CARBON MECHANISMS REVIEW

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Accelerating Action

How the interplay of carbon markets with other arenas fosters climate-smart development

Innovate4Climate
Special Edition

Content

June – August

editorial

Dear Reader!

Asia is on the rise, both in economic terms and in terms of greenhouse gas (GHG) emissions: According to the Financial Times, Asian economies will be larger than the rest of the world combined in 2020. However, this has also been accompanied by the world's most rapid GHG emissions growth. Against this background, Innovate4Climate, the global summit and trade fair on climate finance, climate investment and climate markets, is taking place in Singapore this year.

Carbon Mechanisms Review dedicates this special issue to the event and we ask how carbon markets can best interact with other arenas in order to foster climate friendly development. Our first contribution therefore looks at the Asia-Pacific region and analyses how market-based interventions under Article 6 of the Paris Agreement can enhance international cooperation in terms of reducing emissions and deepening climate ambition in the region.

This is complemented by an introduction of the CI-ACA initiative, which aims at broadening the uptake of carbon pricing approaches worldwide. This activity supports developing countries in considering, developing, adopting and implementing carbon pricing policies when implementing their NDCs.

Ambitious climate policy requires bold and rapid mitigation action at scale. We thus present two articles on upscaling, the first on lessons learnt from the programmatic approaches of CDM and JI for future market-based activities and the second on a regional carbon finance instrument to promote the uptake of renewable energy in southern Africa.

Finally, we widen the perspective, taking a look at the interplay between the Paris Agreement and the Montreal Protocol and exploring how the Kigali Amendment can foster the linkages between the two.

On behalf of the editorial team, I wish you an inspiring read and a successful I4C!

Christof Arens, Editor-in-chief

Wuppertal Institut

Carbon Mechanisms Review (CMR) is a specialist magazine on cooperative market-based climate action. CMR covers mainly the cooperative approaches under the Paris Agreement's Article 6, but also the broader carbon pricing debate worldwide. This includes, for example, emission trading schemes worldwide and their linkages, or project-based approaches such as Japan's bilateral offsetting mechanism, and the Kyoto Protocol's flexible mechanisms CDM/JI. CMR appears quarterly in electronic form. All articles undergo an editorial review process. The editors are pleased to receive suggestions for topics or articles.

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Piloting Article 6 in Asia and the Pacific

Marginal experimenting or an absolute necessity?

by Virender Duggal, Asian Development Bank

"The Asian century, the numbers show, begins next year".[1] The Asian century typically refers to the economic dominance of Asia from 2020 and onwards. Asia will also dominate global greenhouse gas emissions, with Asia expected to account for 50% of global GHG emissions by 2030.[2] Asia and the Pacific therefore has an opportunity, and a responsibility, to shape global efforts to reduce GHG emissions, as the fastest-growing source of them.

All possible means of reducing emissions must be used to address the challenge of growing emissions in the region and to mitigate the climate change impacts. Article 6, as the section of the Paris Agreement that deals specifically with international cooperation, is a crucial toolbox to achieve cost-efficient emission reductions, and to deepen ambition levels.

The bottom-up ethos of the Paris Agreement is reflected in Article 6.2, providing a framework for bilaterally or multilaterally defined cooperative approaches.[3] Article 6.4, in contrast, provides a specific tool – a centrally governed mechanism for mitigation and sustainable development. Countries will need access to a selection of effective instruments of which some will be developed under the frame of Article 6. These instruments, tools, or mechanisms, need to be elaborated, tested, proven, and regularly reviewed and improved.

In the current period, when negotiations will continue with the aim of operationalizing Article 6, it is critical that Parties begin to gather practical on-the-ground experience of these tools and instruments through pilot activities. A recent study of ongoing and planned pilots shows that there are already diverse approaches that we may see under Article 6.[4]

There is an urgent need to undertake pilot activities that will contribute to the development and road-testing of alternative approaches for many of the elements of Article 6. This will be especially important for those aspects of market-based cooperation that are new under the Paris Agreement compared to the Kyoto Protocol.

