FNI Climate Policy Perspectives 3 November 2011

# Driving Meaningful Adaptation Action through an Adaptation Market Mechanism

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- Approaches and criteria for allocating adaptation funds vary significantly among current sources – UN-backed funds and bilateral cooperation – and to some extent lack transparency and consistency. Such funding risks being spent in a haphazard way that repeats many of the mistakes made in development assistance over the past decades.
- An Adaptation Market Mechanism (AMM) could contribute to efficient allocation of adaptation funds, promote adaptation activities by private and public actors through additional financial incentives, and raise additional and reliable adaptation money. This would help to avoid future public criticism of the effectiveness and efficiency of spending adaptation funding.
- The proposed AMM would specify mandatory adaptation targets, on international, regional or domestic level. Participants who achieve their targets either by generating adaptation units or by buying them in the market would incentivize private, commercial and institutional actors to develop adaptation projects that create verified adaptation units.
- A universally accepted and verifiable trading unit applicable to all types of adaptation activities would help to maximize the cost reduction potential for the AMM. We suggest applying net present value (NPV) for property saved; Disability Adjusted Life Years Saved (DALYS) for health benefits; and potentially a separate unit to consider the environmental benefits of an adaptation activity.

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# Driving Meaningful Adaptation Action through an Adaptation Market Mechanism

## Background: market mechanisms in the context of adaptation

Despite two decades of climate policy, global greenhouse gas emissions are creeping upwards. The 2008 financial crisis failed to curb this increase, and even rapid successes in greenhouse gas mitigation will not prevent significant anthropogenic climate change. Recent analyses of pledges made under the Copenhagen Accord show that they are unlikely to keep global temperature increase below 2°C. And whether these pledges will be kept depends on the political salience of the climate change problem, which has decreased considerably in recent years. Moreover, the Fukushima nuclear accident has called into question an emissions mitigation technology deemed important by many analysts.

Therefore, adaptation to climate change becomes increasingly important, especially as many developing countries in the tropical latitudes are likely to be hard hit by even relatively low levels of climate change. Poor countries already suffer from an 'adaptation deficit' to current climate variability. For the year 2030, the UNFCCC has estimated annual global adaptation costs at USD 49 to 171 billion. The estimate of USD 27 to 66 billion of this accruing in developing countries contrasts with World Bank[1] estimates of USD 70–100 billion.[2] Other researchers support this, arguing that the UNFCCC figures exclude the impacts on mining and manufacturing, energy, retailing, tourism, and neglect of various vector-borne diseases.

In that context, developing countries have consistently asked industrialized countries to provide financial resources for adaptation. In the Copenhagen Accord, industrialized countries pledged USD 30 billion as 'fast-start finance' for mitigation and adaptation in developing countries, aimed at increasing funding to USD 100 billion annually by 2020. However, the modalities of financing remain vague and all types of channels are included – bilateral, multilateral, concessional, private and even market mechanisms. So far, industrialized countries have preferred bilateral financing modes, which suffer from lack of transparency, to multilateral channels (for exceptions, see Box 1). Non-Annex I countries may fear a re-labelling of official development assistance, or other types of political double-counting.

### Box 1: Overview of multilateral funds for adaptation

The few multilateral funds are dispersed among several funds. Three multilateral funds have each around USD 150–250 million of funding: the Adaptation Fund financed by a levy on Clean Development Mechanisms (CDM), the Least Developed Countries Funds (LDCF) and the Special Climate Change Fund (SCCF). While the Adaptation Fund might become the largest of the three due to the steady inflow of the CDM levy – if there is an ambitious agreement on the international climate policy framework at the UN level – it may need some time to reach the Program for Climate Resilience (PPCR), part of the Climate Investment Funds which has raised more than 900 million USD, of which 300 are deposited.

With this unclear and heterogeneous financing situation comes the risk of funding for adaptation being spent in a haphazard way that repeats many past mistakes made in development assistance, including politics-driven allocation of funds and not needs-based allocation. New mechanisms are needed to avoid future problems with public reviews on the effectiveness and efficiency of spending the adaptation funding –in particular, taxpayer

[1] World Bank, 2010: *Economics of Adaptation to Climate Change*. World Bank, Washington, DC.

