Towards a Global Climate Agreement

Synthesis Briefing Paper June 2009

ClimateWorks
REAL-WORLD SOLUTIONS

Table of contents

About Project Catalyst

Project Catalyst is an initiative of the ClimateWorks Foundation. ClimateWorks is a global, non-profit philanthropic foundation headquartered in San Francisco, California with a network of affiliated foundations in China, India, the US, and the European Union. The ClimateWorks family of organizations focus on enacting policies that reduce greenhouse gas emissions through three general policy areas: energy efficiency standards, low-carbon energy supply, and forest conservation/agriculture (see www.climateworks.org).

Project Catalyst was launched in May 2008 to provide analytical and policy support for the United Nations Framework Convention on Climate Change (UNFCCC) negotiations on a new international climate agreement. Project Catalyst members have been organized in working groups: mitigation, adaptation, technology, forestry, climate-compatible growth plans and finance. Each working group has received analytical support from the international consulting firm, McKinsey & Company. Working group members include a total of about 150 climate negotiators, senior government officials, representatives of multilateral institutions, business executives, and leading experts from over 30 countries.

Project Catalyst and its working groups provide a forum where key participants in the global discussions can informally interact, conduct analyses, jointly problem solve, and contribute ideas and proposals to the formal UNFCCC process. This paper summarizes output from Project Catalyst, but the views expressed in this paper have not necessarily been endorsed by all of the members of Project Catalyst or by their governments or organizations. The ClimateWorks Foundation takes sole responsibility for the content of this paper.

Introduction — Why we need a global agreement

In December 2009 representatives from 192 nations will meet in Copenhagen to complete negotiations on a global climate agreement. This paper summarizes why action in Copenhagen is urgently required, what needs to be accomplished in the negotiations, and how an effective climate regime might be designed.

The overall message of this summary is that climate change is a solvable problem. If we act quickly, we can contain the risks from warming and adapt in ways that are consistent with goals for sustainable growth and development. The technologies required are largely available today and the costs are manageable—even in the current economic climate.

But *how* the world shifts rapidly from its current high-carbon path to a low-carbon, climate-resilient path presents several challenges, given the existing high-carbon asset base coupled with system inertia. Infrastructure needs to change, technologies need to diffuse, behaviours need to evolve, all underpinned by deep, irreversible shifts in policies and regulatory incentives. Although the incremental costs of such a transition are manageable and will decline over time, there will still be costs in the near- to medium-term. And like any other economic transition, it will create winners and losers whose adjustment costs need to be addressed.

A particular challenge of this transition is the speed with which it must occur. Global greenhouse gas (GHG) emissions have risen significantly over the past 15 years, from roughly 38 gigatonnes (Gt) in 1990 to over 45 Gt in 2005 (despite the steep decline in emissions from former Soviet Union countries).[1] The business-as-usual (BAU) forecasts suggest that, absent fundamental policy and technological change, global emissions will reach 61 Gt by 2020 and 70 Gt by 2030. The science tells us that to stay on a 450 parts per million (ppm) pathway (which gives a 40–60 percent chance of keeping global warming to within 2 degrees Celsius above pre-industrial levels), global emissions need to peak before 2020 at less than 50 Gt and then decline sharply thereafter.[2] We do not have the luxury of time to enter into a global climate agreement where developed countries move first and developing countries follow on behind. Instead, the vast global differences in economic development need to be taken into account by providing adequate financial and other support for abatement, low-carbon growth, and greater climate resilience. Only if all countries put in place plans for sustainable, low-carbon development, starting now, do we have a reasonable chance to contain climate risk. The 'global deal' needs to unleash a dynamic, competitive race to a low-carbon economy—one which delivers measurably superior performance to the high-carbon economy permanently—within the next one to two decades.

While the private sector will carry out most of this transformation, it will not occur without policies that create the necessary incentives and mandates. Such policies include energy efficiency standards for industry, buildings, and transport; policies on renewable energy, sustainable forestry and agriculture; mechanisms for putting a price on greenhouse gas emissions; investment incentives for clean technologies and infrastructure; and measures to adapt to unavoidable climate change. If such policies are well designed, they can cost-effectively reduce emissions, increase energy security, make economies more robust, boost innovation rates, and support economic growth and development.

Global success in moving to a low-carbon, climate-resilient path will thus depend on whether these policies are enacted swiftly and ambitiously. But if that transition lies largely on the shoulders of national governments working in concert with the private sector, one might rightfully ask why we need a global agreement.

There are three things a successful global agreement must accomplish:

1. Create commitments and lead to actions by individual nations that add up collectively to meet the scale and urgency of the global challenge, in particular to 17 Gt of emissions reductions versus BAU by 2020;

2. Result in policies that mobilise the capital, technology and capabilities needed for low-carbon, accelerated economic development on a global basis;

3. Deliver the financial and technical support needed for developing country efforts to adapt to climate change and create climate-resilient growth.

Without these outcomes, it is unlikely that countries acting individually will respond quickly and aggressively enough to meet the threat that the science has identified. Transforming the global economy will be a multi-decade-long process and an agreement is needed that will help sustain action and ratchet up ambition over time and through political cycles. An agreement will need to be flexible enough to create early international action on all of these dimensions, as well as set up improved institutions that can adapt and scale up even further over time.

While achieving such an agreement is both politically and technically challenging, and the negotiations to date have at times been discouraging, such a deal is possible. It will inevitably involve trade-offs and compromises—particularly between developed and developing countries—but the elements of a workable architecture are beginning to emerge.

The paper is organized as follows:

I. The case for action—the key scientific facts that need to inform any agreement

II. Costs and opportunities—an assessment of the economics of a low-carbon, climate-resilient transformation

III. What a global agreement must accomplish—given the science and economics, the outcome a deal must deliver

IV. Elements of a potential agreement—discussion of the key building blocks of a potential agreement

More detail on each of the major points and proposals discussed in this paper is available in further working papers from Project Catalyst.

I. The case for action

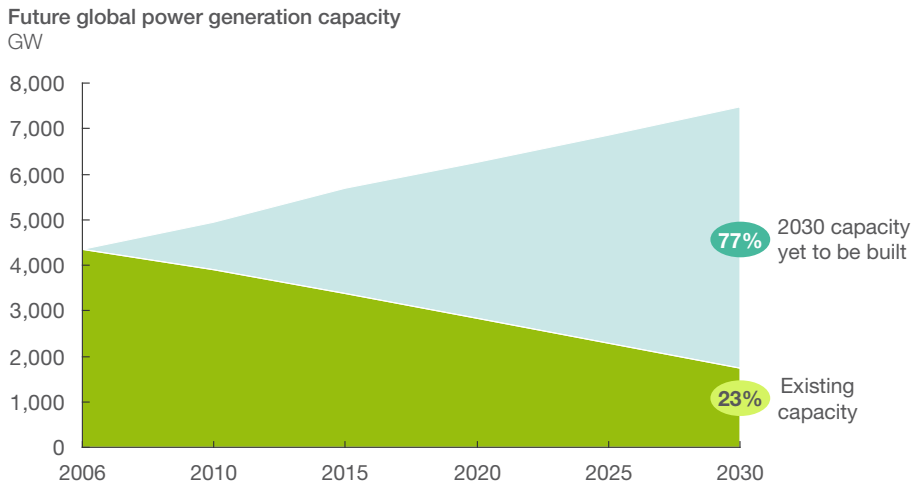
The risks from climate change are large and growing; without immediate action the world may lose its ability to contain warming to below 2 °C.

The IPCC's 2007 assessment clearly demonstrated that climate change is caused by human activity and is already occurring, and that warming greater than 2°C presents a severe danger to human society.[3] Since 2007, the scientific evidence has only confirmed this assessment and become more concerning. Emissions growth rates are at the upper boundaries of the IPCC's worst case scenarios, arctic sea ice loss is faster than forecast, melting of the ice sheet in Greenland and Antarctica is accelerating, sea level rise is at the upper end of IPCC projections, and additional non-linear risks have been revealed that could make certain climate changes irreversible.[4]

Even if warming is contained to below 2°C, significant climate change is already unavoidable. Many countries, particularly in the developing world, are by now facing mounting adaptation challenges—agricultural loss, water shortages, flooding, severe weather, and the spread of disease vectors.[5]

The economic crisis is temporarily slowing emissions—we estimate a 1–3 percent reduction of global emissions by 2020—but it has not fundamentally changed their trajectory. Despite the economic slowdown, the developing world will add massive amounts of infrastructure during the next two decades and the developed world will replace much of its energy related capital stock—77 percent of the world's power supply for 2030 has yet to be built (Exhibit 1).

