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Working Paper

RAISING THE BAR:
CLIMATE ACTION SYNERGIES TO INCREASE AMBITION AND COOPERATION

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This Working Paper looks at the different ways that can help to make the most of Intended Nationally Determined Contributions (INDCs) by combining mitigation, adaptation, and means of implementation. INDCs are the pledges that each country has put forward for the 21st Conference of Parties (COP21), stating what they plan to do to tackle climate change. They can represent a long-term goal and vision of integrated climate action for the countries proposing them.

In recent UNFCCC debates between the mitigation and adaptation focus of INDCs, we highlight the importance of mitigation, while underlining at the same time the additional benefits that synergies between climate mitigation, adaptation and means of implementation can provide when deploying INDCs. As INDCs are advanced, there is an opportunity to clearly acknowledge these links; not only helping to move each country's contributions from 'intended' to 'implemented', but also by using synergies to increase the ambition of collective, long-term mitigation efforts and optimize domestic efforts. We examine how their development and implementation can help countries and groups of countries to take advantage of synergies and co-benefits that exist between climate action and domestic development objectives - while contributing towards a collective goal of staying below 2 degrees of temperature.

This Working Paper also examines examples of on-going efforts by different countries and actors along these lines, and considers how these can help countries to develop and become more competitive, while simultaneously reducing their greenhouse gas (GHG) emissions and becoming more resilient to climate change. We look at options for advancing these objectives within domestic and international climate initiatives, the opportunities for cooperation in the design, implementation and measurement, report and verification of these actions, and the benefits of doing so for both participants and the emerging multilateral regime. Finally, an annex integral to the paper models regional and collective global economic benefits of using synergies.

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1. Introduction

Of the 196 parties to the United Nations Framework Convention on Climate Change (UNFCCC), more than 120 are middle- and low-income countries. These countries typically have relatively low emissions and high exposure to climate change impacts, both of which are likely to increase substantially in the future. It can be argued that around 30 high-income countries are in a similar situation, having low emissions coupled with high exposure.

It has frequently been the case at UNFCCC debates in recent years, that many countries – mostly developed, but many developing parties as well – have prioritized mitigation contributions. Other parties who argue that their priority is adapting to climate change counter this focus. The former group, argues that adaptation only addresses local concerns, and that if adaptation was to be made the primary priority of the contributions, the chances to address the root cause of the problem will be jeopardized.

However, there has been much less of a collective conversation around an alternative. The alternative would highlight the benefits for INDC implementation of advancing both mitigation and adaptation in mutually supportive ways, which take advantage of their synergies, and those co-benefits that emerge from their joint deployment with increased cooperation and means of implementation. Properly advanced, this alternative could help raise individual mitigation contributions and/or parties individual capacity to face climate challenges.

INDCs implementation in this alternative would then be an opportunity to make the most of climate action and increase collective participation and ambition towards achieving dynamic economic growth trajectories that are both low carbon and climate resilient. This course of action would help to align national and international interests for greater collective action and cooperation, while increasing capacity of societies and economies to prepare and prosper even in the face of climate change impacts. Moreover, if more extended participation and ambition increases pressure for high-emissions countries and actors act on mitigation, it increases the chance of keeping warming to well below 2 degrees – the maximum agreed level needed to avoid irreversible catastrophic impacts – and reduces the need for adaptation to manageable levels. This will benefit all parties, but especially those more vulnerable to climate change.

Key questions

The ideas set out in this Working Paper come from the initial research into low-carbon societies conducted between 2007 and 2009. This was advanced with participation from research institutions in 20 countries (DEFRA, 2007; Strachan, Foxon, & Fujino, 2015). This programme of work called for deep changes – in both behaviour and technology – across different sectors to achieve the required low-emissions trajectories. Subsequent international research has continued to explore these arguments, more recently through a deep de-carbonisation project that involved a similar number of countries (Sachs et al., 2014; see also: http://unsdsn.org/what-we-do/deep-decarbonization-pathways/). Through this and other research, we now know keeping global warming below 2 degrees will require zero global GHG emissions in all regions sometime between 2050 and 2100. However, we also know that this will need to be achieved at the same time as severe climate impacts hit most regions, both developed and developing. Societies and economies will have to constrain their emissions while adapting to climate change and striving to develop.

Some interesting questions emerge from this research. A large majority of countries do not have large emissions, and their major costs relate to adaptation, rather than mitigation. Can INDC implementation take advantage of mitigation and adaptation interactions in a mutually reinforcing relation, which benefits both global and domestic interests? Can these interactions be used to expand mitigation contributions towards

climate stabilization from more parties, propelling the evolution of the climate regime now being negotiated in a more proactive direction? What opportunities this entails for cooperation across different levels of development?

The organisation of this Working Paper

A comprehensive response to the questions above will need to consider collective efforts and outcomes, as well as the circumstances facing many individual countries. It should also not neglect opportunities in countries whose emissions are currently low, but might grow rapidly in the future.

We have divided our arguments to explore the synergies, co-benefits and mutual support that arise from INDC implementation in five sections. After this introduction, section two puts forward our core hypotheses on both the priority of mitigation as well as the further untapped benefits of synergies between mitigation, adaptation and means of implementation,. The third section describes policy examples, the concept of low-carbon resilience, and how these can help to align INDCs with long-term development objectives. Section four highlights opportunities for cooperation and some potential common aspects of this. The conclusion summarises how the approaches described could contribute to the collective and national efforts, and the climate regime emerging at the UNFCCC. Finally, in the annex we detail the modelling used to arrive at these conclusions.

2. The interactions between mitigation and adaptation

Mitigation, adaptation and means of implementation have some differences in character which have made them to be treated separately at the UNFCCC. This is also reflected in the two negotiation tracks agreed in Durban in 2011: one towards a treaty, protocol, or decision with legal form to be agreed by 2015 (decided at the Paris COP) and to enter into force in 2020, including all aspects of climate action; and another to identify mitigation options in the meanwhile. In COP 19 at Warsaw in 2013, it was also agreed countries would make intended national contributions towards this goal (thus the INDCs)

A majority of negotiation groups at UNFCCC have prioritized mitigation action as the core of national contributions. This has included the Umbrella group (mostly formed by the US, Canada, Australia and other OECD countries) and in a more nuanced way, the European Union (EU), as well as the Association of Small Island States (AOSIS). On the other hand, the Like Minded Developing Country (LMDC) group, but also the Alliance of Bolivarian Countries (ALBA) the Arab group and others, have highlighted instead the priority of adaptation – with a majority of countries from these groups yet to present an INDC at the time of writing.