[2] UNFCCC (2007) *Investment and Financial Flows to Address Climate Change*. Climate Change Secretariat, Bonn.

doubts as to how their money is spent. Market mechanisms can also facilitate the participation of private industry and other non-governmental stakeholders – crucial for achieving the investment levels needed. Finally, it is worth noting that unit costs of adaptation projects may differ by several orders of magnitude: a recent paper on unit costs of hurricane damage protection in Florida estimates the cost-benefits ratio as ranging from 0 to 9.4.[3] *Adaptation funding can be made more efficient by choosing least-cost solutions, as through market-based mechanisms for resource allocation and even to raise funding.*

**Trading adaptation?**

Markets have not yet been used to promote adaptation, nor has the idea been examined in detail,[4] although quota trading has been applied to reduction of resource use in the case of water-rights. An exception is Schultz (2011), who proposes a market mechanism for mobilizing resources for vulnerability reduction based on the polluter pays principle.[5]

The discussion below is based on experiences with pollution abatement and greenhouse gas mitigation. While pollution is a 'bad' and tradable units are called 'licenses', 'allowances' or 'permits', adaptation is a good – and this has important consequences for instrument design. We focus on quota systems, on the design of an Adaptation Market Mechanism (AMM) in particular.

The key feature of market mechanisms (or market-based instruments) is that a price signal is used to promote the production of a certain service or good, or to reduce it. Market mechanisms may take various forms. The purest one is the trading of quotas in form of obligations or permits. With obligations, each quota embodies the obligation to produce one unit of the public good. This needs definition of participants and a public regulation that requires surrendering quotas in a certain period. A participant who can produce the public good at low cost may sell quotas to another participant at market price.

Another form involves generating tradable units through projects that produce the public good. These units can be used to comply with a public regulation. Instead of obligations to produce a minimal quantity of the public good, quotas can be used to limit pollution: permits to produce a certain (maximum) amount of environmental pollution may be allocated to participants and the permits can be traded. A well-known example here is the EU Emissions Trading Schemes. Unlike mitigation of climate change, most forms of adaptation are not automatically a global public good. Adaptation may occur along a continuum ranging from a pure private good (protection of private property) to a global public good (breeding of drought-resistant cultivars). However, if adaptation is defined broadly as protection of societies as a whole against impacts of climate change, then it generally can be seen as public good, like the provision of public security.

Adaptation policies typically have one or several of the following main objectives:

- Fund-raising/mobilization for adaptation activities;
- Identification of vulnerabilities and incentivization of action to address vulnerabilities;
- Efficient allocation of funds available for projects aimed at avoiding climate-change-related damages – deciding which adaptation activities to support with available funds;
- Promotion of sustainable adaptation by various stakeholders – e.g. discouraging settlement in flood-prone areas;
- Sharing financial risks – e.g. transfer of risks through insurance-based mechanisms.

The objective of an Adaptation Market Mechanism (AMM) as suggested here is to *create a market that honours adaptation activities of private and public actors by providing financial incentives*. It can be designed to include not only the concept of tradable permits but also that of project-based offsets. A second, equally important aim is to *maximise cost-effectiveness of adaptation measures:* to direct funding to those projects that bring greatest benefits.

[3] Economics of Climate Adaptation (2009): *Shaping Climate-resilient Development: A Frame-work for Decision-making*. Economics of Climate Adaptation Working Group, p. 109.

[4] Without developing the idea further, it was introduced by Callaway, J. (2004): Adaptation benefits and costs: are they important in the global policy picture and how can we estimate them?, *Global Environmental Change* 14, pp. 273–282.

[5] Schultz, Karl Harvey (2011): Financing climate adaptation with a credit mechanism: initial considerations. *Climate Policy Online,* September 2011: http://www.tandfonline.com/doi/abs/10.1080/14693062.2011.605563, accessed 15 November 2011.

