

Turning Carbon into Gold

How the international community can finance climate change adaptation without breaking the bank

Recognizing that poor communities in developing countries are the least responsible for climate change but most vulnerable to its impacts, the Bali Action Plan calls for 'new and additional resources' and 'innovative finance mechanisms' to address urgent climate adaptation needs. Oxfam suggests that new financing mechanisms linked to emissions reduction regimes could be the way forward in the post-2012 climate negotiations and yield the minimum of \$50 billion per year necessary for adaptation needs in developing countries.

Summary

Poor communities in the developing world are hit hardest by the impacts of climate change, while they are least responsible for the problem and most vulnerable to climate impacts, such as severe floods, drought, and storms. At the climate change negotiations in Bali in December 2007, governments recognized that adaptation should be central to the negotiations. In the Bali Action Plan, adaptation is one of the four building blocks besides mitigation, finance, and technology transfer, and the Plan provides a mandate to negotiate on 'new and additional resources' and the use of 'innovative finance mechanisms' to address urgent and compelling climate adaptation needs.

Oxfam estimated that at least \$50 billion per year was needed to finance adaptation in developing countries—UN estimates have since called for up to \$86 billion per year. The means to generate these funds was not clear, however.

Now Oxfam can propose an immediate and compelling source that can be used towards generating those funds. Innovative financing mechanisms can be implemented as part of absolute funding commitments in the post-2012 climate negotiations, providing tools for developed countries to help fulfill their commitments to provide adaptation assistance to vulnerable developing countries.

Readily available financing options can be linked directly to emissions reduction schemes, ensuring that the obligation to provide substantial financing is fulfilled by those countries with the greatest historical responsibility for emissions and the economic capability to provide assistance. With a global financial crisis unfolding, one benefit of these mechanisms is that they do not depend on political will from countries to find funds from their national treasuries.

Communities around the world are experiencing natural disasters with increased severity and frequency—the occurrence of drought in sub-Saharan Africa has seen an almost 25-fold increase since the 1960s.¹ If we fail to act, more than a billion people will face water shortages and hunger by mid-century, including 600 million in Africa alone.²

Financing mechanisms are needed that are capable of providing the additional, predictable, stable, and adequate resources that vulnerable communities so urgently need to build their resilience in the face of water scarcity, severe weather events, floods, declining agricultural productivity, and exacerbated disease. These mechanisms should build on already established adaptation financing tools and should contribute towards absolute financing commitments from developed countries to developing countries.

To finance adaptation needs in a post-2012 regime, Oxfam calls for the following:

- A portion of the international emissions allowances allocated to each developed country with an emissions commitment should be set aside and auctioned off, rather than simply given away for free. Oxfam

estimates that auctioning just 7.5 per cent of these Assigned Amount Units (AAUs) from the countries currently designated as Annex I parties under the UN Framework Convention on Climate Change (UNFCCC) could yield approximately \$50 billion by the year 2015.

- Revenues should be generated from international sectors that are currently not regulated under the Kyoto Protocol. The international aviation and shipping sectors have been identified by country delegations and observers to the UNFCCC negotiating process as sectors where it's possible to reduce greenhouse gas emissions while generating new adaptation financing. Oxfam has calculated that establishing emission limits for aviation and shipping, focused on developed countries only, and auctioning off emission allowances in those sectors could generate more than \$12 billion and \$16.6 billion, respectively.
- Funds should be delivered through a UN adaptation finance mechanism that is responsible for oversight and delivery with a focus on the perspectives and needs of those communities that are most vulnerable to the impacts of climate change. The best way to achieve an adaptation funding mechanism under the governance of the UNFCCC parties is to maintain and bolster the Adaptation Fund as part of a post-2012 climate agreement.

Figure 1: Revenues from Oxfam's adaptation finance recommendations

Estimated revenues for year 2015 in billions USD	
Recommendation	Annual revenue at \$45/ton allowance price
AAU Auction (7.5% of allowances auctioned)	\$52
Aviation Emissions Trading Scheme	\$12.4
Maritime Emissions Trading Scheme	\$16.6

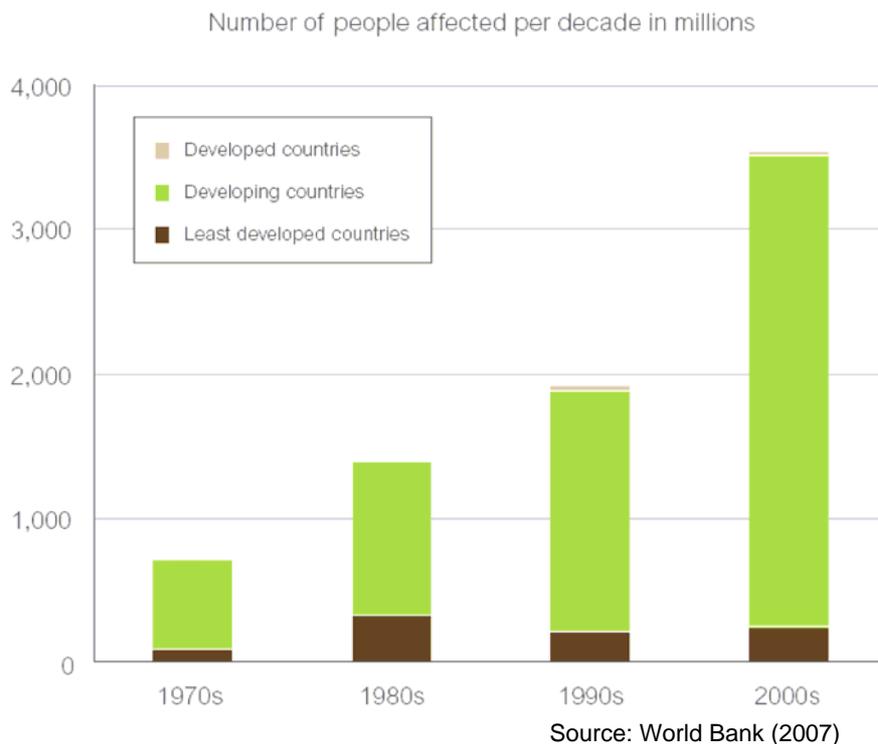
Source: Oxfam 2008

1 Introduction

Climate change is a global humanitarian crisis in the making, and the greatest challenge to our efforts to promote development and reduce global poverty in the twenty-first century. Poor and vulnerable communities around the world will increasingly bear the brunt of the consequences of global warming; climate change will threaten the lives of millions of people and undermine global stability and security. Urgent action is needed.

As demonstrated in Figure 2, the number of people affected by climate-related disasters in developing countries has increased exponentially during the past four decades.

Figure 2: The number of people affected by climate related disasters (in millions)³



These observed trends are expected to get worse in the absence of urgent action. By 2020, up to 250 million people across Africa could face increasingly severe water shortages. By mid-century, more than

a billion people will face water shortages and hunger, including 600 million in Africa alone. Weather extremes, food and water scarcity, and climate-related public health threats are projected to displace between 150 million and one billion people as climate change progresses.⁴

The agricultural sector provides perhaps the starkest example of what the global community stands to lose if significant resources for adaptation are not committed soon. Agriculture is the economic sector most at risk to climate impacts – and the sector in which the consequences of global warming will affect the lives of the greatest number of people. More than 70 per cent of poor people in developing countries depend on agriculture as the main component of their livelihoods.⁵ These countries, which have been overwhelmed by the recent high food prices, may also experience the halving of yields from their staple crops, such as corn and rice, by 2020. The UN Framework Convention on Climate Change (UNFCCC) estimates that about \$14 billion per year is needed for investment in agriculture to adapt to climate change.⁶

Women are especially vulnerable to the effects of climate change as they tend to do jobs and daily household tasks that are most affected by changing weather patterns. In developing countries, it tends to be women who grow the family's food, collect fuel and water, and raise children. When clean water becomes harder to find during times of drought or when crops are destroyed by floods, it is often left to the women to find solutions.