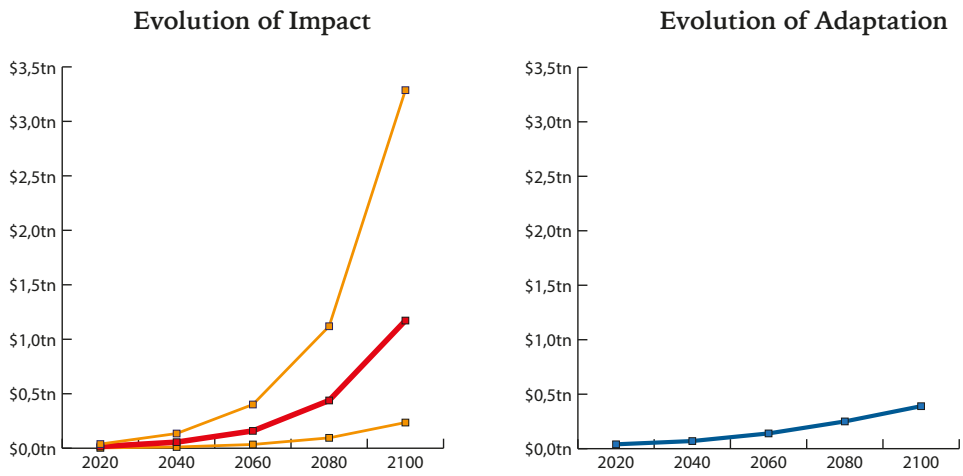
However, while at the UNFCCC divisions between mitigation and adaptation might be more clear cut, when deploying them on the ground differences are not equally so clear cut. It is potentially possible – and we would argue, fruitful- to take advantage of the synergies and mutual benefits between them and with means of implementation to achieve more mitigation effort, in order to support the Durban and Warsaw mandates. This path might also provide content for a fertile middle ground that not only helps support action on the ground, but also provides a more proactive interpretation of the 2014 Lima decision, which opens the door to adaptation aspects within an INDC. AILAC, Mexico, the Dominican Republic and others have been pressing for this middle path.

In fact, there are several reasons why a country might consider the relation between mitigation and adaptation in mutually reinforcing ways. For example, the infrastructure required for low carbon development (such as electric lines or generation facilities, railway lines or riparian port facilities for transport, and/or low carbon buildings and the associated built environment) can be located in places where there will be fewer climate impacts, making it more climate resilient. Increased temperatures might require more attention to climate in architecture, better insulation, and/or more air conditioning. Water availability will affect options for hydro energy, and in turn, the design of hydro energy projects can affect water availability in specific river basins, affecting multiple users. Food security in countries already stressed by a challenging climate might also be further affected by climate change, triggering the need to alternative food sources and transport needs. Again, this can be provided in a low carbon or high carbon way. Other synergies exist elsewhere, such as in the water, transport and energy sectors. Specific examples are described later in this Working Paper.

As in national actions, there are also synergies apparent at the collective global level. Figure 1 shows a key reason why this is so: in the collective aggregate, the probabilistic nature of climate impacts means the cost of climate impacts grows in a more than proportional curve, with the associated adaptation needs growing similarly. This reflects the fact that as global emissions grow, it is more probable that the associated temperature growth might also trigger additional unexpected but reinforcing changes, with further negative impacts on the climate – thus increasing more than proportionally the level of overall impacts, and the need for further adaptation efforts. However, it is unlikely in most countries that the available multilateral and local adaptation financial means required to address those needs can grow at the same rate. Thus, it is likely more parties will suffer more than proportionally as more GHGs are emitted.

What is more dangerous is that if mitigation activities are inadequate, the global community might soon reach what could be 'natural' limits to what it can adapt to. On the other hand, if there is greater collective action on mitigation, it is likely that the impacts of climate change will be less severe – and thus it will more likely to be possible to handle them.

Figure 1: Costs of Climate Impacts versus costs of Adaptation



Values given in USD/trillions (for 2005). Due to their probabilistic nature, climate impact risks will grow much faster than the capacity and funds available in order to adapt to them, risks need to be kept within a manageable range through vigorous mitigation and adaptation. For the most part, synergies should be encouraged and tradeoffs avoided.

Three hypotheses, an argument, and some tests

We can express this situation by understanding that 1) the total costs faced by parties go beyond mitigation to include impacts and the associated adaptation (plus any gains coming in from carbon markets and or any cooperation) and 2) larger effective collective mitigation action could reduce the larger impact cost (and the associated need for adaptation) at the expense of an increase of the smaller cost (mitigation); in contrast, taking no mitigation action will increase the larger costs for most parties (i.e. those of impacts and the associated adaptation).

In this context, we argue that:

1. Even relatively small increments in the aggregate differentiated collective mitigation action by parties would reduce the overall cost for most parties –including those of impacts at developing countries, where they are the largest climate cost- at the expense of mitigation costs, which are substantially lower for a large majority of UNFCCC parties.

2. If developing countries advance adaptation first and mitigation later, costs would grow for them and collectively; if they advanced mitigation first and adaptation later, costs would be reduced; and if they are advanced both at the same time, they would be reduced further, for them and collectively.

3. Cooperation among parties can take advantage of ways in which mitigation and adaptation support each other in synergy, providing further local and collective benefits.

Following these hypotheses, we could thus propose it is in the common interest for the majority of parties in the convention to signal their intention to take mitigation action, and do and cooperate as much as possible to achieve this intention. Those doing this would be in a good position to lead by example and press other countries and actors with larger emissions to do more. If the fewer large emitting parties actually follow in this direction, this would reduce the total costs the majority faces. While there is a risk of others not acting, it would be a much lesser risk of facing the massive costs of not acting collectively.

Moreover, it would also make sense for the majority to take a holistic view of what it really wants to achieve in the long term, considering mitigation, adaptation and capacity building together, and to press for as a much integral climate action and cooperation as possible. It is likely this would spur new forms of development, helping increase both the capacity and the resilience in a country or region: simultaneous action on both mitigation and adaptation enables countries to exploit the advantages of integrated climate action and respond better to interrelated challenges – while collectively steering away from the natural limits to adaptation. These conclusions are demonstrated more clearly in the annex of this paper, with further explanation of the modelling used.

Testing the hypotheses

Overall, integrated climate modelling suggests these hypotheses hold. The annex presents some modelling results testing them using scenarios and integrated assessment models. Overall, the results of the modelling indeed shows that collective mitigation action does deliver global cost savings, all costs considered. As the annex shows, deploying even a modest action scenario (Scenario 1) would cost US$53 trillion more than just following a baseline, but would reduce total aggregate costs by US$60 trillion – meaning a saving of US$7 trillion overall. While peaking at 2.15 degrees by 2100, it still delivers not a minor benefit compared with the alternative. At regional level, early regional mitigation action is also shown to be preferable: it allows costs to be distributed across decades, while failure to act in the immediate or near future results in greater mitigation costs later on – at the worst possible moment, when countries would be suffering more climate change impacts. This coincides with multiple global and regional research findings.

It is even more interesting to consider what happens under a slightly more ambitious scenario 2. This takes the same INDCs as Scenario 1, but assumes the region or country acts addressing mitigation and adaptation together, taking advantage of the synergies between these two. Based on empirical studies and trying to be as conservative as possible, the annex assumes these synergies could reduce emissions by 15% more than the scenario 1. In this case, results deliver a warming of 2.08 degrees by 2100, and the probability of staying below 2 degrees increases to 51% (from 46% under Scenario 1). This scenario 2 also sees a further global reduction of US$ 4.4 trillion in the costs of impacts: there is a global and not only a local benefit in advancing these synergies. Again, not what is collectively needed to stay below 2 degrees, but still better than the alternative. What is more important for our purposes, is that all things equal, the effort pays for itself.

Last but not least, if some form of cross-country cooperation mechanism for reducing emission through markets or any scheme could be developed, modelling shows participants would tend to experience further costs reductions: resources would flow to those acting early, rather than those acting later - a powerful incentive rewarding prompt climate action. Such a mechanism could also raise substantial funds for adaptation by extending the current approach of levies beyond the Clean Development Mechanism transactions to support the Adaptation Fund.