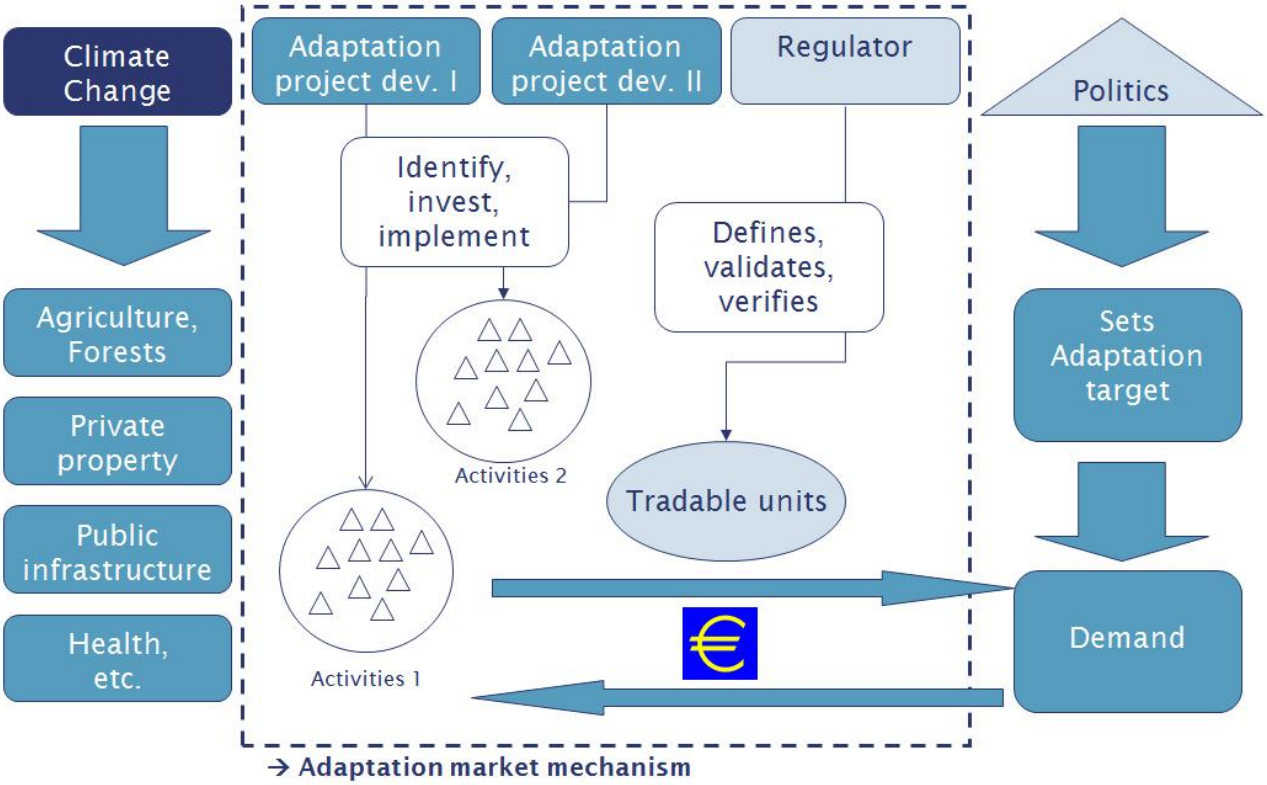


***Figure 1:*** *Overview: functioning of an adaptation market mechanism.*

## AMM in practice

A market mechanism requires a quantifiable policy target regarding the generation of a 'good', and an array of possibilities to contribute to this policy target whose costs per unit differ considerably. To avoid local hotspots of impacts, there should be only limited negative externalities involved in producing the good.

To promote adaptation, tradable units must be created through governmental regulation[6] specifying a quantity of adaptive benefits, determined in prevented 'climate change impacts'[7]. Certain entities would then be required by the regulators to take responsibility for mobilizing adaptation and to surrender sufficient units. Various principles exist for allocating these requirements to entities, including ability to pay, size of the entity (in revenue, inhabitants/employment numbers), the polluter pays principle, or simply a poll tax.