Exhibit 1: Power supply yet to be built

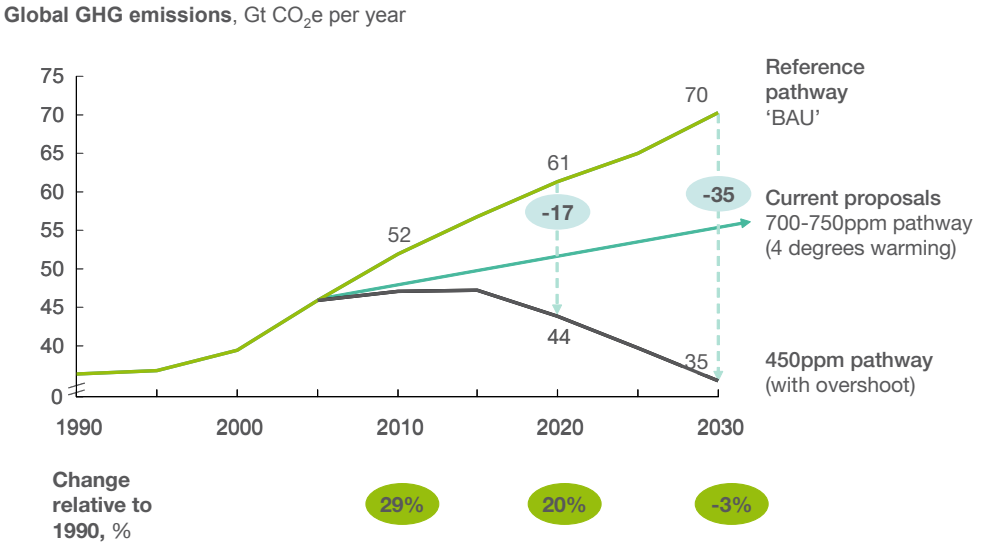


Source: IEA; Project Catalyst analysis

There is a reasonable chance (40-60 percent) of containing warming to below 2°C if long-term greenhouse gas concentrations are stabilized below 450 ppm carbon dioxide equivalent (CO_2e). But without urgent action we may find it impossible to stabilize concentrations at 450 ppm, let alone at lower levels that we may come to aspire to as we learn more about the impact of climate change.[6]

Current commitments and actions are insufficient to steer the world on to a 450 ppm path (Exhibit 2). Unless all parties lift their ambitions, the likely outcome is warming of at least 4°C, with a non-negligible risk of catastrophic warming above 6°C. To get on the 450 ppm pathway, the maths shows that the global economy needs to peak emissions before 2020, that developed economies need to be on a sharply declining emissions pathway immediately, and that middle income countries will need to deflect significantly from BAU paths, in many cases peaking emissions by the mid-2020s. Instead of locking in high-carbon infrastructure, countries must speed up the deployment of technologies with potential for long-term carbon reduction. And given the decades required to fundamentally re-structure economies, they need to act *now*.

Exhibit 2: Current proposals put us on a 700-750 ppm path and 4 degree future



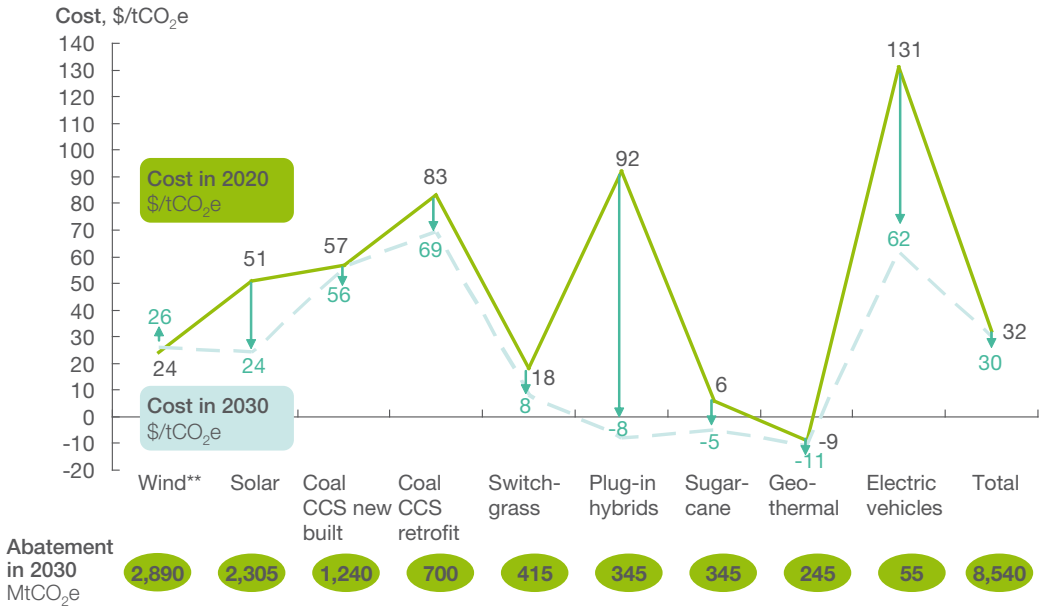
Source: McKinsey Global GHG Abatement Cost Curve v2.0; Houghton; IEA; US EPA; den Elzen, van Vuuren; Project Catalyst analysis

II. Costs and opportunities

The costs of addressing climate change are manageable. Low-carbon investments can create new sources of growth and jobs, greater energy security, and a better model for economic development.

Existing technologies can achieve over 90 percent of the global emissions reductions needed by 2020—technology costs are already rapidly declining and new technologies will further reduce costs and increase effectiveness (Exhibit 3).[7]

Exhibit 3: Potential cost declines* for selected low-carbon technologies



* These costs are the weighted average of all abatement opportunities operative in the relevant year (even if infrastructure built/started in earlier years) not the actual costs of new technology deployment in that year

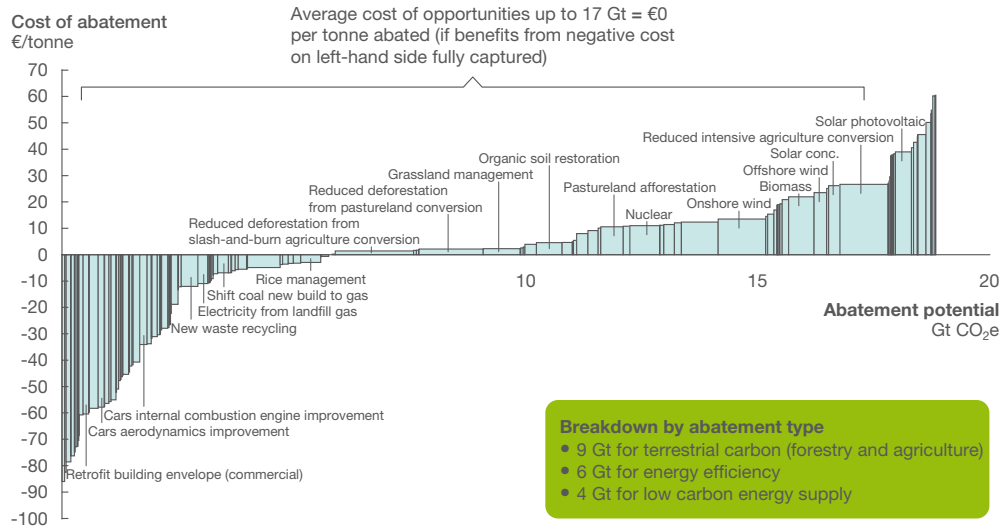
** Increase in costs due to shift from onshore to offshore and other more expensive sites over period

Source: McKinsey Global Greenhouse Gas Abatement Cost Curve v2.0; Project Catalyst analysis

The costs of low-carbon transition are manageable. A global bottom-up analysis of over 200 abatement actions shows that the net cost to society as a whole of a low-carbon transition to a 450 ppm path could be approximately zero, as many of the gains from energy efficiency measures offset other, costly actions (Exhibit 4).[8] Even if energy efficiency savings are not counted and transaction costs are included for the whole set of abatement opportunities, the incremental cost of achieving a 450 ppm path is €55-80 billion per year between 2010–2020 for developing countries[9] and €40–50 billion for developed countries, or less than 1 percent of global GDP, compared with the €215 billion per year currently spent subsidizing fossil fuels.[10]

Exhibit 4: Abatement potential and cost for year 2020

McKinsey Global GHG abatement cost curve, 2020
(up to costs of €60 per tonne abated)

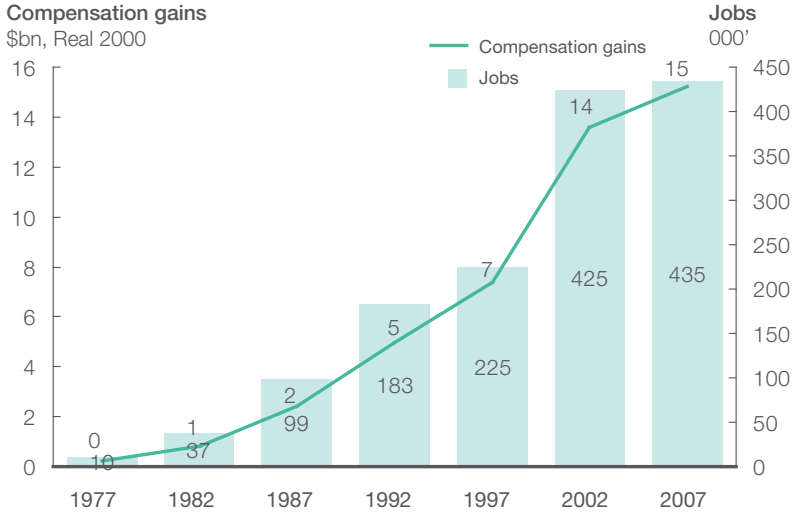


Source: McKinsey Global Greenhouse Gas Abatement Cost Curve v2.0

These transition 'costs' are in fact investments in modern, low-carbon infrastructure (e.g., cleaner power, better buildings, more efficient transport and industry); approximately one-third pay for themselves with energy savings with an average return of 17 percent on investment.[11] A growing body of studies shows that a period of elevated low-carbon investment would be likely to stimulate economic growth, as have past investments in railroads, electrification, highways, and broadband.[12] Low-carbon policies and investments are creating jobs today—the US renewable power sector for example employs approximately 400,000 people, and California alone has created 450,000 energy efficiency jobs (Exhibit 5). Germany has created 25,000 new jobs and preserved 116,000 existing ones by upgrading the efficiency of its apartment buildings.[13] There is significant evidence that low-carbon investments create more jobs than higher-carbon choices for an equivalent unit of capacity; for example it is estimated that every $1 million invested in new energy efficiency projects in the US creates 21.5 new jobs, compared with 11.5 for natural gas.[14]