Oxfam believes that a rights-based approach should be at the center of all policy making, including climate change. International human-rights law states that, 'In no case may a people be deprived of its own means of subsistence.'⁷ Yet, due to excessive greenhouse gas emissions produced primarily by developed countries, such as the USA, Western Europe, Canada, Australia, and Japan, millions of the world's poorest people's rights are effectively being violated. Consistent with this charge, countries must commit financing based on their historical per-capita responsibility for emitting greenhouse gases and their capability to assist. Financing must also be channelled to those most vulnerable to climate impacts, such as women, minority groups, and children.⁸

Current funding commitments are nowhere near the scale needed for developing countries to address this adaptation challenge. Oxfam estimates that at least \$50 billion is needed annually to support adaptation in all developing countries, and far more if global emissions are not cut fast enough.⁹ The \$50 billion minimum primarily accounts for the costs of integrating adaptation into

ongoing planning and practices; climate-proofing ongoing infrastructural investments; climate-proofing the existing stock of natural and physical capital; financing new investments needed specifically because of climate change; and meeting the adaptation needs of households, communities, and local NGOs.

Other estimates of adaptation costs exceed this \$50 billion minimum threshold. In its most recent Human Development Report, the United Nations Development Program (UNDP) estimates that the adaptation needs of developing countries may reach or exceed \$86 billion per year from 2015 onward.¹⁰

The developed countries with the most responsibility for historical greenhouse gas emissions and with the greatest capability to assist have thus far done little to respond.¹¹ Contributions to the Least Developed Country Fund, created to direct immediate financing to those countries most vulnerable to climate impacts, as well as other funds created to finance adaptation, have thus far totalled a mere \$152 million.¹² The UNFCCC's Adaptation Fund, financed by a two per cent share of the proceeds from the trade of carbon credits generated under the Clean Development Mechanism (CDM), is expected to raise at most \$5 billion per year by 2030.¹³ Developed countries are not living up to their obligation under the UNFCCC to help the developing world finance adaptation to the unavoidable impacts on climate change.¹⁴

Adaptation finance must be accounted for separately from development assistance, as the developed countries' responsibility to finance developing-country adaptation is *additional* to and *distinct* from their role in providing Overseas Development Aid (ODA). Financing adaptation is distinct from ODA because of the origin of the responsibility. The funding required is not on the basis of developed countries providing aid to developing countries, but on the basis of polluting countries providing compensatory finance to those most vulnerable to the effects of that pollution. It should be additional because funding for adaptation should not be diverting or re-branding aid funding that is much needed to support children going to school or help the poorest farmers create livelihoods. Therefore, funding should be raised through innovative financing mechanisms that can ensure a reliable flow of funds independent of current ODA.

A massive increase in adaptation financing is a primary objective of the post-2012 climate negotiations.¹⁵ The Bali roadmap includes as a negotiating mandate, 'improved access to adequate, predictable and sustainable financial resources and financial and technical support, and the provision of new and additional resources', for both

adaptation and mitigation activities in developing countries. This theme was underscored by developing countries throughout the 2008 UN intercessional meetings with a call for developed countries to commit absolute financing for adaptation and other financing needs in developed countries.

Support for adaptation is only one component of the financing necessary to be delivered from developed to developing countries as part of a post-2012 global climate deal. Developing countries will also need support to develop and deploy clean energy technologies to fund avoided deforestation.¹⁶ To address adaptation and these broader financing needs, the G-77 and China released a proposal to the intercessional meeting of the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA) in Accra in August 2008 calling for Annex 1¹⁷ countries to commit 0.5 per cent to one per cent of their GNP toward these ends.¹⁸

Oxfam's recommended minimum of \$50 billion per year for adaptation needs represents only a fraction – approximately 0.17 per cent – of GNP or approximately a third of the minimum level called for in that proposal.¹⁹ Additional adaptation finance may be needed from developed countries beyond the minimum of \$50 billion called for in this paper. While we will not address broader financing needs here, additional absolute funding commitments may be necessary. Several financing mechanisms outlined in this paper could also be expanded on to finance such activities in the post-2012 regime (for example, the 7.5 per cent AAU auction could be expanded to 10 or 15 per cent).

2 Criteria for adaptation financing recommendations

The international community's primary objective in identifying financing mechanisms should be promoting solutions that adhere to the principle of a country's historic responsibility for emitting global greenhouse gas emissions and its financial capability to assist (hereafter referred to as the 'responsibility-capability' principle).²⁰ The UNFCCC listing of Annex 1 countries includes many of the countries most responsible for emissions and most capable of providing financing. Most importantly, these countries already have existing commitments to support adaptation financing under the Convention.²¹ Furthermore, Annex I countries are expected by developing countries to make quantified commitments of adequate and predictable financing for adaptation as part of the post-2012 regime.²²

Besides meeting the responsibility-capability principle, the financing mechanisms outlined here are also designed to first, deliver a minimum of \$50 billion per year in adaptation financing and second, achieve emissions reductions while simultaneously generating adaptation revenues.²³ Dramatic developed-country domestic emissions reductions must be achieved at least in the order of 25 per cent to 40 per cent below 1990 levels by 2020. Globally, emissions need to fall at least 80 per cent below 1990 levels by 2050 to avoid catastrophic future climate change.

Moreover, several additional criteria are important in identifying future solutions:²⁴

- Funds should be new and additional as means for developed countries to fulfill commitments to provide adaptation assistance to vulnerable developing countries.²⁵ This is essential to both ensure that existing Official Development Assistance (ODA) commitments – currently 0.7 per cent of Gross National Income (GNI) are not simply redirected towards adaptation, and also avoid overlap with other mechanisms already in place to fund core development needs.
- The chosen mechanism should deliver predictable and sustainable funding, which is crucial in providing developing countries with some assurance that they can rely on a sustained flow of resources, something which has not been achieved under other global development policy schemes.
- Funding should have the potential to be scaled-up over time, which is important to generate sufficient revenues to meet potentially

increasing adaptation needs, especially if emissions reduction commitments are not met.

- The chosen mechanisms should be able to galvanize political will, since developed and developing country governments alike will have to rally behind such measures in order for them to be integrated into an international funding scheme.
- Funds should be international by nature and thus less likely to be dependent on national budgets from developed countries, which are under increasing stress due to global financial instability and are subject to shifting political winds.

3 Assigned Amount Units auction

The best approach for generating new adaptation financing is one that links directly to a fundamental emissions-reduction system as part of a post-2012 global agreement. The most effective and fair way to link financing to this system is to auction – rather than give away – a portion of the emissions allowances that are allocated to developed countries each year, thereby generating tens of billions of dollars in resources. A post-2012 global agreement is likely to follow the approach of the Kyoto Protocol, which allocates a set of emission allowances – called assigned amount units (AAUs) – to the Annex I countries that adopt emissions-reduction commitments. The AAUs that are allocated are equal to the total amount of greenhouse gases that a country is permitted to emit.

Auctioning a portion of these allowances is consistent with the ‘polluter pays’ principle, obliging those who discharge pollutants into the environment to pay for that privilege. The post-2012 regime could be structured in such a way that a portion of the emission permits created are auctioned to public or private entities, rather than simply being assigned for free to countries. Norway proposed exactly this approach in February 2008 and August 2008 to the AWG-LCA.²⁶ While this approach is new in the context of international AAUs, the European Union and the USA are increasingly taking this path in their domestic climate policies.²⁷

In the post-2012 negotiations, some countries might seek to use the auction as an excuse to inflate their overall emissions cap (or the total amount of AAUs they are assigned) by arguing that setting aside AAUs for auction to finance adaptation reduces the allowances that are available to them for free.²⁸ However, if there were cap inflation, a country may no longer have to purchase allowances to cover a portion of their emissions. This could lead to market distortions by

deflating the price of allowances, and would threaten the environmental integrity of the program. As a result, measures must be taken during the negotiation process to guard against this behaviour by closely scrutinizing Annex 1 countries' current and historic emissions totals.²⁹

Ideally, adaptation revenues generated by auctioning AAUs should be handed over to a multilateral adaptation-finance mechanism that would be a part of the post-2012 climate regime under the UNFCCC. The Adaptation Fund, already established under the Kyoto Protocol, is a possible candidate for this, or a new multilateral adaptation fund established under the post-2012 agreement.³⁰ The structure and evolution of that Fund is discussed in Section 5.

