

# Scaling up Climate Finance

Finance briefing paper, September 2009



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# 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 organisations 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 ([www.climateworks.org](http://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 post-Kyoto international climate agreement, and related stakeholders. Project Catalyst members have been organised in working groups: abatement, 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 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 summarises output from Project Catalyst, but the views expressed in this paper have not necessarily been endorsed by all members of Project Catalyst nor their governments or organisations. The ClimateWorks Foundation takes sole responsibility for the content of this paper.

## Acknowledgements and thanks

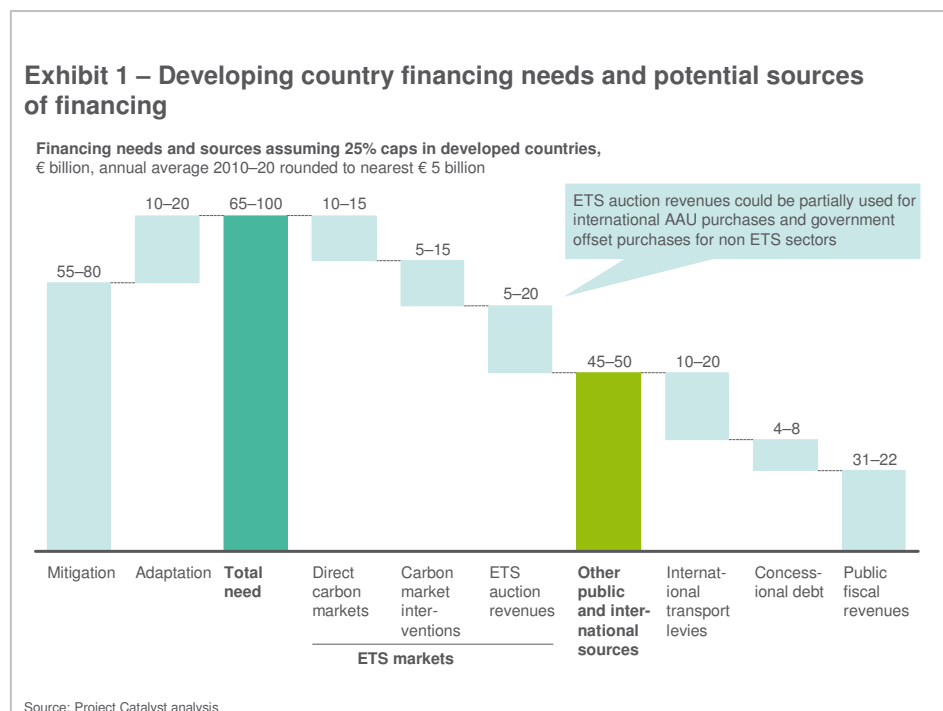
Project Catalyst would like to thank the Finance Working Group members for their contributions in creating this report. At the time of publishing, this paper reflects the views of Project Catalyst on finance but these views have not necessarily been endorsed by all of the members of the Finance Working Group nor their governments or organisations. The ClimateWorks Foundation takes sole responsibility for the content of this paper.

# Executive summary

In September 2009, finance ministers of the G20 will meet to discuss a future global climate financing architecture to be agreed in Copenhagen. They will do so in the context of a world economy beginning to show signs of recovery and adapting to a more conservative approach to capital provision. The purpose of this memo is to inform the debate by setting out key facts and providing a concrete, integrated proposition for debate.

1. The world will require a global commitment to a 2°C pathway (limiting temperature increases to 2°C above pre-industrial levels), which means stabilising CO<sub>2</sub>e emission concentrations below 450 ppm<sup>1</sup>. Versus an estimated 61 Gt BAU in 2020<sup>2</sup>, this translates into 17 Gt of required abatement globally, with 5 Gt physically delivered in developed countries (i.e., their full abatement potential up to a specified, marginal cost, here assumed at €60 per tonne) and 12 Gt in developing countries. Developing countries will require support by developed countries as agreed under the UNFCCC to meet the agreed incremental cost of 9 Gt of cost positive abatement measures, but should deliver cost negative abatement, estimated at 3 Gt, primarily through self-financing. Importantly, developing countries will also require support for adaptation, since climate change is already impacting the most vulnerable communities today, and support for technology development and deployment. Meeting these objectives will require scaling up international climate financing flows to developing countries from €15-30 billion annually between 2010-2012 to an average of €65-100 billion annually over the next decade.
2. Individual developed countries will need to contribute to this financing requirement on the basis of an equitable formula agreed to in Copenhagen. Contributions should consist of financing both through offset purchases (but only on top of delivery of full domestic abatement potential) and through direct transfers of public funds (e.g., in the form of cash, concessional debt, guarantees). Delivering financing at the scale required will mean that developed countries need to mobilise funding from a range of different sources. Exhibit 1 illustrates how the financing requirement could be met. It is important to note that the role of private sector carbon markets will be significantly smaller than most people expect. Even with developed country targets of 25% below 1990 levels (which is significantly more stringent than current proposals), private sector carbon markets are estimated to contribute

only 15% of total financing needs through direct offset purchases – or up to 30-50% if auction revenues and a multiplier due to market interventions are taken into account, leaving 50-70% of financing needs to other public and international funds. To provide €65-100 billion annually, the mix of funding could look as follows:



- **Direct carbon markets:** Offset purchases by private sector carbon markets in developed countries (i.e., domestic emission trading schemes) could finance €10-15 billion of abatement per year directly (or around 15% of the total in our central scenario) in developing countries, under the key assumption that caps of at least 25% below 1990 are adopted by developed countries (which is much tighter than currently proposed levels of 10-16%).
- **Carbon market interventions:** Interventions that increase the effectiveness of offset purchases by private sector companies in developed countries could increase the abatement financed by €5-15 billion per year. Intervention could take for example the form of intermediation or discounting.
- **ETS auction revenues:** Financing raised by developed country governments from auctioning emission allowances to private sector players in the domestic carbon markets (ETS) could potentially raise €5-20 billion per year. This would require earmarking auction revenues for international finance.

- **Other public and international finance sources:** The remaining €45-50 billion required per year from 2010-20 could be raised from international maritime and aviation levies (€10-20 billion), concessional debt (€10-20 billion assuming €200-400 billion of loans are provided at 5% interest below commercial rates) plus €10-25 billion from direct public fiscal revenues. Offset purchases by developed country governments to meet their targets or AAU auctioning as proposed by Norway could be ways to channel public funds initially raised from public fiscal revenues or ETS auctions into the international climate finance system. It is important to note that government purchases of offsets or AAU allowances are not an additional source of financing for a developed country.
3. To transfer financial resources from developed to developing countries Project Catalyst proposes a global financing architecture with institutions that enable an effectively regulated, credible and transparent transfer mechanism between developed and developing countries:
- **Low carbon growth plans (LCGPs)** completed by developing countries would enable a transition to a climate resilient economy. LCGPs would specify abatement (NAMAs) and adaptation (NAPAs) programmes, the level of self-financing, and the required international support for delivering these programmes.
  - Through **climate partnership agreements (CPAs)** developed and developing countries would enter into evolving, long term partnerships to finance LCGPs, either in full or in part. Other forms of funding agreements, such as multilateral arrangements or shorter term partnerships, could also form part of the system. Monitoring, reporting and verification (MRV) would be required for both funding commitments of developed countries and the delivery of mitigation and adaptation actions.
  - **A network of bilateral trust funds**—on both developed and developing country sides of the partnership—would create funding commitments ready to be drawn down by developing countries. Developed country trust funds could receive funding from ETS auction revenues, financing captured from intermediation, raise concessional debt with government guarantees from the capital markets or directly from the public fiscal revenues. Developing country trust funds would deliver programmatic and sectoral schemes and could act as intermediaries where appropriate.
  - **A global green fund** would help to finance adaptation and abatement measures not addressed by the bilateral deals. It would be funded through direct transfers from governments, international maritime or aviation levies or AAU auctions.

- **A fast start fund** would enable and encourage early action by funding capacity building, NAMAs and NAPAs in the first years post Copenhagen. Fast-track funding is especially needed to accelerate progress on REDD. An interim finance facility to slow down deforestation rates could generate over 1.5 Gt of abatement annually by 2015 at less than €5 billion per year.
  - **Carbon markets** would be intermediated and/or regulated in both developed and developing countries to maximise the impact of direct carbon market financing and require tight developed country caps (25-40% below 1990 levels).
  - **A global oversight function** would provide system coordination, account for the contribution of different parties, match sources and uses of funds (smoothing geographically and inter-temporally), and support the emergence of a set of shared rules, conduct norms, and best practices.
4. Financial resources should be delivered to developing countries through mechanisms and instruments that are appropriate for the specific uses and that maximise the mobilisation of private capital.
- Public finance can be used to support policy reform and institutional capacity building; to provide incentives for performance against proxy indicators for emissions reductions (e.g., international REDD finance); to pay for accelerated technology deployment; and to support investments in strengthening climate resilience and adaptation.
  - Carbon market finance is a highly versatile instrument for any sectoral abatement programme (or project) that meets the following tests: (a) predictable volume of reduced emissions; (b) low delivery risk; (c) relatively simple MRV; and (d) a carbon market price close to the incremental cost of the abatement programme on a per tonne basis.
  - Our estimates suggest extra upfront capital investment requirements of €55-130 billion per year (2010-20) to support developing countries' climate programmes. To mobilise the private capital needed, the system will need to encourage and give credit for blended financing instruments that create predictable future income flows for the private sector (e.g., feed-in tariffs), reduce or transfer policy related risks, and increase financial market liquidity.

# Introduction – key questions addressed in this paper

The next decade requires a dramatic scaling up of climate finance for both abatement and adaptation. Financing for capacity building and early investment in NAMAs and NAPAs needs to be made available quickly. Given the commitment of developed economies to cover the agreed full incremental costs of abatement and to support adaptation measures in developing economies, Finance Ministry officials are asking:

1. What are the overall climate financing requirements of developing countries?
2. How might these be funded? What mix of finance from direct carbon markets, indirect carbon market sources, and public sources is desirable and possible?
3. What institutional system could deliver, on one side, the required funding and, on the other, actual abatement and adaptation performance?
4. What are the roles of different financial instruments in delivering funding to developing countries?

A climate financing system that enables and accelerates the transition to a low-carbon, climate-resilient economy is possible, and is the focus of this paper. The facts around potential financing needs and delivery instruments are critical to system design choices, and so we base our proposal on the available estimates.

