

Achieving increased ambition through targeted mitigation actions in the global power sector

Mandate: COP 17 Decision regarding the Establishment of an Ad Hoc Working Group on the Durban Platform for Enhanced Action¹

February 24, 2012

1. Introduction

- As part of the Durban Platform, parties will be submitting to the COP proposals to increase the ambition of action against climate change.
- Although motivated to benefit the common good, it is reasonable to expect that these proposals will also aim to safeguard the national interest of the negotiating parties.
- Therefore, the key challenge facing the Durban Platform will be to reconcile these diverse views.
- In order to fulfill the stated goal of the COP to “develop a protocol, another legal instrument or a legal outcome” by 2015, all party proposals must be harmonized to ensure that they are consistent with the overall goal of “holding the increase in global average temperature below 2 °C or 1.5 °C above pre-industrial levels”.
- To achieve this, both individual parties and the COP will need excellent modeling capabilities to assess different mitigation scenarios and estimate their costs and therefore reach an agreement that meets the global goal and, to the degree that it is possible, respects individual parties’ interests.
- In this submission we present a concrete **vision** to achieve greater ambition based on a global sectoral mechanism in the power sector complemented by a Green Fund supporting mitigation in other sectors. By focusing mitigation effort on the most important sector initially, a global deal can be forged which achieves sufficient emissions reductions to bend the global emissions curve and facilitate the decarbonization of the wider global economy.

¹ Establishment of an Ad Hoc Working Group on the Durban Platform for Enhanced Action. Framework Convention on Climate Change. FCCC/CP/2011/L.10. (December 10, 2011)

- In practice, this vision can be achieved in a number of ways, depending on how the burden is shared among countries, and the details of the financial and regulatory mechanisms involved. These will be determined by the negotiations.
- Having specified our vision, this submission also makes a concrete first step towards it: we propose a number of scenarios, and we quantify the potential economic impacts.
- These scenarios are meant to offer a starting point for the discussions on the Durban Platform. In the coming months and years we intend to develop more detailed and increasingly sophisticated scenarios to both mirror and inform the evolving international debate and negotiations.
- The scenarios set out in this document were developed using a modeling tool known as GLOCAF Plus. Appendix II provides more information about the tool and gives examples of scenarios and options to further increase the level of ambition of action against climate.
- GLOCAF Plus can support:
 1. individual parties in a) designing and substantiating their own proposals and b) analyzing, assessing and responding to the proposals of their negotiating partners.
 2. the COP, acting as a neutral observer, in ensuring that individual party proposals are consistent with the global goal of increasing the level of ambition.

2. Vision for a post-Kyoto global deal on climate change

The sooner the growth in greenhouse gas emissions peaks and declines the better, both in scientific terms and in terms of communicating that progress is possible and the problem resolvable.

The question is how to achieve this rapid peak and decline? Looking at the lack of progress in the past two decades it may seem that there is not much hope of success. However, there is reason to be optimistic.

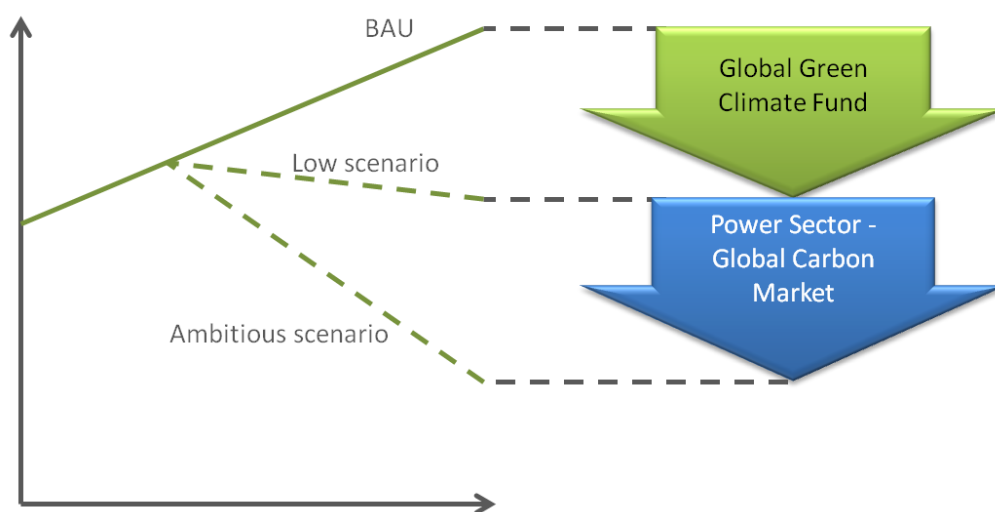
One key reason for the slow pace of progress has been that a relatively long time ago the UNFCCC and Kyoto Protocol divided the world into just two categories of developed and developing nations. While there were strong reasons behind this choice, such as equality and responsibility, many developing countries are projected to become major emitters in the years to come. China is already the world's biggest emitter. This puts significant obstacles in reaching an agreement on how to share the burden.