Exhibit 5: Jobs created from energy efficiency policy—California example

Energy efficiency related* new jobs and consequent employee compensation gains



* Estimated by CERES on the base of re-direction of efficiency gains towards other goods and services. Includes inner-state job loss impact due to reduced energy production sector

Source: CERES; Clean-tech Venture Network; Global Insight; Project Catalyst analysis

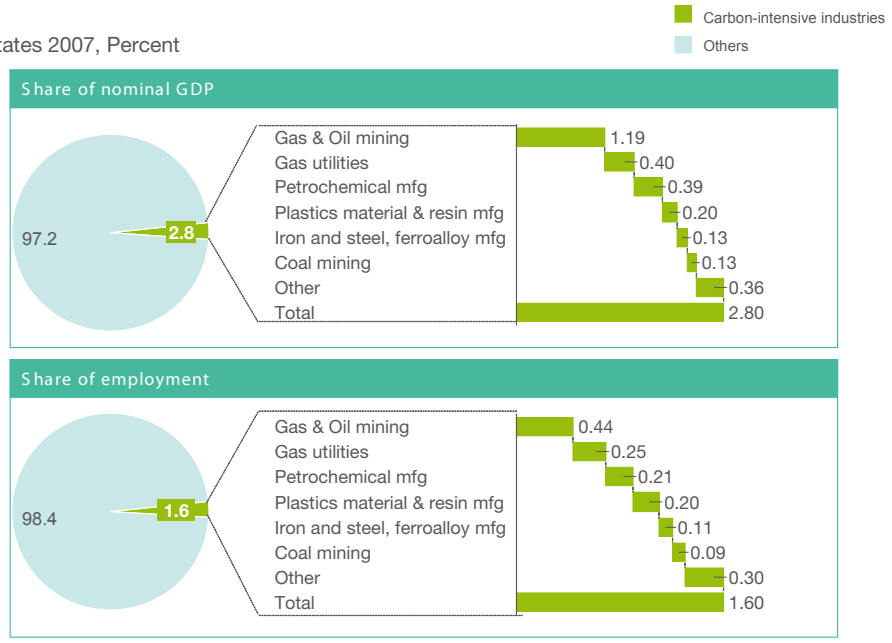
While no country has yet achieved the level of carbon productivity that will be required—€5,800 of GDP per tonne emitted by 2050—evidence shows that economies as a whole are able to dramatically increase carbon productivity as they grow.[15] For example, California succeeded during the past 30 years in keeping its energy consumption flat while nearly doubling its GDP. By contrast, the U.S. as a whole grew less quickly and increased its energy consumption more than 40 percent over the same period. Denmark offers another example of low-carbon prosperity, where economic activity increased by more than 45 percent between 1990 and 2007, while CO_2 emissions fell by more than 13 percent.[16] A projected 'low-carbon growth pathway' for Mexico also illustrates the potential for low-carbon growth to create jobs—an extra 500,000 by 2030 compared with BAU.[17]

While economic growth and employment could increase during a low-carbon transition,[18] as with any large economic change there will be businesses and individuals who lose out. Evidence suggests, however, that this is likely to occur in relatively few industries and regions, that losses could be limited, and that they could be managed through careful adjustment assistance (Exhibit 6).[19]

US EXAMPLE

Exhibit 6: Carbon-intensive industry share of GDP and employment

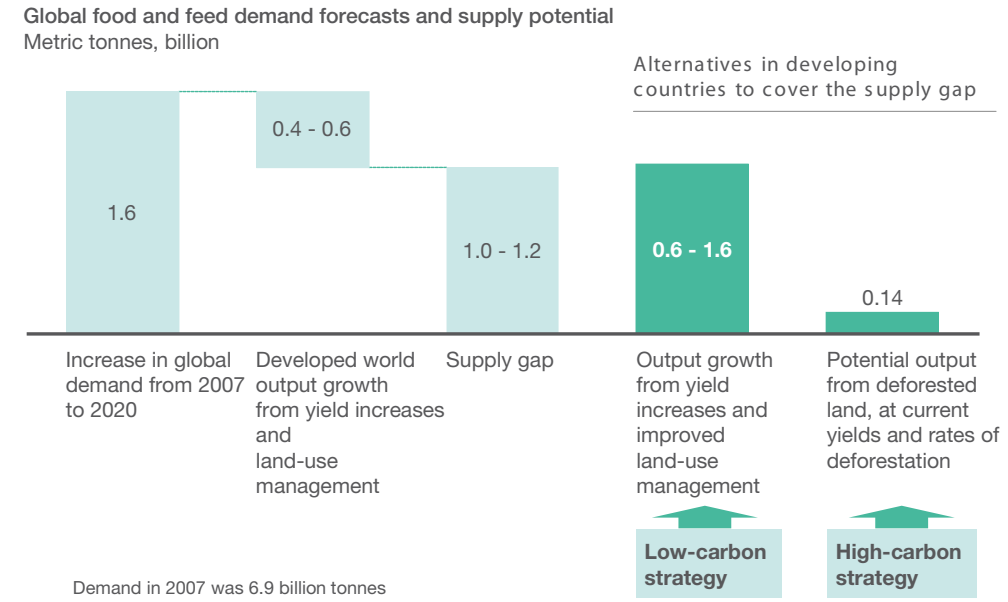
United States 2007, Percent



Source: U.S. Bureau of Labor Statistics: Ho, Morganstern, Shih (RFF 2008); Podesta, Stern, Batten (Center for American Progress 2007) BEA, Moody's economy.com, Global Insight; Project Catalyst analysis

Low-carbon investments have the potential to reduce global energy demand by 20 to 24 percent by 2020 (relative to BAU), increasing energy security, reducing energy prices and volatility, and increasing global financial stability.[20] These effects would help to offset any increase in unit energy prices resulting from the shift to (initially more expensive) clean energy sources. Low-carbon and adaptation investments offer significant additional benefits for developing countries, such as better health from lower particulate emissions, greater agricultural and land-use productivity (Exhibit 7), greater water and energy security, less vulnerability to energy price shocks, and opportunities to leap-frog to new technologies such as village solar or sustainable biofuels. Low-carbon economies will need to offer demonstrably better outcomes of this nature to society overall, steady-state, following the immediate years of transition.

Exhibit 7: Low-carbon agricultural strategies to help meet rising food demand



Source: FAO; Global Insight; Project Catalyst analysis

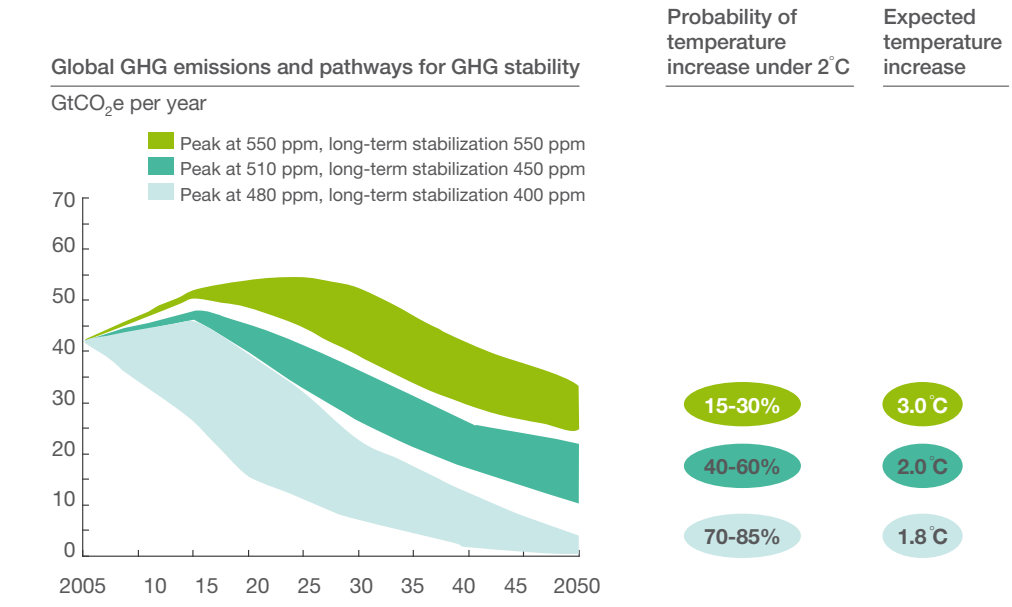
III. What a global agreement must accomplish

There are three outcomes a global deal must deliver: emissions growth reductions, low-carbon, accelerated economic development, and climate resilience for developing countries.

1. Managing climate risk requires global emissions reductions of at least 17 Gt versus BAU by 2020

The most aggressive category of mitigation scenarios contained in the IPCC's Fourth Assessment in 2007 refer to stabilizing atmospheric concentrations of CO_2e at 450 ppm. This would provide a 40–60 percent chance of containing warming to 2°C above pre-industrial levels. However, since that Assessment a number of prominent scientists have presented evidence suggesting that 450 ppm may not be a 'safe level' and that pathways as low as 400 ppm CO_2e may need to be considered.[21] The mitigation path this paper analyzes includes peak CO_2e concentrations at 510 ppm and then reductions to 450 ppm (Exhibit 8). This path should be interpreted as the upper limit of what most scientists would view as an acceptable level of risk.