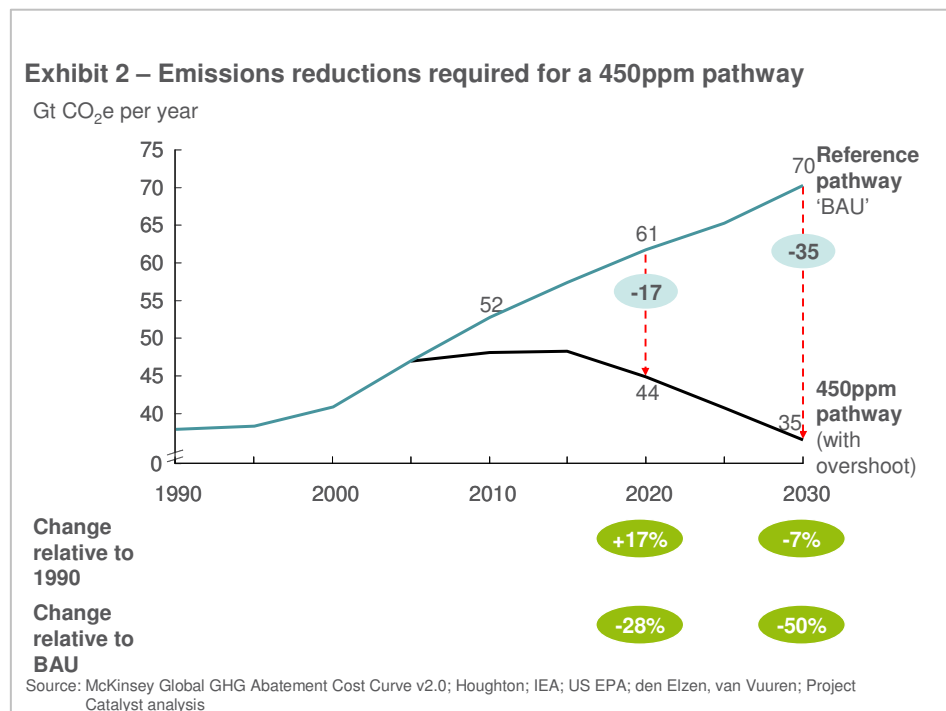
In that vein, we outline a system that could scale up rapidly, attract private finance into the overall investment programme, reduce uncertainty and transaction costs for all actors, and allocate scarce resources in line with performance.



# 1. What are the climate financing requirements of developing countries?

*The financing system will need to deliver a total of 17 Gt of abatement by 2020, with 5 Gt physically delivered in developed countries, and 12 Gt in developing countries. Required international climate financing flows to developing countries to cover the full agreed incremental cost of abatement measures and to fund adaptation are estimated at €65-100 billion per year on average between 2010-20 in our base scenario. While these figures depend on a number of key sensitivities, they can be viewed as a reasonable basis for projecting the required scale of the system.*

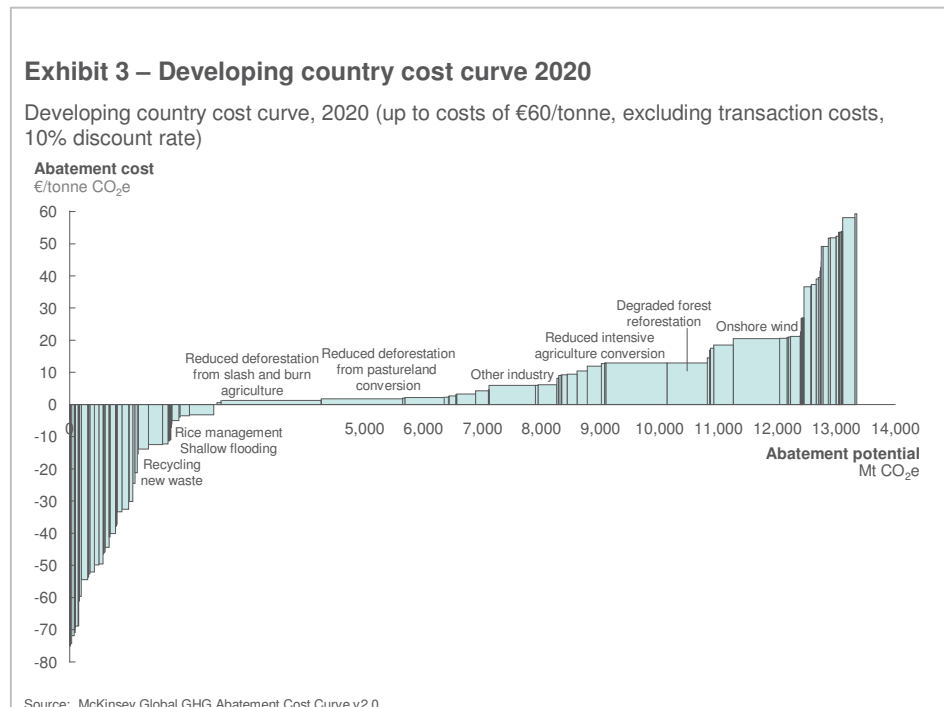
The world will require a global commitment to a 2°C pathway, limiting temperature increases to 2°C above pre-industrial levels – considered a dangerous threshold beyond which uncontrollable climate change may occur – which means stabilising CO<sub>2</sub>e emission concentrations below 450 ppm<sup>3</sup>. Project Catalyst estimates that in order to stay on a 450 ppm pathway, the global economy will need to achieve up to 17 Gt of carbon abatement, versus 61 Gt<sup>4</sup> business-as-usual (BAU) by 2020 (Exhibit 2).



## 1. What are the climate financing requirements of developing countries?

Analysis based on the McKinsey Global GHG Abatement Cost Curve v2.0 suggests that:

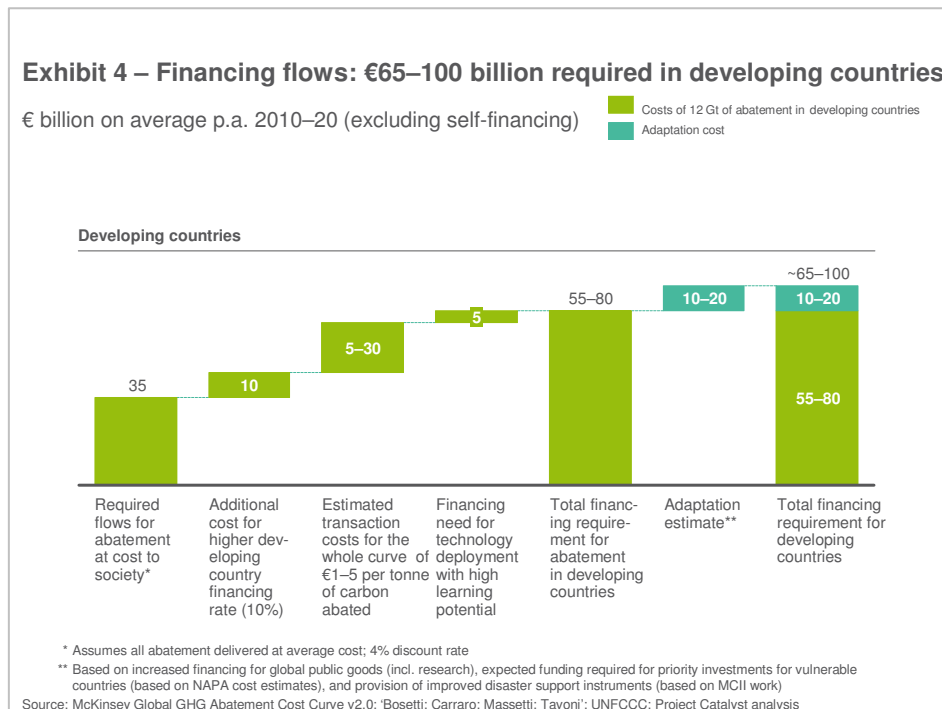
1. It is possible to deliver this level of abatement globally.
2. Developed countries can cost-effectively deliver 5 Gt domestically, assuming that they implement all measures costing up to ~€60 per tonne.
3. Developing countries can cost-effectively deliver up to 12 Gt, assuming that they implement all measures up to ~€30 per tonne. Approximately 3 Gt of this abatement potential is available on a cost-negative basis (primarily through energy efficiency measures), while over 4 Gt depends on the introduction of an effective REDD regime to reduce deforestation rates. Exhibit 3 lays out the marginal abatement cost curve for developing countries in 2020 up to €30 per tonne.
4. In developing countries, there are only an additional 1.2 Gt of abatement available at reasonable cost (up to €60 per tonne) (Exhibit 3). This means that it is critically important that almost all abatement measures described above in both developed and developing countries are delivered in order to reach the necessary 450 ppm pathway.



1. What are the climate financing requirements of developing countries?

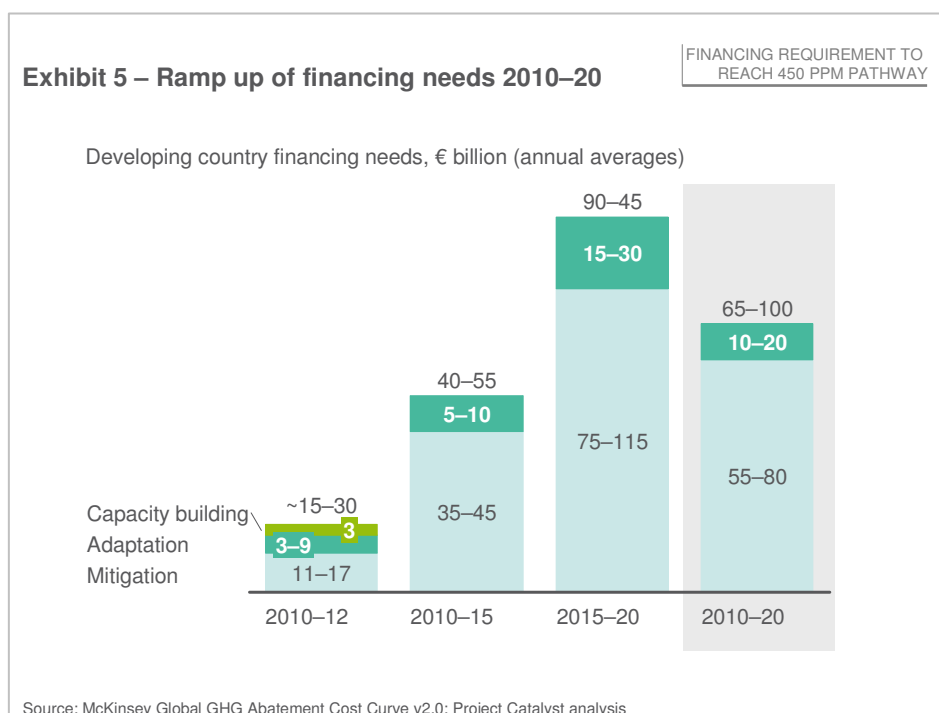
- 5. While measures to decarbonise the power and transport sectors (other than increased energy efficiency) are relatively expensive, they are also the measures with the highest rates of technological learning. Hence, it is critical to start deploying these technologies (in both developed and developing countries) in order to create options for even more aggressive abatement post 2020.
- 6. Adaptation costs comprise significant up-front capacity building in the 2010-20 timeframe combined with selective public good investments (e.g., information systems for weather, local climate modelling) and infrastructure investments. Our estimates of public sector investment requirements are €10-20 billion per year, starting relatively low at an estimated €3-9 billion on average between 2010-2012, but increasing sharply to €15-30 billion per year between 2015-2020. Almost all of this requires public financing and depends on limiting warming to 2°C – adaptation costs will be significantly higher otherwise.

Project Catalyst estimates that developing countries will need around €65-100 billion of incremental cost financing flows on average per year between 2010-20. Abatement accounts for €55-80 billion of this amount, and adaptation for €10-20 billion. As Exhibit 4 shows, the abatement financing needs consist of incremental costs for abatement measures (adjusted beyond a 4% ‘cost to society’ discount rate to meet higher financing rates in developing countries), transaction costs of €1-5 per tonne, and €5 billion to support deployment of higher cost abatement technology (e.g., solar and CCS).



In practice, financing requirements will need to ramp up very rapidly (Exhibit 5). Between 2010-12, financing needs are estimated at €15-30 billion per year, increasing to €90-145 billion between 2015-20. Obviously, it will be challenging to raise this amount of financing as well as build the absorption capacity in developing countries for flows of this order of magnitude.