The Durban Platform offers a new start: an opportunity to look at the problem with a fresh pair of eyes. The question to answer is: how can we share the burden in a way that is consistent with the global goal while respecting the principle of common but differentiated responsibilities? The answer should build on the achievements made so far, including the successful establishment of the Global Green Climate Fund (GGCF).

2.1 The vision

The diagram below summarizes **our vision**:

1. **The Global Green Climate Fund should be the basis of the new global deal.** The GGCF was established in Durban, and it was agreed that it should receive US\$100bn yearly by 2020. Around half of this should go towards mitigation efforts. As the diagram below shows, this would take us a long way towards our global mitigation goal.
2. **Enhance ambition with a Power Sector Global Carbon Market.** The goal of the Durban Platform is to increase the level of ambition. Given the complexity of the negotiations, we should focus on the lowest hanging fruit that has the biggest potential. We believe that this is the power sector, where it is possible to envision an international carbon market centered on the power sector. The following pages will explain the reasons behind this recommendation, and present scenarios of what this could look like and what the impact could be on different countries.



2.2 The devil is in the detail: 'reference scenarios' and 'what if discussions'

Achieving this vision is easier said than done. The number of variables is enormous, and the interests of the various countries are extremely diverse. Reaching an agreement will take a lot of discussions, debates and negotiations. In the end, a deal will be signed only if all the parties are content with it, and if it is consistent with the global goal. This will ultimately depend on the costs involved. So parties will need a platform to share, harmonize and coordinate their views. This platform should be capable of handling the complexity of the negotiations, and should allow parties to check whether their proposals are consistent with the global goal. It should also enable them to test other countries proposals. Above all, this platform should be objective, credible and trustworthy.

The sections below offer a first step towards the development of such a platform. We use the modeling tool GLOCAF Plus to begin to delve into the details of our vision. We begin to put numbers next to our

vision, and explore some initial scenarios. Concretely, we designed two scenarios for the Green Climate Fund, and two scenarios for the Power Sector Global Carbon Market.

In this early stage of the Durban Platform negotiations, these scenarios are intentionally idealized to some extent. For example, the carbon market is a global free market with no restrictions to trade. Also, the green fund requires all countries to contribute funds (with a simple and transparent contribution formula), and all countries have access to it.

Our purpose is to create a set of '**reference scenarios**'. These should be seen as discussion starters, and are meant to create an opportunity for '**what if discussions**' or '**yes but discussions**'. For example:

- What if only developed countries were required to contribute to the Green Fund: how would this affect the costs?
- What if there was a limit to how many credits any one country could buy from or sell to the carbon market?

These are all scenarios that can and should be modeled, studied and discussed in detail. However, the number of such scenarios is basically unlimited, and the purpose of this paper is to propose a vision and offer a platform to discuss the details of such vision, and not to take a specific stand. That is the right and purpose of independent, sovereign nations.

In other words, we invite parties to actively participate in this dialogue, and take ownership of it. We would be happy to share our tools.

Having set up the vision and the context, let us delve into our reference scenarios. The next section discussed the Green Climate Fund. The following section explores the role of the Power Sector Global Carbon Market and its potential to enhance the level of action.

3. The Global Green Climate Fund

The COP-17 in Durban established the Global Green Climate Fund. It was agreed that by 2020 the GGCF should receive U\$100bn yearly to support mitigation and adaptation actions.

This represents the foundation of the post-Kyoto global deal, and the starting point of our vision.

Many of the details of the GGCF have yet to be decided, particularly how it is going to be funded and how it would support actions against climate change, particularly for mitigation.

In this section we explore a couple of reference scenarios and see how far it takes us towards our global mitigation goal. This would give us an indication of what would be the contribution required by the Power Sector Global Carbon Market.

3.1 Reference scenarios

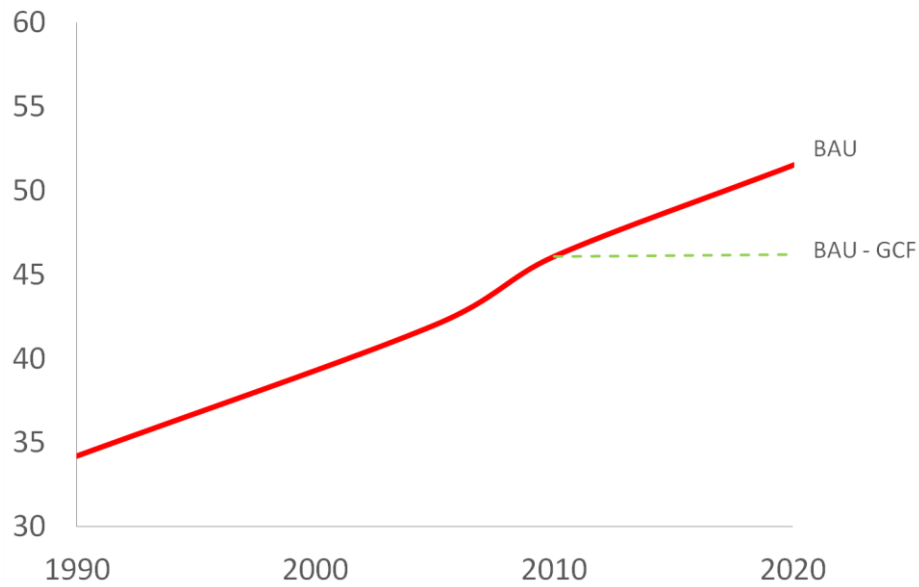
Here we assume that the GGCF would work as follows:

