

Measurable, reportable and verifiable: the keys to mitigation in the Copenhagen deal

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The climate negotiations up to Copenhagen will need to elaborate on measurable, reportable and verifiable (MRV) mitigation commitments and actions as part of the future of the climate regime. The conceptual, political, scientific, financial and institutional principles for MRV are explored for (1) mitigation commitments in developed countries, (2) mitigation actions in developing countries, supported by (3) means of implementation. For developed countries, the procedures in Articles 5, 7, 8 and 18 of the Kyoto Protocol will be critical in order to ensure comparability of commitments, both in effort and compliance. Outcomes should be reportable and verifiable through Annex I national communications and in-depth review. Existing procedures could be enhanced and need to apply across Protocol and Convention. MRV mitigation actions by developing countries should result in measurable deviations below baseline. Inventories will be important to measure, and enhanced national communications for reporting. The challenge will be to make mitigation actions verifiable, and options include verification by domestic institutions working to internationally agreed guidelines. A critical distinction is to be made between unilateral mitigation actions and those with international support. MRV applies to the provision of the means of implementation, including technology and finance. Investment in technology can be measured, so that institutional arrangements for technology and finance should be aligned. Verification of funds raised at international level would be simpler than raising funds nationally.

Keywords: Bali; climate negotiations; Copenhagen; developed countries; developing countries; finance; measurable, reportable and verifiable (MRV); mitigation; post-2012; technology

Les négociations d'ici à Copenhague vont devoir élaborer les termes des engagements et des actions de mitigation en matière de surveillance, déclaration et vérification (MRV) dans le cadre d'un futur régime climatique. Les principes conceptuels, politiques, scientifiques, financiers et institutionnels pour MRV sont explorés dans le cadre (1) des engagements de mitigation dans les pays développés, (2) des actions de mitigation dans les pays en développement, soutenus par (3) les moyens de mise en œuvre. Pour les pays développés, les procédures définies par les articles 5, 7, 8 et 18 du protocole de Kyoto seront primordiales pour assurer la comparabilité des engagements, tant pour l'effort que pour la conformité. Les résultats devront être déclarables et vérifiables selon les communications nationales de l'Annexe 1 et l'examen approfondi. Les procédures actuelles pourraient être améliorées et doivent être applicables à travers le protocole et la Convention. Les actions de mitigation des pays en développement soumises à la MRV devront aboutir à des écarts mesurables au-dessous de la baseline. Les inventaires seront d'importance pour la surveillance, et les communications nationales améliorées pour les déclarations. Le défi sera de rendre vérifiables les actions de mitigation, les options comprenant une vérification par des institutions domestiques travaillant selon les règles établies à l'international. Une distinction fondamentale doit être faite entre les actions de mitigation unilatérales et celles dotées d'un soutien international. La MRV s'applique aux moyens de mise en œuvre, y compris les technologies et le financement. L'investissement technologique est mesurable, pour l'alignement des dispositions institutionnelles en technologie et financement. La vérification de fonds accumulés au niveau international serait plus simple que pour une accumulation de fonds nationaux.

Mots clés: Bali; Copenhague; financement; mitigation; négociations sur le climat; pays en développement; pays développés; post-2012; surveillance, déclaration, vérification; technologie

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1. A core balance

Measurable, reportable and verifiable (MRV) mitigation action is a key component in the Bali Action Plan, and likely to be central to the negotiations about the future of the climate regime. MRV is pertinent in quantifying action on mitigation, and the enduring balance between commitments and actions. It is to be applied in an enhanced way to developing countries' mitigation and to the means of implementation: technology and finance. MRV is fundamental to the balance between action on climate change and support. An improved balance between adaptation and mitigation is also needed, but the focus of this article is on mitigation.

The balance of mitigation commitments in Kyoto was that Annex I countries took on QELROs (quantified emission limitation and reduction objectives), while non-Annex I Parties continued with mitigation programmes without quantified levels. In the Bali Action Plan, the same balance was applied to an evolving context, outlined in paragraphs 1b(i) and 1b(ii):

- (b) Enhanced national/international action on mitigation of climate change, including, *inter alia*, consideration of:
 - (i) Measurable, reportable and verifiable nationally appropriate mitigation commitments or actions, including quantified emission limitation and reduction objectives, by all developed-country Parties, while ensuring the comparability of efforts among them, taking into account differences in their national circumstances;
 - (ii) Nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner' (UNFCCC, 2007a).