If the auction is open to all participants (such as governments, private entities, and institutions), there will be enough buyers in the auction to generate a true market price and to guard against collusion and other gaming behaviour that may occur when only a few players are participating. To have an open auction would require domestic and regional emissions-trading programs to recognize AAUs as exchangeable with other carbon currencies (such as EU allowances). All participants would have to meet a defined set of qualification requirements, including proof of financial security.

However, a concern has been raised that in an open auction, a limited number of buyers would control the market. To address this concern the auction could be designed so that no single Annex 1 government or private entity could purchase more than a certain percentage of the allowances. The guidelines could also limit the total number of allowances that any one private entity could hold.

A minimum auction of 7.5 per cent of AAUs would yield tens of billions of dollars for adaptation by 2015 (see Figure 3).³¹ When accounting for other developing country emissions needs through support for clean technology transfer and avoided deforestation, the percentage of allowances auctioned would have to be increased.

Figure 3: AAU auction estimate for adaptation

Annual value of allowance auction for 2015 in billions USD			
% of allowances auctioned	Allowance price (USD per ton)		
	\$30	\$45	\$100
5%	\$23.1	\$34.7	\$77
7.5%	\$34.7	\$52	\$115.5
10%	\$46.2	\$69	\$154.1

Source: Oxfam 2008

This analysis assumes an emissions-reduction trajectory for Annex 1 countries leading to a 12 per cent reduction below 1990 levels by 2015, a trajectory that should enable Annex 1 countries to be on a path to at least 25 and 40 per cent domestic reductions by 2020.³² At least a 25 to 40 per cent reduction from 1990 levels is consistent with IPCC estimates of what is needed to avoid catastrophic climate change (see Technical annex).³³

An AAU auction designed in this way is mostly consistent with the responsibility-capability measure, in that Annex 1 countries would be responsible for paying more towards adaptation than those with lower emissions levels. For example, 7.5 per cent of AAUs from the USA would total \$16 billion in 2015, assuming a 12 per cent reduction target by 2015, whereas New Zealand would pay a total of \$208 million, consistent with their share of historic global emissions.

While this commitment to reduce emissions would signify a major step towards achieving the responsibility-capability measure, it does fall short on the side of capability. Oxfam's Adaptation Financing Index calls on the EU and USA together to contribute 72 per cent of the adaptation financing needed for developing countries.³⁴ However, only 62 per cent of the total AAU contribution would be made from the EU and USA combined – 13 per cent less than their capacity vis-à-vis other developed countries. The additional monies could come from revenue generated from domestic sources like emissions trading programs.

Should the negotiations fail to reach agreement on an Annex 1 commitment of at least 25 per cent to 40 per cent domestic emissions reductions from 1990 levels by 2020, the percentage of auction revenues allocated to adaptation finance should be increased to compensate developing countries for the further harms and resulting costs they would expect beyond a temperature increase of 2°C above pre-industrial levels.³⁵ The UNFCCC should agree to language that includes periodic reviews of the auction percentage level based on these reduction goals.³⁶

4 International aviation and shipping

Other financing mechanisms should be explored to increase funding levels over time and to avoid relying on national treasuries for funds. Country delegations and observers to the UNFCCC process and UN governing agencies suggest that the international maritime and aviation sectors could become significant sources of revenue for adaptation financing under a post-2012 regime.³⁷ These sectors are not currently regulated under the Kyoto protocol, and therefore

emissions from these sectors may not be covered by the AAU auction in a post-2012 regime. Because these two sectors are truly international in scope, financing can be more easily directed to compensate those countries which are most vulnerable to climate change impacts and least responsible for generating the problem. Since the proposals currently on the table do not adequately address the principle of responsibility-capability, Oxfam proposes that this is done by including Annex 1 countries only.

Greenhouse gas emissions from international aviation and shipping are growing faster than emissions from any other industry. CO₂ emissions from international aviation are projected to grow at a rate of 4.5 per cent per year from 2000 through 2030 and those from international marine transport are projected to grow at a rate of 0.4 per cent to 2.5 per cent per year.³⁸ Some estimates reveal that these sectors could represent 10 to 15 per cent of total global emissions by 2050.³⁹

Article 2.2 of the UNFCCC directs Annex I parties to pursue limitations or reductions of greenhouse gases from international aviation and marine bunker fuels through their respective global agencies: the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO). Thus far, Annex 1 countries have been unable to reach agreement on how these sectors should be regulated, although more proposals are being put forward in the context of the post-2012 negotiations.⁴⁰

Aviation emissions trading scheme

Approximately 65 per cent of global aviation emissions can be attributed to international flights originating in Annex 1 countries. An emissions trading scheme within the airline sector can be designed for these flights based on an emissions cap; then emission allowances can be auctioned to generate revenue.⁴¹

How would an aviation emissions trading scheme work to produce revenue? An emissions reduction target would be established for flights originating in Annex 1 countries.⁴² Since aircraft operators register the amount of jet fuel purchased per international flight, it is possible to estimate the level of emissions attributed to international flights originating in Annex 1 countries. This currently covers approximately 65 per cent of global CO₂ emissions from air travel. A cap would be established based on an agreed emissions reduction target and applied to airline operators. Airlines would have to purchase one emissions allowance for every ton of CO₂ emitted.⁴³

Once the system is established, 100 per cent of the allowances should be auctioned under the program and the proceeds be directed to a multilateral adaptation finance institution. It is likely that part of the cost of an allowance would be passed down to airline passengers in the form of increased ticket prices, or, for airfreight transport, in the form of higher prices for goods. The level of price increase is dependent on the overall cost of carbon allowances and the relative share of freight costs in the products' retail value.

However, because the air travel and tourism industries can account for up to 40 per cent of a country's Gross Domestic Product (GDP) a *deminimis* threshold could be established to exempt flights travelling to non-Annex 1 countries that depend on the tourism industry. For instance, if a threshold of 30 per cent of GDP accounting for air travel and tourism is used, this will primarily exempt small island states, with an impact on emissions coverage at less than one per cent of total emissions.⁴⁴ Other thresholds could also be negotiated.⁴⁵ Most importantly the threshold should recognise that economic activities from developing countries are not unduly burdened, as developing countries are not responsible for causing climate change in the first place.

Auctioning 100 per cent of the aviation sector's emissions allowances would generate approximately \$12.4 billion in 2015, assuming a \$45/ton carbon allowance price (see Figure 4).⁴⁶ These revenues should primarily be used to support adaptation in developing countries. However, further discussion is required regarding the appropriate percentage breakdown between funding for adaptation and that for other developing country needs, such as clean energy technology transfer.

Figure 4: Total allowance auction estimate for aviation

Annual value of allowance auction for 2015 in billions USD (assumes 100% total auction and that emissions peak in 2015)			
	Allowance price (USD per ton)		
	\$30	\$45	\$100
Total revenue	\$8.3	\$12.4	\$27.6

Source: Oxfam 2008

If the aviation sector program were designed to incorporate Annex 1 national allocations into country emissions totals, then the revenue generated would be significantly lower, probably less than \$1 billion per year. This approach would expand the number of international AAUs attributed to Annex 1 countries, thus increasing the total revenue generated through an AAU auction, yet would generate less

revenue overall because only 7.5 per cent of the allowances would be included in the AAU auction (instead of 100 per cent of auctioned aviation sector allowances as proposed above).

A preferred approach would be to administer an emissions trading system within the sector itself. However, institutional questions have been raised regarding how such a stand-alone system might be administered. In recent years the International Civil Aviation Organization (ICAO) has resisted attempts to regulate emissions or to generate financing through the sector, and hence it seems unlikely that the body would enforce a global market-based system or levy.⁴⁷

An alternative to auctioning aviation sector allowances as part of an emission-trading scheme would be to implement an aviation passenger levy to raise revenue for adaptation. An international aviation levy has been proposed that considers the passenger ticket price and level of emissions attributed to the flight.⁴⁸ Therefore, passengers paying for higher priced business class and first class tickets would pay more than passengers travelling economy class.

This is one potential way to generate adaptation funds from the aviation sector, provided that the levy does not in any way reduce the level of the 'solidarity levy', a levy dedicated to fund UNITAID, or any other voluntary solidarity contribution dedicated to medicines.⁴⁹

An international aviation levy could generate revenues of the order of \$13 billion (if all proceeds are directed towards adaptation), an estimate that is comparable to the \$12.4 billion that could be generated from an emissions trading scheme (see Technical annex).