- We focus on the year 2020
- A total amount of US\$50bn are dedicated towards mitigation actions (this is half of the US\$100bn that would make up the GGCF)
- The GGCF would fund projects in all sectors except the power sector, which will be covered by the Power Sector International Carbon Market.
- Since it is not yet clear how much each country would contribute into the GGCF, here we make a simple and transparent assumption: all countries contribute to the fund, both developed and developing. As to the share of the contributions, we assume two simple formulae to explore the concepts of 'responsibility' and 'equity':
 1. Responsibility: this formula takes into account per capita emissions, and more polluting countries make larger contributions to the fund.
 2. Equity: this formula takes into account the ability to pay, and relates a country's contribution to its share of world GDP in 2020.
- We also assume that the GGCF pays for mitigation actions at a fixed price per ton of CO₂e.
- This would be equivalent to a carbon price, and would create automatic incentives to economic actors around the world to implement mitigation actions wherever it is economically convenient. By looking at the marginal abatement cost curves of each country, we are able to estimate the level of mitigation that this mechanism could induce. Furthermore, this would also allow us to estimate the actual price of each ton of carbon. (Studies show that it is actually important to determine this price as precisely as possible because a higher price would lead to a demand larger than the GGCF could finance, while a lower price would leave funds unutilized).
- This mechanism is also efficient in that it does not require the administrators of the GGCF to centrally select the projects eligible for finance, but it would automatically create a pseudo market mechanism whereby individual actors would identify the most suitable projects. In a way, this design can be seen as a carbon market with one single buyer: the GGCF – and would have all the efficiency advantages of a full carbon market.

The two contribution formulae result in two different scenarios; however, they affect only the share of the action taken by each country and not the global action. In other words: these scenarios affect how the cake is sliced, but not the size of the cake itself.

Under the above design, the model indicates that a US\$50bn mitigation fund could result in 5.3GtCO₂e of mitigation action in 2020. The diagram below compares this with BAU emission projections.

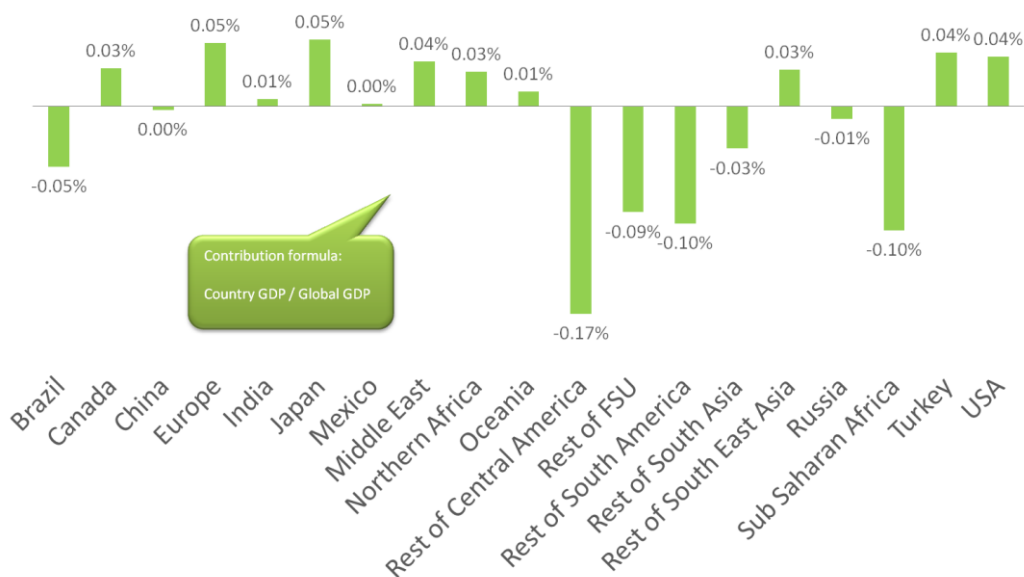
Global GHG emissions (GTCO₂e)



The next question is: how are the actions and costs distributed among the participating countries? GLOCAF Plus outputs a wide range of interesting variables, including mitigation actions by country and by sector, how much each country contributes to the fund, how much it actually receives, whether the country experiences a net economic loss or an actual economic gain.