MRV is applied to mitigation in both developed and developing countries, but applied in the former to 'commitments or actions', including QELROs, and in the latter simply to 'actions'. MRV in 1b(ii) also applies to the means of implementation.

This raises the bar on both sides in three important ways. Firstly, it does so while honouring the principle of equity and common but differentiated responsibilities and respective capabilities. All developed countries, including those who have not ratified the Protocol, need to make legally binding commitments or take actions that constitute comparable efforts, i.e. have comparable outcomes and consequences for non-compliance. The Ad-hoc Working Group on further commitments for Annex I Parties under the Kyoto Protocol (AWG-KP) considered a range of emission reductions of –25% to –40% below 1990 levels by 2020. For Annex I Parties as a group to achieve this target, it is clear that significant reductions in absolute emissions will be needed in the key remaining non-Kyoto Annex I Party, the USA.¹

Secondly, the bar is also raised for developing countries, moving from qualitative commitments under Article 4.1 of the Convention to mitigation actions that are quantifiable (in the sense of measurable, reportable and verifiable). This short paragraph, 1b(ii), reflects a very significant shift: developing countries have agreed to negotiate measurable, reportable and verifiable (MRV) mitigation action. Not only can the emissions implications of actions be measured, they could also be reported to the international community and be capable of verification.

Thirdly, technology transfer and financial resources from developed countries also need to pass the test of being measurable, reportable and verifiable. This, similarly, is a significant departure from the past, when much financing was through voluntary contributions to funds and the quantum of technology transferred was neither measurable nor reportable. FCCC Article 12.3 does

require developed countries to report ‘details of measures taken’ in accordance with Articles 4.3 (finance), 4.4 (costs of adaptation) and 4.5 (technology transfer) (UNFCCC, 1992: Art. 12.3). However, this requirement does not specify reporting a quantum of technology transferred. Quantifying the means of implementation will be significant for the deal to be made in 2009, since the extent of developing-country mitigation action depends on developed-country support being subject to the MRV criterion as well.

The balance between paragraphs 1b(i) and 1b(ii) and that within paragraph 1b(ii) are likely to remain central in refining the architecture of the climate regime after 2012. These balances reaffirm a core balance in the Convention, in its agreement that the extent of developing-country action is dependent on the provision of finance and technology by developed countries (Art. 4.7). In other words, the degree to which the distributional issues are addressed remains critical to the future of the climate regime.

This goes to the core of trust-building in an evolving climate regime. Given the lack of technology transfer and low levels of financial support in the past, developing countries require MRV technology and finance as an enabling condition for deepening and widening mitigation action. The G5 statement in Sapporo (in July 2008) stated that they ‘would increase the depth and range of these actions supported and enabled by financing, technology and capacity-building with a view to achieving a deviation from business-as-usual’ (G5, 2008).

The relationship between support (from developed countries) and action (by developing countries) encoded in the Convention was maintained in the Bali Action Plan (BAP), but raised to new levels, in response to greater urgency.

2. The scientific basis: what are we MRV’ing?

The IPCC AR4 clearly establishes what is needed to keep stabilization levels low and hence avoid the worst impacts of climate change. It is equally clear that for *any* stabilization level, the assessment considers absolute emission reductions by Annex I and relative emission reductions for non-Annex I countries. If we agree to pursue the lowest stabilization level assessed (450 ppm CO₂-eq), then developed countries need to reduce their aggregate emissions by 25–40% from 1990 levels by 2020 and, from the same base year, by 80–95% by 2050 (Table 1).

For developing countries, the reductions required in the most ambitious IPCC scenario are a substantial deviation below baseline in several regions by 2020, extended to all developing regions by 2050 (IPCC, 2007: Box 13.7). If one wishes to consider the less ambitious stabilization levels (not forgetting the associated adverse impacts), then the numbers change, but the pattern remains the same. Developed countries must reduce absolute emissions significantly and in absolute terms by 2020, and massively by 2050. For developing countries, only for the 650 ppmv level can emissions follow the business-as-usual emission trajectories, and then only in the medium term, but not the long term. In all other scenarios, developing countries as a group would be required to make relative reductions.

In short, developed countries must reduce absolute emissions, while developing countries must take action to reduce emission growth, i.e. keep emissions below business-as-usual emission trajectories – and increasing the gap between BAU and the actual emissions trajectory so that, over time, the deviation is represented as a ‘wedge’.

