; Van Noort et al., 2012	IPCC SRES A1B (IPCC, 2000)	↘20%		16	35,000	35,000			
McMichael et al., 2004	S750 (IPCC, 2007)	↗42%		17	225,000	380,000			
McMichael et al., 2004	S750 (IPCC, 2007)	↘15%		18	20,000	20,000			
Adamo et al., 2011; Sheffield and Wood, 2008	SRES A1B (IPCC, 2000)	↗25%		19	30,000	40,000			
Cline, 2007	Cline, 2007		↗157%	4			50,000	350,000	
Cheung et al., 2010; O´Reilly et al., 2003	SRES A1B (IPCC, 2000)		↗355%	6			15,000	150,000	
US Forest Service (2010)	SRES A1B (IPCC, 2000)		↗182%	9			5,000	45,000	
Lehner, 2003; Nohara, 2006	SRES A1B (IPCC, 2000)		↗134%	21			-5,000	-25,000	
ECLAC, 2011; Steiger, 2011	SRES A1B (IPCC, 2000)			20					
Jonkeren et al, 2011; Nohara et al, 2006	SRES A1B (IPCC, 2000)		↗96%	13			1,000	5,000	
					400,250	632,000	575,985	4,299,910	
CAPP, 2011; CERES, 2010			↗12%	5			5,000	25,000	
Muehlenbachs et al., 2011; Schmidt, 2004; Westwood, 2010			↗5%	3			10,000	40,000	
Costanza, 2006; Hooper, 2012; Reilly, 2008			↗109%	1			300,000	1,750,000	
OECD, 2012			↗24%	7			1,000	5,000	
OECD, 2012			↘18%	6			5,000	10,000	
Bell et al., 2007; OECD, 2012; Sheffield et al., 2011		↗32%		8	1,400,000	2,100,000			
OECD, 2012		↘17%		9	3,100,000	3,100,000			
BP, 2012; Mathers and Loncar, 2006		↘26%		10	55,000	80,000			
Martens, 1998; WHO IARC, 2005		↗87%		11	20,000	45,000			
Avnery, 2011; Hansen et al., 2007; Ramanathan et al., 2008; World Bank, 2005			↘494%	12			15,000	-150,000	
IGBP-DIS SoilData(V.0), 2008; OECD,2012			↗203%	2			10,000	75,000	
Costanza et al., 1997; OECD, 2012; Reilly, 2008; Wentzel, 1982			↗5%	4			30,000	85,000	
					4,575,000	5,325,000	376,000	1,840,000	

$ Additional economic costs in 2010 USD (negative numbers show gains) (thousands) – yearly average

Order no. of impact by overall economic scale versus the climate section (or carbon section for carbon indicators)