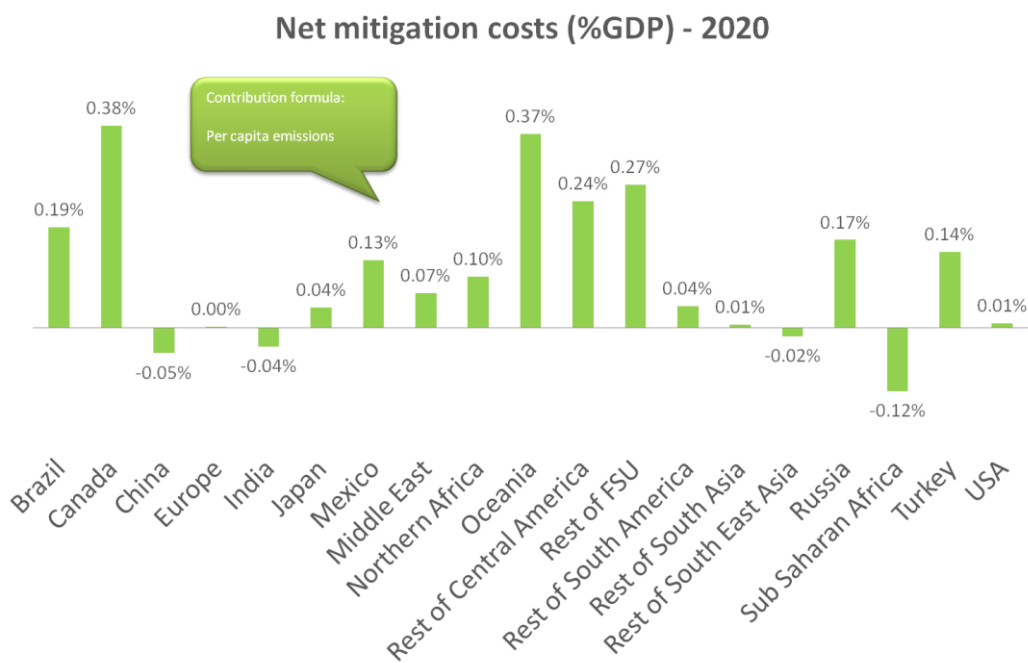
As an illustration, the diagram below shows the net mitigation costs experienced by 19 regions and countries in the world. The costs are measures as a percentage of projected GDP in 2020. The diagram uses the Equity formula, and thus requires countries to contribute to the fund based on their share of world GDP.

Net mitigation costs (%GDP) - 2020



The negative costs represent net economic gains. So for example, under this scenario Brazil could earn around 0.05% of its GDP from the GGCF. Sub Saharan Africa could earn around 0.10%. On the other hand, the USA would experience a net cost of 0.04% of its GDP.

The diagram below shows the Responsibility scenario, where countries contribute to the GGCF in terms of their per capita emissions. This scenario is generally less favorable to developing countries: here Brazil experiences a net loss of 0.19% of GDP. However, Sub Saharan Africa experiences an even larger gain: 0.12% of GDP.



3.2 'Yes but' discussion

One potential immediate criticism to the above reference scenarios would be that only developed countries should contribute to the GGCF and perhaps only developing countries should have access to its resources for mitigation purposes. Indeed, under the UNFCCC agreement, only developed countries are required to contribute.

However, at this stage it has not yet been decided what amounts developed countries shall be contributing into the GGCF. Also, developing countries are not excluded from contributing, and future negotiations may perhaps lead to some developing countries deciding to contribute to the GGCF.

The number of permutations of possibilities would be almost infinite. Different parties would be interested in exploring and supporting different scenarios. The purpose of this paper is to offer a structured platform to explore, discuss and compare these scenarios. GLOCAF Plus can quantify these as well as a host of much more sophisticated scenarios and thus support the discussions.

4. A global carbon market for the power sector

In this section we explore and justify how a global carbon market on the power sector could build on the GGCF and considerably enhance the level of ambition.

A number of countries (most notably the US and Japan) have proposed that a sectoral approach to the issue of tackling emissions could be adopted – that is to say that the global carbon budget could be divided by sectors of the global economy as well as by nation state.

Taking a sectoral approach has the advantage of more directly engaging the economic actors who control investment decisions in energy infrastructure, which often has a long life span. The economic actors in a sector are also a homogenous group compared to country economies and many are multi-national organizations capable of deploying international strategies.

Three major sectors make up the majority of global carbon dioxide emissions – the generators and suppliers of electricity, the suppliers of transport fuels and the suppliers of fossil fuels for heat processes. Additional industrial sources of CO₂ include iron ore processing and cement manufacture.

4.1 Power sector first

The biggest sector by volume of carbon dioxide emissions is the global power sector accounting for around 30% of global emissions – emitted from ~50,000 installations controlled by ~4,000 companies; this is a relatively small number. Furthermore, the location of such installations is fixed, as opposed to much more complex and less predictable sectors such as transport.

The sector is sufficiently large that effective regulation in this sector alone could help to bring about a bend in the global curve in emissions. Only with a decarbonized power sector is it possible to decarbonize the remaining sectors either through increased electrification or the use of electricity to manufacture hydrogen and synthetic fuels.