Whether the deal in Copenhagen will agree to actual numbers to all parts of the absolute–relative emissions reduction balance, or only to an architecture in which we would in principle be able to put numbers to absolute mitigation commitments for developed countries and relative deviations for developing countries, remains to be seen.

TABLE 1 Ranges of emission reductions and deviations from baseline for various stabilization levels for Annex I and non-Annex I countries as a group (IPCC, 2007: Box 13.7)

Scenario category	Region	2020	2050
A 450 ppm CO ₂ -eq	Annex I	–25% to –40%	–80% to –95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia and Central Asia	Substantial deviation from baseline in all regions
B 550 ppm CO ₂ -eq	Annex I	–10% to –30%	–40% to –90%
	Non-Annex I	Deviation from baseline in Latin America and Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and Middle East
C 650 ppm CO ₂ -eq	Annex I	0% to –25%	–30% to –80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America and Middle East, East Asia

What is clear is that a fair, effective, flexible and inclusive package deal will have to strike a core balance between development and climate imperatives (Winkler and Vorster, 2007). A fair deal in Copenhagen will need to balance developed countries' commitments to absolute reductions and developing countries' actions to reduce emissions relative to baseline, because of historical responsibility, different levels of emissions per capita, and the levels of development. Development is doubly important because it relates both to responsibility *and* to capability to act.

Given this background, the rest of this article focuses on MRV mitigation by developed countries that ensures comparability of efforts and compliance among their commitments, MRV mitigation actions in developing countries, and MRV of the means of implementation – i.e. support in the form of finance, technology and capacity-building. Three questions that will need to be addressed in negotiating outcomes or decisions that give further content to paragraphs 1b(i) and 1b(ii) of Decision 1/CP.13 of the Bali Action Plan, are:

1. How should measurable, reportable and verifiable mitigation commitments by all developed countries be made comparable?
2. What does measurable, reportable and verifiable mean in relation to nationally appropriate mitigation actions by developing countries?
3. What does measurable, reportable and verifiable mean in relation to technology, finance and capacity-building support by developed countries for developing countries?

While there are two sub-paragraphs, there are three key questions: MRV occurs first in paragraph 1.b(i) in relation to developed countries, next 1b(ii) refers to mitigation actions by developing countries but in the same paragraph also applies to the support/enablers. The remainder of this article considers each of these three dimensions in turn.

3. MRV for developed countries

In the Bali Roadmap, mitigation commitments by developed countries are negotiated in the AWG-KP and in the Ad-hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) in terms of paragraph 1b(i). The post-2012 commitments for Annex I Parties under the

Protocol would continue to be measured, reported and verified according to Articles 5, 7 and 8. To ensure comparability of effort with mitigation commitments or actions, including quantified emission limitation and reduction objectives, by non-Kyoto developed-country Parties under the Convention, the same procedures for MRV would be simplest. Similarly, using procedures established under Article 18 of the Protocol would guarantee that compliance is comparable.

The consistency of reviews across the Convention and Protocol is already established, in that the reviews are to be conducted

pursuant to the relevant decisions of the Conference of the Parties and in accordance with guidelines adopted for this purpose by the Conference of the Parties serving as the meeting of the Parties to this Protocol (UNFCCC, 1997: Art. 8.1).

A key principle of MRV for developed countries would be that the commitments meet the stringency of the Protocol mechanisms, or improve on them.

What might mitigation commitments by non-Kyoto developed countries under the Convention be compared to? If a developed country adopted 'mitigation commitments or actions, including quantified emission limitation and reduction objectives', as foreseen in paragraph 1b(i), to what should that be compared?

Efforts by developed countries must be comparable in their legally binding nature and effectiveness to reduce GHG emissions. An obvious option is the range of mid-term emission reductions of 25–40% from 1990 levels by 2020. At this stage of the AWG-KP work programme, this has been considered for Annex I Parties as a group.

At the first part of its fourth session, the AWG recognized that the contribution of Working Group III to the AR4 indicates that achieving the lowest levels assessed by the IPCC to date and its corresponding potential damage limitation would require Annex I Parties as a group to reduce emissions in a range of 25–40 per cent below 1990 levels by 2020, through means that may be available to these Parties to reach their emission reduction targets.²

Commitments by non-Kyoto developed-country Parties negotiated in the AWG-LCA will need to be compared by their outcome, and the benchmark would have to be the numerical expression given to outcomes under the AWG-KP. If the overall effort of all Annex I Parties were based on a lower common denominator than the one expressed in the AWG-KP, 'comparability of efforts' in the BAP would become an escape clause for developed-country Parties that wish to defect from the Kyoto regime, instead of a guarantor of more stringent action.