Exhibit 8: Potential emissions pathways and expected temperature increase



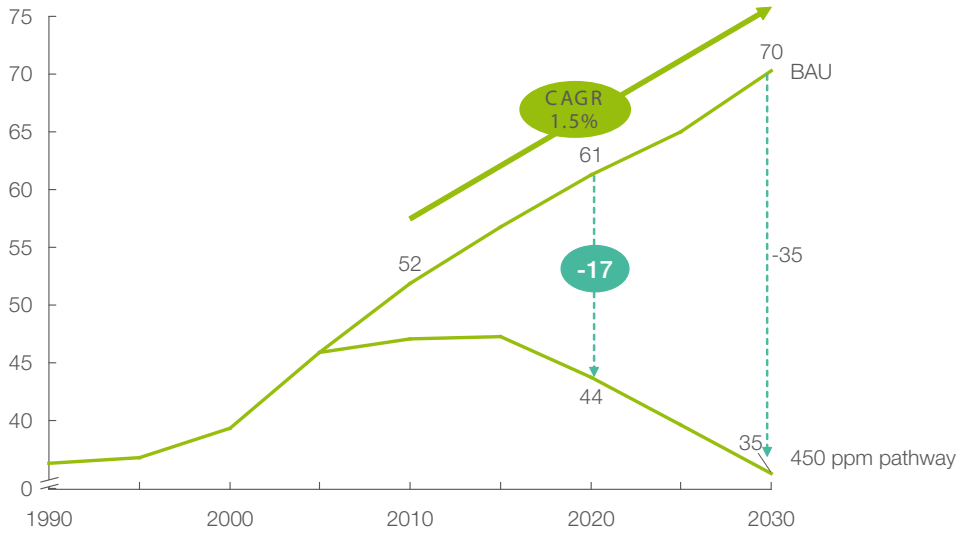
Source: IPCC WG3 AR4; Project Catalyst analysis

Achieving such a 450 ppm path requires global annual emissions to peak within the next decade and decline to 44 Gt CO_2e by 2020. This is compared to a BAU forecast of emissions of 61 Gt by 2020. Therefore a reduction of 17 Gt (28 percent versus BAU) is required by 2020 (Exhibit 9).

19 Gt of abatement is technically and economically feasible in 2020, with today's commercial or near-commercial technologies, at a cost below €60 per tonne (Exhibit 4). This potential comes from three main sources: greater energy efficiency in buildings, transport, and industry—6 Gt or 32 percent; low-carbon power—4 Gt or 21 percent; and better management of forests and agriculture—9 Gt or 47 percent.

Exhibit 9: Emissions reductions required versus business-as-usual

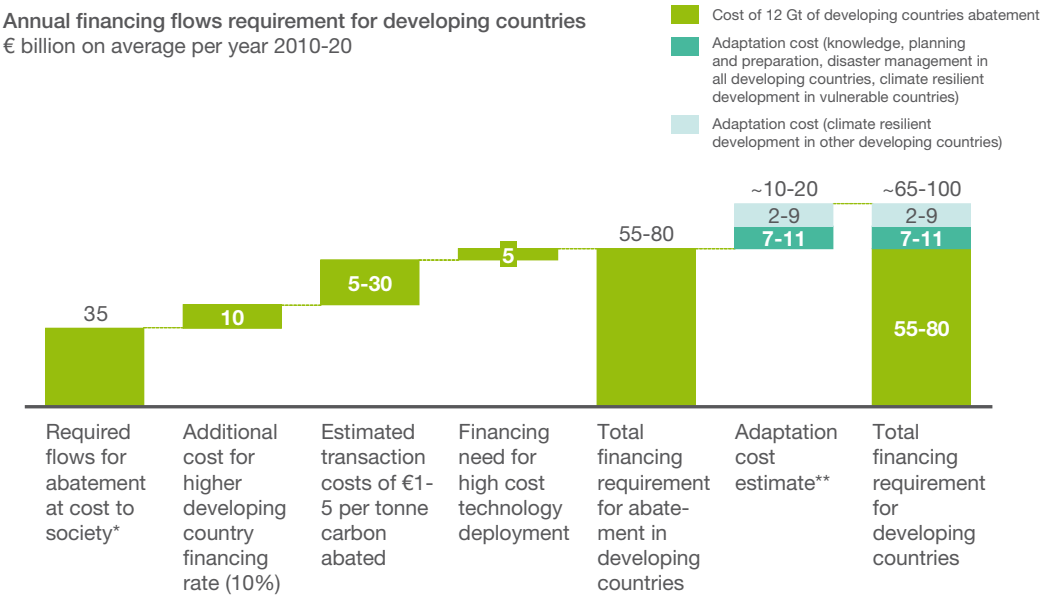
Global GHG emissions, Gt CO_2e per year



Source: McKinsey Global Greenhouse Gas Abatement Cost Curve v2.0; den Elzen, M.G.J. and M. Meinshausen, 2006: Multi-gas emission pathways for meeting the EU 2°C climate target; IEA World Economic Outlook 2007; Project Catalyst analysis

A 450 ppm path requires the world to capture 90 percent (17 Gt out of 19 Gt) of its 2020 abatement potential below €60/tonne and to lay the groundwork for continued rapid abatement beyond 2020—virtually every country must participate, all abatement options must be pursued, and every sector must deliver. We estimate that achieving a 450 ppm path will require developed countries to fund on average €55–80 billion per year in incremental mitigation costs in developing countries from 2010–2020 (Exhibit 10)[22].

Exhibit 10: Financing needs identified for developing countries



* Assumes all abatements delivered at average cost; 4% discount rate

** Based on increased financing for global public goods (including research), expected funding required priority investments for vulnerable countries (based on NAPA cost estimates), and provision of improved disaster support instruments (based on MCII work)

Source: McKinsey Global Greenhouse Gas Abatement Cost Curve v2.0; Bosetti; Carraro; Massetti; Tavoni; UNFCCC; Project Catalyst analysis

Proposals currently on the table or under consideration in the negotiations add up to approximately 8 Gt of abatement versus 2020 BAU, less than half the required amount.[23] This would put the world on a path towards atmospheric CO_2e concentrations exceeding 550 ppm—potentially by a wide margin. An effective deal to reduce climate risk would have to achieve stronger, mutually binding commitments.

2. An agreement must result in policies that create low-carbon, accelerated economic development

Given the economic and societal development paths of developing countries, a rapid, structural transition to a new economic growth model needs to be enabled by a global deal.

Low-carbon development will not only mean shifts to greater energy efficiency and carbon productivity—for example, middle-income countries' emissions will need to deviate 15–30 percent from BAU by 2020—it also means accelerated growth, often based on a shift of economic activity (and employment) to higher value-add, more knowledge-intensive sectoral composition of growth. Every country, whether developed or developing, will need to develop and implement its own tailored set of policies to best support low-carbon economic growth. In particular in developing countries, the transition to a low-carbon economy needs to be a net contributor to increased prosperity, more effective poverty alleviation, and greater economic security, rather than a perceived constraint. The global trading system will therefore need to be highly supportive of a more rapid migration by developing countries up the international economic value-chain—as a necessary pre-condition for low-carbon growth.

Low-carbon growth must therefore translate concretely into improved agricultural performance, accelerated access to low-cost, clean energy, a more sustainable approach to the development of urban and transport systems, and a step-change in energy efficiency, especially in the building and industrial sectors. The global deal should also support technologies which require scale deployment in developed and developing countries to become more cost-effective, and those which are critical to developing countries but currently under-supported by the private sector (so-called 'orphan technologies'). This could be particularly relevant to provide clean energy/water solutions to the 1–2 billion who today lack reliable, safe, or cost-effective access to energy.

3. The deal must provide support for the most vulnerable countries to adapt and become more resilient

A significant degree of climate change is already inevitable and all countries will need to take steps to adapt, including collecting better data on climate-driven risks, creating planning and response capacity, improving disaster management and insurance, and investing in climate resilient infrastructure and technology.

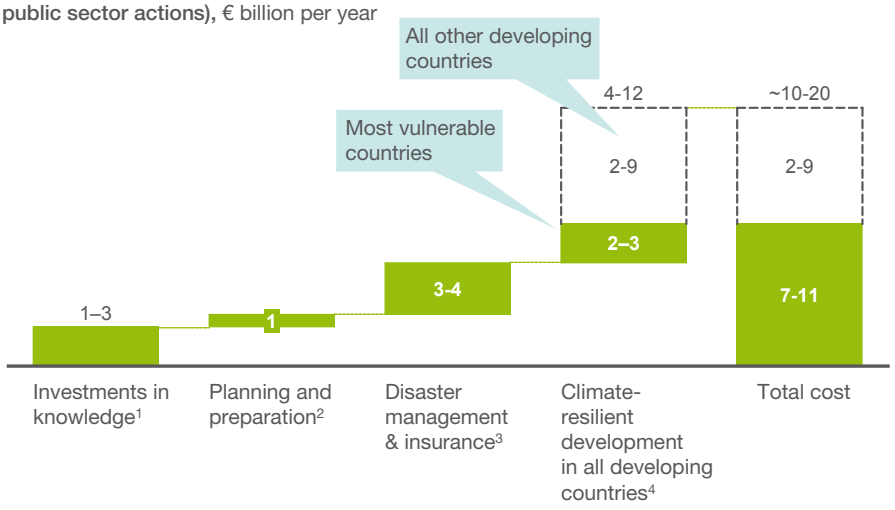
Developing countries face the greatest risks, have fewer resources able to buffer or insure against climate risk, and have the least historic responsibility for climate change. They are also likely to experience fast rates of infrastructure and urban development over the next 20 years—and would therefore benefit from climate-proofing these investments. More generally, developing countries will need to invest in new development strategies and policies, capabilities, and assets to overcome the challenge of developing in a more hostile climate. Some of these investments and policy shifts have the potential to improve underlying economic performance—but many will be a direct response to climate risk.