Overall, the results above tend to fall in line with what the hypotheses would claim, and are also consistent with what other studies within the emerging literature on bold collective action would argue. As part of the ACT2015 project, and using different models and assumptions, den Elzen et al (2014) examined a similar hypothesis. Their results also showed that middle-income countries benefitted the most from a more ambitious scenario. Garibaldi (2014) used a similar approach to the one described here, and found that more ambitious if differentiated climate action reduced overall costs in Latin America and Asia. If bottom-up regional studies are considered instead, the five-study survey described in Vergara et al. (2013) shows that in Latin American and Caribbean countries, the impacts are the major cost, not mitigation actions – which again is inline with the arguments above. Similar results are found in the ADB's climate economics study for Asia. The DARA vulnerability reports (2012, 2013) make it patently clear that this the case for most of Africa and other least developed countries.

3. Where are the opportunities for synergy?

In addition to the theoretical approach to different mitigation and adaptation scenarios modelled above, it is clear from examples and case studies that mitigation and adaptation aspects are now being delivered side by side as matter of empirical practice on the ground. This generates benefits at the sub-national and national level, but also on the collective global one. The following sections list some examples from rural and urban settings.

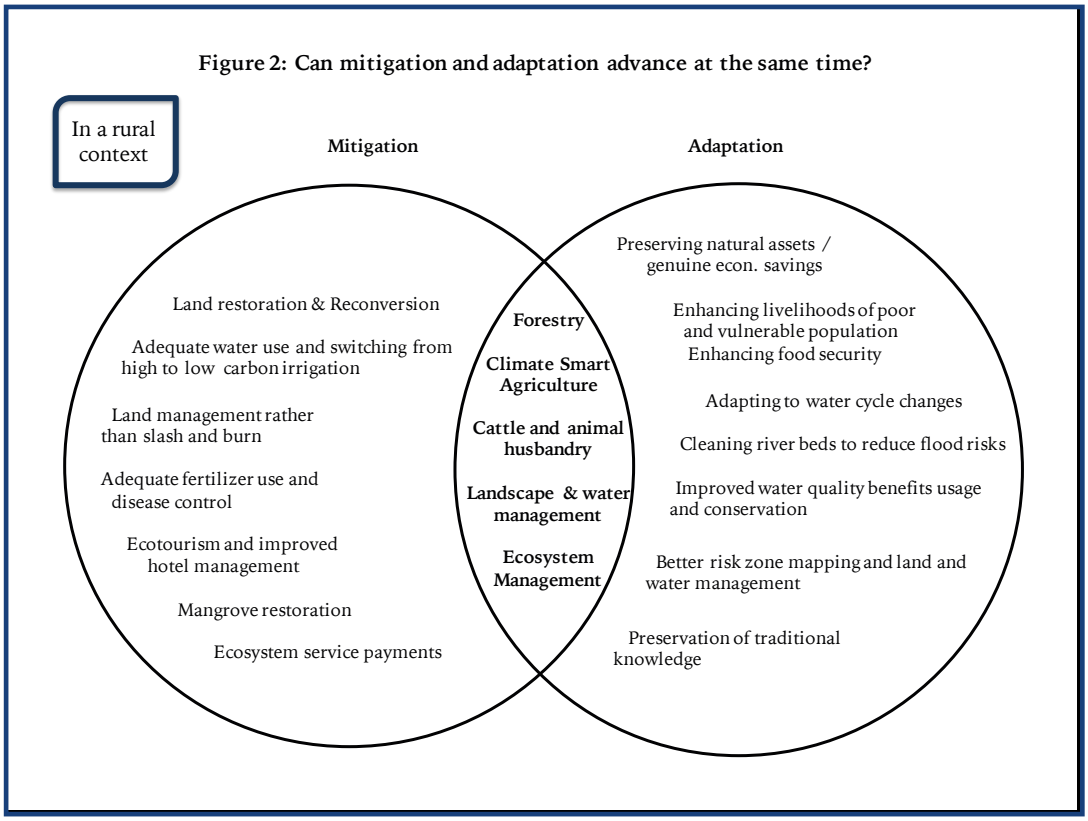
Synergies in a rural environment

The case for synergies between adaptation and mitigation is clear in rural settings. For example, a country's mitigation policy might promote land management and restoration practices that seek to prevent emissions from changing land use or practices such as slash and burn agriculture. At the same time, the country might seek to reduce emissions from the hotel industry by promoting ecotourism and better hotel management, as well as from payments for ecosystem services. Meanwhile, the country can promote better animal husbandry and fertiliser use to reduce GHG emissions in the agriculture and cattle industry.

Most of these actions have adaptation co-benefits. For example, most low-carbon agriculture and livestock practices help to increase food and water security, which improves the livelihoods of poor and vulnerable people and helps them adapt to living in climate-vulnerable regions. Better land and forest management helps to preserve natural assets, which are vital for adapting to climate change. Tourism both can enhance adaptation while contributing to a low carbon lifestyle.

Figure 2 presents areas where there are potential synergies in forestry, agriculture, livestock husbandry, land use and ecosystem management.

Figure 2: Can mitigation and adaptation advance at the same time?



Synergies in an urban environment

The same case can be made for synergies in urban environments, presented in figure 3. For example, good urban planning can limit GHG emissions from land use change (which can happen with unregulated urban expansion) by making better use of under- or non-utilised inner-city spaces. This approach to urban planning also delivers adaptation benefits, in terms of building or refurbishing urban infrastructure to make it resilient to landslides, floods or extreme weather events, rather than encouraging expansion in areas vulnerable to these threats. Further adaptation benefits include creating urban forests and better-managed rivers, which all help to prevent landslides and floods that can damage infrastructure built in at-risk areas. Making use of underused urban spaces can also be cheaper than urban sprawl.