It would be unrealistic to expect progress under the AWG-KP without progress in the AWG-LCA, and vice versa. One can hardly imagine Kyoto developed countries finalizing their numbers under the AWG-KP without the same level of detail under paragraph 1b(i) of the BAP, where the numbers for Annex I parties that remain outside of Kyoto would be agreed. Likewise, developing countries would need to understand the quantum of MRV technology and financing in developing a yardstick for MRV deviations from baseline.

These outcomes would also be reportable. For reporting, the basis will most probably remain Annex I national communications (UNFCCC, 1997: Art. 5, 7 and 8; 1992: Art. 12.2(a) and (b)). Annex I Parties are required to communicate, i.e. report detailed information; and their communications are subject to review (UNFCCC, 1992: Art. 4.1). The in-depth review includes verification by expert review teams. Improvements on the procedures for reporting could help to

promote best practice. Improvements will, crucially, have to be defined multilaterally. Unilateral definitions of comparability will not be accepted.

Under the Convention, all Parties agreed to use, each ‘to the extent its capacities permit ... comparable methodologies to be promoted and agreed upon by the Conference of the Parties’ (UNFCCC, 1992: Art. 4.1(a)). Here, Parties might look to enhance procedures for verification that could further develop existing work on measurement (including IPCC (2006), ISO, WRI/WBCSD (2007), etc.). Greater detail could be provided through a focus on measurement at the facility level and local capacity-building for implementation of IPCC methodologies for national inventory reporting. Comparability will be aided by the use of common methodologies by Kyoto and non-Kyoto developed-country Parties.

4. MRV mitigation action by developing countries

MRV applies to both nationally appropriate mitigation actions and to the provision of technology, financing and capacity-building. With the debate around MRV being politically charged, a way of making some progress might be to establish principles for MRV – for both developing countries and developed countries.

Another way, the main one explored below, is to break the issue down into its components and focus on details – clearly defining what is meant by *measurable*, *reportable* and *verifiable*. Once the details or technical parameters are better understood, political consensus may follow more readily.

4.1. Measurable

Measurement is a fundamental starting point for any kind of mitigation action. Considering measurement in a practical way needs to ask *what* can be measurable. For example, promoting renewables may require national legislation, regulations, zoning laws, scoping studies, contracts, investment packages, construction, etc. These different efforts can be measured, but in the end, it is the outcome, in terms of electricity produced and relative emissions reduction, that needs to be measured.

All countries are committed to develop, periodically update, publish and make available to the COP, inventories of GHG emissions and removals by sinks (UNFCCC, 1992: Art. 4.1). It is difficult to imagine a system of measurement that would *not* draw on this fundamental data – the status of emissions in a country. The unit of measurement clearly should be tonnes of CO₂-equivalent.

Another option might be ‘national inventories with footnotes’. The idea of the footnotes would be to provide a place for describing actions for emission reductions. They would allow developing countries to enhance reporting on their actions, and thus gain recognition for actions taken.

Perhaps inventories for developing countries could start in the sectors with the best information. This would allow for the required human and institutional capacity to be developed, expanding the coverage to all sectors over time.

To measure ‘deviations from baseline’ and recognize relative emission reductions, one effectively needs to establish national baselines. The experience gained under the Clean Development Mechanism (CDM) with project baselines provides a valuable basis for moving to larger scales. Already, the CDM is evolving to include programmes, and the discussions for the period after 2012 may include further evolution of the CDM or other innovative market mechanisms, possibly to a sectoral or policy level. The CDM experience indicates that we will have to consider whether to include provision for suppressed demand;³ and exclude national policies from national baselines. This should be supplemented by methodologies that apply MRV to *both* the local sustainable development and the emission reduction measures (Winkler et al., 2008). Such methodologies could be further elaborated by a group of experts under the SBSTA (UNFCCC Subsidiary Body on Scientific and Technological Advice).

The long-term goal (e.g. beyond 2020) would be to develop the MRV'ing of actions into MRV based on inventories, for all.

4.2. Reportable

All Parties have existing reporting commitments under the Convention (UNFCCC, 1992: Art. 4.1). Non-Annex I national communications provide an obvious avenue for reporting, even if the negotiations relating to them have been difficult. Rather than adding new provisions on reporting, use of the existing provisions could be enhanced through new and improved procedures, and previous decisions could be re-examined (South Centre, 2008).