Facilitating Piloting in Asia and the Pacific

At COP24 in Katowice in December 2018, ADB launched the Article 6 Support Facility ("A6SF") under its Carbon Market Program (CMP).[5] The A6SF will provide technical, capacity building and policy development support to ADB's Developing Member Countries (DMC) to enhance their capacity and prepared-

1 https://www.ft.com/content/520cb6f6-2958-11e9-a5ab-ff8ef2b976c7
2 ADB. 2016. The Economics of Greenhouse Gas Mitigation in Developing Asia. Manila.
3 ADB. 2018. Decoding Article 6 of the Paris Agreement. Manila.
4 Greiner,S. Chagas, T. Krämer, N. Michaelowa, A., Brescia D., and S. Hoch (2019) Moving Towards Next Generation of Carbon Markets - Observations from Article 6 pilots
5 https://www.adb.org/projects/50404-001/main

ness to access new carbon markets under the framework of Article 6.

A6SF will support DMCs to identify, develop, and pilot mitigation actions and will provide capacity building, technical and policy development support to help DMCs in setting up institutional arrangements to facilitate their participation in new carbon markets.

A6SF is a $4 million facility funded by the ADB, the Government of Germany, and the Swedish Energy Agency. Through A6SF, ADB will encourage innovation in the development of mitigation actions, contribute to achieving a critical mass of expertise, draw lessons from pilot activities, build DMC institutional capacity and enhance DMCs' ability to contribute to international negotiations and their preparedness to operationalize Article 6.

At the time of launching A6SF, ADB also published a report "Article 6 of the Paris Agreement– Piloting for Enhanced Readiness"[6] . The report outlines the rationale for pursuing pilot activities under Article 6 and the potential benefits, emphasizing the need for testing alternate approaches and sharing of experiences. Key messages from the report are summarized below.

Testing readiness: Wastewater treatment at a palm oil mill in Thailand.

Rationale for piloting

International cooperation through markets can generate carbon revenues for host countries and additional climate finance streams. It can also stimulate technology transfer and deliver significant sustainable development co-benefits, for example, by reducing emissions of air pollutants such as sulfur oxides and nitrogen oxides and creating jobs. Such co-benefits would reduce transboundary environmental stresses and improve the economic and social systems between the Parties involved. [7]

Collaboration can also lead to the discovery of technology-specific mitigation costs, which provides a solid basis for target setting in the revision of NDCs, and facilitate regional economic integration, given the increasing importance of carbon-related issues. Several of these benefits were also present for the Kyoto Protocol mechanisms and we expect to see them continue in post-2020 markets.

The linking of domestic carbon markets could also provide many benefits for Parties, including contributing to reducing the cost of reaching NDCs and incentivizing an increase in ambition.[8] The linking of

6 ADB. 2018 Article 6 of the Paris Agreement - Piloting for Enhanced Readiness. Manila.
7 J. Ewing. 2016. Roadmap to a Northeast Asian Carbon Market. Asia Society Policy Institute.
8 International Carbon Action Partnership. 2016. On the Way to a Global Carbon Market: Linking Emissions Trading Systems. ETS Brief #4. https://icapcarbonaction.com/en/?option=com_attach&task=download&id=388.

carbon markets should enable the aggregate caps to be achieved at a lower cost, since the cheapest abatement actions would be carried out irrespective of the system in which they fall. This reduces compliance costs for participants.

Linking also enhances regional or international cooperation on climate change mitigation and by leveling carbon prices, helps to address competition and carbon leakage impacts between the systems (but not with regions outside the systems). Linking carbon markets should also increase liquidity, improve price discovery, and reduce volatility. This would be particularly beneficial to countries that are unlikely to have enough liquidity in their own market. Linking is also expected to increase efficiency, through a more diverse system, with greater abatement options.

Decisions on the operationalization of Article 6 have been deferred to COP25 at the end of this year. There are several technical issues to be resolved through negotiations before then. Pilot activities will play a critical role in this, and future periods in providing practical insights on how mitigation actions can be designed and implemented. They will provide an opportunity for Parties to test approaches and share lessons on critical aspects of Article 6.

Pilot activities will stimulate activity under Article 6, thereby encouraging early stage innovation, upscaled action, and the wider application of climate-friendly technologies. Pilot activities will also contribute to two other critical areas: (i) capacity building, especially in developing countries, and (ii) developing infrastructure, such as national registries and tracking systems and the necessary regulatory apparatus. Pilot activities can also serve to identify elements, processes, and infrastructure that could be brought from the Kyoto Protocol mechanisms.