An emissions trading scheme is ultimately preferable to a levy system because it can adequately address the issue of responsibility-capability between countries and it achieves emissions reduction goals. The emissions trading approach is also consistent with how the EU is beginning to regulate greenhouse gas emissions from the aviation industry, and thus would provide for more fluid integration between these programs in the future.

Maritime emissions trading scheme

Approximately 60 per cent of global maritime emissions can be attributed to ships importing goods to Annex 1 countries.⁵⁰ An emissions trading scheme can be designed for these shipping routes based on an emissions cap, and then emission allowances can be auctioned to generate revenue.⁵¹

A market-based approach to maritime emissions reduction on an international scale has strong potential to be sustainable over the

long-term, especially given recent support for this approach within the International Maritime Organization (IMO).⁵² As in the case of an AAU auction, revenue generated from a maritime emissions trading scheme has the advantage of not being tied to unpredictable national budgeting processes.

How would a maritime emissions trading scheme work to produce revenue? Emissions would be allocated to ships over a certain size threshold⁵³ using a route-based approach that attributes CO₂ emissions to Annex 1 countries according to a ship's country of arrival.⁵⁴ In most cases, this would cover the last leg of a ship's journey to what is referred to as the final 'port of call' in an Annex 1 country.⁵⁵ It is estimated that this approach would cover 60 per cent of global maritime emissions.⁵⁶

The methodology used for attributing emissions to Annex 1 countries in this sector differs from Oxfam's aviation recommendation in that ships en route to Annex 1 countries are covered, rather than ships departing from Annex 1 ports. Coverage of ships importing goods to Annex 1 allows for more complete emissions coverage and thus a higher level of revenue generation, since the majority of shipping trade flows from developing to developed countries.⁵⁷ Possible evasion by ships docking in non-Annex 1 ports before completing their route can be at least partially addressed by including provisions such as requiring ships to unload at least half their cargo at the last port visited (see Technical annex).

It is essential to examine the degree to which these measures might affect imports to and exports from developing countries. The predominant economic assumption is that end consumers pay for import tariffs, which are typically in the form of a levy, at the point of entry into the country.⁵⁸ The cost of imports to developing countries would not be affected because shipping routes between non-Annex 1 countries would not be covered and ships en route to developing countries originating in developed country ports would also not be covered. In terms of a cost increase for developed country consumers, recent analysis suggests that the cost of imports would increase less than one per cent, with some even predicting an increase as low as 0.1 per cent, when tied to a uniform emissions reduction scheme.⁵⁹

An emissions trading scheme could affect exports produced in developing countries if the cost of an emissions allowance is transferred to the producer of goods or if there is a reduction in demand for the product due to increased shipping costs. Estimates of how much this might affect the cost of goods vary, but this increase generally appears to be marginal. Most goods would incur emissions allowance costs of 0.1 per cent of import value or less (see Figure 5).⁶⁰

Figure 5: Cost of emissions scheme as % of import value (for US port destinations only)

Commodity	Country of origin	Emissions charge as % of import value
Clothes	Cambodia	0.06%
Oil	Nigeria	0.2%
Coffee	Ethiopia	0.05%
Rice	Thailand	0.3%
Steel	Brazil	0.1%

Source: Oxfam

Overall, studies on the price elasticity of maritime transport show that an emissions-reduction scheme will be likely to have little effect on global demand.⁶¹ If there does prove to be an effect on some countries due to a shift in global demand for specific goods, IMO should establish a monitoring system to evaluate impacts and to determine an appropriate level of compensation for the affected sector. It may also be feasible to establish a *deminimis* threshold that excludes smaller ships from the program, which could minimize the impacts on goods being shipped from specific countries.⁶²

In the case of shipping, IMO has demonstrated a willingness to engage in emissions-reduction discussions for the sector, making it feasible that they provide oversight to the system. IMO, or another global agency, would administer a 100 per cent auction of emissions allowances to ship owners covered under the program.⁶³ The auction proceeds could then be allocated to developing countries through a multilateral adaptation finance institution.

A 100 per cent auction of emissions allowances in 2015 would yield a total of up to \$16.6 billion at an average carbon allowance price of \$45/ton (see Figure 6).

Figure 6: Total allowance auction estimate for maritime

Annual value of allowance auction for 2015 in billions USD (assumes 100% total auction)			
	Allowance price (USD per ton)		
	\$30	\$45	\$100
Total revenue	\$11bn	\$16.6bn	\$37bn

Source: Oxfam 2008

If the program were designed to incorporate Annex 1 national maritime allocations into country emissions totals, then the revenue generated would be significantly lower, about \$1.7 billion. This approach would expand the number of international AAUs attributed to Annex 1 countries, thus increasing the total revenue generated through an AAU auction. However, it would generate less revenue, because only 7.5 per cent of the allowances would be included in the AAU auction, instead of a 100 per cent auction of maritime sector allowances as proposed above.

In lieu of a maritime emissions trading scheme, an emissions levy could be implemented in the maritime sector so that ship owners are charged at the developed country port of arrival based on fuel use (this would mirror the route-based approach outlined previously). This levy could be tied to an emissions-reduction goal for the sector, sometimes referred to as 'cap-and-charge', and could be applied to ships en route to developed country ports only.⁶⁴

Existing proposals, such as the International Maritime Emissions Reduction Scheme (IMERS), suggest that emissions reductions can be made in the sector through the purchase of allowances on the global carbon market. The levy would have to be set high enough to purchase emissions credits from the international carbon market as well as to generate revenues for adaptation, to support technology improvements in the sector, and to support other needs in developing countries.

Under the IMERS proposal, revenue generated from the levy could be directed to a fund, managed by IMO, to purchase emissions allowances as well as to support other funding activities.⁶⁵ If implemented, revenue generated for adaptation should be directed to a multilateral adaptation finance institution, rather than distributed through IMO.

A maritime levy would be consistent with the responsibility-capability principle if only ships en route to developed countries are covered under the program. The levy would need to be set at a level adequate to fund both emissions reductions and adaptation. Estimates conducted for the IMERS proposal show that a levy of \$27 per tonne of fuel would generate approximately \$4 billion for adaptation under a uniform scheme, which is far less than what an emissions trading scheme would be likely to provide.

5 Institutional structure and principles for adaptation finance delivery

Generating resources to adequately address the adaptation needs of vulnerable communities in developing countries must be coupled with an institutional structure that is capable of appropriately overseeing and delivering those resources.

The financial delivery mechanism must be part of a multilateral process that is focused on addressing climate change and fully includes developing countries in the governance, management, and delivery of funds. As the key multilateral arena for addressing climate change, the UNFCCC is the most appropriate context for overseeing adaptation finance. Indeed, given the central role that adaptation finance must play in a comprehensive global agreement, the oversight and governance of finance delivery should be retained under the control of all the countries participating in an international climate deal. Notably, it will be critical to include the worst affected countries, since this will create the most promising context for the concerns of vulnerable communities to be addressed.

The Adaptation Fund

The best way to achieve an adaptation funding mechanism under the governance of the UNFCCC parties is to maintain and bolster the Adaptation Fund as part of a post-2012 climate agreement, perhaps embedded within a broader financing arrangement. The Adaptation Fund was created under a UNFCCC process to use the revenues from a two per cent share of proceeds from the trade of Certified Emissions Reduction (CER) credits, as part of the Kyoto Protocol's Clean Development Mechanism (CDM), to fund adaptation activities in vulnerable developing countries.

The Adaptation Fund is an appropriate implementing structure, not only because it is subject to oversight by the UNFCCC parties, but also because its governance structure provides a fair and appropriate level of representation for developing countries. At the Bali Conference Of the Parties in December 2007, developing countries rightly secured strong representation in governing the Adaptation Fund, constituting the majority of the 16 member board, with four places reserved for Africa, small island states, and the Least Developed Countries (LDCs): *'A major victory'*, according to the Chair of the LDC Group; an arrangement that gives *'developing countries a more direct and equitable voice in how funds are prioritized and spent'*, according to South Africa's environment minister.⁶⁶ During the

course of 2008, the Adaptation Fund Board has made steady progress in adopting a set of guidelines for its operation and use of funds. Plans are also underway to begin monetizing the carbon credits that come from the special adaptation levy on the CDM.