A key question will be how developing countries should report on inventories. Perhaps the periodicity could be less often than for Annex I Parties, but establishing trends will be important in the long run.

A simple extension of the existing reporting requirements might be to have more regular reporting of GHG inventories by (at least some) developing countries. This could still be less frequent than the annual reporting by Annex I Parties, for example every 2 or 3 years.

Inventories measure emissions, not reductions. If developing countries implement unilateral mitigation actions (e.g. CDM, but also other policies and measures, or investment in cleaner technologies), how would one assess reductions?

Changes in inventories would reflect not only mitigation supported from multilateral sources, but also unilateral action. MRV would require separate tracking of domestically financed and internationally supported action. Changes in inventories would reflect reductions only if all actions are considered. The question of whether such inventories would be reviewed must be addressed under the verification procedures that will have to be negotiated.

Reporting would ideally include both unilateral mitigation actions and those implemented with international support (MRV finance and technology). The purpose may differ, with unilateral action reported to provide recognition of action by developing countries and a comprehensive picture of the actions by a country, while international support action would be reported to enable verification.

A separate format for reporting might be considered. For sustainable development policies and measures (SD-PAMs), for example, there have been suggestions to establish a new register to give recognition to mitigation actions by developing countries, voluntarily pledged. A new procedure could be developed to report on the implementation of SD-PAMs. Such a procedure might be elaborated by a group of experts.

4.3. Verifiable

If emission reductions are to be real, long-term and measurable, then verification is critical. The central questions are: what can be verified, how, and by whom?

One of the biggest challenges, in political terms, is the verification of mitigation actions by developing countries. Should the verification be done domestically or internationally? Are combinations of the two possible and useful? This is essentially a political question, as it raises issues of sovereignty and differentiation.

As a starting point, the establishment of broadly acceptable principles might be useful. These principles could include: requirements for independence, acceptability of the verifying institutions, accuracy, and building on existing capacity and experience.

Under any arrangement, domestic institutional capacity in developing countries to undertake both measurement and verification will be significant. A principle could thus be to build on national capacity for MRV – but to ensure that institutions measure and verify according to international standards (e.g. ISO, IPCC).

For example, we could build on national capacity to measure and verify energy efficiency savings. The difference between theoretical and actual savings in electricity is examined carefully and reported to national utilities or others sponsoring part of the investment. Converting energy savings to MRV emissions savings essentially only requires an emissions factor – and an effective standard has been established for grid-electricity factors, for example, in the CDM (ACM 0002). More broadly, the experience gained with CDM verifying emission reductions in developing countries can be a building block for MRV.

Institutional capacity is probably a better guarantor that climate-friendly policies would be implemented in developing countries than any international agreement. Another important factor is broad public support within the country. The international review process to make mitigation actions verifiable should build on these dimensions. For internationally supported mitigation action, reporting on how funds have been spent is standard practice already.

If mitigation actions in developing countries are supported only by national finance and do not involve technology transfer, then why would they need to be verified internationally? Would it be sufficient for international best practice to be applied by a domestic verification institution? The balance struck in Bali around paragraph 1b(ii) was that these two matters would go together, and therefore the scope of mitigation actions subject to MRV could be limited to those that receive international support. Extending verification beyond this would probably have to be left to the developing country concerned.

One option to address the issue of verification of mitigation actions by developing countries might be to follow a dual-track approach: actions with international financial support would be verified internationally (e.g. using mechanisms under the carbon market, or reporting on public funds spent), and unilateral mitigation actions would be verified domestically (e.g. unsubsidized energy efficiency measures), but then reported on in one reporting format/instrument under the Convention.

In Figure 1,⁴ national verification would apply to enhanced nationally appropriate mitigation actions (NAMAs) enabled through domestic funding in a developing country, but going beyond current levels of action. Existing CDM projects add to that, with verification by entities that can