Pilot activities are of crucial importance for Article 6.2 and Article 6.4 to become operational, elaborating, for example, methodologies for crediting of policy instruments and sectoral activities under Article 6.4, the national level authorities, and the development of accounting systems that will ensure that a government is always fully in control of the net balance of internationally transferred mitigation outcome (ITMO) inflows and outflows.

Pilot activities include outcomes that contribute to

(i) informing negotiations;

(ii) helping define scope, including what falls under national and international responsibility;

(iii) establishing institutional frameworks such as a registry and tracking systems;

(iv) building institutions and capacity, e.g., for authorization of participants, accounting and data collection and management;

(v) evaluating mitigation outcomes for use toward nationally determined contribution; and

(vi) developing methodologies for crediting of policy instruments and sectoral (or upscaled) activities.

Pilot activities will specifically contribute to the development of

- approaches to projections and baseline setting,
- additionality tests for upscaled activities,
- approaches for the operationalization of overall mitigation of global emissions,
- frameworks for reporting and assessing sustainable development impacts and co-benefits,
- analyses of what can be used from Kyoto Protocol mechanisms,
- an understanding of how Article 6 can work under a conditional nationally determined contribution target, and
- approaches for the sharing of mitigation outcomes and attribution of carbon finance to mitigation outcomes.

A major difference with the use of market approaches under Article 6, compared to the Kyoto mechanisms, is that all Parties will be able to use Article 6 strategically to attract additional finance streams to achieve and enhance their NDCs. This means that the political commitment for participation in international cooperative approaches will potentially be stronger. It also means, under Article 6.2, that mitigation activities could be tailored specifically to national needs and circumstances. This may impact on the design and type of mitigation activities that are pursued, for example, in terms of sector, country, or size.

The Asia Pacific GHG Emissions Challenge

Implementing pilot activities in the Asia and the Pacific region is important for many reasons. Although the region stands for a limited contribution in terms of historic emissions, it is now responsible for a significant part of global emissions, and this share is increasing.

In Asia, greenhouse gas (GHG) emissions grew by 330% over the last 4 decades, reaching 19 gigaton carbon dioxide equivalent per year in 2010. By comparison, emissions grew by 70% in the Middle East and Africa, by 57% in Latin America, by 22% in the OECD countries, and by 4% in the economies in transition region. [9]

Per capita production and consumption growth are major drivers for increasing GHG emissions worldwide. Economic growth is very strong in Asia, averaging 5.0% per annum over the 1970–2010 period [10] and emerging economies in the region have had very high economic growth rates at aggregate and per capita levels, leading to the largest growth in per capita emissions. [11]

Another driver of emissions is population growth. The total population of the developing member countries (DMCs) of the Asian Development Bank (ADB) increased from approximately 1.23 billion in 1950 to 3.90 billion in 2015. This number is projected to range between 4.14 billion and 5.19 billion in 2050. [12]

Piloting in Asia and the Pacific

The region has a successful track record in using market mechanisms for sector transformations and emission reductions. This track record brings a wealth of knowledge and expertise that could contribute to facilitating the implementation of pilot activities.

The region dominated CDM both in terms of volume and number of projects. This means that in several countries, there is a deep understanding of the carbon finance concept and solid technical experience. The experience from carbon markets is partly reflected in the NDCs, in which 26 countries in the region have expressed their willingness to use market-based approaches and are exploring the possibility of pursuing cooperative approaches under Article 6 of the Paris Agreement.[13] Most of these countries have provided commitments in their NDCs that are conditional (fully or partially) on international support and cooperation under Article 6 could provide part of this support.

As important stakeholders, countries in the region can be meaningful participants in developing the modalities, rules, and procedures and supporting the forthcoming work of international Article 6 oversight bodies. While much expertise still exists in the region based on CDM experience, there is much less experience on the type of cooperation envisaged under

9 Ibid p.354
10 Ibid p.371
11 Ibid p.355
12 ADB. 2017. A Region at Risk: The Human Dimensions of Climate Change in Asia and the Pacific. Manila.
13 UN Economic and Social Commission for Asia and the Pacific. 2017. Responding to the Climate Change Challenge in Asia and the Pacific: Achieving the Nationally Determined Contributions (NDCs). Bangkok.

Successful track record: The Asia Pacific region dominated the CDM in both volume and number of projects.