Estimates of adaptation costs for developing countries range from €3–89 billion[24] per year depending on time frame and methodology. We estimate a minimum of €10–20 billion per year will be needed in the near-term just for knowledge development, disaster management, and planning in all developing countries, as well as public sector investments between 2010 and 2020 (Exhibit 11), and potentially considerably more thereafter. A global deal must support these activities and investments.

FOR PUBLIC SECTOR ACTIONS ONLY

Exhibit 11: Financing required for adaptation up to 2020

2010-20 estimated annual adaptation funding requirements for developing countries (for public sector actions), € billion per year



1 Figures based on benchmarking of existing leading institutions (e.g. NOAA, NASA, Met Office, CGIAR)
2 Figures calculated on the basis of costs of Pilot Programme for Climate Resilience in 10 countries, scaled to all developing countries
3 Figures based on Munich Climate Insurance Initiative proposal
4 Figures based on UNFCCC cost estimates

Source: NASA; UK Met Office; NOAA; CGIAR; UNFCCC; NAPAs; Munich Climate Insurance Initiative; EM-DAT International Disaster Database; Project Catalyst analysis

An increasing number of developing countries are proposing forms of 'climate compatible growth plans' (CCGPs), containing measures to reduce emissions, accelerate low-carbon development, and increase climate resilience. These plans would articulate long-term sustainable, climate-resilient development strategies, specify near-term policies and measures, and commit to specific targets and outcomes. A deal could accelerate CCGP development and mobilise specific funding for them.
In each of these areas, an agreement will need to create early international action. It must also ensure that the institutional set up to achieve the needed abatement, growth and resilience is flexible enough to keep working as it scales up dramatically from now to 2020 and beyond.

IV. Elements of a potential agreement

By building on existing agreements in the United Nations Framework Convention on Climate Change, the Bali Action Plan, and emerging areas of consensus in the negotiations, it is possible to create an agreement that delivers the outcomes required over time. Such an agreement would have six major elements:

1. A long-term goal of limiting global emissions to 20 Gt (or less) by 2050

A long-term numerical goal in Copenhagen would be politically significant as it would enable world leaders to show their citizens that the countries of the world can come together and work towards a common objective. Long-term goals can also aid commitments to shorter-term goals and actions.

The IPCC identified a 50–85 percent reduction in annual CO_2e emissions versus 2000 by 2050 as consistent with stabilization at around 450 ppm, provided annual emissions peak no later than 2015. We would recommend articulating the goal as a fixed emissions ceiling on global annual CO_2e emissions by 2050 (e.g., 20 Gt, an approximately 50 percent reduction versus 2000) to avoid political arguments over base years (e.g., 1990 or 2005). Other options include a temperature goal (e.g., 2°C above pre-industrial levels) or a concentration goal (e.g., 450 ppm or below), but the advantage of an emissions goal is that it is directly measurable and relevant on an annual time scale. Other target formulations would be less direct, are subject to more interpretation, and only apply over longer time scales.

Some countries have proposed a long-term per capita goal, (e.g., 2 tonnes per person per year). If one views the atmosphere as a globally shared resource, this could be the most equitable long-term measure (given developed country responsibility for historic emissions, this forward-looking measure could be a minimal equitable position).[25] But given the wide disparity between countries on emissions per capita today—for example, 23 tonnes CO_2e per person for Canada versus below 2 tonnes for India—it is very unclear what convergence is possible by 2050. Nonetheless, per capita convergence of emissions is a principle that could be incorporated in an agreement even if specifications are added longer-term.

The 2050 targets need to be revisited at regular intervals, to allow for new scientific input based on IPCC assessments.

2. Developed country commitments to reduce emissions to 25–40 percent below 1990 levels by 2020

In Bali, developed countries agreed to undertake quantified emissions reduction targets that are 'measurable, reportable, and verifiable'. The IPCC has identified a 25–40 percent reduction for developed countries versus 1990 by 2020, and 80–95 percent by 2050, as equitable vis-à-vis developing countries and consistent with a 450 ppm path. Three key questions about developed country abatement have emerged in the negotiations. They concern reduction that should be accomplished domestically, comparable commitments between developed countries, and how to quantify reduction over time:

A. **Reduction that should be accomplished domestically:** For developed countries, a domestically delivered 25 percent reduction below 1990 would result in 2020 emissions of ~13 Gt versus a BAU estimate of ~22 Gt—in other words, an ~8–9 Gt reduction. However, research shows that

only about 5 Gt of abatement is available domestically at a cost of below €60 per tonne in these countries–beyond this level of domestic abatement in 2020, the cost rises very sharply. This analysis strongly supports the need for developed countries to meet the overall 25–40 percent reduction commitment versus 1990 through (i) achieving domestically a minimum of 5 Gt of the required ~8–9 Gt reduction (and more if further abatement opportunities are established); and (ii) funding and achieving ~3–4 Gt of additional abatement in the developing world to ensure the ~8–9 Gt target is accomplished. In addition, developed countries will need to provide incremental finance to support incremental costs in developing countries, as discussed later in Section 5.

B. **Comparable commitments between developed countries:** Based on the above logic, we suggest the benchmark below for comparing commitments. For each country, the benchmark consists of three components:

- Domestic abatement potential (e.g., potential below €60/t);
- Share of the global reduction commitment above domestic potential needed to achieve a 25–40 percent reduction below 1990 levels. This global reduction commitment of ~3–4 Gt (25 percent case) or ~5–6 Gt (40 percent case) should be shared among developed countries according to a measure of ability to pay (e.g., GDP). Eventually (cumulative) per capita emissions could be considered, to incorporate the 'polluter pays' principle;
- A share of the additional funding likely to be required to support developing country actions (e.g., on forestry, technology development, or adaptation). As above, this would be shared according to the ability to pay.

The first and the second component form the benchmark for the quantified reduction target, the third for the funding target. The latter can be converted into reductions by applying an average price for reductions to be funded.

Actual commitments can be compared to the benchmark, allowing for some substitution between the components as long as the total benchmark is achieved. (For example, a higher quantified reduction commitment could reduce the necessity for funding commitments.) Such a benchmark will be useful in comparing commitments, even if it is unlikely that any formula will be enshrined in the agreement.

Furthermore, credit will need to be reflected for efforts to date such as in high cost technology investment.

C. **Quantifying reduction over time:** The third issue is how to define the quantified reductions, notably whether a percent target against a single year should be used (e.g., 2020), or whether a longer-term path is defined (e.g., a full path to 2050). Ideally the full path would be defined as this gives greater specificity to commitments against which performance could be measured over time. But some countries find making such long-term commitments politically difficult, and there would be questions about the credibility of commitments stretching out beyond 2020. The developed countries agreed in Bali to have their progress against emissions targets measured, reported, and verified (MRV). In order to facilitate MRV and create symmetry with developing

countries, developed countries should prepare 'climate-compatible growth plans' and report on progress against those strategies along the same lines as described for developing countries below.

3. Developing Countries enact 'Climate-Compatible Growth Plans'

In Bali, developing countries agreed to undertake 'nationally appropriate mitigation actions' contingent on financial, technical, and other support from developed countries. The global agreement needs a mechanism for countries to gain recognition for their abatement and adaptation efforts and for channelling the flow of international support. We recommend that 'Climate-Compatible Growth Plans' (CCGPs) form the core component of that mechanism.

We recommend that the agreement require all countries (including developed countries) to create CCGPs. These plans would articulate long-term sustainable, climate-resilient, development strategies; specify near-term policies and measures (these are the 'nationally appropriate mitigation actions' or NAMAs and 'national adaptation programme of action' or NAPAs); anticipate or commit to specific outcomes; estimate incremental costs associated with carbon reduction strategies; and identify needs for financial, technology, and other support. Developing countries would receive financial and technical support for plan preparation.

CCGPs would follow common guidelines, have common data requirements, and draw on a 'tool-box' of best practice policies. Contents, however, would vary based on country-specific sectors, respective needs, and capabilities. Once completed, CCGPs would be entered in a UNFCCC registry enabling them to be subject to measurement, reporting and verification (MRV), and to be eligible for funding.

South Africa, South Korea, Mexico, and other countries have piloted this approach. Their experience shows that a key to success is using the process to create domestic political alignment and not just as an exercise in international reporting. They have also shown that many developing countries are willing to commit to early actions on low-carbon growth, based on an assessment of national development priorities and on the willingness to make a contribution to a collective global challenge.

Forests would be viewed as a sector in the CCGPs (albeit for some countries a very major one). By articulating forestry policies, economic development strategies for forestry regions, and funding needs, CCGPs would provide a vehicle for fully integrating forestry into the global agreement. Given that many rainforest nations are amongst the least developed countries, it may make more sense for them to generate land-use (forestry and agriculture) CCGPs rather than full national CCGPs. The key is to keep barriers to entry low, maximise participation of countries in an effective system, and accelerate learning through on-the-ground action.