The above estimates are based on the McKinsey Global GHG Abatement Cost Curve, v2.0 and contain a number of critical assumptions outlined in Annex 1. These estimates are necessarily imprecise, depending on a number of macroeconomic variables (e.g., the oil price), as are all other existing estimates. However, we believe they are accurate enough to provide directional guidance about the nature and scale of financing that an international financing system needs to provide.



There are several sensitivities with respect to these assumptions:

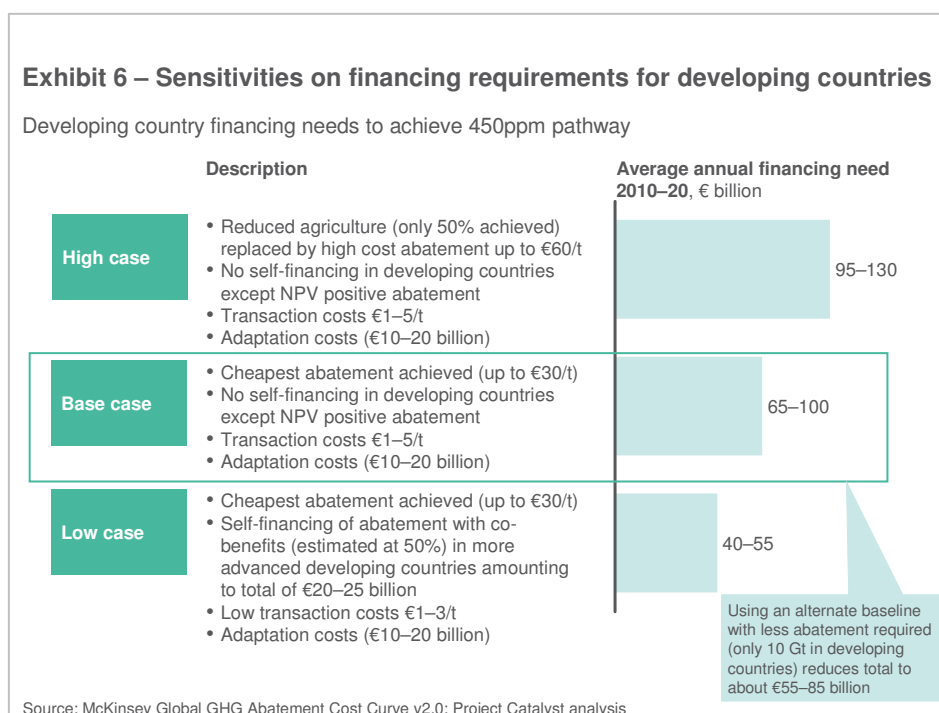
- 1. To what extent will developing countries self-finance?** Many of the more advanced developing countries have already started to self-finance large-scale abatement efforts for their other, non-climate-change benefits (e.g., energy savings, improved energy security, lower local pollution). China is a case in point with heavy investment in nuclear, wind, and energy efficiency. Project Catalyst estimates suggest that if the more advanced developing countries were to self-finance about 50% of their cost positive abatement efforts, it could reduce the required international financing flows by around €20-25 billion per year.

## 1. What are the climate financing requirements of developing countries?

Project Catalyst also assumes that all developing countries would deliver cost negative abatement measures with limited support from developed countries – support should primarily be provided for policy implementation and in the form of loans (at commercial rates), where access to capital is a limiting factor.

2. **To what extent will recession impact baseline emissions?** Recent estimates, which are still in progress, suggest that the global emission baseline could be 3 Gt lower than outlined in Exhibit 2, primarily due to the impact of the recession. This could reduce the financing need in developing countries by about €10-15 billion.
3. **To what extent will upfront investment in capacity building affect transaction costs?** Transaction costs are estimated within a broad range of €1-5 per tonne. This creates a range of €25 billion in the total financing flows. Assuming upfront investments in capacity building plus learning-by-doing over the next decade, it may be possible to limit these transaction costs to €1-3 per tonne by 2020.
4. **To what extent will countries deliver lowest cost abatement first?** The cost curve assumes that abatement measures are delivered in the most efficient way, starting with lowest cost abatement. If 1-2 Gt of agricultural, forestry or energy efficiency abatement were not delivered and had to be replaced with higher-cost abatement, the financing cost could increase by €30 billion per year.

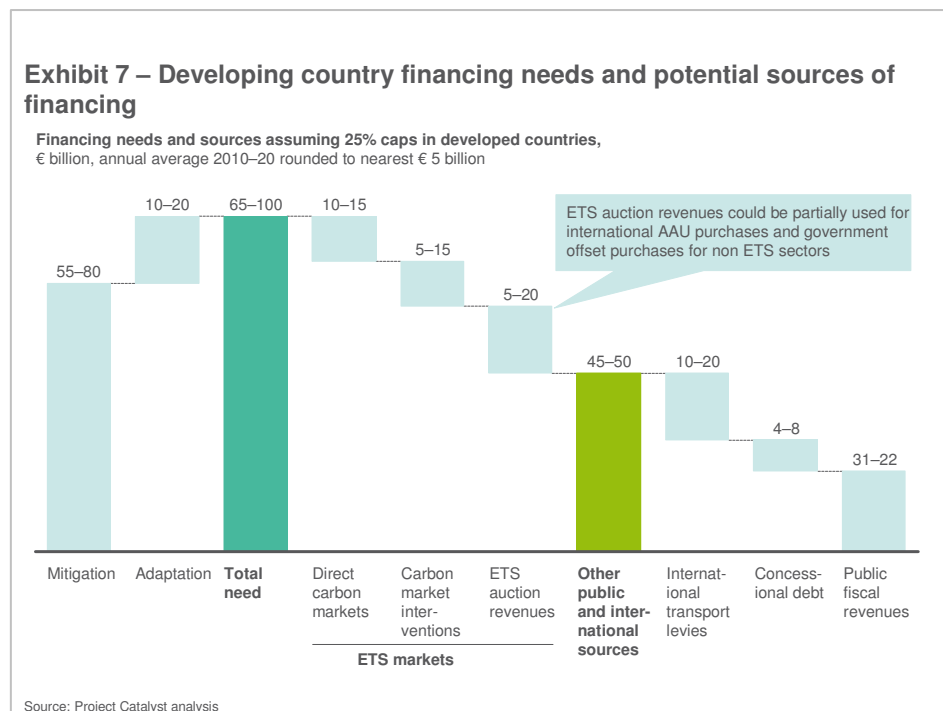
Based on these sensitivities Project Catalyst has gone beyond the central case and defined three different scenarios of financing demand (Exhibit 6). These suggest that financing needs could range from €40-55 billion in the low case to €95-130 billion per year (average between 2010-20) in the high case.



The financing flows above are estimated on the basis of covering *incremental costs*, which include an annualised estimate of the capital costs of abatement programmes by including amortisation and interest costs. Project Catalyst has separately estimated the *incremental (beyond BAU) capital requirements*. These are estimated at €55-130 billion per year in incremental capital that is required to be in place on average between 2010-20. The lower end assumes that developing countries implement an aggressive energy efficiency programme, and that as a result capital investments in the power sector are reduced by over €35 billion per year compared to BAU.

## 2. How might financing requirements be funded?

Meeting the required financing need of developing countries will require contributions from developed countries that are shared based on an equitable formula to be agreed in Copenhagen. Contributions should consider financing via offset purchases (but only for countries where the full domestic potential has been delivered) and direct transfers of public funds (which could be in the form of cash, concessional debt, guarantees). Delivering financing of the scale required will mean that developed countries need to mobilise funding from a range of different sources. This chapter illustrates how the €65-100 billion could be funded – clearly, the precise mix of funding will in the end come down to a number of political decisions and depend heavily on whether caps are tight enough to mobilise significant financing from carbon markets. In our base scenario (€65-100 billion in financing flows, 25% cap below 1990 for developed countries), direct carbon markets would deliver about 15% of the total funding required, which could be increased by 15-35% from carbon market interventions and ETS auction revenues to a total of 30-50%. This would leave 50-70% of total financing needs to public finance sources.



In Copenhagen, an agreement will need to be reached as to how developed countries share the necessary commitments to support developing countries in an equitable way. Project Catalyst believes that developed country contributions should be allocated taking into account three factors:

- Developed countries should deliver their full domestic abatement potential up to a specified, marginal cost, e.g., €60 per tonne. An alternative approach could be to have a country deliver abatement up to a total, aggregate cost expressed as a percentage of GDP.
- Additionally, developed countries should use carbon market finance, purchasing offsets from developing countries to meet the difference between their caps and the amount of abatement they can deliver domestically. The amount of tonnes of carbon market finance, estimated at 3 Gt under a 25% below 1990 scenario should be allocated based on ability to pay and on responsibility. In practice, it will be important that developed countries limit the amount of international offsets purchased to ensure that offsets do not substitute for delivering the full domestic abatement potential<sup>5</sup>.
- Lastly, developed countries need to commit to a public finance contribution which, similar to the carbon market finance contribution, could be allocated based on ability to pay and responsibility.

Delivering financing of the scale required means that developed countries will need to mobilise funding from a range of different sources. The remainder of the chapter assesses sources of financing from a developed country government perspective (i.e., not the international finance system perspective). As a result, government offset purchases and AAU auctions as proposed by Norway are viewed as a transfer mechanism for delivering finance to the international finance system, not as a source of finance given that these transfers need to be paid for from public budgets.

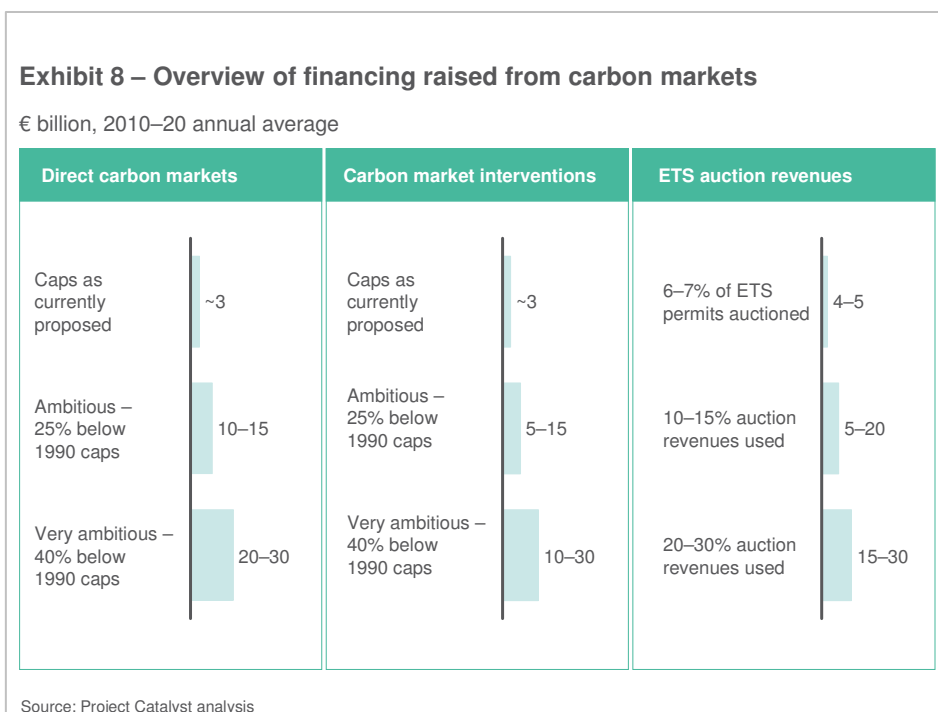
## 2.1. Direct carbon market financing

Direct carbon market financing is defined as the purchase of developing country credits (offsets) by private sector compliance buyers in developed country ETS's. The amount of financing available depends on the share of the total emissions in developed countries covered by the ETS (e.g., USA: ~85%, EU: ~40%, Japan: no ETS), the caps set in the ETS (which can be different from the country's cap), the rules for access to offsets (currently around 0.1-0.2 Gt in the EU per year, up to 1.5 Gt in the US under ACESA (Waxman-Markey) per year), and any regulation regarding discounting.