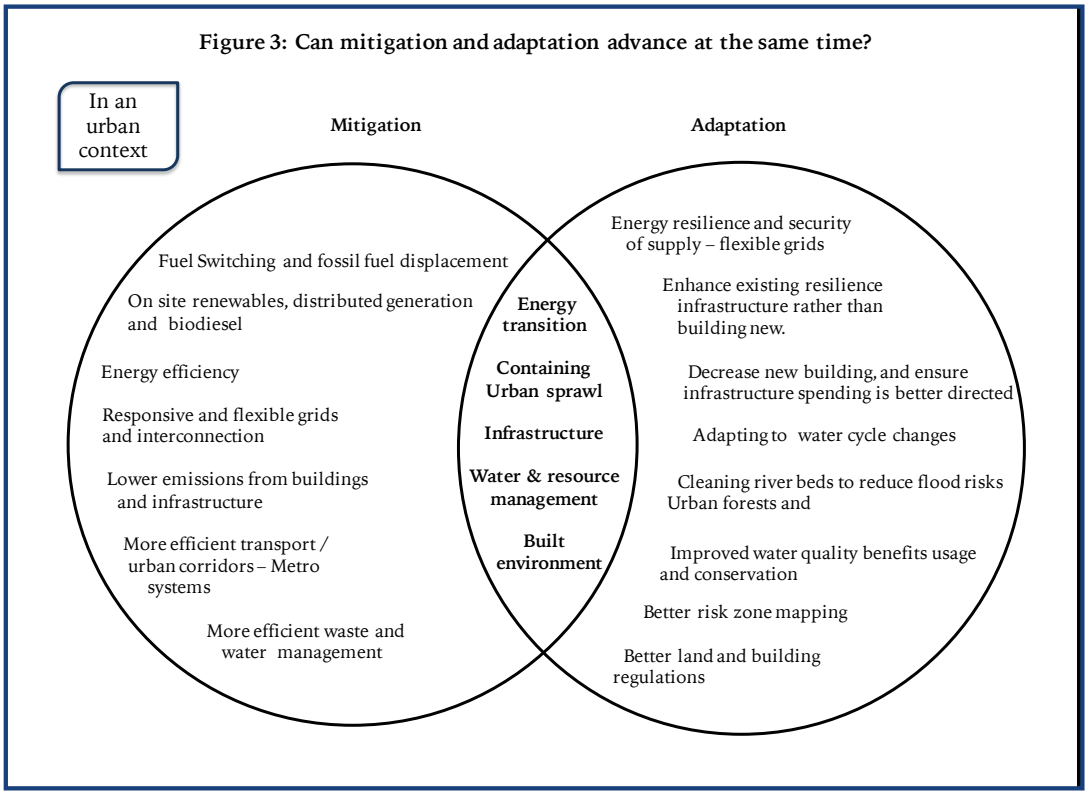
The natural inter-relations between mitigation and adaptation actions are also noticeable at the city and/or sub-national level, which are closer to everyday activities.

Studies by Centro Mario Molina on the city of Merida, Mexico (CMM, 2014), attempted to simulate the growth of the city under two scenarios: one of urban sprawl, where there was no policy constraints to growth; and one which included policies to redevelop the neglected urban centre, refurbish run-down dwellings and constrain urban growth along unused hillsides and creeks. The results found that the second scenario reduced the risks for people who would have tried to establish homes in high-risk hillside areas, but also reduced emissions from the reduced need to build new infrastructure, as well as from the transport system: the compact city needs less fossil fuel based transport. More interestingly, the second scenario also cost less to achieve.

A similar case can be found for urban water management. A recent study by the University of Leeds and the Pontifical Catholic University of Peru (Gouldson et al., 2014) assessed planning and policy options for the worst effects of climate change on Lima, Peru, which is located in a desert.

In the worst-case scenario, a 21% growth in the demand for water was coupled with a 7% decrease in supply from the rivers coming from the Andes, which supply the city. This would create a 29% water deficit by 2030.

Figure 3: Can mitigation and adaptation advance at the same time?



A supply-side policy to counter this would need an investment of US$ 2 billion, which could potentially be paid back in under 8 years with a 15% increase in water tariffs.

Interestingly, combined supply- and demand-side measures to save energy would also reduce emissions. Moreover, when all potential energy and water improvements and investments in transport, water and infrastructure in the city were considered, investments of 0.8% of the city´s annual gross domestic product (GDP) resulted in a net benefit and savings of around 8% of the GDP for 2014 (equivalent to US$22.2 billion). These investments would be spread over 15 years, with the impacts being felt far beyond the city and reaching the whole country. Altogether, cost-effective measures to deploy water and energy improvements would achieve a 19% reduction in emissions by 2030 compared to 2000; this would reach 30% under even more proactive measures for cutting edge technologies that need not cost more, but require more coordinated action.

Aligning political will with measures to combat climate change can also help to increase domestic buy-in and coordination. The city of Quito, Ecuador, has advanced an Environmental Agenda (Zambrano et al., 2012) and an Action Plan (Zambrano, 2011) that both combine adaptation, mitigation and finance measures in key sectors: transport, climate risk management, natural resources management, agriculture, urban settlements, energy, industry and health. Simultaneously, they build the city's capacity to cope with climate change through plans to manage information, develop human and institutional support to advance the climate plans, and the policies and political agreements to deliver them.

National actions

In many cases, the links between mitigation and adaptation activities are deeper than just a synergy or a co-benefit; some activities would not be possible without some adaptation measures. In general, adaptation activities can make important mitigation measures possible. For instance, preserving forests in river basins will not only help maintain water capacity for agriculture (an adaptation measure), but also help supply water for hydropower (which will mitigate GHG emissions). Hydropower supplies almost half of South America´s capacity, so preserving this will be crucial to prevent further increases in the use of gas or coal-fired turbines.

This is true for countries at different development levels. For example, flood protection is essential in both Bangladesh and the Netherlands for economic activity to continue in vast areas of each country. This is an adaptation issue, but flood protection can be done in a low-carbon or high-carbon way. In Bangladesh, mangroves are currently both protecting against floods and reduce emissions from land use change. In the Netherlands, wind turbines placed above dykes generate renewable electric energy, helping to provide energy for pumping towards water management– both reducing emissions and preventing floods,. Many other parties could benefit from similar experiences.

The reverse case is also possible: mitigation activities make it possible to advance adaptation. Costa Rica provides a clear historical example. In recent decades, the country has been taxing fossil fuels and other similar measures in the transport sector (which mitigates climate change by reducing fossil fuel consumption). The fiscal revenue produced can help fund afforestation and reforestation activities. The resulting expanded forest cover has not only protected biodiversity and increased the resilience and adaptation potential of many communities, it has also supported a burgeoning ecotourism industry and created new jobs and opportunities – the money from which increases people's ability to adapt. Costa Rica now has

a robust resource base upon which to advance sustainable climate policies. These include the recent creation of a Nationally Appropriate Mitigation Action (NAMA) for coffee, which has both mitigation and adaptation effects. Other NAMA initiatives are advancing around livestock, agriculture and the urban environment – all with the potential for synergies between mitigation and adaptation.

One of the best-known examples of synergies between mitigation and adaptation in an INDC is Mexico's. This builds upon a sustained effort to create a national climate strategy and law, and thus articulates a long-term vision of action. It commits the country to a 22% reduction in GHGs compared to a 'business as usual' scenario (up to 36% under certain conditions) and a 51% reduction in black carbon (up to 70% under certain conditions). Under these conditions, the country's emissions would peak by 2026.

The INDC includes substantial co-benefits for mitigation. Mexican law mandates that actions to reduce GHG emissions must look to exploit 'win-win' options in the first instance, taking advantage of the 'no regret' aspects of climate action. Beyond that, the black carbon reduction target provides global benefits and substantial local health benefits.

In terms of adaptation, the INDC includes pure adaptation elements but also synergies between mitigation and adaptation. For example, it commits to zero deforestation by 2030 to ensure that biodiversity and ecosystem services are key mechanisms for adapting to the adverse effects of climate change. Preventing deforestation will also reduce emissions from land use change. It also includes other pure adaptation activities - ensuring for instance that half of Mexico's towns are no longer in the 'most vulnerable' category, and no new town falls into this category

Other examples highlight more unusual dimensions of synergistic climate action. In Asia, Bangladesh has launched an extensive adaptation and research programme that increases the country's knowledge of different aspects of climate change. This includes actions such as protecting agriculture and fisheries from the threat of marine salt intrusion by planting mangroves (which also reduces the threat for populations and fisheries of sea level rise) as well building many relatively low-carbon disaster shelters. Mangroves however not only increase protection, but are also a way of reducing emissions from land use changes. To take advantage of these changes, the country has created two funds: one to disburse multilateral resources, and one to disburse domestic resources. Both will support mitigation, adaptation and capacity building activities. More actions like these will be needed.