The entities that must surrender the adaptation units then have the option of embarking on adaptive activities themselves, or acquiring units from other entities capable of implementing adaptive activities at lower cost than the market price for the units.

Activities that are conducted under an AMM may cover many sectors, like agriculture, protection of private/public infrastructure against climate-change-related damage, improving cooling systems in building, improving medical care systems to save lives or avoid disability/sickness induced by climate-change-related events. Figure 1 summarizes the basic functioning of an AMM.

To ensure that the AMM delivers real impact on adaptation, a robust monitoring, reporting and verification (MRV) scheme is required, together with solid baselines for estimating the economic and social benefits of an adaptation activity.

## Defining the unit to be traded

A universally accepted and verifiable trading unit is a precondition for any market mechanism. For an AMM, the unit should be applicable to all types of adaptation activities, for maximization of the cost-reduction potential.

[6] Theoretically, a voluntary market approach could be an alternative. However, as we doubt that such an approach could mobilize sufficient funds in the current political and economic situation, this paper focuses on a mandatory approach.

[7] A discussion of feasible units follows below.

An adaptation project is successful if it delivers protection against negative impacts of climate change. The protection might concern private and public property as well as human lives. A 'perfect' adaptation project would prevent any negative impact on those.

Theoretically, the trading unit could be denominated in net present value (NPV) of property and human lives protected, plus the NPV of environmental benefits like saved habitats and ecosystems. The challenge is how to value human life, human health and environmental benefits. With regard to human life, Fankhauser and Tol (1998)[8] have argued that 'values of a statistical life' embodying people's attitude to mortality risks should be used for that valuation. These values depend heavily on income, and are substantially lower for a poor person than a rich one, varying by a factor of 15 between China and OECD countries. This approach became controversial in the elaboration of the 2nd Assessment Report of the IPCC, when developing-country representatives strongly attacked what was seen as 'Northern arrogance'. Fearnside (1998)[9] then proposed separating human lives and property values – an approach that we follow to avoid endless political debates on equity issues. We suggest the following trading units:

- *Net present value (NPV)* of property saved, expressed in current currency units10
- *Disability-adjusted life years saved (DALYs)* DALYs calculate the number of years of life lost due to premature mortality and/or the number of years lived with disability or disease. The basis for comparison is standard life expectancy, and different types of disability / illness are accorded different weights (WHO 2010a, b).

Additionally, account can be taken of *environmental impacts* that cannot be directly measured in terms of monetary wealth.[11]

The concept of DALYs has been thoroughly tested by the World Health Organization, which has elaborated a comprehensive system and ready-to-use standard values for quantifying the level of disability through a given event.[12] Box 2 provides a numerical example. Since the criteria 'property saved' and 'DALYS saved' implicitly cover the risk and exposure of protected entities, there would be an incentive not only to minimize relative costs but also to engage in most effective activities: using those options for adaptation that have greatest impact in economic and social terms.

### Box 2: Example of DALY calculation for a river embankment activity

A region in a river basin, populated by 0.5 million people, has historically not been affected by floods. Climate change is expected to change rainfall patterns in the country and independent studies project a strong increase in the frequency and force of flood events. As yet, no embankments have been established to protect human life and wealth.

Among the expected health damages from a flooding event: 2,500 people will die and 25,000 suffer severe diarrhoea with an average duration of 6 weeks (or 0.115 years).[13] Life expectancy in the region is 55 years, average actual age 28 years. For calculation of DALYS, we use the 'disability weights' (DW)derived by WHO for the health loss categories: death = 1, diarrhoea = 0.11.

Total DALYs achieved by the embankment thus reach the following value: DALY = YLL + YLD

[8] Fankhauser, S., Tol, R., Pearce, D. (1998): Extensions and alternatives to climate change impact valuation: on the critique of IPCC Working Group III's impact estimates, *Environment and Development Economics,* 3, pp. 59–81.