Much of the current debate assumes that direct carbon market financing will fund the majority of abatement, with a parallel role for public finance primarily focused on adaptation. However, Project Catalyst's analysis suggests that this belief might be unrealistic. Even in the relatively ambitious scenario of a cap at 25% below 1990 for developed countries and ETS in all major developed countries, direct financing from carbon markets would be lower than many currently expect:



- Assuming developed countries deliver all their domestic abatement (up to €60 per tonne), they would need to purchase about 3 Gt of offsets in total (purchased by private sector ETS buyers and governments).
- Of this total, 2 Gt are estimated to be bought by private sector compliance buyers<sup>6</sup>. The abatement financed by direct carbon markets is estimated at €10-15 billion per year on average between 2010-20 (Exhibit 8).



It is important to note that current proposals could result in a significantly lower offset demand: current proposals add up to 10-16% below 1990 and translate into only €3 billion<sup>8</sup> of carbon market finance. On the other hand, if developed countries committed to a cap of 40% below 1990, up to €20-30 billion of direct financing could in theory be mobilised (assuming that the supply of programmatic credits is in place).

## 2.2 Direct carbon market financing with market interventions

The impact of direct carbon market financing can be increased through market intervention, either in the form of regulation (discounting, taxation, baseline setting) or intermediation. These mechanisms either increase the number of tonnes delivered for each tonne that is offset (discounting, baseline setting), or capture the surplus between incremental cost and market price (taxation, intermediation) and reinvest it in further abatement. In a scenario with caps at 25% below 1990, the effectiveness of direct carbon market financing from emission trading schemes could be increased by up to €5-15 billion through appropriate interventions. However, with the lower number of offsets expected under current proposals, there may only be potential to capture an additional €3 billion (Exhibit 8). All factors that make direct carbon markets more or less effective (e.g., level of caps) will influence the impact of market intervention.

Project Catalyst believes that, on the developing country side, carbon market intervention should take the form of intermediation. Intermediation will be essential for delivering programmatic/sectoral schemes where the government or a national climate trust fund would orchestrate delivery of the reductions for which it would issue offset credits. On the developed country side, interventions could take the form of discounting (credits could be sold to private sector buyers in the ETS) or intermediation (in which case a national entity would purchase the offsets, resell them into the ETS, and capture the price difference to reinvest into international abatement and adaptation measures).

## 2.3 ETS auction revenues

Carbon markets could also be an indirect source of financing through auctioning of allowances to domestic emission trading schemes (as opposed to issuing them for free). Auctioning 50% of ETS credits could raise €60-120 billion per year between 2010 and 2020, assuming carbon prices of €15-30 per tonne. However, most of these funds have been earmarked for other domestic causes, often not related to climate change. Project Catalyst estimates that using 10-15% of ETS auction revenues could raise €5-20 billion. The total financing available will depend on the percentage of allowances auctioned, any factors that influence prices in the ETS (e.g., the levels of caps), and the percentage of revenues allocated to international climate finance. Based on current proposals, including ACESA, auction revenues earmarked for international abatement and adaptation efforts are likely to be significantly lower, as little as €4-5 billion per year<sup>9</sup>.

## 2.4 Other public and international financing

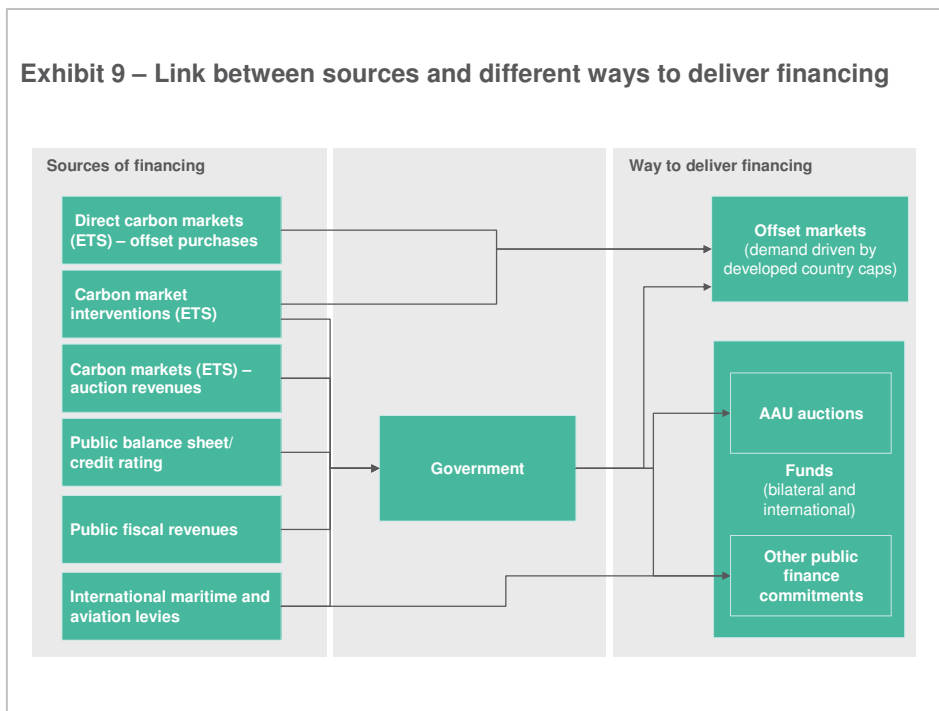
The maximum likely to be generated through private sector carbon markets from the sources above is €20-50 billion, assuming a scenario with caps at 25% below 1990 (i.e., greater commitments than currently stated) and realisation of full domestic abatement up to €60 per tonne. This would leave around €45-50 billion that will need to come from sources such as:

- **International transport levies:** There is potential to raise up to €10-20 billion from air and sea bunker fuels.
- **Public balance sheets / credit ratings to provide concessional debt:** Developed country governments could raise financing from capital markets, issuing bonds with government guarantees leveraging their balance sheets / credit ratings. They could use the financing raised to provide concessional debt to developing countries. Concessional debt could substitute for financing costs of €5-8 billion per year (on average between 2010 and 2020) if a total of €75-150 billion<sup>10</sup> of debt is financed at 5% below commercial rates.

General taxation would need to make up the rest—around €10-25 billion. While theoretically there are no hard limits on how much funding can be raised, it is unlikely to be much more than €20-40 billion per year (around 0.1-0.2% of GDP).

It is important to note that there are different ways to transfer public finance (including revenues from ETS auctions) into the international system. In addition to an agreed transfer based on a contribution formula such as the one proposed by Mexico, the two most important alternatives are offset purchases by governments to meet developed country caps and AAU auctions as proposed by Norway (Exhibit 9).

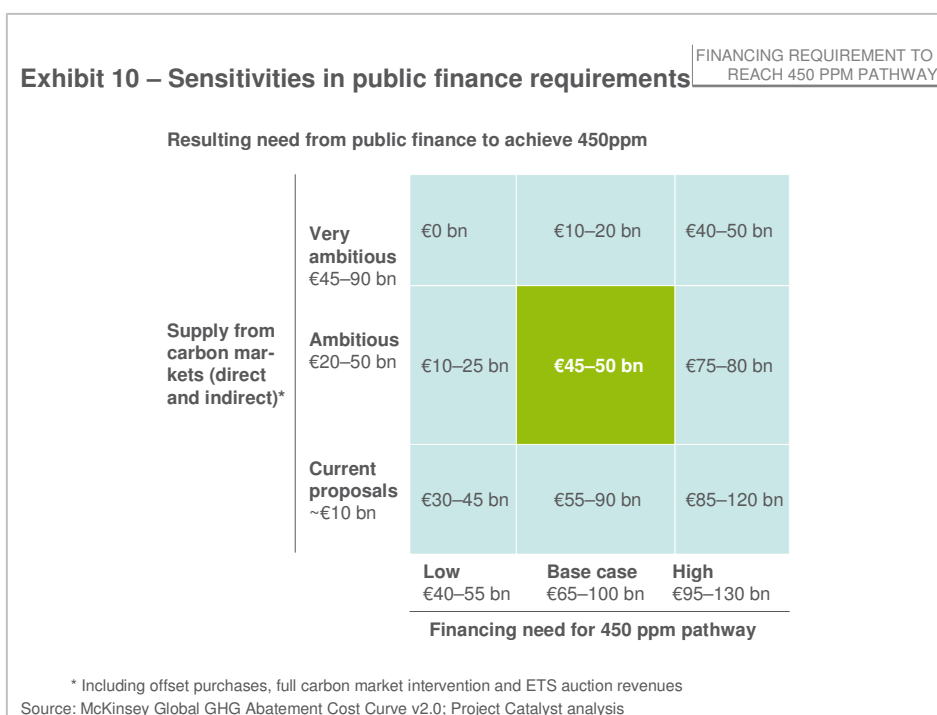
- **Offset purchases:** as outlined above, developed countries will need to purchase an estimated 3 Gt of offsets by 2020, assuming caps of 25% below 1990. Of this demand, 1 Gt is expected to be purchased by governments to meet their emission caps. The total demand will depend on several factors: the caps agreed by developed country governments, the share of the ETS of total emissions, the caps set for the ETS, and, importantly, the treatment of the 'AAU overhang' from the first compliance period (an estimated total of 7 Gt of excess AAU is expected to be carried over from the first to the next compliance period). This AAU overhang could replace demand for developing country offsets and therefore divert public financing away from mitigation in developing countries.



- AAU auctions:** Norway has made a proposal to use AAU auctions to raise international financing in a reliable way. AAU auctions have the appeal that they are based on the ‘polluter pays’ principle and create improved international certainty that financing flows will materialise. The idea is that AAUs would be withheld from developed countries by a UNFCCC body that would auction them to developed country governments and use the proceeds to finance international abatement or adaptation measures. The amount raised from AAU auctions is in theory unlimited, but assuming 2-6% of AAUs are withheld and sold at €15-30 per tonne, AAU auctions could raise about €5-30 billion. It is important to note that some governments might use the proceeds from domestic ETS auctions to finance AAU purchases—but only if both are earmarked separately would funding be additional.

## 2.5 Overall financing mix

In our base scenario, direct carbon markets would deliver about 15% of the total €65-100 billion required, which could be increased by carbon market interventions, and by ETS auctions, to a total of 30-50%. This would leave 50-70% of total financing needs to be covered by public finance sources.



However, this mix will be fundamentally different if developed country caps and auction revenues are set as currently proposed, even if interventions are used to increase the leverage from carbon markets. Under current proposals, only ~€10 billion of the total financing needs per year could be mobilised through the markets, directly or indirectly, and €55-90 billion (or 80-90%) of the total financing would need to come from public finance (Exhibit 10 for a full range of possible scenarios). At the other end of the spectrum, a solution with tight developed country caps (e.g., 40%) could require only €10-20 billion per year in public sources, funded from, for example, €5-10 billion in bunker fuels and aviation taxes, €5 billion substituted by concessional debt, and €0-5 billion provided directly from public fiscal revenues.