Article 6.2 that will require innovation and totally new approaches, reflecting the situation globally. [14]

There is momentum in the region for engaging under Article 6, but there is a critical need for practical on-the-ground activities, to help addresses challenges such as understanding what the new approaches called for under the Paris Agreement would look like in practice. For example, how mitigation activities can be scaled up and go beyond project-based approaches.

It is also important to foster understanding in the region that countries are not limited to being sellers, as they were in the carbon market in the Kyoto Protocol period. Creating pilot projects for bilateral, project-based cooperation, under Article 6.2 or Article 6.4 rules, may be seen by some as not very innovative, but will help get things off the ground, provide the learning experience, and draw attention to opportunities in carbon markets under the Paris Agreement.

Going Forward

ADB is now engaged in consultations with DMCs to ensure that piloting of Article 6 activities will bring important experiences and provide for the development of activities that will contribute to the joint effort of making the Asian Century as green as possible. International collaboration under the Paris Agreement will be an important part of this endeavor and piloting is therefore a necessity.

14 ADB. 2018. Decoding Article 6 of the Paris Agreement. Manila.

Towards Carbon Pricing in Developing Countries

CI-ACA initiative supports the development of carbon pricing approaches for NDC implementation

by Nicolas Muller, UNFCCC Secretariat

Worldwide, there is a growing realization that the cost of GHG emissions needs to be reflected in economic activities. With the strong increase in jurisdictions which have taken steps to adopt carbon pricing, it is already expected that around 20% of global GHG emissions will be managed under a carbon pricing system by 2020. Nevertheless, this is still very far from the vision put forward in 2016 by key leaders under the Carbon Pricing Panel, which calls for achieving 50% within the next decade.

Achieving this bold vision would most likely require substantial uptake of carbon pricing in developing countries. And while many developing countries are interested in the use of economic instruments and carbon market instruments, support for them is needed when considering, developing, adopting and implementing carbon pricing. In addition, it is important that such support be delivered in a timely manner as the introduction of carbon pricing can be a lengthy process, in both political and technical terms.

To "assist Parties in the development of carbon pricing approaches for implementing their NDCs", at COP22 the network of Regional Collaboration Centres (RCCs) launched the project "Collaborative Instruments for Ambitious Climate Action" (CI-ACA). The project is part of broader activities conducted by the RCCs to support NDC implementation. It is implemented on the ground by the network of RCCs, consisting of six centers established as partnerships between the UNFCCC and leading partner institutions in the respective regions. The project also benefits from the global coordination structure of the RCCs which is managed by the UNFCCC secretariat in Bonn. The first project phase, from 2017 to mid-2019, was supported by funding from the governments of Germany, Norway, Québec, Sweden and Switzerland.

Box 1: Regional Collaboration Centres of the UNFCCC support national climate action through capacity-building, technical assistance and strategic networking. They were established to support the uptake of the CDM in regions which were underrepresented in the mechanism at that time. Since adoption of the Paris Agreement, the RCCs have broadened their focus to supporting the implementation of countries' Nationally Determined Contributions (NDCs).

Activities conducted

The project team, consisting of the RCC coordination and teams in the region, engaged with a total of 18 jurisdictions on various activities for advancing carbon pricing for mitigation action.

With their regional presence and local-level knowledge, the RCCs conducted activities such as engagement, awareness raising and capacity building. In parallel to this, the CI-ACA funded consultants to

carry out regional or country-specific studies. Priority was given to models which can further strengthen capacities at the domestic and regional levels and make them more robust: selection of local experts, placing experts in the regional centers and, in some cases, placing technical officers directly within the relevant ministries.

For Senegal, the Dominican Republic and Pakistan, the project evaluated whether there is an opportunity to introduce carbon pricing and, if so, what would be the most suitable approach. To assess the technical feasibility, studies were carried out to determine which of the possible approaches could be feasible given domestic circumstances and key sectors. To assess the political feasibility, stakeholder consultations were conducted at the start of the process and, equally importantly, at the end to consider the results of the technical analysis. In assessing the suitability of various technical options, a key challenge was to assess the potential for an ETS, looking at whether a sufficient scale can be achieved – either at the domestic level or through linked/joint markets, for example at the regional level.

For nine of the ten ASEAN member states, the project explored the possibility of developing a harmonized approach to measuring, reporting and verifying (MRV) greenhouse gas emissions as a first step towards further regional collaboration on carbon markets. The activities involved in particular a stock-taking of the domestic status-quo in terms of MRV infrastructure and capacity as well as plans for carbon pricing activities.