[9] Fearnside, P. (1998): The value of human life in global warming impacts, *Mitigation and Adaptation Strategies for Global Change,* 3, pp. 83–85

[10] For a more detailed discussion see Stadelmann et al. (2011/2012), Universal metrics to compare the effectiveness of climate change adaptation projects, forthcoming in *Climatic Change*. This paper also discusses distributional effects of different NPV approaches.

[11] There are other 'goods' that do not exactly match the above categories, such as cultural values. Given the challenges of quantifying these values and wishing to reduce the complexity of the suggested AMM, we do not consider such goods in this paper.

[12] See e.g. WHO, 2010a: Disability weights, discounting and age weighting of DALYs. http://www.who.int/healthinfo/global_burden_disease/daly_disability_weight/en/index.html, accessed 16 October 2010; and WHO, 2010b: Global Burden of Disease. http://www.who.int/healthinfo/global_burden_disease/en/, accessed 16th October 2010.

[13] These are highly simplified assumptions used for illustrative purposes only. In practice, one would derive probability-weighted damage functions.

where:

YLL (years of life lost due to premature mortality) = N (number of deaths) * L (standard life expectancy at age of death (in years)).

YLL = 2,500 * (55-28) = 67,500 DALYs

YLD (Years lived with disability) = I (number of incident cases) * DW (disability weight) * L (average duration of disability (years)).

YLD Diarrhoea = 25,000 * 0.115 * 0.11 = 316

Total DALYs of the project amount to 67,816. This amount of DALYS would count as 'Saved Health' adaptation units, and could be directly traded (see below).

The total value of an adaption activity or project ($TV_{Adapt}$) would be determined as:

$TV_{adapt}$ = *Saved wealth* (public infrastructure, private property, income loss) + *Saved Health* (avoided disease, avoided disability, avoided deaths) + *Environmental Benefit* (saved endangered species and protection of habitat)

As the units of these categories differ significantly, they should be evaluated them separately from each other. Hence, the AMM should define targets for each of the categories.

## Allocation of adaptation targets

Once the units of an AMM have been defined, the next step is to specify mandatory adaptation targets. In principle, the AMM can be applied on an international, regional or domestic scale. Obviously, targets and covered entities will depend heavily on the geographical scale chosen. An international scheme that requires certain countries/country groups to deliver certain volumes of adaptation units could be implemented under the UNFCCC. Alternatively, a region or country could define adaptation targets e.g. for certain industries, sectors or companies.

For instance, the UNFCCC could set an annual target for protecting €50 billion of property ('saved wealth', SW) and 500,000 DALYs ('saved health', SH) per year[14]. Subsequently, these commitments would be allocated to a predefined group of countries. As noted, various technical allocation criteria could be chosen, like actual or cumulated historical emissions, level of economic development, per capita income, or a poll tax. Other possible allocation principles such as ability to pay and inverse of vulnerability appear less compelling.

Countries can meet the defined target by investing into adaptation activities that result in Saved Wealth and/or DALYS, or by buying tradable units from other countries with an AMM target, or by buying project-based AMM units ('offsets'). One option for countries with an AMM target is to pass on their responsibilities to sub-national entities such as companies. For example, if the EU has an AMM target, it may decide to pass on part of it to companies participating in the EU Emissions Trading Scheme (EU ETS), which would lead to approximately 11,000 emitting entities covered.

Politicians would have to determine the regional scope for adaptation project investment; e.g. if it is to be a truly global mechanism (allowing projects and funding from any country worldwide), or a regional one. For efficiency, global scope would be preferable; that would also make it possible to account for flows to developing countries as part of the financial pledges for mitigation and adaptation.[15]

## Project cycle of AMM 'offsets'

The AMM offset cycle would bear many similarities to the Clean Development Mechanism (CDM) project cycle. Before a project can qualify for generating adaptation units, standardized documentation would need to be validated by an auditor who would check the assumptions and parameters underlying the estimates of Saved Wealth, Saved Health and Environmental Benefits. These parameters should be calculated on the basis of politically agreed climate models, to be updated periodically.

A key parameter for calculating Saved Wealth is the projection of the autonomous develop-

[14] For simplicity, we exclude environmental benefits from the example.