## 3. What institutional system would deliver the required funding?

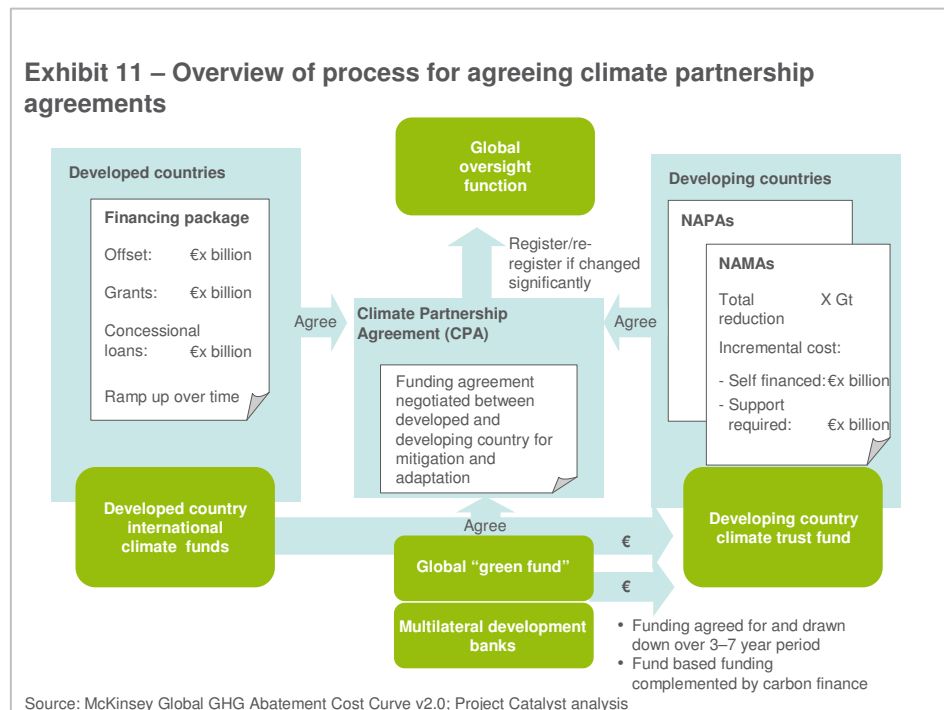
*To deliver financing to developing countries at scale the world needs a system with reformed carbon markets and a fund architecture that consists of bilateral trust funds in developed and developing countries, a global 'green fund' and a fast start fund. This would be supported by a global oversight function that enables an effectively regulated, credible and transparent transfer between developed and developing countries. More specifically, transfers between developed and developing countries could be based on Climate Partnership Agreements (CPAs) that build on monitored, reported and verified (MRVed) Low Carbon Growth Plans (LCGPs) enabling a transition to a low carbon economy.*

To scale up over the next 5 to 10 years, the climate finance system needs to:

1. Mobilise a predictable, sufficient supply of climate finance (from carbon markets, directly and indirectly, and from different forms of public finance), reducing uncertainty for all actors in the system
2. Generate demand for that finance through building an investible pipeline of large-scale abatement and adaptation programmes
3. Deploy climate financing resources against the most cost-effective abatement and adaptation opportunities
4. Provide a range of differentiated instruments in line with highly diverse funding requirements by country and by programme. (REDD funding requirements in Peru, for example, will have little in common with capital-intensive solar financing in India.)
5. Free up an increasing share of public financing over time to tackle likely increasing adaptation investment requirements
6. Attract and mobilise complementary private sector capital investment at scale, while significantly reducing the cost of that finance
7. Operate synergistically with existing development finance systems
8. Deliver transparency on performance for both the sources and uses of the climate financing

This is clearly a long set of requirements to be met. To address these requirements, Project Catalyst proposes the following climate finance system that could ramp up from 2010 (Exhibit 11):

- 1. Project-based CDM only in least-developed countries (LDCs):** For the least economically developed countries, there would continue to be direct carbon market access on a project basis for abatement actions (i.e., within the context of a streamlined clean development mechanism). They would also develop adaptation projects/programmes (NAPAs) that would be eligible for international financial support. This support would be (a) clearly additional to existing ODA flows, and (b) operationally integrated with these flows.

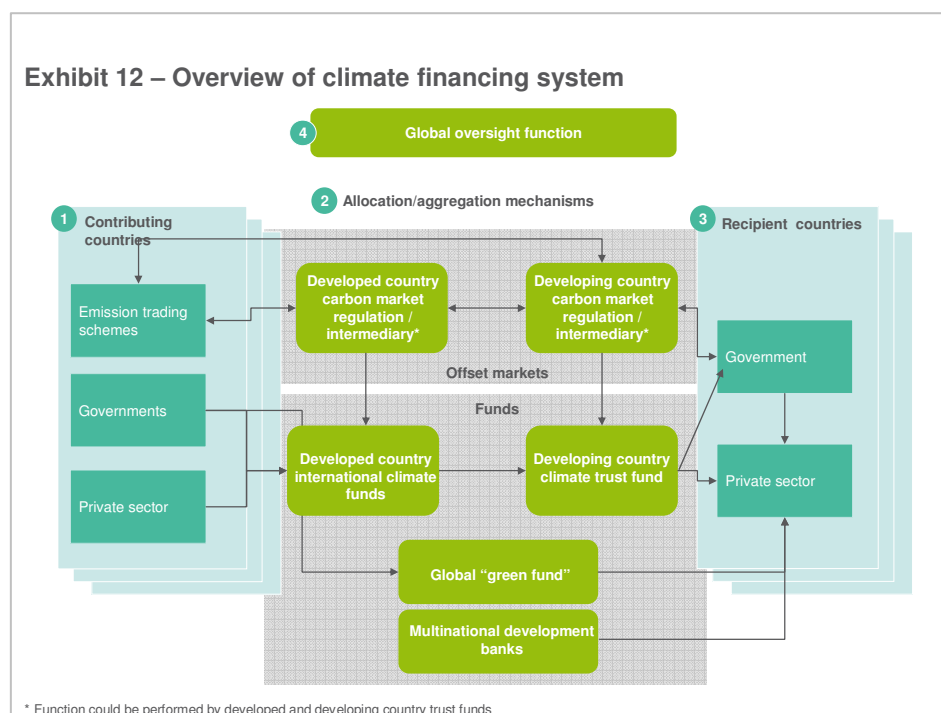


- 2. Low-carbon growth plans developed by all other developing countries:** All other developing countries would develop specific abatement (NAMAs) and adaptation programmes (NAPAs) as part of developing well structured, credible and MRV-able low carbon, climate-resilient growth plans (LCGPs). These LCGPs would specify the incremental costs of implementing the programmes on top of self-financing commitments and outline the total abatement to be measured and accounted for under the global oversight mechanism. In early years, NAMAs and NAPAs would play this role while LCGPs are being developed.

- 3. Programmatic/sectoral schemes as the main delivery mechanism:** To deliver abatement measures at the scale required, developing countries need to move increasingly to programmatic and sector-based schemes, and away from the current, predominantly project-based, delivery mechanism. Programmatic and sector-based schemes would typically require a government entity to implement a comprehensive set of measures (e.g., regulation, standards, feed-in tariffs) in a specific sector, with MRV completed on the programme or sector level.
- 4. Developed country financing commitments:** Developed countries would put together potential financing packages for these programmes, in line with their overall financing commitment, to be MRV-ed by the international oversight mechanism. These packages could be constructed on either a bilateral or multilateral basis. They would specify a schedule of funding over time. They would also specify the mix of financing instruments (i.e., grant support for capacity building, low-cost debt for capital investment, carbon credits for abatement performance) and the basis upon which direct access to carbon markets would be provided.
- 5. Climate partnership agreements:** Developing and developed countries would negotiate a set of climate partnership agreements (CPAs) with respect to LCGPs, NAMAs and NAPAs, which could cover the full plans or parts of it, and be purely bi-lateral or involve several funders. Agreed partnerships would then be registered within the global system (which would need to provide a consistent framework of rules for these agreements). Partially funded partnerships or un-funded NAMAs/NAPAs could be additionally supported by a proposed global 'green fund'. Developing countries would implement the NAMAs and NAPAs over an agreed programme period, and would receive funding support, paid into national climate trust funds. These national climate trust funds would be responsible for overall programme orchestration, deployment of funds, and compliance with MRV requirements. An initial set of funding commitments would be drawn down over time as the developing country climate trust fund met an agreed set of milestones. Although shorter term or more ad hoc arrangements could exist alongside, CPAs would have the advantage in providing stability and reducing transaction costs. Given the need for partnership agreements (providing predictability to both developed and developing countries), developed countries would need to establish their own 'international climate funds' to act as counterparties to developing country funds/implementing authorities.
- 6. Revision of CPAs over time:** Inevitably—as in any partnership—the initial specification of each joint venture (i.e., the NAMA implemented by the developing country and co-funded by the contracting parties) will need to be revised in light of a changing reality: revealed implementation barriers, technology costs, shifts in relative prices, etc. Revised partnership agreements would be re-registered within the global system, which would also provide a dispute resolution facility



Institutionally, this model—in which climate partnership agreements are created between a decentralised network of national entities (the ‘parties’) within a global partnership—requires **four classes of institutions in the system**: (i) developing country climate trust funds; (ii) developed country international climate funds; (iii) a global ‘green fund’ to provide funding where other bilateral or multilateral agreements do not; and (iv) a global oversight system (Exhibit 12).



A network of bilateral trust funds – on both developed and developing country sides of the partnership – would create funding commitments ready to be drawn down by developing countries. **Developed country trust funds** could receive funding through ETS auction revenues, financing captured from intermediation, concessional debt with government guarantees from the capital markets or directly from the public budget. **Developing country trust funds** would be responsible for delivering programmatic and sectoral abatement schemes and adaptation measures and could act as intermediaries issuing credits where appropriate.

There is a strong case for a global funding mechanism or global ‘**green fund**’, potentially accounting for around 20% of total climate finance resources. Such a fund would provide support for investment in global public goods including pre-commercial low-carbon technology (e.g., CCS), facilitate market coordination (for example through co-financing partially funded CPAs), reinforce global regulatory standards, and strengthen global safety nets in the face of increased climate risk. This global green fund should work in a coordinated fashion with other multilateral (development) institutions.

In the early years, a '**fast start fund**' (potentially hosted by the global green fund) would enable and encourage early action by financing capacity building in developing countries and providing support for actions in NAMAs and NAPAs. For much of the early action, countries might not be ready to provide sophisticated MRV for their actions, and the use of proxy payments (i.e., a payment based on an indirect measure for abatement, e.g. reduced deforestation in hectares or solar capacity connected to the grid in MW) might be necessary, as long as they are defined in a conservative way that ensures countries have incentives to move towards full MRV. Interim financing of REDD (reducing emissions from deforestation and forest degradation) should be a particular priority, given the scale of short-term abatement potential (1-2 Gt by 2015) and the irreversible consequences of delayed action. Working together with the Informal Working Group on Interim Finance for REDD (IWG-IFR), our estimates suggest that an interim partnership for REDD could generate 1.5 Gt of annual abatement by 2015 (i.e., 25% reduction in deforestation rates) at less than €5 billion per year.

**Key global oversight functions** to support the implementation of climate partnership agreements would include: (i) parameters for sectoral programmes, including MRV-able metrics on abatement delivery, incremental costs by major abatement lever, and use of funds; (ii) accounting rules to provide 'credit' for developed country financial commitments by type of financial instrument; (iii) contractual rules between the parties, including pricing, fund disbursement, liabilities, performance milestones, and force majeure ; (iv) market matching and coordination functions; (v) dispute resolution; and (vi) overall system performance/reporting.