Finally, for five East African Parties (Ethiopia, Kenya, Mauritius, Rwanda and Uganda), a study assessed the feasibility of carbon pricing with a focus on the existing legal framework. For Panama, the project focused on the development of a platform for tracking various mitigation outcomes.

Results from country-specific support activities

The first result of the activities involves, of course, topic-related engagement, interest generated and capacity built, especially for countries that did not previously consider carbon pricing in the set of climate policy instruments.

The second important result relates to the analysis of country circumstances. Looking at the fiscal frameworks of many of the countries studied, some clear common patterns were observed: (i) often, existing petroleum levies on transportation fuels already translate into effective carbon prices from USD 20 to USD 130 per tCO2e, but with strong imbalances in favor of diesel fuel; (ii) many existing taxes/levies (for example on industrial outputs) could be redesigned to be based on GHG outputs. Their level of taxation is often equivalent to USD 5 to USD 25 per tCO2e. This could cut emissions and improve competitiveness; (iii) overall, existing taxation structures show imbalances in the level of taxation for various fuels and GHG-intensive products, with most considered countries exhibiting a "coal gap", meaning that coal, the most GHG-intensive fuel, is often not taxed. For the countries supported, this seems at first to indicate a strong opportunity for rolling out broad or perhaps even economy-wide carbon taxes with relatively simple MRV systems which can be upstream.

A third important result is, however, that such broad carbon taxes are often less feasible due to the larger political context. For example, one issue is the timing as their introduction may in some cases only be possible in conjunction with broader fiscal reforms. The need to address the impact on and perception of the broader public is another issue. Furthermore, it should be noted that to be effective, carbon taxes would need to reach high levels, which may face even stronger barriers in terms of public perception and require elaborated compensation mechanisms. For example, in the case of Senegal, targeted subsequent studies may be required to quantify the impacts and devise concrete compensation mechanisms. Given

Source: ADB / Flickr / CC BY-NC-ND 2.0

On the road to carbon pricing? Wind power generation in Pakistan.

these constraints, a result is that for the Dominican Republic, Pakistan and Senegal, instruments focusing mostly on large-scale emitters are often more politically feasible: only a limited number of stakeholders are directly impacted, most of them are used to being regulated and compensation measures may be easier to design. This can either be done in the form of a carbon tax on large-scale emitters or as an ETS if sufficient scale can be found. A carbon tax on large-scale emitters can even be a stepping stone towards a future ETS. A short to mid-term obstacle for the Dominican Republic, Pakistan and Senegal alike is that such approaches would require implementing a more complex facility-level MRV.

Results related to cooperative action

An important point to consider is that many of the supported jurisdictions are interested in cooperative action under Article 6 of the Paris Agreement. For them, carbon pricing can be an enabling foundation as it provides two important elements: with the MRV, it quantifies carbon emissions and with the price signal, it assigns a value. And in terms of scale, it goes beyond the project or programme-based approach used up to now. So far, for participation in activities under Article 6, an ETS clearly appears the most straightforward solution since outcomes (constraint in emissions represented by emission allowances) are directly expressed in tCO_2e-based units.

A major drawback is, however, that an ETS requires a sufficient scale, in terms of emissions covered and number of participants, to ensure a vibrant, well-functioning market. But even in the case of Senegal, which is the first LDC supported by the project, the number of large-scale emitters in the country could be in the range of 21 to 26 by 2021. While this in itself is not sufficient for a purely domestic ETS, the potential is certainly interesting.

Linkage with other markets or forming a regional market with a couple of countries in the region could be a solution. For the Dominican Republic, a regional market with other countries in the Latin America and Caribbean region is also worth considering, especially given the regional platform "Carbon Market in the Americas". Also, forecasts made for Pakistan estimate that the country would have sufficient scale for an ETS on its own, with around 121 large scale emitters by 2023 – representing probably well over 150 MtCO2e.

But even if a purely domestic ETS is possible, there are still plenty of reasons for considering an ETS as a foundation for engaging in cooperative action under Article 6. In particular, a win-win situation in which the mitigation action is opened to external sources of funding, enabling the host country to attract investments in mitigation action and benefit from the sustainable development co-benefits. By linking with markets with a higher price, developing countries could benefit from a stronger price signal for long term decarbonization.