The central role of the Adaptation Fund is being challenged, however, by a proliferation of competing funds with fewer linkages to the UNFCCC process and less representative governance. While increasing levels of adaptation finance and other support are welcome, it is clear that the Adaptation Fund's critical role as a fair, effective, and representative mechanism could be undermined.

For example, the EU's Global Climate Change Alliance has been established in order to finance the response to climate change in developing countries, including adaptation.⁶⁷ The European Commission (EC) has launched the Alliance with \$85 million that will be counted towards ODA, potentially diverting much needed increases in aid finance. Moreover, the Alliance has no plans to ensure that developing countries and their citizens have a strong role in its governance.

Meanwhile, the World Bank recently created a Pilot Program on Climate Resilience (PPCR) aiming to support developing country governments, civil society, and affected communities in integrating adaptation into national planning, which is important for promoting national participation and accountability.

It is now critical that developed countries support the Adaptation Fund, and that its structures and guidelines will hold governments accountable for delivering finance to the communities that are most at risk from climate impacts.⁶⁸ Notably, other multilateral funding mechanisms created for specific purposes, including the Multilateral Fund for the Implementation of the Montreal Protocol and the Global Fund to Fight AIDS, Tuberculosis and Malaria, offer models of successful international funds in specific sectors.⁶⁹

The Adaptation Fund could be strengthened in a post-2012 international climate agreement in the context of a broader agreement on climate finance. While created under the Kyoto Protocol, the Fund could be embedded within a UNFCCC agreement at Copenhagen to link together mitigation finance with adaptation finance. The Adaptation Fund could expand to become a comprehensive adaptation finance mechanism for a variety of programs under its oversight, including risk management and insurance. Moreover, the other current UNFCCC adaptation funds, the LDC Fund and the Special Climate Change Fund, could be brought within the umbrella of the Adaptation Fund, maintaining their specific purposes such as

preparation and implementation of LDCs' National Adaptation Plans of Action (NAPAs) in the case of the LDC Fund.

If the Adaptation Fund is to fully and effectively carry out its mission, it will also be essential that it adopts and implements a set of key principles to ensure accountability and effectiveness in the financing it provides. In particular, these principles will need to guarantee that the perspectives and needs of local communities will be fully incorporated into the development and implementation of adaptation financed by the Fund.

These principles include:

- Financing that is focused on funding adaptation programs and activities in the most vulnerable communities in developing countries. Planning should involve the identification of the most vulnerable people and prioritize their adaptive capacity. As part of this emphasis on vulnerable populations, the particular challenges facing women should be specifically addressed.
- The Fund should ensure the engagement and participation by local communities and civil society in the development, decision making, and implementation of adaptation activities.
- Support should be provided to adaptation programs and strategies by developing country governments, in line with broader development strategies.
- Robust monitoring and evaluation of the funding of adaptation activities should be undertaken, especially the degree to which local communities' adaptation needs are met.
- The creation of an expert panel, similar to the one used by the Global Fund, should be considered in order to ensure that funding decisions are made with the greatest information and expertise possible.
- Adaptation financing should be transparent, and should draw on knowledge and learning from similar programs, while formulating locally appropriate programs.
- An accountability mechanism should be created so that local communities can address any adverse effects in the implementation of funded adaptation activities.

6 Recommendations

Innovative mechanisms that dedicate immediate and substantial sources of international funding towards adaptation are necessary to move the post-2012 global climate negotiations forward. The current

and potential consequences of climate change on the world's poor people are too dire to ignore. The developed world can and must address the urgent needs of poor people in the face of climate change, while significantly reducing emissions. The new solutions proposed can be implemented internationally without having to depend on national treasuries which are already overwhelmed by the global financial crisis. Most importantly, Annex 1 countries must identify solutions to address the financial needs of developing countries as they face national financial and economic concerns in their own markets, while coping with the impacts of climate change.

An AAU auction has great potential for contributing tens of billions of dollars to adaptation financing in the context of a post-2012 regime. Innovative financing mechanisms in the aviation and maritime sectors can also generate significant funds by implementing solutions that are grounded in the principle of responsibility-capability, as well as other key criteria.

Oxfam calls for immediate action in the post-2012 climate negotiations to finance adaptation needs and deliver funds fairly and effectively:

- A portion of the international emissions allowances allocated to each developed country with an emissions commitment should be set aside and auctioned off, rather than simply given away for free. Oxfam estimates that auctioning just 7.5 per cent of these Assigned Amount Units (AAUs) from the countries currently designated as Annex I parties under the UN Framework Convention on Climate Change (UNFCCC) could yield approximately \$50 billion by the year 2015.
- Revenues should be generated from international sectors that are currently not regulated under the Kyoto Protocol. The international aviation and shipping sectors have been identified by country delegations and observers to the UNFCCC negotiating process as sectors where it is possible to reduce greenhouse gas emissions while generating new adaptation financing. Oxfam has calculated that establishing emission limits for aviation and shipping, focused on developed countries only, and auctioning off emission allowances in those sectors could generate more than \$12 billion and \$16.6 billion respectively.
- Funds should be delivered through a UN adaptation finance mechanism that is responsible for oversight and delivery with a focus on the perspectives and needs of those communities that are most vulnerable to the impacts of climate change. The best way to achieve an adaptation funding mechanism under

the governance of the UNFCCC parties is to maintain and bolster the Adaptation Fund as part of a post-2012 climate agreement.

Notes

¹ **World Health Organization** (2006) EM-DAT: The OFDA/CRED International Disaster Database.

² **Intergovernmental Panel on Climate Change** (2007–08) 'Climate change 2007', Fourth Assessment Report.

³ **I. Noble** (2007) World Bank analysis based on EM-DAT (CRED) data. Last checked by author in February 2008.

⁴ **IPCC** (2007–08) op. cit.

⁵ **FAO** (2005) 'The State of Food and Agriculture 2005: agricultural trade and poverty: can trade work for the poor?'

⁶ **UNFCCC** (2007) 'Investment and Financial Flows'. UNFCCC's estimate includes forestry and fisheries in this category.

⁷ International Covenant on Civil and Political Rights (ICCPR), Article 1.2, and International Covenant on Economic, Social and Cultural Rights (ICESCR), Article 1.2.

⁸ **Oxfam International** (2008) 'Climate Wrongs and Human Rights'.

⁹ **Oxfam International** (2007) 'Adapting to Climate Change: What's needed in poor countries and who should pay'.

¹⁰ This funding call is additional to existing Overseas Development Assistance commitments of 0.7 per cent of Gross National Income. Some of this funding need is broken down on a sectoral basis by an analysis of the secretariat of the UNFCCC, which will be updated by Poznan.

¹¹ **Oxfam International** (2007) 'Adapting to Climate Change', op. cit.

¹² As of June 2008, based on GEF updates. See www.gefweb.org/interior.aspx?id=264. Currently pledged for the LDC fund: \$173 million, and \$92 million is disbursed. For the Special Climate Change fund, \$75 million is pledged (only for adaptation) and \$60 million is disbursed.

¹³ **Oxfam International** (2007) 'Financing Adaptation: Why the UN's Bali Climate Conference must mandate the search for new funds'. The dollar figure of \$5 billion per year is based on estimates for a strong mitigation target.

¹⁴ Article 4.3 of the UNFCCC commits Annex I countries to 'provide new and additional resources to meet the agreed full incremental cost of implementing measures...' including 'preparing for the adaptation to climate change'. In addition, Article 4.4 states that Annex I countries 'shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects.' For a complete listing of Annex I countries see note 17 below.

¹⁵ Hereafter, use of the term 'post-2012 climate negotiations' or 'post-2012 regime' refers to the negotiations taking place for the Kyoto Protocol's post-2012 second commitment period as well as the Bali Action Plan discussions under the UNFCCC treaty negotiations.

¹⁶ Financing for technology transfer and avoided deforestation (and degradation) were also clearly stated as objectives in the Bali roadmap.

¹⁷ Annex 1 Parties include the industrialized countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT Parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States. Non-Annex 1 Parties are mostly developing countries.