Box 1. Synergies in a sector: the Panama canal

The new locks at the Panama Canal provides an interesting example of sector-specific synergies between adaptation and mitigation. The Canal depends on its surrounding forests and river basins to provide the fresh water it needs to operate. Careful stewardship of these resources, through the preservation of the forest and its environment, has preserved this precious resource. At the same time, the design of the new, expanded locks substantially reduces the amount of water needed to move each vessel between the oceans by recirculating it. The locks therefore operate not only with mechanical and technological innovation, but also within a scheme of improved environmental stewardship, thereby allowing more, larger vessels to transit the canal; improved forest and water management also increases the resilience of the whole system, for the benefit of not only revenues to Panama, but broader emissions reduction to international maritime transport. Of course, the Canal's improved reservoir also has co-benefits for the domestic water supply of the country.

The table on the following page illustrates further synergies within key policy areas.

Table 1: Synergies in key policy areas.

Issue	Policy Component	Adaptation Effects	Mitigation Effects
Energy transition	Fuel switching/ renewables/ efficiency	Enhanced resilience and security	Less GHG forms of energy
Urban environment	Containing sprawl	Enhanced resilience – less risk of building in risk zones	Less GHG emission, less transport needs, less infrastructure
Built environment	Better and enforceable building codes	Less construction in risky areas; more resilient buildings	Lower emissions from better buildings
Infrastructure	Improved infrastructure setting and usage; expanded inner city use	Less damage to infrastructure due to climate change	Less emissions derived from infrastructure due to efficient deployment
Forestry	Forest preservation	Biodiversity preservation; control of landslides and floods	Lower emissions from use change
Agriculture and cattle	Fertilizer and cattle practices	Better food security; enhanced livelihoods for poor population	Lower emissions from fertilizers and cattle
River management and coastal management	River bed control and management	Less flood damage, more water and food security	REDD+ effects; lower need to rebuild
Sustainable management of resources	Suppression of water leaks	Less pressure on scarce water resources	Less use of pumping equipment
Water usage	Grey water reuse/ flood control	Adapting to changes in water regime	Less water pumping/clean water waste

Development and policy consequences: mitigating and adapting

These examples in this Working Paper outline a different approach of development, in which countries and actors actively pursue low-carbon resilience – adaptation that is achieved in a way that also mitigates climate change. They can leave their middle- or low-income circumstances by exploiting the links between resilience, low-carbon growth and domestic and international capacity to act on climate change. This takes advantage of the synergies between mitigation and adaptation and can increase their long-term competitive advantage and capacity. They can then advocate for a climate regime that rewards such early, bold action.

Dynamic low-carbon resilience can be described as the capacity of people and systems to prosper at the same time as responding to various climate hazards types and the collective need reduce global emissions. There are multiple examples. For instance, dynamic low-carbon resilience is not only installing more efficient watering systems for fruit trees with high water needs, but also shifting to new agave shrubs with very low water needs; likewise, it is not only preserving forests for the environmental and agricultural services they provide , but

also using them to generate electricity with the water that these forests help preserve – rather than building more fossil fuel plants.

While the countries in a region may be at different levels of development and institutional strength, they often share similar resource bases. These can provide the foundation for regional and cooperative action and the exchange of experiences, and provide for a better management of common resources. Box 2 provides an example of this.

Mobilising support

Shared problems and responses create a basis to engage citizen support around emerging climate change. Economic imperatives can also create new opportunities for citizens to get involved, or to use climate action to address related development issues. For example, the Dominican Republic has proposed to reduce GHG emissions by 25% (from baseline levels) between 2010 and 2030 with support from cooperation The planned activities are based on replacing costly fossil fuels with diverse, climate-friendly renewable energy sources, as well as a drive towards energy efficiency. These activities not only reduce emissions, but also increase the resilience of the energy system, as it now reduces fuel supply risks, as it is supplied by a portfolio of sources rather than a single, fossil fuel based one. It will also create jobs and raise GDP.

A major driver behind this approach was an understanding of the increased risks from climate change facing the Dominican Republic if no action was taken. These measures include more frequent and severe hurricanes, but also more subtle risks, such as the geopolitical threat of relying on foreign sources of fossil fuels that might not be available in the future, or the threat to the highly concentrated bananas and tobacco plantations, where expensive crop management technologies might be ruined as the climate changes. Overall, this not only creates a clear economic case for mitigation action while increasing resilience to future climate impacts, but also expands the constituency supporting integrated climate action.

Box 2. Synergies and shared resources

Taking advantage of the links between mitigation and adaptation can help to better exploit shared resources, enhancing the collective effort of a region.

An interesting example can be found in the island of Hispaniola (also known to its inhabitants as Quisqueya), which is shared by the Dominican Republic and Haiti. Unlike in other places, the rivers in Hispaniola are do not form a natural border between the two countries: the Artibonito River, for example, starts in the Dominican Republic, passes into Haiti, and then goes back into the Dominican Republic.

Across this shared river basin, resources are shared and joint activities occur that help people to adapt and increase climate resilience. These include agricultural practices that combine forest protection and agriculture (for instance, crops that can grow in a forest setting such as coffee), and hydropower that helps to diversify and secure the countries' energy supplies (Ramirez & Garibaldi, 2013; Crawley, 2012). As both countries share the river, they need to manage it jointly. Moreover, adaptation actions on one side need careful management that considers the mitigation actions on the other (and vice versa).

Activities that combine mitigation and adaptation in both the Dominican Republic and Haiti would raise the level of ambition to tackle climate change in both countries. This could also contribute to both countries seeing adaptation and mitigation as working in harmony – not in silos. This concept is applicable to other regions and sectors around the world.

In a similar, vein and more generally, increasing productivity is a major requirement for countries looking to progress beyond middle-income status. However, this also decreases the intensity (that is, the proportion of outputs produced

Box 3. Delivering short-term benefits from long-term projects

The multiple cases of combining mitigation and adaptation are interesting examples of activities that by enhancing resilience or increasing adaptation, also make possible new lower carbon and resilient forms of social activity. The same case can be made with projects that combine technologies supporting low-carbon, resilient lifestyles. These are perceived to take a very long time to mature, but this is not always the case. Some short-term benefits can be realised through combining new technologies with tried and tested ones, or packages that combine well-known practices and technologies with policies and finance in ways that provide a return in a short period of time.

In this vein, the issue of financing can be addressed through schemes that allow for blending support from sources with different levels of maturity and risk. Financial packages can include, inter alia, secondary or partial guarantees, blended sources of finance combining public, private and multilateral funds, revolving funds and/or microfinance schemes. Moreover, technology packages, by combining productive activities with the technology, can contribute to substantially shorten the return period of the projects. These finance and technology combinations, coupled with a supportive policy environment, can start delivering results in the relatively short period of time of 2 to 4 years, even if the overall return of the project can take several years more.