There are significant questions as to whether the entire CCGP would be subject to MRV or just the specific actions (NAMAs and NAPAs) the country was requesting funding for. At a minimum, it would be highly desirable to have the full CCGP be reported to create transparency and enable sharing of best practices. It would also be highly desirable to extend national reporting requirements to include regular reporting on progress against CCGPs so that assessments can be made against overall treaty objectives. More intrusive forms of verification, however, could be limited to funded NAMAs/NAPAs. Developing country CCGPs should add up to total mitigation contributions which can be compared against some benchmark. Some researchers for example have suggested that a

developing country deflection of 15-30 percent versus BAU by 2020 would be consistent with an equitable contribution to a 450 ppm path.[26]

The system needs to provide the support and incentives that enable an exceptionally fast transition to a low-carbon growth pathway for rapidly industrialising nations. Under BAU assumptions, a set of rapidly industrialising nations[27] will account for over 30 percent of global emissions by 2020 and over 50 percent of emissions growth between 2005–2020. The challenge is both to decrease emissions of existing sectors as they grow, and also to shift towards a different sectoral mix of growth as part of their overall economic development strategy, especially given the global need to peak emissions before 2020. The system—extending beyond the climate regime—needs to support that deep shift in underlying development strategy.

Overall urgency suggests that a dual track process be followed that promotes early mitigation action while countries develop CCGPs. Some countries, including a number of rainforest nations, have already taken the lead in creating NAMAs. Such steps by developing countries need to be recognised and countries should be provided with accelerated access to funds with low entry hurdles to kick-start implementation of these NAMAs. NAMAs, which are likely to be project- or programme-level actions in these early stages, need to be funded through bilateral agreements or through the existing Clean Development Mechanism (CDM) until the fully-fledged financial architecture designed to implement the global deal becomes functional.

4. Technology supported by five specific measures

The most critical impact that the global agreement will have on technology will be the incentives created by national policies to spur innovation and deployment. The ambition level of those policies will in turn be linked to quantified targets for developed countries, CCGPs for developing countries, and to the effectiveness of transitional incentive regimes put in place to help level the playing field (versus incumbent technologies). The more ambitious the developed country targets and developing CCGPs, and the more efficient the design of national incentive regimes (such as feed-in tariffs), the more technology innovation and diffusion will exist.

For developing countries, the primary channel for technology transfer will be the acquisition of technologies on commercial terms through developed country support for full incremental cost (which includes technology costs). However, predictable funding for incremental clean technology-driven costs, while necessary, will not be sufficient to achieve the scale of global clean-tech deployment we need. In addition, there are five other contributions a global deal should make on technology:

- **Significantly increase developed country R&D investment into clean technologies**—As part of their commitment, developed countries could pledge significant increases in public sponsored R&D and specific incentives for private sector R&D, creating broad portfolios of innovation. History shows that such investments have positive spill-over effects for the world. Developed countries could also provide favourable IP access to developing countries on publicly funded innovations.

- **Create an R&D fund for developing country-specific technologies**—Developing countries will need more than just spillovers and diffusion of technology created in the developed world. While there may be high-impact opportunities for innovation, there may also be little commercial incentive to pursue that innovation. Solar-powered cook-stoves that reduce deforestation, fossil fuel use, and particulate emissions, are cheaper to operate, and have major health benefits could be a good candidate. Biochar tillage for agriculture or village solar might be another.

- **Support international pilot and demonstration projects**—International technology projects have a mixed history. However, there are a number of technologies that could benefit from international scale and expertise, particularly in the piloting and demonstration phase. Carbon Capture and Storage (CCS) is the prime example. Such pilots can also help accelerate diffusion. The key is to construct them as networks of companies (or in the case of more basic R&D, as networks of scientists) with governments as enablers (e.g., through risk-sharing arrangements) rather than as the principal actors.

- **A dispute resolution mechanism for IP with funding attached**—While there are disagreements in the negotiations over the significance of IP as a barrier, it is likely that a process will need to be created that can enable those who believe they are encountering IP barriers to have their issues heard and evaluated in a fact-based way. Such a process would only be used if existing (e.g., national, WTO) forums are not appropriate. Legal remedies would be difficult due to intersections with national and international IP law and the potential to create incentive problems for innovation. But the process could have a technocratic panel that could evaluate claims and offer financial remedies from a dedicated fund. There are other proposals for technology, including patent buy-out funds, or 'protect and share' proposals that effectively nationalize the risk of IP licensing. The common challenge with these proposals lies in the details of how they would be administered (e.g., how prices are set in a buy-out fund) and how disincentives for innovation are avoided—more work is needed.

- **Up-front support for capacity-building, standard setting, and training in the context of sectoral plans**—While funding of new technology remains the primary barrier to deployment in most developing countries, study after study makes it clear that there are a range of other barriers to technology diffusion which relate to qualified technical/engineering manpower, information availability, tacit know-how, regulatory system design, technical standards, contract negotiation, complementary infrastructure, financing, and risk management systems.[28] These barriers may be more prevalent in the least developed countries, but are also present in key sectors in rapidly industrialising nations. Capacity building or so-called technical assistance has become much maligned in the world of official development assistance (ODA) over recent years. The international community will need to get serious about providing effective support for human capital formation in developing countries, to have any hope of going after more than the lowest-hanging fruit.

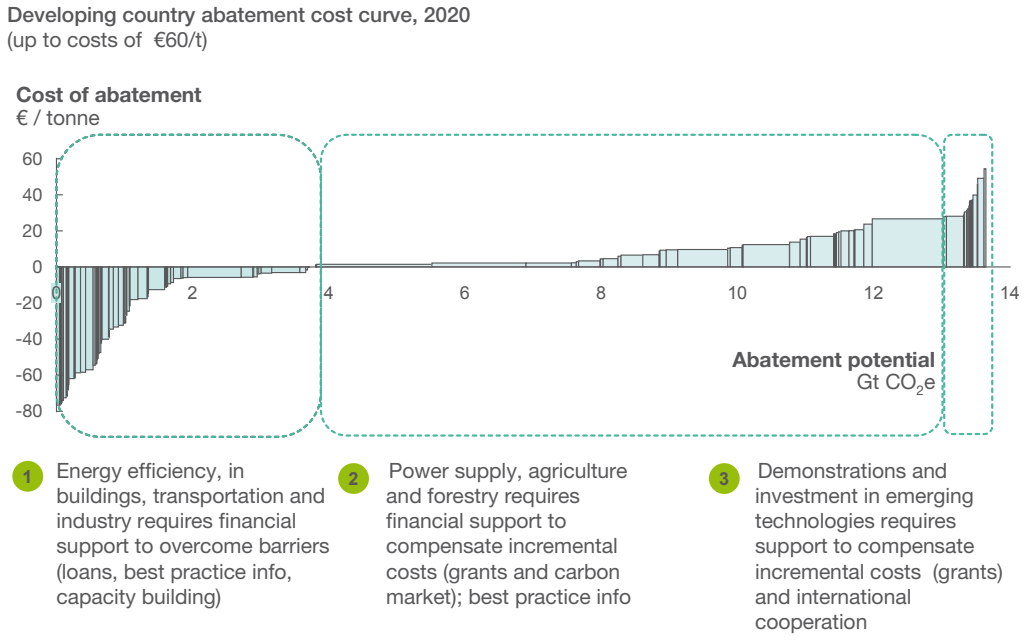
Finally, it is clear that the UNFCCC may not be the best forum for all technology issues. Detailed analyses of specific technology supply chains suggest that many issues are best resolved at the level of individual companies in bilateral discussions with the support of their respective governments. More broadly, bilateral technology cooperation between key trading partners could address many of the most important technology issues.

5. The finance and carbon market system must be dramatically scaled up

As discussed previously, we estimate that €55–80 billion in funding flows will be needed annually on average between 2010–2020 for the incremental costs of developing country abatement actions[29], plus €10–20 billion for a set of public adaptation actions in developing countries. We assume here that developed countries will need to support incremental costs in developing countries (Exhibit 12). This adds up to a total of at least €65–100 billion per year on average from 2010-2020, ramping up over that time.

- **What would the funding be used for?**
  - **Adaptation** (€10–20 billion)—This amount would include €5–8 billion for knowledge building (little data is available on adaptation challenges for many countries), planning and preparation, and disaster management and insurance in all developing countries. It would also include €2–3 billion for investments in climate-resilient infrastructure and technology for 'particularly vulnerable countries'[30] and a further €2–9 billion for other developing countries. It is important to note that these latter estimates include only public investments and are an average per year for 2010–2020 when climate impacts are still modest. Investments required are likely to rise sharply after 2020, even on a 450 ppm path.

Exhibit 12: Different financial support for different areas of the cost curve



Source: McKinsey Global Greenhouse Gas Abatement Cost Curve v2.0

- **Energy efficiency in buildings, transport, and industry** (€7–14 billion)—Because these actions generally have positive paybacks from energy savings and technically have no 'incremental costs', strong policies should attract private capital to them. However, public funding is needed to support policy implementation, build capabilities, acquire technologies, and provide access to capital. Much of this capital should be available in the form of long-term debt, potentially leveraging loan guarantees or first-loss provisions that could be funded during a transition period in which financial institutions learn how to credit-score energy efficiency debt.