Starting the process of bringing emissions into a global regulatory framework by focusing on the power sector has the following advantages:

- It is the sector with the most developed and best understood mitigation technologies.
- Europe has already demonstrated its willingness to take on very challenging caps in this sector (the EU ETS already places a significant cap on power stations – the UK, Germany and Spain all handed out approximately 35% fewer permits in 2008-12 than emissions in 2007).
- The US has already introduced caps on the power sector in some states (via the RGGI state level trading scheme) and federal legislation is expected to follow.
- Fossil fueled power stations are a highly concentrated source of emissions and often subject to some form of pollution regulation already making the establishment of registries relatively easy.
- It is not a sector exposed to international competition or risk of ‘leakage’ making differentiation within the sector easier to agree.
- It is sufficiently large to have a material impact on the global emissions curve.

- Once decarbonized, this sector can help to deliver mitigation in the transport and heating sectors.
- Once built, infrastructure is long lived – early regulation avoids lock in to a high carbon future and prevents stranded assets being created.
- There are energy security and air quality co-benefits associated in a rapid decarbonization of this sector that can offset the extra cost of ‘leap-frogging’ traditional technologies.
- If the world moves together, economies of scale will be increased making it cheaper for everyone.
- The good news is there are plenty of solutions available – investments in non-fossil electricity technologies already exceed investments in fossil fuel projects. The momentum is clearly there but action on the ground needs to be significantly increased. And that can only flow from sound policies at an international and national level.

If we want to stem the tide of emissions we need to act quickly, with focus. The Durban Platform is a new opportunity for countries to put aside their differences and started collaborating. Fortunately, a huge chunk of the world’s emissions of carbon dioxide come from a relatively small number of countries and installations. Coordinated action need not be complex.

We want leaders in key countries to commit to turning off the tap of emissions by focusing their attention on their power stations. If the companies who operate these stations can be incentivized to clean up their act, by investing in improved efficiency and cleaner technologies, then we can make huge strides in reducing total global emissions. And this can happen quickly – because this sector has the most developed and commercially proven alternative technologies with plenty more on the drawing board just waiting for sufficient investment to make them a reality.

4.2 Is it equitable?

Perhaps the hardest question people raise is how can we be advocating that countries like India, who have so many rural poor with currently no access to power, should be required to limit their emissions?

To that we say: lower emissions do not need to mean less electricity or power. Spending less on polluting, inefficient, fossil fuel power stations will make it easier, not harder, to provide access to more people via decentralized local sustainable energy options. India is a nuclear power and has huge potential for renewable power and like many countries who are just starting on the process of urbanization and industrialization it has a choice – it can take the clean development path or the dirty one – States like Tamil Nadu have already chosen the right path and India has itself indicated it is ready to apply emissions trading to the task of reducing the carbon intensity of its economy. Furthermore, clean energy microgrids may be most competitive in poor rural areas currently not serviced by the main power grid: for example, many rural areas in India currently meet most of their energy needs with kerosene, which is more expensive and dirty than the latest solar and wind technologies.

Another fortunate thing about emissions is that they tend to correlate quite well with industrialization. Generally speaking burning carbon leads to wealth. So, in reverse, this means high emissions means a relatively high capacity to do something about it.

4.3 The reference scenarios

This sections uses GLOCAF Plus to model the Power Sector Global Carbon Market. The results show that developing countries, which could be net sellers of carbon credits, could actually be earning from the carbon market. More interestingly, the results show that a higher level of ambition could even result in more significant gains for developing countries. The reason for this is that, if the size of the market increases, net sellers would have an opportunity to sell more carbon credits at a higher cost.

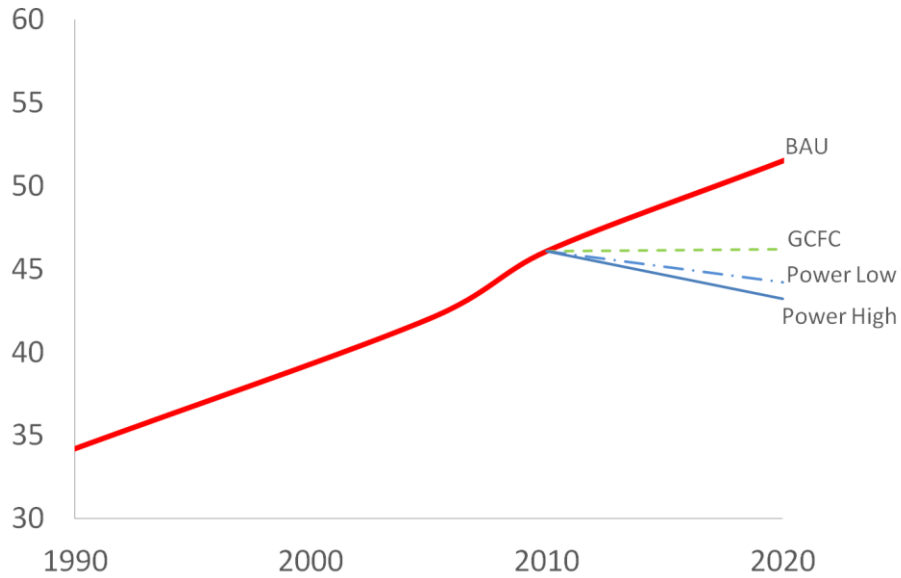
As for the GGCF, here we propose a couple of reference scenarios for the power sector. These allow us to estimate the potential impact on the global mitigation goal and to explore the possible impacts on individual countries.