[15] If the adaptation benefit for a certain region or country is to be maximized, the scope should be limited to that region/country. However, that would raise the costs per adaptation unit, due to the lower number of projects.

ment of the property value of the relevant region over time. From this, and on the basis of a frequency distribution of climate-change induced events derived from the approved climate model, one can calculate the property that would be lost due to climate change if there were no adaptation project. Regional discount rates should be used to calculate the net present value of Saved Wealth. Hence, this process would be similar to the determination of baselines in the context of CDM projects.

To preserve the credibility of the trading scheme, the generation of adaptation units by projects should be subject to strict periodical verification by independent auditors. Audits would be based on standardized monitoring reports for outcome parameters of the project, cross-checked by a regulatory Adaptation Unit Panel (AUP). Like the CDM Executive Board, the AUP would be empowered to approve adaptation projects and to approve/ reject issuance of adaptation units. Given the high variety of possible adaptation action, AUP and auditors would need considerable expertise. For each distinct adaptation project type, monitoring methodologies must be defined. In the context of the embankment project example above, monitoring would check whether the embankment has been constructed as per the project design and whether its maintenance status assures stability as per the design parameters. If, for example, the verification should find a risk of the embankment failing the maximum design flood of 25%, the adaptation unit level would be decreased by 25% compared to the estimate in the validated project documentation.

Once the adaptation units have been issued, they can be transferred. As with the mitigation market, brokerage companies will emerge once a sufficient number of entities are covered by the AMM. At the end of each year, companies would have to surrender sufficient adaptation units to cover their targets. Non-compliance should be punished by strict penalties.

## Conclusions

The introduction of an Adaptation Market Mechanism as discussed above can serve to

a) efficiently allocate available adaptation funds,

b) promote sustainable adaptation by private and public actors due to the additional financial incentives,

c) raise additional and reliable adaptation money.

Such a mechanism could bring new impetus to the UNFCCC talks and might help to overcome the current deadlock situation. Specifically, it could serve to build a bridge between Annex I and Non-Annex I countries discussing future commitments. Broadening the scope from a mitigation-focused approach to one that entails targets for both mitigation and adaptation could, for example, lead to the following compromise: Annex I countries accept stringent absolute commitments for mitigation and adaptation (implementation through the AMM), while advanced Non-Annex I countries accept effective and adequate absolute mitigation commitments. This would take into account issues of historical responsibility while also reflecting current and expected future emission realities.

Finding a compromise along this line would put adaptation activities on a more stable footing as well as safeguarding private-sector engagement in mitigation and adaptation. With many private actors already drawing back from carbon markets due to the lack of perspectives, relevant policy signals must be provided quickly.

The AMM will face various challenges – not least as regards the uncertainty of future climate change. Here, it must be recognized that adaptation and damage baselines are uncertain. In our view, a credible AMM can be set up even with this uncertainty – one just needs to acknowledge that the exact benefit of any activity cannot be accurately quantified. Since this uncertainty applies to all activities, it is still possible to undertake relative comparison of projects and select those with the highest predicted benefit. Other challenges might concern the project cycle, which might easily become complex and create relatively high transaction costs. Here it will be important to draw on the lessons learnt from the CDM when designing detailed rules for the AMM. Likewise, easy to handle but effective approaches must be elaborated for dealing with adaptation additionality. And finally, there will be the challenge of political debates about the allocation of adaptation commitments and the question of defining priority regions.

An AMM would complement current approaches of financing and implanting adaptation action: it would not replace current bilateral initiatives, but could channel the additional action required and pledged on the

UNFCCC level. Such a tandem approach could also ensure that some costly adaptation projects deemed necessary for political or social reasons could still be implemented.

### *Acknowledgements*

*The authors would like to thank Karl Schultz and Tor Håkon Inderberg for their comments.*

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ISSN 1893-1510 / ISBN 978-82-7613-634-0
Series Editor: Anna Korppoo (anna.korppoo@fni.no) / Cover photo: Val Gempis, USAF