## 4. What are the roles of different financial instruments in delivering financing?

*Financing will need to be transferred to developing countries through mechanisms and instruments that a) are appropriate for the specific uses and b) maximise the mobilisation of private capital.*

### 4.1 Financing mechanisms appropriate for specific uses

To deliver financing to developing countries, a mix of financial instruments will be required, linked to the sources discussed above. The main delivery mechanisms will be either offset markets (i.e., payment for credits generated) or flows from bilateral or multilateral funds.

**Offset markets**, or carbon market finance (carbon credits), is a highly versatile instrument for any sectoral abatement programme (or project) which meets the following tests: (a) predictable volume of reduced emissions; (b) low delivery risk; (c) relatively simple MRV; and (d) a carbon market price close to the incremental cost of the abatement programme on a per tonne basis.

**Bilateral or multilateral funds** are sourced from indirect carbon market finance and other forms of public finance to support public good provision or strengthen market-based responses (through, for example, reducing risk). Delivery of flows from funds to developing countries can occur via a range of different instruments. These include:

- **Grants** for adaptation, capacity building or policy reform, high-cost technology R&D and pre-commercial deployment or investment in abatement programme enablers which do not generate direct emission reductions (e.g., smart grids), among others.
- **Payments** linked to performance for the incremental costs to governments of implementing sectoral programmes, for example feed-in tariffs particularly for investment in the power sector or REDD payments for forestry.
- **Concessional debt** to support capital-intensive investment, in particular in power or afforestation, helping to reduce financing costs and risk for private investors, thus mobilising more private investment.

In addition to the instruments mentioned above, funds could also be used to purchase carbon credits (potentially at a deeper discount for non-compliance grade carbon) either to resell them to a domestic ETS (as an intermediary) or to retire them.

4. What are the roles of different financial instruments in delivering financing?

**Exhibit 13 – Suitability of different financing instruments for different uses**

NON-EXHAUSTIVE

✓ Where instrument should be used  
 ✗ Where instrument should not be the main financing instrument

		Capacity building	Power & Industry*	Forestry	Energy efficiency	Technology	Adaptation	Description
Offset markets	Project based offsets	✗	✓	(✓)**	✗	✗	✗	<ul style="list-style-type: none"> <li>Mitigation in sectors that are MRV-able on installation basis, e.g., power, industry</li> <li>To be limited to least developed countries</li> </ul>
	Sector / programmatic schemes	✗	✓	(✓)**	✗	✗	✗	<ul style="list-style-type: none"> <li>Mitigation in sectors that are MRV-able on sector basis, e.g., power, forestry, industry, which use credible baselines</li> <li>Sectoral plans are part of LCGPs and reviewed by independent panel</li> </ul>
Funds	Grants	✓	✗	✗	✗	✓	✓	<ul style="list-style-type: none"> <li>Grants primarily for capacity building, adaptation, technology</li> </ul>
	Payments (linked to performance)	✗	✓	✓	✗	✗	✗	<ul style="list-style-type: none"> <li>Payments with link to performance for positive cost sector (e.g., advanced market commitments like feed-in tariffs in power, reduction of deforestation)</li> </ul>
	Concessional debt	✗	✓	(✓)**	✓	✗	✓	<ul style="list-style-type: none"> <li>Concessional loans (or debt guarantees) should be used in positive cost sectors with project finance/ high upfront capital expenditure</li> </ul>

\* Excluding energy efficiency \*\* Concessional debt and offsets could be used for afforestation (where national REDD strategy exists); limited market access for REDD, only with sectoral caps and in case of tight developed country caps

Source: Project Catalyst analysis

### 4.2 Mobilising private investment

Beyond the instruments outlined above, there are a number of other instruments that could help to mobilise private investment. This will be particularly important given the capital-intensive nature of many abatement programmes. These instruments include: (i) debt guarantees; (ii) equity investment guarantees or co-financing instruments; and (iii) advance market commitments, such as the use of public finance to fund feed-in tariffs (or other advance market commitments), substantially reducing perceived risk. Both (i) and (ii) have the effect of reducing the financing cost of the upfront investment capital through lower interest rates and reduced risk on the remaining debt. This form of financing is particularly useful for capital-heavy sectors (e.g., power). Instruments could be designed at the project level or preferably (to reduce transaction costs) at the fund level, mobilising private finance into large-scale, low-carbon debt or equity funds. This approach has three main attractions. First, it would mobilise upfront capital needed for many programmes. Second, it would significantly reduce incremental costs. Third, the guarantees would send a long-term, incentive-compatible signal to private investors that governments are committed to a low-carbon, climate resilient future.

## 4. What are the roles of different financial instruments in delivering financing?

While government guarantees and other risk transfer instruments are a potentially attractive way to catalyse private investment into low carbon assets, they are a form of off-balance sheet contingent liability and do need to be used selectively. These instruments should be deployed on a time-bound basis (i.e., until carbon markets, policies and technologies are more mature) and targeted on correcting for regulatory imperfections and for temporary investor misperceptions of risk. They should be designed in a way to generate scale (where appropriate at the global level through leveraging MDB balance sheets) but also local accountability by aligning incentives with domestic policy commitments. They should not be used either as a substitute for private sector risk-bearing capacity (e.g. around energy prices) or as a substitute for first-best policy interventions to correct market failures (e.g. putting energy efficiency standards in place).

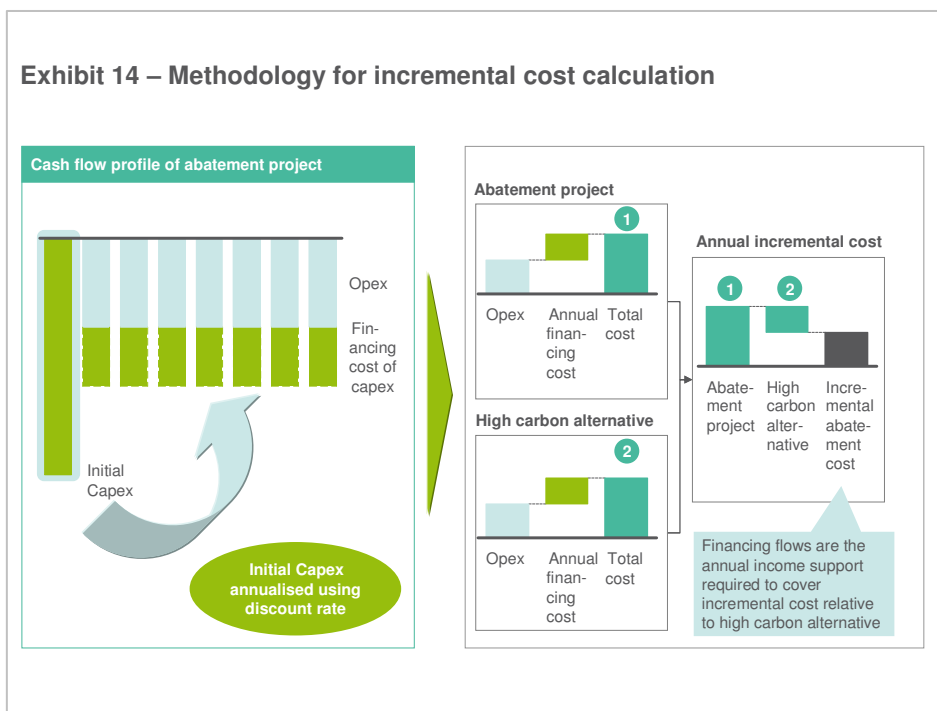
# Annex 1: Assumptions on financing needs

Financing requirements for abatement in developing countries (base case) have been estimated under the following assumptions:

1. Abatement financing needs covers the needs in all developing countries
2. Developing countries deliver about 3 Gt of negative-cost abatement measures (without developed country support or carbon market finance, except support for capacity building or policy implementation)
3. Developing countries will not self-finance the 9 Gt of cost-positive abatement actions on the basis of co-benefits (e.g., for energy security)
4. Abatement financing needs include incremental costs of abatement actions plus an estimate of transaction costs (see Annex 2 for definitions)
5. Abatement financing needs assume an optimal mix of abatement measures – in other words that developing countries abate carbon emissions starting with the lowest cost measures
6. All abatement programmes across all developing countries have a 10% real cost of capital

## Annex 2: Definitions

- 1. Business as usual (BAU) baseline:** Where they exist, total historic emissions are taken from the UNFCCC (this is Annex I countries, 1990-2005). For future forecasts and for historic emissions for other countries, BAU is calculated based on data from the International Energy Agency (IEA) for industry and power, Houghton for forestry and land use, and the US Environmental Protection Agency for non-CO2 emissions from agriculture and waste. Clearly, a range of other BAU baselines exist due to different methodologies, different macroeconomic assumptions, different assumptions for efficiency improvements and different possible future technology mixes. Some more recently analysed baselines suggest lower emissions partly as a result of the recession. A baseline that is 3 Gt lower in 2020, would imply 14 Gt of abatement rather than 17 Gt and reduce the overall cost of abatement in developing countries by around €10-15 billion.
- 2. Incremental cost and financing flows:** In our analysis, incremental cost includes incremental operating expense (i.e., annual cash flows required to pay for abatement) and the incremental cost of funding capital investment (i.e., interest costs and amortisation of incremental capital investment), as shown in Exhibit 14. The analysis is grounded in article 4.3 of the UNFCCC where developed countries agreed to fund 'agreed full incremental cost'. The financing flows shown in this document refer to the average incremental cost per year (2010-20 unless stated otherwise), excluding the benefits of measures with a positive net present value, which are assumed to be captured as rent by private investors. They typically show the investment required to reach the 17 Gt of abatement needed to achieve the 450 ppm pathway. They also include finance required for adaptation, and for investment in technology deployment with high learning potential (as shown in Exhibit 3).



3. **Discount rate:** Unless stated otherwise, financing costs discussed in this paper are calculated at a real (i.e., excluding inflation) discount rate of 4 percent for developed countries, and 10 percent for developing countries. The same discount rates are used for both high-carbon and abatement technologies.
4. **Transaction costs:** Transaction costs are assumed to be €1-5 per tonne (for all abatement measures), based on a range of external sources<sup>4</sup>. These transaction costs are assumed to cover initial capacity building, transition costs, and project-specific transaction costs. They are applied to both positive and negative net-present-value (NPV) measures, and do not take into account the benefits of positive NPV measures.
5. **Incremental capital:** We define the incremental capital of an abatement measure as the additional upfront investment relative to the BAU technology. A key difference between incremental capital and incremental cost is that the incremental capital is the upfront cost that is invested to create an abatement measure (e.g., the investment required for a new plant), while incremental costs look at an annual cost over the lifetime of a plant. The incremental capital required is highly dependent on how energy efficiency savings and the resulting demand reductions in sectors such as buildings and industry, affect the investment requirement in new power generation (Exhibit 15). The incremental capital is much lower than the total capital requirement. In the power sector, for example, total investment required in developing countries (average 2010-20) is €143 billion, but compared to a BAU investment of 110 billion (once demand reduction due to energy efficiency savings taken into account), the incremental capital is just €33 billion (Exhibit 16).