The following assumptions underlie our model results:

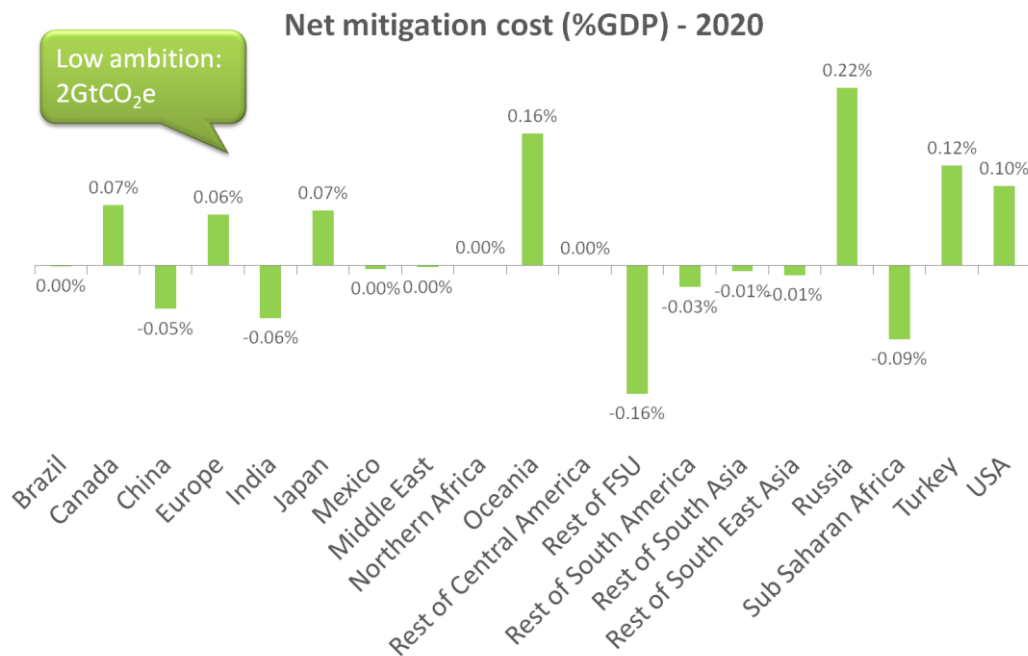
- The year under consideration is 2020.
- We assume a free trade carbon market for the power sector. All countries participate in the market.
- There are no restrictions to trade: neither on demand nor on supply.
- We assume two global targets for the power sector carbon market:
 1. Low ambition: 2GtCO₂e,
 2. High ambition: 3GtCO₂e.
- The next question is: how do the countries of the world share this global target. Again, as in the case of the GGCF and for the sake of transparency and simplicity, here we assume an idealized burden sharing scheme:
 1. All countries take legally binding targets. These are expressed in terms of percentage reductions relative to BAU in 2020.
 2. The targets are different for developed and developed countries; however, all developed countries have the same targets, and all developing countries have the same targets. Here we assume that developed countries cuts are ten times larger than developing countries cuts relative to BAU. The actual magnitude of the targets is chosen so that the global targets agree with the two scenarios. Specifically:
 - Under the low ambition scenario, developing countries cut their emissions by 30% relative to BAU, while developing countries cut it by 3%.
 - Under the high ambition the cuts relative to BAU are: 47% for developed countries and 4.7% for developing countries.

The diagram below shows how the Power Sector Global Carbon Market helps push down global emissions, as indicated by our vision.

Global GHG emissions (GtCO₂e)