The study conducted for the nine ASEAN countries also showed similar results: many of the countries in the region are engaged in carbon pricing efforts and an ETS is often seen as the most politically feasible instrument as well as one of the most suitable for engaging in cooperative action. Specifically, for the ASEAN countries considered, a key benefit of a potential regional carbon market could be to increase flexibility and economic efficiency in mitigation action. Indeed, it is now well established that cooperative action can lead to substantial cost savings in mitigation action, ranging from 32% to 59% at the global level.

For many ASEAN countries, a domestic ETS would only cover between 50 to 120 facilities, while a regional market could bring the scale to around 600. As a first and urgent step, the study looked at the current status-quo of MRV in the nine ASEAN states, and the potential for harmonizing MRV at the facility level to enable the option of a regional carbon market. And while the study showed different levels of advancement for the technical structure, the biggest concern was the differences in the monitoring and accounting of GHG emissions.

But fortunately, only a limited number of sectors were found where different ASEAN member states had already adopted their own monitoring guidelines: for the power sector, the cement sector and petrochemicals. For those, a future phase of the project could perhaps look at pathways for convergence.

Lessons learned

A first lesson is perhaps that most of the key ingredients needed to implement carbon pricing in developing countries are already available. Developed countries have decades of practical experience in designing and operating carbon taxes and emission trading systems (ETSs), and this can be drawn upon and adapted to the specific circumstances of developing countries. In particular, developing countries have a greater need to mitigate the cost impact on low income households (e.g. through systems of progressive pricing of electricity). The various studies conducted also indicate that often, the legal framework is already compatible with carbon pricing. The support provided to countries at different levels of development under this project also indicate that the feasibility of carbon pricing may not be related to the level of development, but rather to the strength of the institutions that can support it, thus providing a highly beneficial approach. Also, the project identified that there is great untapped potential for regional synergies and cooperation on carbon pric-

Enhancing existing policies: A solar field in Rwanda.

ing, whether for delivering capacity-building, providing and sharing technical expertise, or aligning schemes to enable cooperative action. And in fact, the project found that South-South sharing of expertise and experience in the field of carbon pricing is already possible in some cases.

Cooperative action: the different layers

Still, an unavoidable topic involves the unknowns related to Article 6 and in particular how carbon taxes and ETSs could fit under Article 6.2 – and possibly even Article 6.4 – of the Paris Agreement. A first layer, consisting of overarching principles for Article 6, is of course already contained in the Paris text. Surely, one issue is still the absence of a second layer consisting of an agreed rulebook for Article 6. But the rulebook itself may or may not be detailed enough to address technicalities in detail. Therefore, a third layer to consider is related to more granular questions on the concrete application of cooperative action under Article 6. Research in this area so far remains either scant or rather vague.

ETSs and cooperative action: many unknowns

Even for the potential use of ETSs under cooperative action, many questions remain open or do not appear to have been raised. Could corresponding adjustments to avoid double counting also be made for the carbon budget of an ETS as a subset of an NDC? Would share of proceeds, if applicable, be applied only to the net annual transfers in the case of linked ETSs with bilateral flows of units? Under what circumstances can an emission allowance from an ETS qualify as an ITMO? What could constitute best practice in this regard? In particular, how should units be treated which are "buffered/set-aside" to

avoid ETS oversupply? How could an ETS be used in the context of NDCs with unconditional and conditional mitigation action? Is a high level of domestic ambition absolutely necessary to generate units with high environmental integrity or are there other pathways to ensure that "one tonne sold is one tonne reduced"? How would transparency in governance be applied given the need to protect confidential data which may be related to GHG and energy performance? Which systems could be deployed to avoid double counting of achievements which result from climate finance as opposed to those achieved from external purchases of units?

Carbon tax: out of the race for cooperative action?

While carbon taxes may be an attractive option for unilateral domestic action, a key obvious downside for their use in the context of Article 6 is that they do not produce mitigation units. Therefore, additional research would perhaps be needed to develop pathways to transform their achievements into units. Are unitized carbon taxes a way forward? Could the solution be to have them as part of a baseline-and-crediting approach? How would the generation of project/programme-based interventions overlap with them?