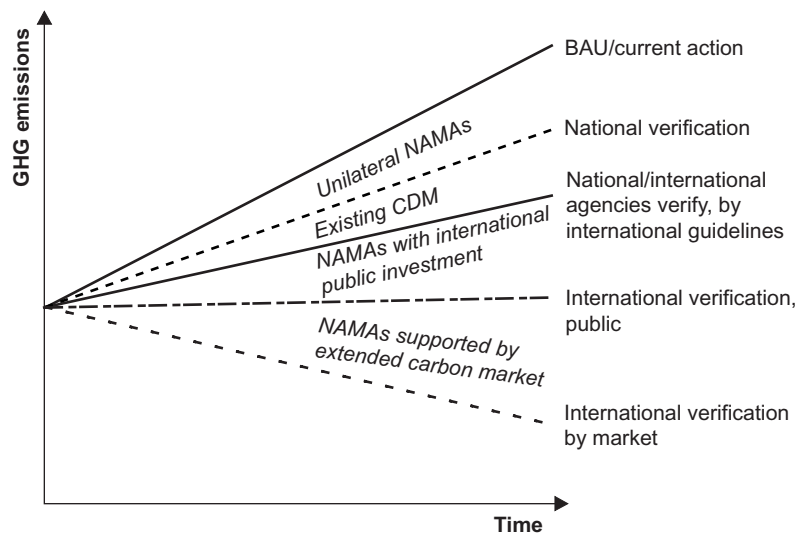


FIGURE 1 Three levels of verification for mitigation in developing countries (see Ward et al., 2008).

be either domestic or international, but work to multilaterally agreed guidelines. International verification would apply only to the bottom two lines, with verification either through public institutions providing finance, or through enhanced carbon markets (e.g. registries).

Another option to consider might be verification by peer-review. Verification could start with national institutions, followed by verification by other developing countries. Politically this might be more acceptable, or more within the 'contract zone' (Winkler and Vorster, 2007). Models of peer-review mechanisms, for example in the African Union or the WTO, might provide useful lessons. Such an approach would make reviews of developing country reporting distinct from the in-depth reviews of Annex I national communications.

Political realities will in all likelihood force us to live with the complexity of differentiation for some time to come. In the longer term, what is needed is to work towards a system where all emissions and all emission reductions are measured, reported and verified. Since we are working on 'long-term cooperative action', we should begin with that end in mind.

5. MRV for means of implementation

As outlined in Section 1, applying MRV to the means of implementation (technology and finance) is critical to the balance expressed in the Bali Action Plan. Developing countries expect developed countries to fulfil their commitments on 'measurable, reportable, and verifiable' support on technology, financing and capacity-building in the Bali Roadmap. Developed countries expect that this would facilitate MRV mitigation actions by developing countries that go beyond their mitigation actions already undertaken by developing countries with their own resources.

5.1. Making finance MRV

The starting point for understanding MRV finance is the Convention in which Annex II Parties agreed to provide 'adequate and predictable' financial resources for agreed full incremental cost of mitigation, adaptation and reporting (Art 4.3); to support adaptation in the most vulnerable countries (Art 4.4); and technology transfer, including promoting and financing technology transfer, facilitating access to technology, and support for the building of internal technology-related capacity (Art 4.5). Annex I Parties are required to report on details of measures taken in this regard.

Unsurprisingly, 'finance' is a critical building block in the Bali Action Plan. There would be very little, if any, delivery on the other building blocks – mitigation, adaptation, technology – without the key enabler: finance. The challenge is how to ensure that the financial flows actually occur, and to operationalize the measurement, reporting and verification of finance.

What is apparent is that the current scale of funding is several orders of magnitude below what is required and will be required in future. Adaptation funding of US\$28–67 billion per year in developing countries will be needed by 2030. Investment in mitigation of US\$200–210 billion per year is needed by 2030, of which 46% is in developing countries (UNFCCC, 2007b). Where might such funds come from?

The simplest solution may be a mandatory formula for collecting money. One option already proposed in the AWG-LCA is that developed countries set aside 0.5% of GDP to support climate change adaptation and mitigation in developing countries.⁵ Besides achieving scale by using this formula, an obvious advantage is that it would make it simpler to clearly distinguish between climate funding and official development assistance (ODA).

However, there is an array of potential sources that might provide the financial flows to meet an agreed target. The UNFCCC Secretariat provided a range of illustrative options in a paper on finance and investment flows (UNFCCC, 2007b).