¹⁸ **G-77 and China Proposal** (August 2008) 'Financial Mechanism for Meeting Financial Commitments under the Convention', UN intercessional meeting in Accra, Ghana.

¹⁹ This estimate is based on University of Pennsylvania GNP figures from 2004.

²⁰ See Article 3.1 of the UNFCCC 'The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.' See **Oxfam International** 'Adapting to Climate Change' (2007), op. cit. and **Greenhouse Development Rights** framework for a more expanded definition of the responsibility-capability principle: www.ecoequity.org/docs/TheGDRsFramework.pdf. Parties should discuss proposals for quantitative criteria concerning responsibility (based on cumulative per capita emissions) and capability (based on measures such as the Human Development Index) to use as a guideline for assessing specific financing options. Also see **Climate Protection Programme** (2004) 'South-North Dialogue on Equity in the Greenhouse'.

²¹ UNFCCC Articles 4.4, 4.7, 4.8.

²² G77 and China proposal, "Financial Mechanism for Meeting Financial Commitments under the Convention,": http://unfccc.int/files/kyoto_protocol/application/pdf/g77_china_financing_1.pdf (accessed on 17 November 2008).

²³ It should be noted that mechanisms must be consistent with the stated objectives of UNFCCC.

²⁴ These criteria have also been articulated by **Benito Müller** (2008) 'International Adaptation Finance', Oxford Institute for Energy Studies, EV 42; **Sven Harmeling** (2008) 'Adaptation Under the UNFCCC', Germanwatch Briefing Paper, Version 1.0; **ActionAid** (2007) 'Compensating for Climate Change, Principles and Lessons for Equitable Adaptation Funding'.

²⁵ UNFCCC Articles 4.4, 4.5, 4.7, 4.8.

²⁶ Norway's Submission on Auctioning Allowances, AWG-LCA 3 and AWG-KP 6 (August 2008) Accra, Ghana:

www.unfccc.int/files/kyoto_protocol/application/pdf/norway_auctioning_allowances.pdf.

²⁷ Under domestic and regional emissions schemes, the rules regarding how allowances are allocated—and whether allowances should be auctioned—have become central points of discussion regarding the design of emissions-trading systems within the EU and USA. Under emissions-trading programs, like US Environmental Protection Agency’s acid rain program and the initial phase of the EU Emissions Trading Scheme (EU ETS), the vast majority of emissions allowances were given away for free to polluting entities. This occurred mostly because companies argued they would go out of business if they were forced to purchase allowances on the open market. The end result, however, was just the opposite. Studies conducted on the acid rain program and on the first phase of the EU ETS have shown the majority of companies actually gain a windfall profit from the allowances. (**Point Carbon, WWF** (2008) ‘EU ETS Phase II - The Potential and Scale of Windfall Profits in the Power Sector’; **A.D. Ellerman and P.L. Joskow**. (2008) ‘The European Union’s Emissions Trading Scheme in Perspective’, Pew Center on Global Climate Change.

²⁸ A global emissions trading scheme will be effective if a strict emissions cap, consistent with a global emissions reduction of 80 per cent below 1990 levels by 2050, is established and adhered to over time. If emissions levels are overestimated or ‘inflated’ from the start of the program, then the integrity of the system and its ability to deliver on emissions reduction goals is suspect.

²⁹ The issue of cap inflation in the context of an auction has been highlighted in the design of the Regional Greenhouse Gas Initiative (RGGI) in the US northeast states and was tested in their first auction in September 2008, see www.rggi.org.

³⁰ An entity such as the World Bank could act as the trustee for purposes of auctioning the allowances on the market. Under this scenario, the revenue should be turned over to a UNFCCC body, such as the Adaptation Fund, for fair distribution of funds to developing countries.

³¹ Norway’s analysis revealed that a two per cent auction for AAUs would generate between \$15 and \$25 billion per annum. However, Oxfam believes that the forecasted price of carbon allowances used in that analysis was high in comparison to allowance price forecasts cited in the technical annex.

³² This trajectory assumes that annual reductions will be steeper from 2015 to 2020 than in previous years.

³³ It is possible to base the auction design on a minimum dollar amount raised or a ‘floor’ (e.g., AAUs would be auctioned until \$50 billion is raised, and the remaining allowances would be distributed to Annex 1 countries at a reduced level). However, since this would likely change the percentage of AAUs auctioned on an annual basis, this method could lead to uncertainty and high fluctuations in the market.

³⁴ **Oxfam International** (2007) ‘Adapting to Climate Change’, op. cit.

³⁵ 2°C is the temperature threshold for which scientists predict that there is a strong likelihood of catastrophic climate changes to occur.

³⁶ Sven Harmeling (Germanwatch) suggests that another way to tie increased financing to emissions reduction commitment levels would be to bank additional AAs and release those into the auction if countries do not meet their emission reduction obligations. This proposal deserves further review.

³⁷ Denmark submitted a proposal to the International Maritime Organization in 2007 for a global levy on marine bunkers, calling for revenue to be applied for the 'funding of adaptation projects in developing countries, or adaptation under the United Nations Framework Convention on Climate Change'. Norway has submitted similar proposals through the IMO and UNFCCC processes. Presentations have recently been made at UNFCCC intercessional meetings on the establishment of an international air travel levy that would direct revenue towards adaptation in developing countries (**M. Chambwera** (2008) 'International Air Passenger Adaptation Levy', UNFCCC intercessional meeting) and the establishment of an aviation emissions trading scheme with auctioning (**J. Graichen** (2008) Institute for Applied Ecology).

³⁸ Prepared for **International Maritime Organization** (2008) 'GHG Emissions from Ships'. It is important to note that the climate impact of flights is significantly higher than the CO₂ emissions only. Given the radiative forcing of other effects (NO_x emissions, cirrus clouds, contrails), it is estimated to be between two- to five-fold the level of CO₂ emissions (IPCC 2007: WGIII).

³⁹ **Norway Submission to AWG-LCA** (August 2008) 'Emissions of GHG from international maritime transport post 2012'.

⁴⁰ The EU ETS will include emissions from aviation, covering all international flights going in and out of the EU, and within the EU countries.

⁴¹ **O. Deuber et al** (2007) This analysis is based on bunker fuels sold in Annex 1 countries for international flights. In 1996, the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) developed eight different allocation options (UNFCCC 1996); however, they considered only five of them feasible at a later date (UNFCCC 1997). Allocation option 3 (allocation according to retail country of the bunker fuels) was used here as well as allocation according to departure country (Option 5).

⁴² Since the airline industry has not yet adopted greenhouse gas emissions reduction targets, it's most likely that emissions will peak at around 2015 and then begin to ratchet down.

⁴³ The EU ETS will cover CO₂ emissions only, however, as noted previously this may amount to favorable treatment as it excludes other GHGs that represent a significant level of emissions from the sector. Airlines should be covered under the program rather than the fuel suppliers for a variety of reasons: as a downstream emitter, airlines have more control to reduce their emissions through measures such as more efficient technologies; there may be international legal hurdles associated with covering fuel suppliers under

the program as this could be seen as a tax on fuel; and it increases the probability of evasion.

⁴⁴ Tourism amounts to between 35 and 40 per cent of GDP in some small island states, making them particularly vulnerable to any decrease in leisure air travel. It should be noted that cross-elasticities could be high, meaning that one country that lies just below the 30 per cent GDP threshold could lose tourism to an adjacent country that is subject to the exemption.

⁴⁵ Further research should be conducted into an exemption for air travel to countries where a large proportion of GDP is from remittance to ensure that migrant workers are not taxed on their journey home.

⁴⁶ According to an estimate from the Institute of Applied Ecology, an auction that covers the total international aviation sector (not limited to flights departing Annex 1 flights only) has the potential to generate \$25 billion, of which a percentage can be directed towards adaptation.

⁴⁷ **European Federation for Transport and Environment** (2007) 'No flight plan: How the ICAO has blocked progress on climate change for a decade'.