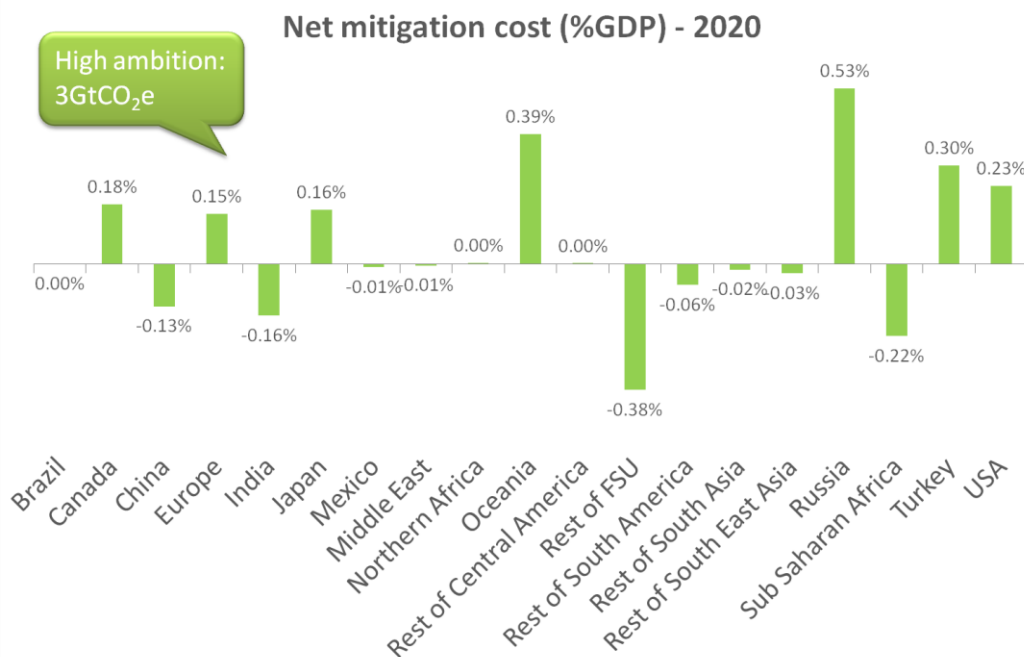


The diagram below shows how the costs would be distributed among the parties under the low ambition scenario. The net costs aggregate mitigation expenses as well as earnings from the sale of carbon credits.



The results show that, even though developing nations are taking legally binding targets, they may be actually earning more from the sale of the carbon credits than they spend on generating them through clean energy projects.

This is even more evident in the diagram below, which shows the net mitigation cost in the ambitious scenario.



Here, the greater demand for credits increases the earning from developing countries. For example, in the low ambition scenario, India earns an amount worth 0.06% of its GDP from the Power Sector Global Carbon Market. In the high ambition scenario this increases to 0.16%.

4.4 'What if scenarios'

As in the case of the Green Fund, the above scenarios represent only a starting point: reference scenarios. Many changes can and will be made to them to explore and accommodate the interests and needs of negotiating parties. Again, our purpose here is not to explore all possible scenarios but to rather set a stage where these could be explored and debated in the months and years to come.

5. Conclusion

This report presented a vision to help increase the level of ambition of mitigation actions to fight climate change. This is comprised of two elements:

1. implementing and strengthening the Global Green Climate Fund and
2. establishing a new International Carbon Market for the Power Sector.

The report also offered a concrete first step in this direction by designing and quantifying some initial reference scenarios. We hope that these spur constructive discussions. As we said earlier, the devil is in the detail, so we would welcome opportunities to support the dialogue and the negotiations with more realistic and sophisticated scenarios developed with [GLOCAF Plus](#).

Appendix I – About the authors



Dr. Federico Gallo is an environmental finance expert who regularly advises senior government officials around the world as well as international organizations such as the World Bank and the World Economic Forum. Federico has contributed to the UK's Climate Change Bill, Mexico's Green Fund, and is also actively working with private investors and project developers to accelerate the deployment of green technologies worldwide. Federico holds a PhD in Applied Mathematics from the University of Cambridge.



Baroness Bryony Worthington is a Labour life peer in the House of Lords and an experienced climate campaigner who has worked for Friends of the Earth, the government and in the private sector. Bryony developed the concept of 'carbon budgets' whilst at FOE and was a key member of the team that drafted the UK's Climate Change Bill. In 2008 she set up Sandbag a climate campaign group focused on carbon markets.

Over the years GLOCAF Plus has gained and continues to benefit enormously from the regular and valuable contributions from a broad range of international experts. Among others, these include Elias Freig, Prof. T. Panayotou, Prof. P.R. Shukla, and Dr. M. den Elzen.

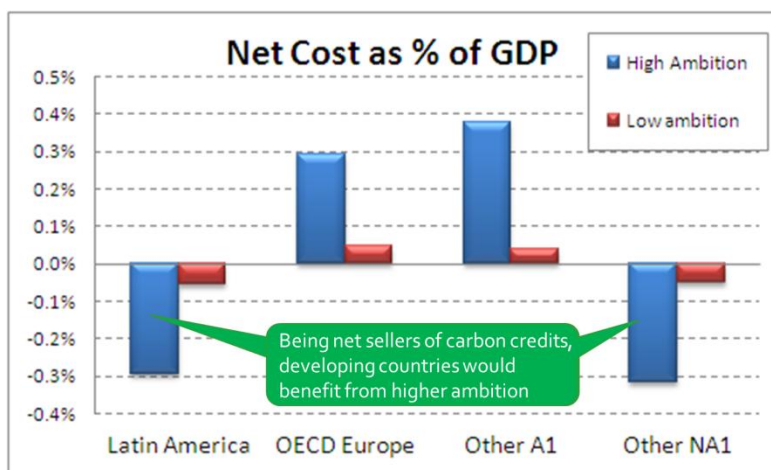
Appendix II – Further options for increasing the level of ambition

In fulfillment of the COP’s request, this section proposes further ideas to increase the level of ambition. The examples below have been developed with GLOCAF Plus and adapted from studies carried out for governments and organizations around the world over the past few years.

Disclaimer: **The results presented here are meant for illustrative purposes only and do not represent the views of any particular country, institution or individual.**

The carbon market rewards boldness

Increasing the level of ambition would considerably benefit developing countries because they are net sellers of carbon credits. This is because, by increasing the global mitigation target, the overall demand



for carbon credits grows, meaning that developing nations would be able to sell more credits at a higher price.

The diagram divides the world into four regions and compares the effects of low and high ambition.