Variants of some of the options in Table 2 are being considered by different actors, for example auctioning of emission allowances. This would allow collection at source. The Liebermann–Warner Bill (US Senate, 2007), which was before the US Congress in mid-2008, includes provisions to auction 2.5% of emission allowances for use in forestry, both domestic and international. If collected and

TABLE 2 Illustrative options for raising additional revenue for addressing climate change (UNFCCC, 2007b)

Option	Revenue	Notes
Application of a levy similar to the 2% share of proceeds from the CDM to international transfers of Emission Reduction Units, Assigned Amount Units and Removal Units	US\$10–50 million Depends on size of carbon markets post-2012	Annual average for 2008–2012 Any estimate for post-2012 requires assumptions about future commitments
Auction of allowances for international aviation and marine emissions	US\$10–25 bn US\$10–15 bn	Annual average for aviation rises from 2010 to 2030 Annual average for marine transport rises from 2010 to 2030
International air travel levy	US\$10–15 bn	Based on charge of US\$6.50 per passenger per flight
Funds to invest foreign exchange reserves	Fund of up to US\$200 bn	Voluntary allocation of up to 5% of foreign exchange reserves to a fund to invest in mitigation projects determined by the investors to diversify foreign exchange reserve investments
Access to renewables programmes in developed countries	US\$500 million	Eligible renewables projects in developing countries could earn certificates that could be used toward compliance with obligations under renewables programmes in developed countries to a specified maximum, such as 5%
Debt-for-efficiency swap	Further research needed	Creditors negotiate an agreement that cancels a portion of the non-performing foreign debt outstanding in exchange for a commitment by the debtor government to invest the cancelled amount in clean energy projects domestically
Tobin tax	US\$15–20 bn	A tax of 0.01% on wholesale currency transactions to raise revenue for Convention purposes
Donated special drawing rights	US\$18 bn initially	Special drawing rights are a form of intergovernmental currency provided by the IMF to serve as a supplemental form of liquidity for its member countries. Some special drawing rights issued could be donated to raise revenue for Convention purposes

monetized, transfer to multilateral funds becomes an issue. A proposal by Norway that a percentage of assigned amounts be levied internationally would avoid this problem (Norway, 2008).

What would be measurable in each of these options would be real amounts in euros or dollars – the unit for MRV of finance would be money. If the deal in Copenhagen is to put numbers to mitigation, it will also need to put numbers to the financial flows.

Reporting may be specific, depending on the source of the funding. Markets – be they carbon or other markets – tend to track financial flows anyway, although robust market rules need to be established. Allowances auctioned by Parties might be measured and reported through registries. Funds raised nationally would also have to be reported into the international system. A key question is how to track scaled-up public investment.

As with quantifiable mitigation actions in developing countries, the most difficult area is probably verification. Who verifies financial flows? Verifying flows of ODA committed in terms of the Monterrey Consensus has proved difficult and controversial. Ultimately MRV of finance is political. And how does one verify that funding for climate change is new and additional, and not merely a redirection of existing ODA away from poverty eradication and development priorities in favour of climate imperatives? If funds were collected at the national level, they would also have to be made subject to international scrutiny, e.g. independent third-party verification.

The consideration of the issue of scaled-up funding also raises issues of the governance of international funding. The guiding principle should be equitable partnership between donors and recipients. The financial mechanism needs to be guided and under the authority of the COP.

5.2. MRV technology

Technology has to be transferred or traded on preferential terms in a measurable, reportable and verifiable manner. How might this be implemented?

The simplest solution may be to apply MRV to the *funding* for technology. But what needs to be measured on technology is broader than technology transfer (if that means the movement of technology that has a higher cost than the commercial standard practice, and is also lower-emitting). It also encompasses the diffusion of technology through commercialization, as well as long-term R&D. Attention should be given to different stages in the technology and the appropriate funding at each stage.

MRV could start, however, with following funding for technology. It may be necessary to distinguish different kinds of financial support, depending on broadly defined life stages of technologies:

- Funding for wider deployment of existing technology and retrofitting
- Venture capital to commercialize emerging technology
- Public and private investment in long-term R&D of new technology.

In all cases, the funding for technology would be measurable, reportable and verifiable. Provision of adequate means of implementation should be a commitment by developed countries in the architecture post-2012. If it is not to weaken the regime, such an additional commitment would have to pass very stringent measures – that the investment in technology demonstrably leads to domestic emission reductions, the finance being MRV and not imposing any conditionalities for developing countries. Investment in technology would not count towards Annex I mitigation commitments, and investments in offsetting mechanisms (such as the CDM) could not be double-counted as MRV finance. Investments would count towards agreed targets for MRV means of implementation.

For the purpose of measuring, reporting and verifying technology transfer, indicators will assist. Work in the UNFCCC Subsidiary Bodies on Implementation and Scientific and Technological Advice (SBI and SBSTA) on performance indicators should help to address the issue of measurement. Indicators would also provide a useful format for reporting. What needs to be verified is the actual transfer of technology, not just long-term R&D. Measurement would also need to include technology transfer under the CDM.