⁴⁸ **Müller, Benito, Hepburn, and Cameron** (2006) 'IATAL—an outline proposal for an International Air Travel Adaptation Levy', Oxford Institute for Energy Studies, EV 36. The IATAL proposal creates an equation: $a = \alpha \cdot p + \beta \cdot e \cdot l$. Where p = price of ticket, e = emissions, l = length of flight, and α , β , are dollar amounts. An aviation levy could also be designed to cover passengers departing from Annex 1 countries only, although this would exempt wealthy individuals travelling from cities such as Singapore, which seemingly conflicts with an individual equity approach. The levy would deliver predictable funds over time, even though the number of international passengers may vary.

⁴⁹ UNITAID is an international facility for the purchase of drugs against HIV/AIDS, Malaria, and Tuberculosis. Effective on 1 July 2006, passengers boarding aircrafts in France have to pay a predetermined surcharge of 1 euro per economy class ticket and 10 euros per business class ticket if their destination is in the European Union. For flights out of Europe, the surcharge is four euros for economy class and 40 euros for business class. France expects its airline tax to generate upward of 200 million euros for UNITAID annually.

⁵⁰ UNCTAD (RMT 2007) www.unctad.org/en/docs/rmt2007_en.pdf. Calculations attributed to Andre Stochniol, August/September 2008.

⁵¹ This allocation option is also attributable to UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA), option 5.

⁵² Consultation with **Peter Lockley** (WWF), September 2008.

⁵³ Existing analysis points to a 400 GT limit. 'Prevention of Air Pollution from Ships,' IMO submission by SPONSOR, August 2008.

⁵⁴ **Andre Stochniol** (2008). The IMO SPONSOR proposal calls for differentiation between different ship classes based on container ships, which tend to transport luxury items, vs. dry bulk ships which tend to transport subsistence cereals. This incorporates equity at the end user level

within countries by differentiating charges for importing merchant and subsistence goods, as wealthier individuals tend to purchase a higher percentage of luxury goods transported via container ship. Differentiation at this level should be considered in the design of the program.

⁵⁵ Ships would be required to register their fuel use in logs so emissions can be calculated on the journey from a non-Annex 1 to Annex 1 port (**Peter Lockley** (2008), WWF position paper for Accra negotiations). The only exception to this rule would be when ships transfer their cargo to other ships at sea. In the liquid bulk trade, large tankers often offload their cargo to several smaller tankers at sea, which in turn transport the cargo to the port.

⁵⁶ This estimate is based on the volume of unloaded goods on a tonnage basis in Annex 1 countries. A more accurate estimate of emissions coverage is currently underway and anticipated for release in fall 2008 by CE Delft.

⁵⁷ It is somewhat simple to determine emissions coverage using this allocation approach based on the historic record of ports of call.

⁵⁸ Importer pays 'landed cost' = price of good + shipping cost (presumably now including the cost of emission allowances passed on by shipowner) + tariff.

⁵⁹ **A. Stochniol and P. Lockley** (2008) An emissions reduction program that only covers a portion of shipping routes would also likely have less of an impact on the price of imported goods.

⁶⁰ Since air freight is six times as expensive per kg as shipping it is highly unlikely, based on the figures presented in figure 5, that goods normally exported via ship would be transported via air freight due to this scheme (O. Deuber et al).

⁶¹ **Oum et al.** (1990) present elasticities ranging from 0 to -1.1, with the low values (-0.06 to -0.25) typically for dry bulk for which there are hardly any alternative modes of transport, and the higher values (0 to -1.1) for general cargo. **Meyrick and Associates et al** (2007) estimate the elasticity of non-bulk maritime transport to and from Australia at -0.23.

⁶² WWF is currently looking into this approach, based on an exclusion of ships that fall below 1000-3000 Gross Tons. They have found that small and isolated economies such as small island states are generally serviced by small ships. For example, all ships sailing to the Cook Islands are smaller than 2,400 GT, although its main port can accommodate ships up to approximately 4,000 GT.

⁶³ At a 2008 IMO meeting all the country delegations that spoke on the issue supported that revenues aggregated through any economic instrument should mainly be used for mitigation and adaptation measures in developing countries, together with transfer of technology and capacity-building.

⁶⁴ **Andre Stochniol** (2008) 'Architecture for Mitigation, Adaptation and Technology Transformation for International Transport: "Global and Differentiated"', Paper for Harvard Project on International Climate Agreements, London.

⁶⁵ IMERS divides the revenue between adaptation, funding for JI and CDM credits, REDD and investments in technology improvements within the sector.

⁶⁶ **S. Granich and M. Kelly** (2008) 'The Bali Road Map', *Tiempo* 66, available at: www.cru.uea.ac.uk/tiempo/portal/archive/pdf/tiempo66low.pdf (last checked by author 13 March 2008).

⁶⁷ **Gareth Porter et al** (2008) 'New Finance for Climate Change and the Environment,' WWF and Heinrich Böll Stiftung Foundation.

⁶⁸ The ability of the Adaptation Fund to effectively provide financing to vulnerable communities in developing countries rests on the establishment of its guidelines, which the Fund's board has made considerable headway in agreeing.

⁶⁹ **ActionAid** (2007) 'Compensating for Climate Change'.

Technical annex: Adaptation financing estimates

The estimate of tens of billions of dollars generated from an AAU auction is calculated by projecting Annex 1 emissions estimates in 2015 (based on a trajectory of reducing domestic emissions by at least 25 per cent to 40 percent from 1990 levels by 2020), and multiplying total emissions in 2015 by carbon prices of \$30/ton, \$45/ton, and \$100/ton. Emissions estimates and carbon price forecasts are outlined here. The 7.5 per cent auction to generate approximately \$50 billion is based on the assumption that carbon prices will fall close to \$45/ton in 2015.

Annex 1 Emissions estimates

Emissions in MMT CO ₂ equivalent	1990	2015
		12% reductions below 1990 level
Australia	412.5	363.0
Canada	656.6	577.8
European Union-27	5,363.30	4719.7
Iceland	3.1	2.7
Japan	1,216.60	1070.6
New Zealand	65.2	57.4
Norway	43	37.8
Russian Federation	2,953.70	2599.3
Switzerland	52.8	46.5
Turkey	291.6	256.6
Ukraine	879.8	774.2
USA	5,573.20	4904.4
Belarus	148.2	130.4
Croatia	28.1	24.7
Total Annex I	17687.7	15565.2

Source: Emissions levels in 1990 for Annex I countries based upon the WRI Climate Analysis Indicator Tool (CAIT) for greenhouse gas emissions, including multiple gases and land use change.

Carbon price estimates

Estimating future carbon prices is difficult, given many uncertainties about the future state of carbon markets. Among many factors, prices are dependent, of course, on the level of emissions permitted and hence the total number of emission allowances in the market. For this paper, the assumed prices were based on future estimated carbon prices in models cited in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC FAR). The prices estimated are for 2030, so they may be somewhat higher than the level of expected prices in 2015 (prices also assume that all auctions remain open to both public and private actors). However, the price examples used in this paper (\$30, \$45 and \$100 per ton) provide a reasonable sense of the range of possible future carbon prices based on emissions scenarios in the IPCC FAR.

The price estimates cited in the IPCC FAR are based on scenarios for stabilization of CO₂ equivalencies at various levels. For Category III stabilization scenarios, which represent stabilization at approximately 550 parts per million (ppm) of CO₂ equivalent, the range of estimated carbon prices is from \$18-79/ton, with a median of \$45/ton (*Source: IPCC WGIII Chapter 3*).¹

A set of models for Category III stabilization that incorporate enhanced technological innovation provide an average estimated carbon price of \$31/ton (*Source: IPCC WGIII Chapter 11*).² For Category I stabilization scenarios, which represent stabilization at approximately 450 ppm CO₂ equivalent, the estimated carbon prices cluster around \$100/ton (*Source: IPCC WGIII Chapter 3*).