Therefore, GLOCAF Plus indicates that developing countries may be better off by proposing more ambitious targets in order to

incentivize developed countries to increase theirs.

Funding the Green Fund through carbon markets

There are many ways to raise public funds from the carbon market, such as charging small transactions fees or withholding allowances.

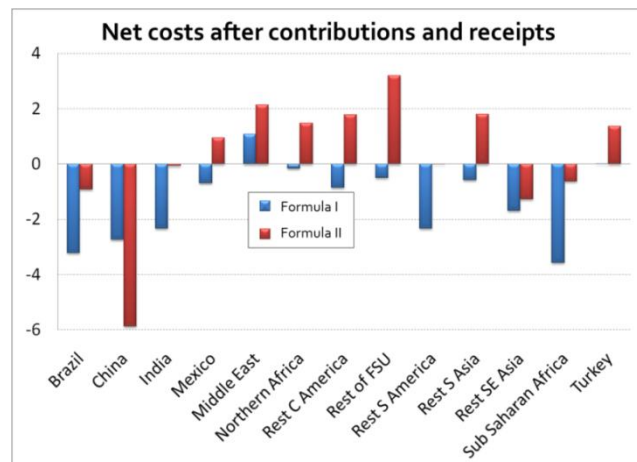
GLOCAF Plus indicates that, under most scenarios, raising the level of ambition could also increase the size of the public funds, and allows us to calculate the shares contributed by the various parties, thus also facilitating the international dialogue and negotiations.

Low-end Copenhagen Accord - Public Revenues [US\$bn]												
Scenario	AAU auctioning revenues			ETS auctioning revenues			Offset levies			Total public revenues		
	2%	5%	10%	10%	20%	30%	2%	5%	10%	Low	Med	High
	3.9	9.8	19.7	6.5	13.0	19.5	0.5	1.2	2.4	10.9	24.0	41.5

High-end Copenhagen Accord - Public Revenues [US\$bn]												
Scenario	AAU auctioning revenues			ETS auctioning revenues			Offset levies			Total public revenues		
	2%	5%	10%	10%	20%	30%	2%	5%	10%	Low	Med	High
	9.0	22.4	44.9	14.8	29.6	44.4	1.3	3.3	6.6	25.1	55.3	95.9

Distributing the funds from the Green Fund

The Global Green Fund was initially proposed to the world by Mexico in 2009. In its initial form, all countries would both contribute and have access to its resources. However, the exact formula was not understood or agreed. Based on the mitigation opportunities of all regions and sectors in the world,



GLOCAF Plus (or MEXCAF, as its Mexican incarnation is named) was able to translate President Calderon’s vision into hard numbers.

The diagram shows two alternative scenarios that are consistent with President Calderon’s proposal at the time, yet result in substantially different costs to all countries, some of them even turning from net winners into net losers.

The Global Green Climate Fund has been established in Durban; however, at the time of writing, its structure has not yet been decided.

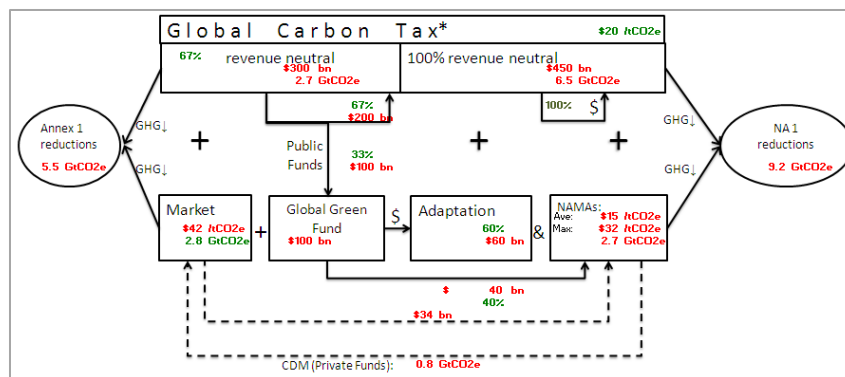
This uncertainty will probably negatively affect countries’ proposals and negotiating positions in the Durban Platform.

By quantifying and inspecting the details of the different possible scenarios, GLOCAF Plus offers a unique tool to help make the international dialogue more transparent and scientific, and thus help reach a global agreement that maximizes the level of ambition while respecting the principle of shared but differentiated responsibilities.

Bringing it all together

GLOCAF Plus is a formidable tool, and this note presented just a sample of its capabilities.

It is hoped that this report also demonstrates the flexibility with which the tool can be adjusted to different needs; indeed, GLOCAF Plus has already been adapting and contributing to an evolving and complex international dialogue.



The diagram illustrates another powerful feature of GLOCAF Plus: its ability to describe and quantify the complex interactions between different carbon finance mechanisms, including markets, funds, taxes. This feature is unique, and will become increasingly essential as these mechanisms are implemented.

More specifically, the diagram also illustrates how the creation of a Global Carbon Tax could help raise hundreds of billions of dollars that could then be redirected toward mitigation and adaptation. This is yet another option that could substantially increase the level of ambition.