A second crucial aspect is to provide an adequate institutional and policy environment to make activities possible at the scale required in a short time frame. Aggregating activities under strategic programs combining public and private actions and initiatives could be a vehicle to support low carbon packages, while allowing scaling up pilots and projects, by removing barriers and combining policies and measures across sectors and regions that share common objectives, thus providing a supportive policy environment.

to resources used) of both energy use and emissions. It is possible from here to take and extra step and start matching gains in competitive options with more stringent emission reductions proposals – and use this drive to attract new types of investment and partnerships and alliances. This would be aligned with the case businesses make in many developing countries for increased national competitiveness and more efficient public/private partnerships.

4. Perspectives for cooperation and common support

Synergies are not only the preserve of developing countries and governments; they exist across development levels and the public–private divide. Cooperation between these different sides could help to scale up action to respond to climate change across the development divide. In fact, the German word for climate protection – *Klimaschutz* – is applied to both mitigation and adaptation. It also involves public and private parties: so do the climate action programmes of the UK and Norway. These are the European versions of the ongoing Klimaschutz already advancing in the developing world. Cooperation could emerge between developing and developed world countries and actors with shared mitigation/adaptation and MOI objective.. Nothing prevents groups of countries exploring means to design, support, monitor, report and verify integrated action combining mitigation, adaptation and capacity building could raise the level

of collective climate action – while raising mitigation ambition.

Cooperation initiatives and mechanisms can help advance mitigation action using synergies and co-benefits from a core group of countries and organisations willing to pioneer and take the lead. Such a case is made in Garibaldi & Arias (2014) focused on cooperation, and Cavalheiro (2015) focused on transparency. For example, Energeia, CAN International, CDKN and Ricardo AEA have been supporting Bangladesh, Kenya, Lebanon, the Dominican Republic and various other countries in Latin America precisely along these lines; other agencies can do the same.

Scaling up such initiatives could increase the level of global mitigation ambition, while helping expand mechanisms for cooperation. Such an initiative could be buttressed by common MRV regimes encompassing mitigation, adapttion, and support. They can contribute to a dynamic regime directed towards rapid increases in mitigation ambition and its associated multilateral processes; to develop sustainable examples of synergies to raise mitigation ambition level under work stream II of the UNFCCC negotiations, (focused on short term mitigation action); and to support action on the ground that raises collective ambition towards 2030 and 2050. This will help to build a cooperation narrative, supporting mechanisms and the associated momentum towards long-term zero emissions by 2050, with actions by all, while protecting against impacts..

This is more important if we consider the future of the climate regime. While its specific character is yet to be decided, and negotiations are ongoing, it is not unrealistic to think that there will be recurrent cycles – every 5 years, 10 years or whatever is agreed – to assess how much the parties are collectively advancing in terms of mitigation, adaptation and capacity building. If countries are to report their advances in these dimensions, then it would be more straightforward to examine how close or far they are collectively from achieving their ultimate outcomes.

Common characteristics and support

However this cooperation is advanced, some characteristics could remain the same. The INDCs will have substantial and transparent mitigation actions with clearly defined goals, but will also benefit from identifying and defining risks, vulnerabilities and adaptation actions. They will calculate emissions reductions on their own, through the addition of any mitigation synergies of adaptation, as well as reporting any associated increases in adaptation, while expanding capacity and preserving low-carbon resilience and providing a collective regional and international benefit.

Instead of being a minimal contribution, more integral INDCs can highlight the overall mitigation and adaptation interests of a country with substantial climate impacts but relatively low current emissions , but potentially larger emissions in the future. They can also highlight the local and global opportunities that expanded domestic action and international cooperation open to address impacts and emissions.

Properly done, advancing developing, leaving low or middle-income status and responding to climate change challenges could be well framed as a source of competitive advantage, and a means to avoid the major negative consequences of climate inaction – in mitigation, adaptation and capacity building.

5. Conclusions

A more integrated treatment of the various aspects of climate action within INDCs can help economies and societies pursue a dynamic, low-carbon resilience pathway. This will increase their capacity to transform themselves and prosper in the face of climatic change – contributing to a 'below 2 degree' outcome.

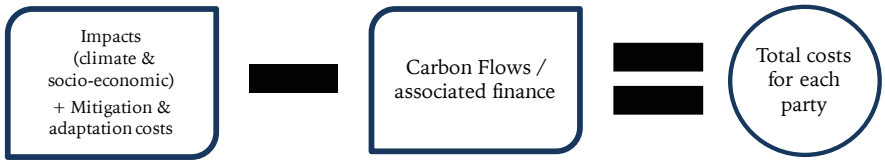
Contributions by countries wishing to develop by leaving middle- or low-income status side by side with other proactive more developed countries through low-carbon resilience could help to support a regime with a "variable convergence" or "variable geometry" towards a 'below 2 degree' outcome. Here, countries could start from an initially diverse – though not divergent – pool of INDCs and policy pathways, which reflect their various circumstances and resource endowments and move collectively towards a 'below 2 degree' outcome (see Garibaldi & Arias, 2014).

The inclusion of the synergies between the various aspects of climate action is relatively straightforward. It can enhance the mitigation contributions of all parties, while increasing their resilience. Likewise, it can make an integrated approach to climate action more appealing to parties that have otherwise been reluctant to commit; and provide a rationale for enhanced cooperation by other parties that have been less keen in advancing it. Last but not least, it can help all to raise the level of collective mitigation ambition, by signalling the willingness of a larger number of parties to deliver. Enhanced efforts by parties and actors, or coalitions of them, can help deliver more substantive collective action – benefiting all parties, but particularly the most vulnerable. This change in approach should be employed, in the near future when countries are seeking to implement the current round of INDCs, and continuously from this point onwards when countries are developing their INDCs for future rounds of negotiation. Overall, this course of action can help align the long-term sustainable development aspirations of the country with the contribution the country can make – and contribute towards the extra effort we will all need to make to face the climate challenge.

Annex: Modelling Results

These hypotheses in the above paper can be tested by comparing high and low ambition collective outcomes using integrated climate and economic models (IAMs) and carbon and investment flow models to assess various regions mitigation, adaptation and impact costs. Overall costs by region resulting from collective action would result from the addition of the costs of individual mitigation and adaptation that each region engages in, as well as the associated impacts, minus the carbon finance mechanisms resulting from this level of action. This gives the total cost for each party. Figure 4 shows this calculation.

Figure 4: Adaptation and mitigation: synergies rather than trade-offs



- Individual costs for each party result from the collective action by each and all parties
- Increased collective action reduces costs for most parties; more free riding increases costs – everybody should do as much as possible.
- MICs and LDCs gain the most from collective action

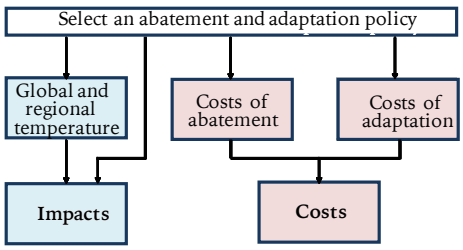
Here, we use the PAGE2009 IAM model, which assesses regional impact, mitigation and adaptation costs, For Carbon and investment flows, we use the CAPRI model, which assesses financial and carbon flows and prices by region. Unlike PAGE2009, CAPRI is a deterministic climate model, that assumes markets expand where there is an opportunity to do so.