¹ **B.S. Fisher, N. Nakicenovic, K. Alfsen, J. Corfee Morlot, F. de la Chesnaye, J.-Ch. Hourcade, K. Jiang, M. Kainuma, E. La Rovere, A. Matysek, A. Rana, K. Riahi, R. Richels, S. Rose, D. van Vuuren, and R. Warren** (2007): 'Issues related to mitigation in the long term context, In *Climate Change 2007: Mitigation Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*' [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

² **T. Barker, I. Bashmakov, A. Alharthi, M. Amann, L. Cifuentes, J. Drexhage, M. Duan, O. Edenhofer, B. Flannery, M. Grubb, M. Hoogwijk, F. I. Ibitoye, C. J. Jepma, W.A. Pizer, and K. Yamaji** (2007): 'Mitigation from a cross-sectoral perspective. In *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*' [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Aviation emissions trading scheme

The revenue estimate from an aviation emissions trading scheme is generated by multiplying emissions estimates for the year 2015 by the carbon price estimates used in the AAU calculation (emissions generated from Annex 1 countries only were estimated by allocating emissions according to the retail country of jet fuels). The aviation emissions estimate for flights departing from Annex 1 countries – 276,627 Gg CO₂ – is based on projected 'Business As Usual' (BAU) scenarios for the year 2015. The assumption is that emissions will level off in 2015 and be reduced in future years.³

Estimates on the impact of price increases on demand for flights were taken from EU studies. The impact assessment of the planned EU ETS for air traffic reveals that the greatest impacts will be felt by countries that are completely dependent on tourism.⁴

Overall growth in tourist arrivals would decrease one per cent to five per cent, but there would be no absolute decline in demand. Other studies on the EU program confirm a reduced growth rate of about two per cent.⁵

In the case of imported goods, prices are estimated to increase somewhere in the range of 0.5 per cent to three per cent depending on the price of allowances. Prices would only exceed that level for products whose share of transport costs amount to over 50 per cent of the product's end price.⁶

This price increase is small when considered in terms of the weight of goods, since less than one per cent of goods are transported via air freight; however, when measuring based on the value of international goods this amount increases to 40 per cent. The cost increase would likely affect those countries highly dependent on food imports, such as the small island states of Jamaica and the Maldives.⁷ Antigua and Barbuda, Barbados, Bahamas, Dominica, Grenada, Jamaica, Maldives, Mauritius, Saint Lucia, Trinidad and Tobago and Vanuatu have a less than five per cent cereal production to consumption ratio – these countries would be exempt from the program based on the proposed *deminimis* threshold.

³ **B. Owen and D. S. Lee** (2005), 'International Aviation Emissions Allocation - Future Cases', (Report 3 of 3) Data Appendix, Tables A9 & A12

⁴ **O. Deuber, J. Graichen, K. Grashof** (2007), European Commission (2006)

⁵ **Badura** (2006)

⁶ **O. Deuber et al** (2007) op. cit.

⁷ *Ibid.*

Maritime emissions trading scheme

Revenues from a maritime emissions trading scheme are generated by the following:

Step 1. Estimate emissions by vessel type:

Cargoes are carried on different kinds of vessels. Tankers and product tankers carry crude oil and fuels; bulk carriers for dry cargoes like grains and metal ores; a mix of containers, general cargo and vehicle carriers handle manufactured goods. IMO's most recent emissions study finds emissions patterns for the different ship types varying widely.⁸ First, they vary by ship type, with relatively low emissions from tankers and bulk carriers but high emissions from container ships and vehicle carriers. Second, they vary by size, with smaller vessels averaging higher levels of emissions than big vessels. For example, the report to IMO finds a 500-TEU container ship emitting an average of 33.3 grams of CO₂ per ton of cargo, while an 8,000-TEU container emits an average of 11.1 grams per ton. IMO's study uses average emissions production rates as follows: Crude oil tanker = 5 g CO₂/ton-mile, Fuel product tanker = 9 g CO₂/ton-mile, Bulk carrier = 4 g CO₂/ton-mile, General cargo = 18 g CO₂/ton-mile, Container = 28 g CO₂/ton-mile, Vehicle = 55 g CO₂/ton-mile.

Step 2. Find Annex I countries' share of shipborne imports:

UNCTAD's *Review of Maritime Transport 2007* finds that ships carried about 7.5 trillion tons of cargo in 2006.⁹ About 60 per cent of this total went to 'developed countries' and 'economies in transition', which together comprise a list of countries roughly synonymous with the Kyoto Convention's Annex I list.¹⁰ This breaks down as follows:

Destination	Total Cargo	Crude oil	Fuels	Dry cargoes*
World	7.5 B tons	1.9 B	0.68 B	4.8 B
Annex I	4.4 B tons	1.2 B	0.35 B	2.8 B
Developing	3.1 B tons	0.7 B	0.33 B	2.0 B
Annex 1 Share	59%	64%	52%	58%

* Includes bulk commodities and manufactured goods.

⁸ IMO (2008) 'Updated 2000 Study on Greenhouse Gas Emissions from Ships, Phase I Report', MEPC 58/INF.6

⁹ http://www.unctad.org/en/docs/rmt2007ch1_en.pdf

¹⁰ The principal difference is that UNCTAD's tables place UNCTAD Review of Maritime Transport 2007, http://www.unctad.org/en/docs/rmt2007annex_en.pdf

Step 3. Find ton-mileage for Annex 1 country imports by product category:

Table 5 of UNCTAD's report gives total ton-mileages for major cargo types. Assuming that the Annex 1 countries' share of ton-mile is roughly similar to their share of unloaded cargo, we get the following figures for ton-mileages by cargo type.

Product	Crude oil	Fuels	Bulk goods	Other dry cargoes
Ton-mileage	9.5 T	2.6 T	9.3 T	9.2 T
Annex 1 share	64%	52%	58%	58%
Annex 1 ton-mileage	5.8 T	1.4 T	5.7 T	5.5 T

Step 4. Calculate emissions by product:

Multiplying the ton-mileage by the emissions produced by various ship-types yields the following emissions levels:

- Crude oil: 5.8 T ton-miles x 5 g/ton-mile = 29.0 MM tons CO₂
- Petroleum prods: 1.4 T ton-miles x 9 g/ton-mile = 12.6 MM tons CO₂
- Bulk cargo: 5.7 T ton-miles x 18 g/ton-mile = 102.6 MM tons CO₂
- Other dry cargoes 5.5 T ton-miles x 28 g/ton-mile = 154 MM tons CO₂

Step 5. Calculate revenue produced by emissions permits:

Multiplying tons of CO₂ by the set rate of \$45/ton produces a figure of CO₂

- Crude oil: 29 MM tons CO₂ x 45 \$/ton = \$1.3 B
- Petroleum products: 13 MM tons CO₂ x 45 \$/ton = \$0.6 B
- Bulk cargo: 103 MM tons CO₂ x 45 \$/ton = \$4.6 B
- Other dry cargoes: 154 MM tons CO₂ x 45 \$/ton = \$6.9 B

\$13.4 B

Step 6. Apply annual emissions growth rate to 2015:

IMO's most recent emissions analysis models annual growth rates for the shipping sector with respect to different variables for shipping within each of the IPCC scenario families (i.e., A1F1, A1B, A1T, A2,

B1, and B2). Five growth rates are established based on these different IPCC scenarios. Oxfam applied an average of 2.4 per cent annual growth to the 2006 revenue estimate, yielding \$16.6 billion by 2015 at a carbon price of \$45/ton.

Evolution of maritime emissions scheme

On the topic of ship evasion (e.g., a ship carrying goods from China to the western USA may port in Mexico first before arriving at its final destination in the USA), a recent analysis conducted by the World Wildlife Fund (WWF) determined that an additional stop in a non-Annex 1 country could add significant costs to a shipping route associated with lost time, additional fuel use, fees and tariffs, etc. However, the incentive for evasion may outweigh these costs, especially if the price of carbon allowances increase to above \$30/ton.¹¹

Such evasion may partially be avoided if ships are required to unload at least half of their cargo at the last port visited in a non-Annex 1 country before setting sail to an Annex 1 country.¹²

Another way to avoid possible evasion would be to track emissions based on the route of cargo as well as the route of the ship itself. The origin of cargo could potentially be captured through the Bill of Lading, which contains information on port of departure, port of destination, shipper, vessel, amount of cargo, owner of cargo, etc. If vessels would register their fuel use on a per trip basis, this registry could be coupled to the Bill of Lading to calculate the amount of emissions associated with the transportation of the cargo. This method, however, has raised concerns regarding complex administration and oversight.¹³

¹¹ **J. Farber** (2008) 'Left on the High Seas', CE Delft.

¹² **P. Lockley** (2008) op. cit.

¹³ **J. Faber, et al** (2007) 'Aviation and Maritime Transport in a post-2012 policy regime'.

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