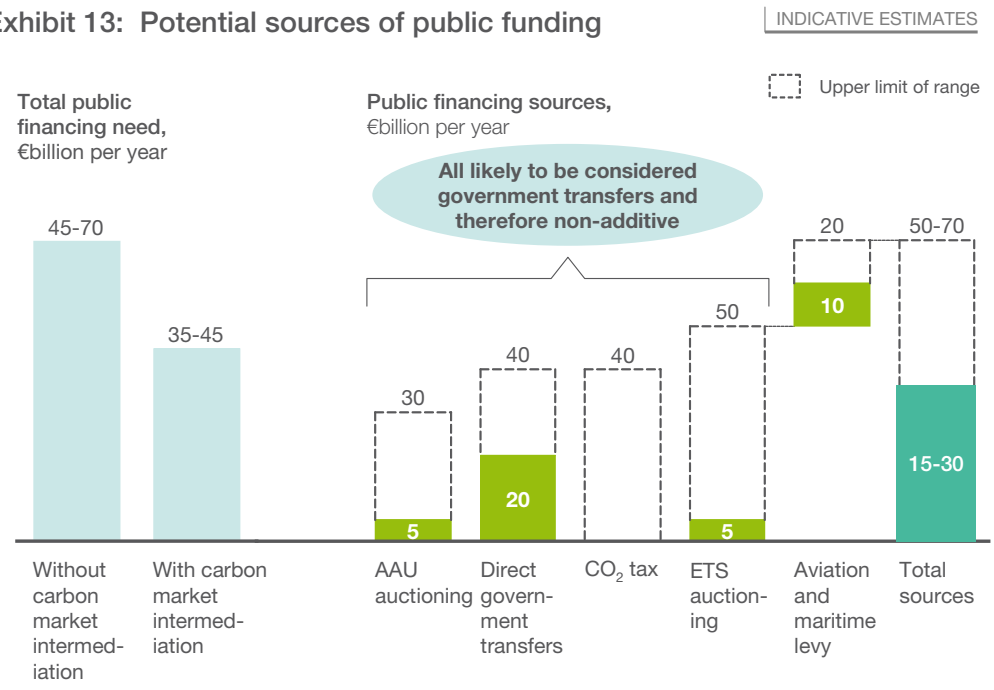
- **Low-carbon power** (€18–22 billion)—Grants are required to provide up-front planning, capability building, and policy support. Tools for mobilizing private capital and accessing technology include grants, loans, risk guarantees, and carbon market offset credits.

- **Forests and agriculture** (€25–39 billion)—Grants are required up-front for institution and capability building, policy support, and on-going policy implementation and enforcement; capital is also required for afforestation/reforestation. In the short-term, it appears unrealistic to integrate avoided deforestation into direct carbon offset markets, given limited demand for non-compliance grade credits. In the medium term, some aspects of forestry could be incorporated into the carbon offset markets as demand for credits scales up, and if institutions and methodologies for measurement, reporting, and verification (along with sector-specific insurance mechanisms to handle permanence and leakages issues) can be established.

- **New technology funding** (€5 billion)—While the above funding would include access to existing commercial technologies, additional funding would be required to demonstrate and deploy technologies with high learning potential relevant to developing country needs, such as solar PV, Concentrated Solar Power (CSP) and CCS.

- **What are the potential sources of funding for the incremental costs of mitigation/adaptation in developing countries?** Funding is always a difficult issue and will be more so in the current economic environment. In addition to any level of self-financing provided by developing countries (e.g., for negative cost abatement opportunities), several sources will be needed to achieve the range required (Exhibit 13):

Exhibit 13: Potential sources of public funding



Source: Project Catalyst analysis

– **Developed country public funds**—Money could be raised from general tax revenue, carbon-specific taxes, domestic emissions trading or system auction proceeds; international credits (AAUs) could be held back and auctioned (e.g., the Norwegian proposal). We estimate the Norwegian proposal could raise €5–30 billion per year. As national treasuries would likely consider a number of these sources to in effect be government transfers, they are unlikely to be fully additive. But a rough estimate across the set of public sources yields potential for €5–50 billion per year. The range actually achieved will depend significantly on budgetary and political considerations.

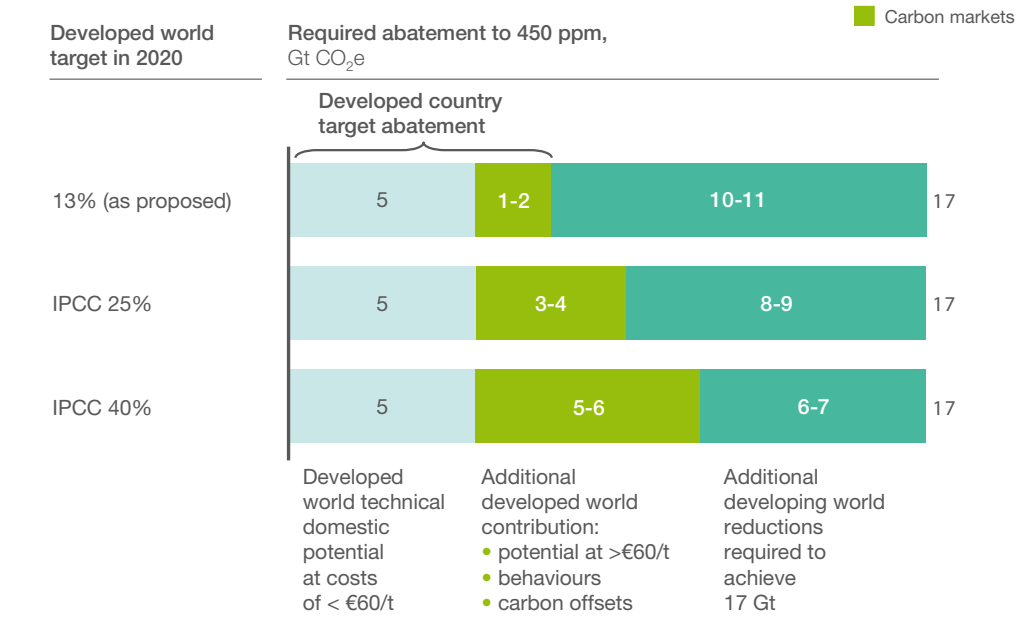
– **International sources**—A levy on international aviation and shipping emissions could yield €10–20 billion per annum between 2010–2020. These emissions would not be captured under developed country caps or developing country CCGPs.

We thus estimate the total that might be raised from these sources to be on the order of €15–70 billion per year (assuming broadly that they are not perfectly additive), well short of the €65–100 billion that we estimate is needed. Given current fiscal constraints, this estimate places a low probability on incremental ODA funding other than for adaptation (within the context of the Millenium Development Goals, e.g., around access to clean water/rural energy). Hence, the need for a third critical source of funding for developing country needs—the carbon markets in developed economies:

- **How might the carbon market support the financing system?** Given the scale of funds required and other sources described above, it is difficult to imagine a politically realistic scenario where the international carbon market would not play a major role. In addition to domestic carbon trading systems (e.g., the existing EU system, proposed systems in the US, Australia, and Japan), there exists an international carbon market created by the Kyoto Protocol that could be reformed and scaled up to meet Copenhagen objectives. The amount of credits required in such a system depends on the mitigation commitments by developed countries—the stronger the commitments, the more offset credits will be needed in the developed world and the more money could flow to developing countries.

  Depending on the price of carbon and the efficiency with which carbon market resources are allocated to pay for the incremental costs of carbon abatement in developing countries, we estimate that between 2–6 Gt of international or offset credits will be needed annually versus the 0.14 Gt flowing in the system today (Exhibit 14).

Exhibit 14: Developed world contributions over and above abatement achieved domestically



Source: Project Catalyst analysis

There are three broad options for scaling up the international carbon markets' offset systems: (i) reform and scale-up of project-based CDM; (ii) programme or sector funding; and (iii) indirect or intermediated programme funding, either at sectoral or national level. Each option has different pros and cons, and they are not mutually exclusive. They could be used to create, in effect, a progressive staircase to support developing countries as they build their own capacity to implement national CCGPs:

i. **Reform and scale-up CDM**—One option is to modify the Kyoto Protocol's CDM and attempt to scale it up. However, the mechanism's project-based nature and the bureaucracy around certifying projects has significantly limited its impact. It currently delivers 140 Mt (2008), equivalent to funding flows of €1.1 billion per year versus the €30–50 billion per year needed. Under most options being considered, project-based CDM would remain during a limited window, focused primarily on the least developed countries (with some grandfathering of projects in rapidly industrialising countries).

ii. **Programme or sector funding**—Another widely discussed option is to create a programme or sectoral crediting mechanism. Under such a scheme, a developing country would put forward plans to transform an industry sector (e.g., power or cement) in its CCGP. That plan would have quantified targets corresponding to tonnes of abatement that could be credited. Funding generated by carbon markets could be provided to pay for costs related to specific abatement plans (e.g., solar feed-in tariffs). Or countries with sector programmes—whether no-lose or based on 'hard sector caps'—could be granted direct access to developed country carbon markets to sell credits for performance against the agreed sector baseline.

   Such schemes would have five main benefits: (1) They could operate/deliver at scale. (2) They maintain a direct, more predictable link between tonnes delivered and payments. (3) They could ratchet up over time as domestic capacity and international benchmarks strengthen. (4) They could be designed to evolve through a series of time-boxed milestones—from programmes (e.g., a national renewables investment programme) through carbon intensity schemes to full sectoral caps. (5) Finally, they could also be structured with sector-specific 'exchange rates', related to sector- or country-specific differences in incremental costs. However, this might significantly increase the complexity of sector programmes. In addition, even the simplest sectoral schemes would require (a) an agreed methodology for establishing the baseline, calibrated against self-tightening international benchmarks; (b) additional sources of up-front funding, since in principle payments might all be ex post 'pay for performance'; (c) effective MRV capacity; and (d) an institutional mechanism within the developing country able both to set and enforce the sector baseline and, in effect, to allocate domestic allowances to the different industry players.

iii. **Indirect programme funding**—A third option would be to turn offset credits into a funding mechanism for national (or sectoral—e.g., forestry) CCGPs. This might work as follows. Developed countries would (a) create a pool of offset credits with an estimated value, (b) allocate the credits as a 'commitment' to trust funds established in developing countries against an agreed CCGP investment plan; and (c) grant them the right to sell these credits for cash into Annex-I country carbon markets on an agreed schedule. The developing country trust fund or funds would then use the money to support CCGP implementation with a charge to maximize the tonnes mitigated per credit received and dollar spent. The

performance of the fund or funds would be subject to MRV. While such a wholesale approach breaks the strict, direct one-to-one relationship between a tonne bought and tonne sold, it could actually yield more tonnes than a strict 1:1 relationship since the average cost of generating a developing country tonne is less than the developed country marginal cost of buying an offset credit.