IAMs have been criticized for being too conservative with impacts, and for considering many mitigation actions as costs - when they can in fact result in net benefits (for such a vision, see the interesting New Climate Economics Project, or NCE 2015). Both IAM critiques however, make our case stronger, not weaker: using IAMs alone makes the hypotheses above harder to prove, not easier to make. To minimize the carbon flow model risks of assuming markets operating without barriers, we will test the hypothesis using the IAMs first, without any helpful use of markets

Figure 5: Modelling Approach

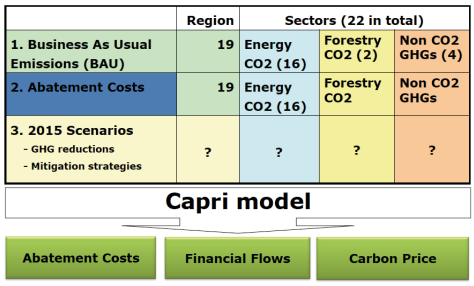
Step 1: model emissions reduction scenario based on publically announced plans from regions

Step 2: Model scenarios for regional impact, abatement, and adaptation costs in PAGE2009



•Input parameters are uncertain. All results are probability distributions.

Step 3: Model financial and carbon flows, prices costs, by region



•Input parameters are certain. Model tries to optimize results based on MACC curves.

Step 4: compare results from models by regions and on the aggregate

Figure 6: Imagining Emissions Trajectories

Reduction scenarios divided between Annex 1 developed country parties (A1) and Non Annex 1 developing country parties (NA1)

Scenario 1:

A1 Group: USA goes further down along its INDC; other A1 countries avoid backsliding, and Russia makes an effort;

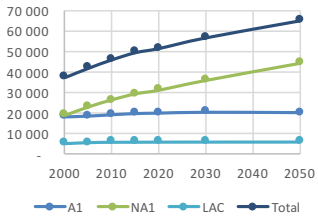
NA1 group: China changes growth rates early and enters plateau; while India, Africa and MENA region start reducing emissions later, by 2030;

Latin America and the Caribbean (LAC) reduces emissions earlier by 2020 and 2030, and then more between 2040 and 2050.

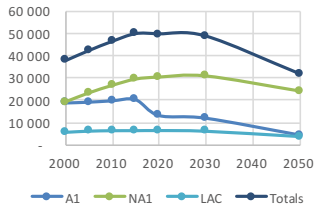
Regional NA1 division (considering China, India, Africa and MENA, and LAC is illustrated in the regional NA1 division graph.

Emissions from all parties drop to 0 by 2100 in scenario 1.

Baseline

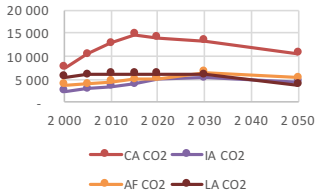


Scenario 1



All figures given in gigatons of Co2 (GtC)

Scenario 1 Regional NA1 division



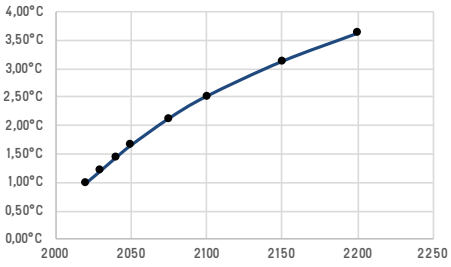
and only afterwards use the carbon finance results - which again makes the hypotheses more difficult to prove.

As a Baseline Scenario for this calculation, we have considered countries in each region delivering what has been promised since the COPs in Copenhagen (2009) and Cancún (2010), plus some additional action from developed and developing countries We then assume emissions are constant after 2050. The more ambitious Scenario 1 includes INDCs for future periods, inspired by current ones, which reduce emissions from an earlier peak, followed by a partial plateauing of emissions, and then reach zero emissions by 2100. Finally, the Regional South division compares costs regionally and by aggregate. Figure 5 describes this process.

Figure 6 presents the different emissions trajectories for this exercise. Scenario 1 is not completely unrealistic, if countries act now. Nevertheless, these are just informed projections for serious debate, a "thought experiment" that asks 'what happens if… ?'

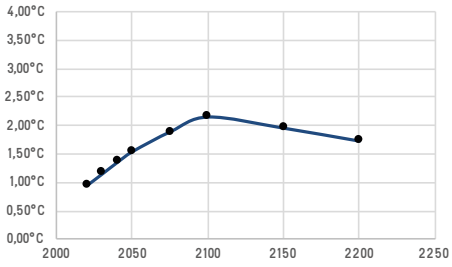
Figure 7: Does more mitigation lead to lower collective costs?

Base Scenario



In the Base Scenario there is a 3.68 degree rise - and it is still rising.

Scenario 1



In Scenario 1, the temperature rise peaks at 2.15 degrees and then trends downwards.

While Scenario 1 does cost 53 trillion dollars more it also reduces impacts by 60 trillion – making a 7 Trillion collective difference. Mitigation clearly leads to lower collective costs.

Collective Outcomes: the benefits of mitigation

Overall, when modelling the scenarios, the results indeed shows that collective mitigation action does deliver overall cost savings. The modest Baseline Scenario delivers a 3.68 degree rise on pre-industrial temperatures by 2100, which will then continue to rise in the next century. The more proactive Scenario 1, while still not keeping warming below 2 degrees, peaks at 2.15 degrees by 2100 and then starts declining in the next century. Importantly, the still modest scenario 1 would cost US$53 trillion more than the Baseline Scenario, but reduces the total aggregate costs by US$60 trillion – meaning a saving of US$7 trillion overall. While not the required ultimate outcome of below 2 degrees, it still delivers not a minor benefit compared with the alternative.

As discussed, these results flow using only the IAM (i.e. under the more stringent case), with no consideration of any additional carbon flows which would it make these outcome even stronger (see the relevant box to see what happens if these are considered).

Regional outcomes: contrasting mitigation and adaptation

The impact of regional outcomes can also be assessed. Overall, early regional mitigation action will allow costs to be distributed across decades, while failure to act in the immediate or near future will result in greater mitigation costs later on – at the worst possible moment, when countries would be suffering from more climate change impacts.

This can be seen by comparing two regions: one which focuses on mitigation early on (we will use socio-economic indicators and presumed emissions for Latin America for the purposes of this exercise) and another which focuses on adaptation at first (we will likewise use indicators for Africa and the MENA region). In Latin America, early mitigation action delivers a transition towards substantially higher mitigation action from 2020–2030, but the subsequent lack of adaptation actions means substantial efforts are required later on. The Africa and MENA region initially focuses on adaptation, and initially sees reduced climate change impacts, but these grow later at almost the same rate, while mitigation action becomes much more

Figure 8: Can adaptation be done sustainably before mitigation?