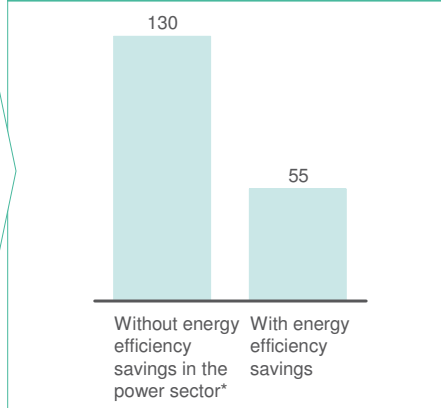
### Exhibit 15 – Incremental capital requirements

FINANCING REQUIREMENT TO REACH 450PPM PATHWAY

#### Definition of incremental capex:

- Incremental upfront capital investment required for mitigation measures in developing countries relative to business as usual pathway
- Based on comparison of mitigation technology (e.g., wind) relative to high carbon alternative (e.g., coal)
- Based on calculation to deliver 12 Gt of reductions to achieve 450 ppm pathway

#### Required incremental capital investment (developing countries) € billion, annual average 2010–20



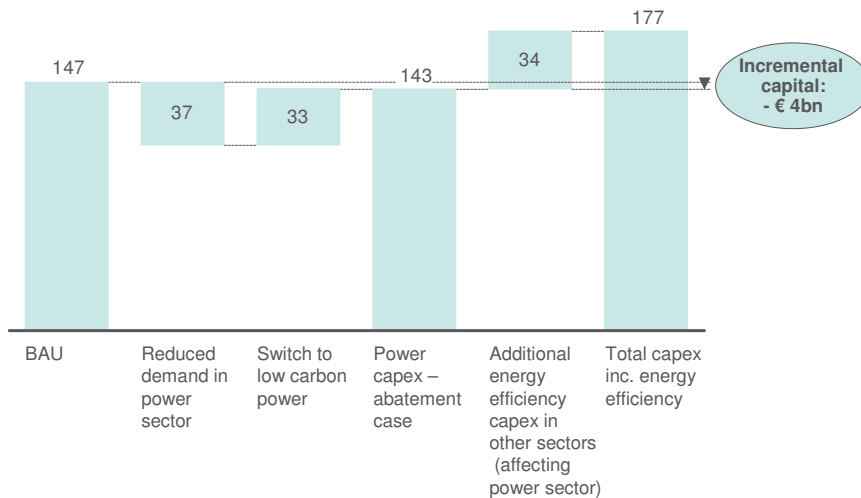
\* Excludes savings in upfront capital investment in power generation as a result of reduced demand from energy efficiency measures as well as other factors (e.g., mix of mitigation levers)

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

### Exhibit 16 – Capital expenditure in the power sector

€bn, 2010–20 average

Capital expenditure in the power sector, developing countries



Source: Project Catalyst, McKinsey Global Abatement Cost Curve v2.0

7. **Carbon price estimate:** This paper derives carbon price estimates from McKinsey's Carbon Market Model. For the ambitious and very ambitious scenarios, it is assumed to be €15-30 per tonne of CO<sub>2</sub>e in developed country emissions trading schemes. Although we assume in both scenarios that developed countries will deliver abatement up to €60 per tonne, we also assume that the price in the ETS systems will not reach similar levels because higher cost abatement will be at least partially financed through other forms of subsidies and/or mandates, such as feed-in tariffs or vehicle efficiency standards. For the current proposals scenario, the carbon price has been calculated at €10 per tonne. In this scenario, the lower carbon price is mainly the result of the large amount of relatively cheap domestic abatement available in the US system (the emissions cap will not be tight enough to require more expensive abatement to be done without additional subsidies), leading to the international offset price being the marginal price in the US ETS. The availability of cheap forestry offsets also has a downward effect on price.

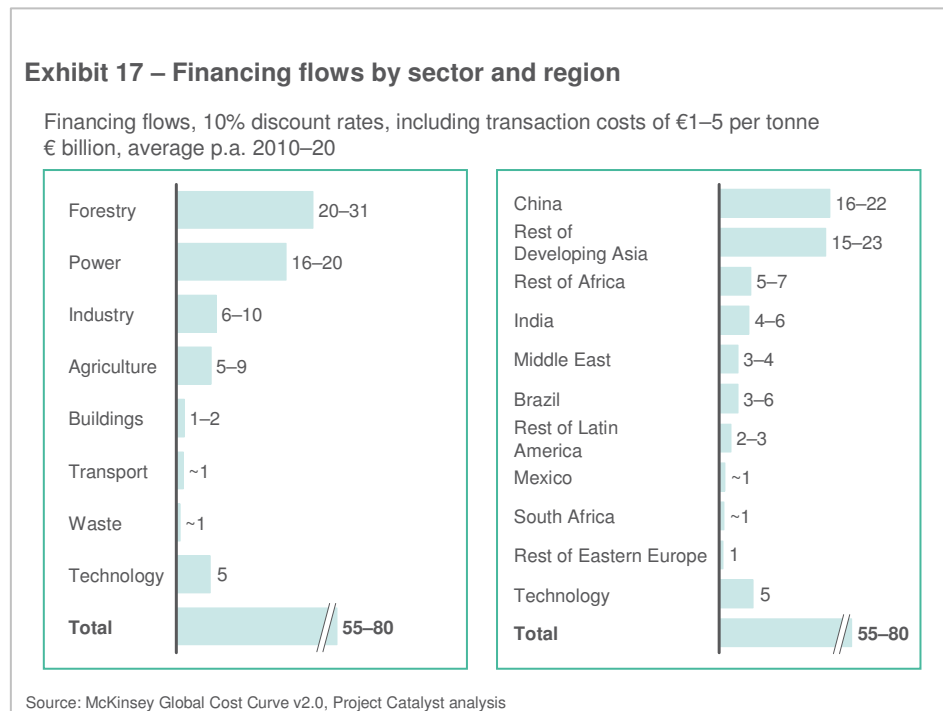
The carbon price estimate affects two key numbers calculated in this paper: the financing raised from the carbon markets with intervention, and the ETS auction revenues. The financing raised from the carbon markets with intervention is a product of the amount of international offsets in the system and the carbon price in domestic ETS systems. This is low in the current proposals case, as both the amount of international offsets and the carbon price are significantly lower than in the other scenarios. The auction revenues are a product of the number of credits auctioned to fund mitigation and the carbon price.

The carbon market model estimates abatement potential, carbon market flows, prices, and required investments for a series of emerging carbon markets and under a range of scenarios. It is based on an investor perspective version of the McKinsey Global GHG Cost Curve v2.0 and takes into account:

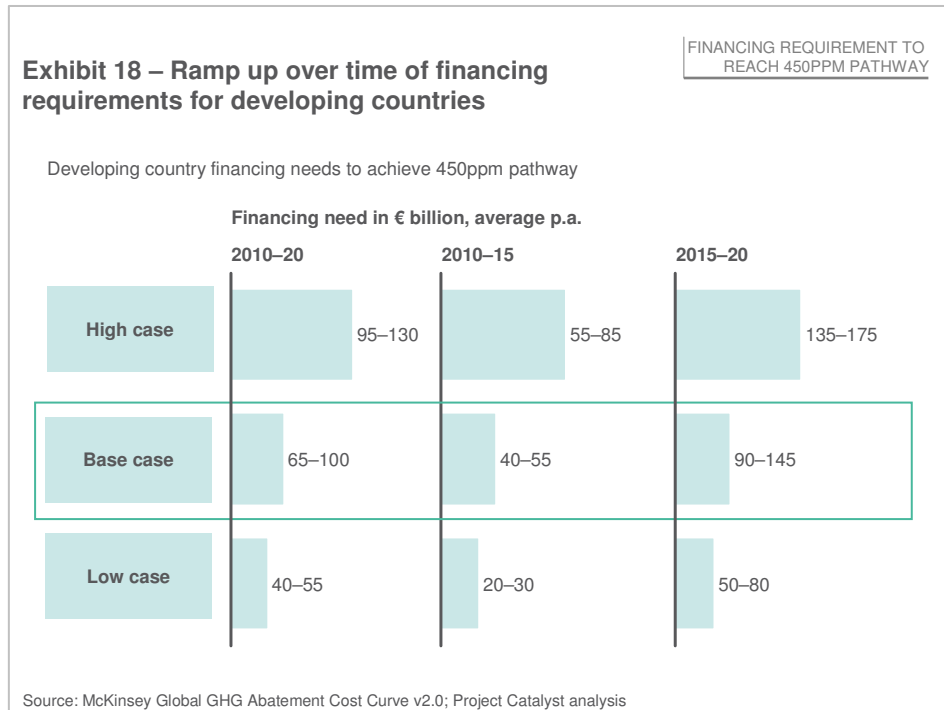
- Intergovernmental Panel on Climate Change (IPCC) scenarios and current target scenarios
- Emissions trading system (ETS) parameters (including scope, targets, offset limits, and price bounds for each regional ETS)
- Offset market scope
- Policy effectiveness estimates
- Banking and linkage

# Annex 3: Financing requirements – breakdown

Exhibit 17 shows the breakdown of the €55-80 billion financing flow requirement for mitigation by sector and region.



The €65-100 billion financing flow requirement for mitigation and adaptation is an average per year 2010-20. In all scenarios, this is likely to ramp up over time, with lower requirements in earlier years, as Exhibit 18 shows.

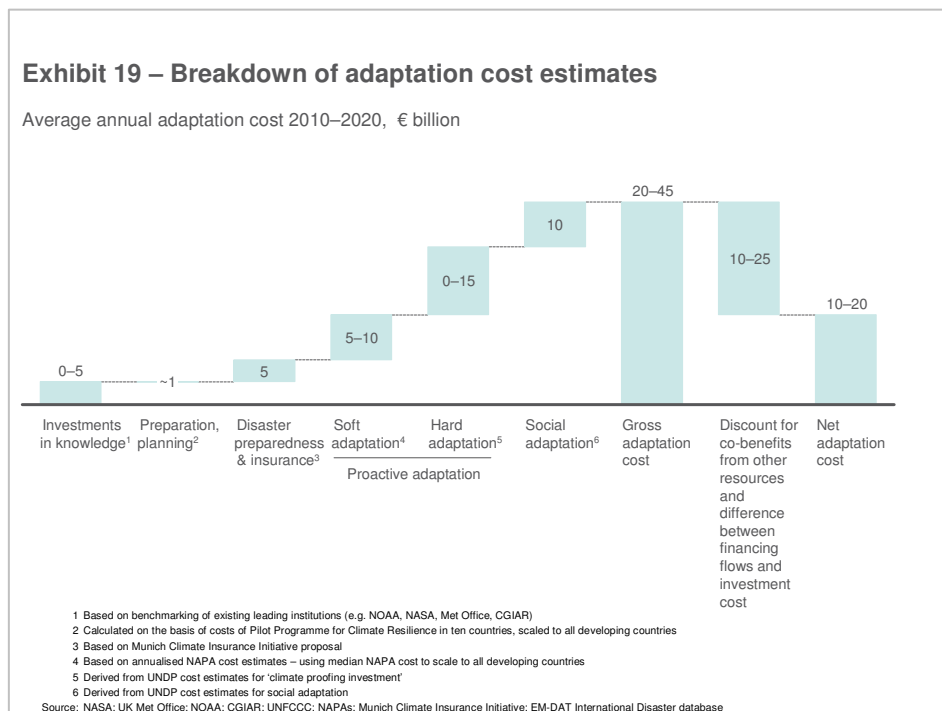


The analysis assumes that negative cost measures are mostly self-financed by developing countries. By definition, negative cost measures result in long-term benefit rather than cost to developing countries. However, developed countries may still need to provide support in the form of access to capital (at commercial rates), and support for policy implementation.