Institutional mechanisms should align the type of financial support appropriate to different kinds of technology transfer and trade. This suggests that institutional arrangements might be considered for the means of implementation in an integrated manner. Distinct aspects will be needed for technology, finance and capacity-building, but aligning them by design is likely to be most effective. Such an integrated institution would need to be placed clearly under the authority and guidance of the COP.

The more difficult issue is how to quantify technology support where it is not financial. Important aspects relating to technology transfer, such as preferential access, collaborative R&D in the form of human resources, and building local institutional capacity to apply technology, are some of the less tangible forms of support.

6. Conclusions

In Bali, the Parties decided to reach an agreed outcome in Copenhagen, by December 2009. Many balances will have to be struck, including that between mitigation and adaptation, but those examined in this article will be decisive to the outcome. The Copenhagen deal will first need to build on the agreement to MRV in principle, elaborating it politically and conceptually in the agreed outcome and decision. What is not yet clear is whether Parties will be ready to put numbers on mitigation commitments for all developed countries, mitigation actions for developing countries, and a technology finance package on the table to fill out the details in terms of this new architecture. Before agreement on numbers, agreement needs to be reached on the principles for MRV in the climate architecture.

In finding the necessary balances, two generic approaches are available to negotiators. One is to start from basic principles. The political dynamics considered in this article suggest that MRV will also need to use a common but differentiated approach. In separating out what is common and what needs to remain (at least for now) distinct, it is helpful to look at specifics and break MRV down into its component parts. This is the second approach.

MRV is first considered for mitigation commitments by developed countries. Policy makers will need to focus, in particular, on comparability, both of efforts and compliance. The procedures in Articles 5, 7, 8 and 18 of the Kyoto Protocol will be critical; the challenge being how to apply them also to mitigation commitments by developed countries that may be undertaken under the Convention. The range of emission reductions for Annex I countries as a group provides a clear measure. In operational terms, Annex I national communications and in-depth reviews – with improvement on existing procedures – would appear to provide a good basis.

MRV mitigation actions by developing countries will need to be debated both politically and at a technical level. What need to be measured are deviations below baseline. Measurement would need to be based on inventories, possibly with footnotes and perhaps starting in areas where the best data are available. Reporting could be through national communications, including on inventories, with the possibility of more regular reporting than under existing provisions. To report reductions, a critical distinction is to be made between unilateral mitigation actions and those enabled with international support. A separate registry may be an option for common

reporting. Verification is one of the biggest challenges, and considering options might be easier if we start with agreement on principles. Building on domestic institutional capacity might be one such principle. Negotiators may want to consider options such as verification by domestic institutions working to internationally agreed guidelines, or the notion of peer-review.

The enabling condition for MRV mitigation actions by developing countries is MRV support in the form of technology, finance and capacity. The discussion in this article has shown that MRV with respect to finance and to technology are closely related, so that negotiators should consider combining MRV for the means of implementation. Institutional arrangements should ensure that financial support is appropriate to the kind of technology being transferred or traded. MRV of adequate means of implementation should constitute a tangible commitment for developed countries. Indicators would be helpful to make MRV operational. Reporting may differ for funds raised from private and public sources, and at national or international level. As with mitigation actions, verification is likely to be the crucial and most politically contentious point. Equitable governance is a key principle but, in practice, it would seem that either developed countries need to allow verification of funds held nationally, or funds should be levied internationally in the first place.

This is a package deal that will ensure a breakthrough on the mitigation building block and the long-term goal in Copenhagen, and the key to that package deal would seem to be MRV as it is applied in the three dimensions discussed in this article.

Notes

1. Turkey is also an Annex I Party but has not ratified the Kyoto Protocol; however, Decision 26/CP.7 deleted Turkey from Annex II to the Convention and invited Parties to recognize the special circumstances of Turkey, in particular that it is 'in a situation different from that of other' Annex I Parties.
2. See document FCCC/KP/AWG/2007/5 for the complete text.
3. Suppressed demand is found in situation of poverty. If a mitigation project delivers a service where there previously was none, the relevant baseline might be the service delivered with conventional technology, not the actual situation of no service at all. For example, if solar water heaters were installed, one can compare this to electric water heaters, rather than no hot water at all (Winkler and Thorne, 2002).
4. The idea for this figure was inspired by Ward et al. (2008: Fig. 8).
5. See document FCCC/AWGLCA/2008/MISC.1, p.19.

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