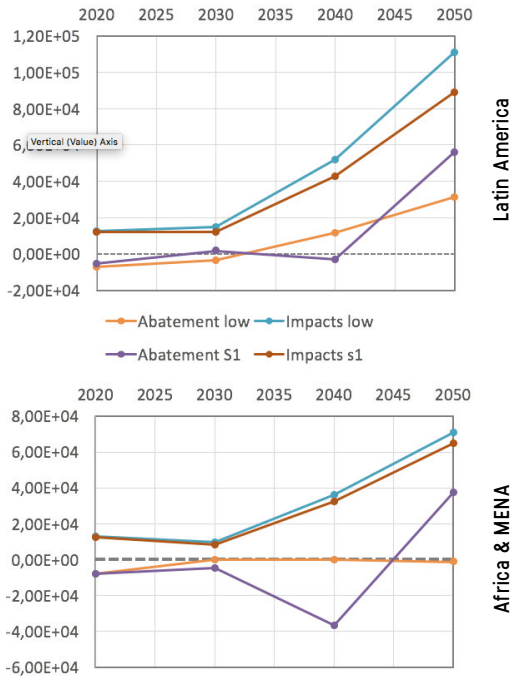
If mitigation is done early,
a) Climate impacts (red and purple lines) go down
b) Abatement (green line) less pronounced

Signals more mitigation collective action; if more parties follow, impacts will be reduced further, and adaptation become more effective

If mitigation is done later,
a) Less impacts early, but
b) Less later impact reduction;
c) Still need to fund more mitigation later

Signals free riding: if others follow, climate impact costs will grow further, and adaptation become less effective

Mitigation must be done in concert with adaption to be effective.



costly. Figure 8 contrasts the outcomes in these two regions.

This comparison shows that if mitigation is the focus of collective action early on, the level of climate change impacts will be reduced regionally. In the example scenarios, Latin America, while acting early on mitigation will also experience reduced climate impacts (meaning less action on adaptation is needed). The red line shows the impacts Latin America would suffer under the baseline, while the purple line shows the substantial reduction in impacts resulting from the more active scenario. In contrast, if mitigation is done later as we have tested for Africa and MENA (as shown in the second graph), there is almost no reduction in regional impacts – but much more mitigation will be required later if much more catastrophic climate change is to be averted.

The green lines show the overall abatement costs for the more ambitious Scenario 1. In Latin America, reduction efforts under Scenario 1 reflect a relatively low level of initial mitigation efforts. These then increase steeply – but in a less pronounced manner than for Africa. This region derives an initial benefit from its decision to not engage in mitigation actions early on but later suffers.

Box 4. Markets, mitigation and adaptation

To assess the case for cooperation, the reductions in Scenario 1 can be modelled using the CAPRI model to assess using similar socio-economic indicators to those employed with the IAM model. This would allow to assess who benefits from associated carbon flows if these were based on markets. Again, results can be examined in the hypothetical actions of the two modelled regions. By 2030, with both LAC and Africa and MENA regions acting as described previously, Latin America would have additional net earnings derived from exchange the outcomes of mitigation actions across jurisdictions of US$41 billion under Scenario 1 at 60% carbon market penetration within the overall economy, compared to only US$4.8 billion under the Baseline Scenario. Meanwhile, Africa would go from earning US$55 billion under Scenario 1 compared to US$10bn under Business As Usual. By 2020, however, Latin America would be receiving a similar amount, while Africa would be one order of magnitude lower. As cooperation rewards early action, this could be a powerful incentive for groups of countries or regions taking the lead.

Moreover, markets or any similar cooperation mechanism can continue to fund adaptation levies. Under these scenarios, the model shows that markets would deliver by 2030, and with a 60% market penetration almost US$10 billion per year to the Adaptation Fund (at a 5% contribution of US$34.9 per ton of carbon dioxide in Scenario 1) versus less than US$941 billion (at US$ 2.9 per ton under the Baseline Scenario). Table 1 summarizes these outcomes.

BAU scenario	Expected Carbon Price	Adaptation fund Totals ($USBn)
100%	6.9	2457
60%	2.9	941
20%	N/A	NA
Scenario 1	**Expected Carbon Price**	**Adaptation fund Totals ($USBn)**
100%	38.7	11,939
60%	34.9	10,366
20%	8.2	1266

Signalling Intentions

More importantly, seen for a collective perspective, the actions taken by each country or region showcases their intentions for all to see. In the first case (Latin America), early and ambitious mitigation action signals to other parties and the world the region's intent to deploy an even greater level of mitigation action in the future. If more parties follow this signal, even in different ways, the impacts of climate change will be reduced further, and the adaptation funds available for the region and others will have a greater impact. In the hypothetical second case, countries that make late or limited actions signal 'free riding' instead, meaning they hope to benefit from others' actions: if others follow this signal, even in a different manner, the costs of impacts will increase beyond the level at which adaptation funds can be used effectively.

Using More Synergies

It is even more interesting to consider what happens under an additional scenario (Scenario 2). This has the same INDCs as Scenario 1, but assumes that the region or country addresses mitigation and adaptation together, taking advantage of the synergies between these two sectors. Based on empirical studies and trying to be as conservative as possible, we will assume this approach could reduce emissions by 15% more than Scenario 1 In this case, results deliver a warming of 2.08 degrees by 2100, and the probability of staying below 2 degrees increases to 51% (from 46% under Scenario 1). This scenario also sees a further reduction of US$ 4.4 trillion in the costs of impacts. Again, not what we collectively need to stay below 2 degrees, but still better overall that the alternatives. What is more important for our purposes, is that all things equal, the effort pays for itself.

If some form of cross-country cooperation for reducing emissions through market or any likely oriented cooperation mechanism can be developed to operate in addition to the individual country actions, those participating in those markets would tend to further reduce their costs, thus rewarding early action: resources would flow to those acting early, rather than those acting later. This could turn into a powerful incentive rewarding prompt climate action. Moreover, such an approach could also generate additional funds for adaptation by extending the current approach of levies on any future mechanism or expanded Clean Development Mechanism transactions to support the Adaptation Fund. This is described in Box 4.

As we described in the main text these results are also consistent with what other studies within the emerging literature on bold collective action would argue.

More specifically, the analysis seems to point in the same direction of the hypotheses: small increments in the aggregate differentiated collective mitigation action by parties do seem reduce the overall cost for most parties – including those of impacts at developing countries. Likewise, advancing mitigation first and adaptation later reduces collective costs; while advancing both at the same time, reduces them further, in the regions advancing them and collectively. Finally, cooperation in various aspects of climate action among parties both can take advantage of ways in which mitigation and adaptation support each other in synergy, as well as providing local and collective benefits.

Together, these arguments point in a direction of new forms of development - the Paris treaty can contribute to make it happen.

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ABOUT THIS WORKING PAPER

This working paper is part of a series exploring mutual support between international cooperation and domestic climate action at a domestic level for bold climate action, and how the various aspects of climate action can be measured, reported, and verified. The document has emerged from and supported multiple discussions, workshops and negotiation group debates advanced in the context of the ACT2015 consortium, and its members, and around the Mitigation and MRV partnership, including at the Global INDC workshop and at summer schools of that same workshop.

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ABOUT ENERGEIA

Energeia was founded by Jose Alberto Garibaldi and Manuel Estrada in 2003 in Mexico, and in London in 2005 by Garibaldi, where it currently operates both as a registered company and as a non-profit entity. It has developed an economics of boldness methodology to analyse negotiation options for developing countries, instruments to support net reduction contributions by developing countries, and networks to exchange ideas around them in Latin America, Asia, and is nascent in Africa. The network has also provided negotiation support to several Latin American and South East Asia countries, as well as the EU and G8 presidencies. Activities around these were one of the contributors to the formation of the Cartagena Dialogue in 2009. It is currently supporting activities in Latin America, Asia and Africa under the UNFCCC the Progressive Latin America Coalition, the Latin American workshop to expand the scale of the response, running since 2006, and the Cartagena Dialogue.

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