# Annex 4: Adaptation costs

Significant uncertainty surrounds the likely impacts of climate change. For example, climate forecasts range from 2 degrees to greater than 6 degrees Celsius of warming by 2100. Even under the same warming scenarios, different climate models provide different projections at a local level (e.g., whether rainfall will increase or decrease in East Africa in the next 20 years). This uncertainty is especially true for predicted climate impacts in developing countries, so the assessments of corresponding adaptation requirements and the associated costs vary considerably.

Project Catalyst estimates adaptation funding requirements at €10-20 billion per year between 2010 and 2020. This figure is likely to rise significantly in later years. These numbers are highly uncertain given the limited data available, the ambiguity of predicted climate impacts, and the difficulty in defining incremental effects.



There are several reasons why the €10-20 billion estimate presented here may be smaller than some other estimates for the same period. First, the assumed adaptation strategy accounts for the sequencing of adaptation measures over time. In early years, capacity building, planning, preparation, and research are the focus

with more expensive structural ('hard') adaptation ramping up over time. Second, some estimates of adaptation costs do not always distinguish clearly between annual financial flows and capital investment. The numbers presented here are for annual flows and so may appear small by comparison with estimates of total capital investment.

The breakdown for deriving the €10-20 billion estimate for average annual adaptation costs between 2010 and 2020 is shown in Exhibit 19.

The gross costs of adaptation (before discounting for co-benefits) are derived from both short-term investments in capacity building and from related climate proofing of investment ('hard' adaptation). In the short run, investments in adaptation should focus on capacity building and preparation as well as on the clear urgent adaptation requirements identified in the national adaptation programmes of action (NAPAs). This would include investments in knowledge, preparation and planning, disaster management and proactive/urgent adaptation.

Estimates, based on NAPA cost estimates (and benchmarking of leading climate institutions), suggest that €10-20 billion would be required annually from 2010 to 2020, depending on which countries are included. Adding 'hard' adaptation costs that are not included in the NAPAs increases this range to €10-35 billion.

To derive the net cost of adaptation, the gross cost is offset by benefits or spillovers accruing from the activities identified above, such as improved average agricultural yields resulting from climate-proofing agriculture to reduce risk and variation in yields, or a sea wall to guard against severe storms also improving protection against baseline storms.

Furthermore, there is not always a clear distinction between development in the absence of climate change, and what is truly incremental adaptation brought about by anthropogenic climate change. Similarly, we need to account for the fact that annual financing flows will be smaller than total investment costs.

Accounting for these considerations, the net cost of adaptation is estimated to be approximately €10-20 billion.

# Annex 5: Estimate of market potential

## How is the carbon market component split between public contributions and ETS markets?

Developed country emission caps need to be met by the entire economy. The ambitious scenario, a cap at 25% below 1990, results in a carbon market with overall size of 3 Gt (assuming all domestic potential is achieved), which is equivalent to financing flows of €5-20 billion.

Most of the 3Gt is likely to be purchased by private companies through national emissions trading schemes. The remainder will need to be purchased by governments to meet their targets. In the US, EU and Australia, which have already introduced or are in the process of developing domestic legislation for Emissions Trading Schemes, the ETS cover on average of 70% of national emissions. For the 25% scenario, it is assumed that other developed countries would adopt a similar ETS, and that their ETS would have similar caps to those of the overall economy. This would result in around 70% of the €5-20 billion being funded by private sources – around €4-15 billion, leaving up to €5 billion for public finance.

## What are the market implications of different intervention mechanisms?

Interventions could take the form of an intermediary institution (e.g., a developing country climate fund that sells credits into developed country carbon markets and pays for incremental costs at home, reinvesting the difference). It could also take the form of regulatory mechanisms, such as discounting, taxation, or the use of more ambitious baselines that imply a share of the incremental costs is self-financed by the developing country. All of these mechanisms would have some impact on market dynamics, as shown in Exhibit 20.

**Exhibit 20 – Impact of market intervention on financing mechanisms**

	Description	Limitations	Current use	ILLUSTRATIVE Implications
<b>No intervention (base case*)</b>				
<b>Discounting</b>	Discount factor between emissions credits in developing country domestic ETS and those bought from developing countries	Steep cost curve causes price jump and surplus increase	Waxman Markey	<ul style="list-style-type: none"> <li>Increases abatement (developing &amp; developed)</li> <li>Increases price</li> </ul>
<b>Tax</b>	Tax on CDM permits, differentiated by sector/technology to reduce gap between price and cost	Reducing incentives may affect CDM supply and price	China CDM market	<ul style="list-style-type: none"> <li>Captures surplus</li> <li>Allows to reinvest to increase abatement</li> </ul>
<b>Baseline</b>	Sector baseline set below expected BAU, requiring some abatement to be done (e.g. positive NPV) before rest is rewarded	Introduces conditionality to funding of mitigation	Waxman Markey - forestry	<ul style="list-style-type: none"> <li>Captures additional low cost abatement</li> <li>Increases price</li> </ul>
<b>Intermediation</b>	Central intervention to source offsets at cost price from developing countries through reverse auction, sell to developed countries at ETS prices and reinvest	Reducing incentives may affect CDM supply and price		<ul style="list-style-type: none"> <li>Same abatement</li> <li>Surplus reinvested</li> </ul>

\* Sectors included: Power, Industry, Waste, Afforestation, 10% discount rate, no NPV positive abatement, cost of abatement for reinvested surplus (€ 8/t) taken from average across all sectors (inc. forestry, agriculture, buildings, transport)  
Source: Project Catalyst analysis, McKinsey Global Abatement cost curve v2.0



# Glossary

<b>Assigned Amount Unit (AAU)</b>	National emission allowances that correspond to the amount a country can emit in accordance with their target under the Kyoto Protocol (their “assigned amount” of greenhouse gas emissions). Each AAU is equivalent to 1 tonne of CO <sub>2</sub> equivalent (CO <sub>2</sub> e)
<b>AAU market</b>	System by which AAUs may be traded between countries that have targets under the Kyoto Protocol.
<b>Abatement</b>	The reduction in emissions versus a business-as-usual baseline.
<b>Annex-I</b>	Countries in Kyoto protocol with an emission cap (Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, European Union, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States of America).
<b>BAU (Business-as-usual)</b>	The projected path of emissions over time in the absence of emissions-reducing activity. In this paper, BAU is calculated based on forecasts by the International Energy Agency, Houghton, and the U.S. Environmental Protection Agency.
<b>Carbon market finance</b>	Funding for abatement that arises from the trade of offsets in the international carbon market(s).
<b>Carbon market intermediation</b>	In the context of this document: intermediation of the carbon market refers to institutions that would sit between private players in the carbon markets to improve the effectiveness of the markets, i.e., increase the amount of abatement delivered
<b>Carbon market intervention</b>	In the context of this document: action by governments that impact the amount of abatement delivered for every tonne offset in developed countries. This could take the form of discounting, taxation, the way baselines are set or intermediation mentioned above
<b>Certified emission reductions (CER)</b>	A Kyoto Protocol (offset) unit equal to 1 tonne of CO <sub>2</sub> e. CERs are issued for emission reductions from CDM project activities.
<b>Clean Development Mechanism (CDM)</b>	A mechanism under the Kyoto Protocol that allows emission-reduction (or emission removal) projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to 1 tonne of CO <sub>2</sub> e. These CERs can be traded and sold, and used by Annex-I countries to a meet a part of their emission reduction targets under the Kyoto Protocol.
<b>Concessional debt</b>	Lending extended by creditors at below-market terms.
<b>Developed nations</b>	Approximation for Annex-I nations in the context of this paper. Due to the resolution of the McKinsey cost curve v2.0, developed nations are not exactly the same as Annex I nations.
<b>Developing nations</b>	Approximation for non-Annex-I nations in the context of this paper.
<b>Emissions cap</b>	A country’s “assigned amount” of greenhouse gas emissions (i.e., the amount it can emit in accordance with its target under the Kyoto Protocol). A cap could be set for a country or for a sector.
<b>Emissions reduction</b>	Absolute emissions reductions versus a previous year.

<b>Emissions Trading System (ETS)</b>	Domestic cap-and-trade system / carbon market that is set up within a country or region as a means to deliver emission reductions. Units traded are different from AAUs (e.g., EUAs in the case of the EU ETS) and the main link with the AAU markets is the CDM, since CERs can be bought both by AAU buyers and ETS.
<b>Incremental capital expenditure</b>	Additional, upfront capital expenditure required above BAU capital expenditure to replace a high-carbon investment with a low-carbon alternative. For example, for a wind farm, it would be the extra capital investment required relative to a coal plant.
<b>Incremental cost</b>	Incremental cost required to implement low-carbon technologies compared to the high-carbon alternative. Developed countries have committed to support incremental cost in developing countries under the UNFCCC.
<b>Incremental financing flows</b>	Definition of incremental costs used by Project Catalyst: financing flows estimate the annual, incremental costs for a low-carbon abatement and are the sum of incremental, annual financing costs (i.e., the annual interest charge for the incremental capital invested), the incremental operating expenditure, and an estimate for transaction costs, all relative to a high-carbon alternative.
<b>Low-Carbon Growth Plan (LCGP)</b>	A plan laying out a country's strategy for achieving sustainable development consistent with low-carbon growth.
<b>Marginal cost</b>	The cost of the activity which sets the market price; i.e. point at where supply and demand are equal.
<b>MRV</b>	Monitoring, reporting and verification
<b>NAMA</b>	Nationally appropriate mitigation action
<b>NAPA</b>	National adaptation programmes of action
<b>Offsets</b>	A tonne of carbon abatement that can be bought to counteract or offset a tonne of carbon emitted.
<b>Public finance</b>	Sources of finance derived from governments or institutions acting on their behalf.
<b>REDD</b>	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
<b>Total capital expenditure</b>	Total investment required to deliver an activity (includes BAU and incremental capital expenditure).

# References

1. 450 parts per million is the maximum atmospheric concentration of CO<sub>2</sub> equivalent that would give a 40-60% chance of limiting increase in global temperatures to 2°C.
2. Recent estimates suggest that, in light of the downturn, 2020 BAU could be closer to 58 Gt. This would result in a lower financing requirement, but only if all other conditions (e.g. full domestic abatement in developed countries) are met.
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5. Although developed countries are expected to realize their technical potential up to a marginal abatement cost of €60/t, the ETS market price should be significantly lower than this (assumed in this paper to be €15-30/t) . Higher cost levers will need either mandates or additional subsidies (e.g. feed-in tariffs)
6. This analysis assumes that offset purchases are proportional to the emissions covered by emission trading systems, about 70% for the main developed country emissions, and that the ETS's have similar caps to the total economy.
7. Current proposals for emissions caps result in a low financing flow (~€3bn) on average 2010-20 for several reasons. The EU has a very limited international offset allowance in the ETS. In the US, the full offset allowance is unlikely to be fully used, due to cheap abatement available domestically. Additionally there is likely to be a large amount of cheap forestry offsets available to the US market. See annex 3 for more detail on carbon price estimates.
8. Calculated based on McKinsey Carbon Market model using US EPA emissions baseline.
9. €4-5 billion per year corresponds to 6-7% of total ETS permits being auctioned to fund mitigation, at a carbon price of around €10/t.
10. €75-150 billion concessional debt is assumed to contribute towards total capital expenditure rather than just the incremental capital expenditure above the BAU technology mix. This would replace existing debt that countries would take on at commercial rates in the BAU case. For example, this would mean concessional debt would cover the entire capital investment required for a solar project instead of the incremental capital required above investment in a comparable coal plant.
11. For example, Lawrence Berkeley National Laboratory; Alston and Hund; Woods Hole Research Center; Conservation Reserve Program; and the United States Department of Agriculture

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