This option would have a number of benefits. It would be highly flexible in terms of what it could fund, although the emphasis would still be on 'paying for tonnes'. It could most closely approximate incremental cost funding, based on an ongoing dialogue between the developed country (which provides the credits) and the developing country whose CCGP is getting funded. That ongoing dialogue could also be the basis for a wider set of mutual commitments and tacit know-how transfer, which go well beyond a carbon market transaction. Competition between developed countries to fund the most ambitious CCGPs could also create a positive race to carbon quality.

However, as with the other options, indirect programme funding has its own drawbacks. First, the flip side of greater flexibility is more discretion and hence, more need for bureaucratic approval mechanisms and audit controls. Second, the system might lead to developing countries bearing significant carbon price risk (although this could be hedged or eliminated completely with an agreed floor price for carbon). Third, a set of rules and standards would need to be put in place to ensure that good, ambitious CCGPs got funded on a consistent and transparent basis—not just those that are politically expedient.

Our hypothesis is that all three approaches to mobilising resources from the carbon markets could usefully be put to work within a global agreement—and that there would be real benefits from some competition between these approaches. We assume that most countries will seek to move rapidly from the project-based CDM given the scheme's relatively high cost-benefit ratio. Some developing countries (most likely, rapidly industrialising nations) may be attracted to move straight to the direct sectoral programme crediting approach, even though it is likely to provide only ex post financing and may impose strict MRV and baseline requirements. It is also likely that this option would set a maximum time window on, for example, sectoral carbon intensity programmes, after which developing countries would be expected to take on a full sectoral cap. Other developing countries may prefer to take the third option—indirect programme funding—on the basis of its greater flexibility and up-front funding provision. Assuming that the accounting system can be put in place, it should also be possible for countries to participate in two or three of these funding mechanisms simultaneously (e.g., going with sector crediting for power, and an indirect trust fund model for forestry).

For all the different possible permutations of funding sources, uses, and intermediation mechanisms, there are three cross-cutting success factors. First, there must be good information systems that enable performance to be measured, in both developed and developing countries. Second, there must be support for early action. Ideally, fast track actions can happen very soon, even before full CCGPs are ready, and the different mechanisms need to be up and running before 2012. Third, there must be rules which set mutual expectations, shape norms and ensure transparency. These rules must also foster overall resource allocation for the global system—helping guide resources towards the most cost effective, high-impact abatement opportunities.

Of course, these rules cannot exist in abstract form, but will be embedded in an institutional architecture.

6. Build an enduring, yet flexible institutional architecture

Just as there are various options for organizing the finance system, there are a number of choices in designing an institutional architecture to link developed country commitments, developing country CCGPs, the sources of financing, the uses of financing, and carbon markets. This system will have to be flexible enough to take risks in the early years to get initial funding and implementation going fast, and then ramp up fast in capacity and scale. There are three broad options:

- **Use existing institutions**—There is a large, complex network of existing national, bilateral, and multilateral funding institutions currently supporting various aspects of the climate issue, and there are existing structures for CDM, UNFCCC reporting requirements, etc. These could be scaled up and adjusted significantly. However, many developing countries feel existing governance arrangements are unfair, and many developed countries believe the existing institutions are not very effective. While existing institutions would certainly have a role to play under most scenarios, it is unlikely the existing system can meet the full needs of an agreement at the scale required over time.

- **Create a new global climate investment fund or portfolio of sector-specific funds**—There are proposals to consolidate funding flows and governance into global institutions. One existing template is the GEF/Adaptation Fund that was established in Bali, which has a governance structure existing of developing and developed nations and an international funding source in the form of 2 percent of CERs issued. Such a global fund could take in contributions from both developing and developed countries (e.g. based on a GDP-weighted formula), with 'windows' for specific activities (e.g., power, forestry), or could be designed as a portfolio of sector-specific or regional trust funds (with the over-arching resource allocation algorithm based on scale of abatement opportunity, incremental costs and emerging track record). If the governance challenge of setting up a major new global fund were believed to be too difficult, it might be possible to set up a new fund but under the trusteeship of an existing institution, such as the World Bank (or even IMF with carbon drawing rights in place of Special Drawing Rights or SDRs).

- **Create a series of national/regional funds and a matching process**—Each developed country could commit money and credits into a ring-fenced national fund for supporting developing country CCGPs (e.g., a U.S. fund). Likewise, each developing country registering a CCGP could create a fund to support its CCGP (e.g., an India or Brazil fund). There could then be periods during which the CCGP funds are 'filled' by developed country funds, following which funds could be accessed by developing country governments and drawn down.

Once the overall institutional structure is established in a global agreement, specifics will need to be addressed for MRV requirements for developed country mitigation and funding commitments, developing country CCGPs, carbon market mechanisms, and financing institutions. Practically, a blend of the above is likely to emerge, leveraging existing as well as creating new international and national institutions to handle both direct financing needs and also associated needs such as

standards, technology assessment and co-operation, dispute resolution, etc. The challenge will be to establish and maintain coherence and focused momentum across so complex a set of arrangements, especially as it emerges over multiple years. We believe the system would require:

- **Effective governance** overseen by the Conference of the Parties, a mandated Executive Board, and a set of 'governance principles' that will be applied to all institutions operating under the agreement.

- **Effective accountability** including adequate and consistent standards of governance, transparency, and financial integrity of all relevant institutions, including appropriate grievance and dispute resolution mechanisms.

- **Standards** mandated to set both MRV and standards for financial integrity and governance, and to conduct assessments focused on institutional adherence on behalf of the Conference of the Parties.

- **System integration** to provide a practical 'clearing house'; minimising the transaction costs of a parallel ODA system from the perspective of developing countries; and providing full visibility onto the international abatement opportunities (including their incremental costs) for both developed and developing countries.

Such arrangements could encourage a diversified and dynamic set of institutional arrangements to emerge. A mix of national trust funds, global fund(s), and an expanding set of carbon markets could co-evolve over time, each with a different role in the system, and each helping to shape rules, norms, performance metrics, information flows and decision rights—in others words, the new 'social contract' of a global low-carbon economy.

A key lesson of successful long-lasting international agreements is that they build trust amongst their members, create effective supporting institutions, and adapt to changing circumstances over time. Institutional learning will need to be fast and will need to encourage aggressive early action. The system will only achieve the necessary pace of development if individual countries or groups of countries take leadership initiatives and put bold plans on the table, ahead of the full articulation of a global architecture. The EU experiment in establishing a carbon market—for all its flaws—will dramatically accelerate the evolution of carbon markets in other developed (and potentially developing economies). Similarly, the development of the Amazon Fund by Brazil will powerfully shape and speed-up the practical design of a global REDD mechanism.

Developed countries will need to take the risk of funding abatement in developing countries before all the MRV systems are in place. Similarly, developing countries will need to take the risk of putting together CCGPs before all the required international funding is locked down. National, regional and bilateral initiatives, while not a substitute for coordinated global action, can and must act as system accelerators. Insofar as this creates an element of institutional messiness and competition for leadership, this is likely to be hugely beneficial for all parties. We need a global climate regime that is alive with scalable initiatives, regulatory innovation, new risk-sharing mechanisms, and competition for leadership. It must, within a clear starting set of targets and principles, use real-world experience to discover the rules, relationships, information sets, and market mechanisms needed for the system's further development.

Conclusion

Research shows that climate change risks can be mitigated and adaptation can be addressed at costs that even a troubled world economy can manage. There are enormous additional benefits to low-carbon growth, ranging from technology innovation that creates new jobs, to greater energy security, to cleaner, more efficient industry and agriculture, to health benefits, to preserving the biodiversity of the world's forests.

While it is in the self-interest of nations to pursue these benefits, it is unlikely that individual countries acting on their own will fully address the risks that climate change presents, or will capture the full benefits that low-carbon growth offers. Strong, rapid international commitments and action will need to move economies into transition fast, but also look forward to the 2020's when the low-carbon economy needs to perform better on its own terms than the high-carbon economy.

There will continue to be selective exceptions in which more carbon-intensive energy sources may not have viable substitutes for some years. But for every one of these exceptions, the rest of the global economy will need to move even faster towards the eventual tipping point when low-carbon models of production, distribution and consumption dominate their high-carbon alternatives.

This paper has attempted to demonstrate the value and potential elements of a global agreement. Through collaboration in Copenhagen, particularly between developed and developing countries, we have a chance to rise to the challenge and create a new, more sustainable vision of what our world might be.

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30 UNFCCC notes LDCs, small island developing states, and African nations in the grouping of 'particularly vulnerable countries'. The IPCC also includes mega-deltas in this grouping. In this paper, we have taken countries eligible for IDA-financing from the World Bank as a proxy for this grouping.

For media enquiries, please contact:
Tom Brookes
Tel: +32 2 894 9310
email: tom.brookes@europeanclimate.org

For general enquiries please contact:
project.catalyst@climateworks.org