Ideally, research on concrete use of carbon pricing approaches for cooperative action should shift gears to the next level. Based on concrete case studies, these should focus on capturing options for concrete implementation and identifying best practices.

Potential next steps

Based on activities and results from the first phase of the project, a number of short-term priorities are clear. On the technical side, increased support is urgently needed to roll-out MRV at the facility level for those countries interested in participating in the use of an ETS, both for domestic purposes and/or for cooperative action,.

Complementary technical studies may be needed for supported countries. Increased technical and policy dialogues are also needed at the regional level to catalyze the potential for cooperation. Ideally, resources could be deployed and shared across regions – not only to provide the necessary support in a cost-effective manner, but also to ensure alignment and coordination among countries.

Finally, research may also be needed to evaluate how cooperative action on the basis of carbon pricing instruments could be implemented at the practical level. As the next phase of the project is currently being developed, priorities will be defined based on the needs identified and expressed by the Parties and the stakeholders involved.

Further information:

Learn more about CI-ACA's activities at https://unfccc.int/about-us/regional-collaboration-centres/the-ci-aca-initiative

Advancing Programmatic Crediting in Article 6

Leveraging existing rules and portfolios for delivering rapid mitigation action at scale

by Stephan Hoch, Axel Michaelowa, Aglaja Espelage

Programmatic approaches in carbon crediting mechanisms represent a significant evolution beyond single projects and are distinct with regard to specific aspects of the activity cycle. Programme of Activities (PoAs) in the CDM have significantly lowered transaction costs, especially in combination with simplified baseline and monitoring methodologies. Thus, PoAs managed to broaden access to the CDM for activities with high sustainable development co-benefits such as rural electrification in low-income countries. Implementing upscaled mitigation action through programmatic approaches is also a key ambition of emerging Article 6 mechanisms as well as climate finance institutions such as the Green Climate Fund (GCF).

The CDM's PoA framework offers fully operational and increasingly mature rules for such programmatic approaches. However, the potential to build on elements of these existing programmatic approaches for the new generation of Article 6 market mechanisms has not yet been fully recognized. Therefore, this article explores key features of existing rules and experience with programmatic approaches, and the potential for harnessing them in the context of nationally determined contributions (NDC).

Reflections on programmatic approaches in the Kyoto mechanisms

The successful establishment and operationalization of programmatic approaches has been one of the most relevant reform achievements in the Kyoto mechanisms. Clean Development Mechanism (CDM) and Joint Implementation (JI) Programme of Activities have tapped into significant mitigation potential, including through decentralized sustainable energy access technologies that boosted access to the CDM by low-income countries. For instance, Africa hosts one-third of all registered PoAs which is a much larger share compared to single projects. These programmes could serve as the basis for upscaled mitigation action provided there is demand for their mitigation outcomes as well as the political appetite to "overhaul" those programmes to make them NDC-compatible (see below).

Box 1: Stand-alone CDM rules for PoAs

- CDM project standard for programmes of activities
- CDM validation and verification standard for programmes of activities
- CDM project cycle procedure for programmes of activities
- Standard: Sampling and surveys for CDM project

Available at https://cdm.unfccc.int/Reference/Standards/index.html

Key features of CDM rules for programmatic approaches include the ability to add an unlimited number of component project activities (CPAs) into a

Scaling up: Efficient lighting PoAs achieved huge success across Africa.

PoA without undergoing the full CDM project cycle for each CPA. CPAs are comparable to single projects; in some cases, the same methodologies can be used for projects and programmes. CPA crediting periods are also aligned with single projects, however, PoA lifetimes can be up to 28 years. This means that some registered CDM PoAs have a validity that theoretically even extends beyond first NDC periods.

In response to CMP guidance, the CDM Executive Board (EB) has been continually adjusting regulatory documents in an effort to capture specific PoA aspects. In an effort to streamline these standards and procedures, the 93rd EB meeting finally developed standalone PoA guidance in June 2017, resulting in two separate sets of regulatory CDM documents for PoAs and single projects (see Box 1).

The role of programmatic approaches for Article 6

As the first NDC implementation period starting from 2021 approaches rapidly, the rules for programmatic and sectoral crediting approaches under Article 6 need to be clarified. This covers institutional arrangements, stakeholder roles, as well as methodological tools, standardized baselines and benchmarks. While Article 6 remains a glaring gap in the Paris Agreement (PA) rulebook, there is already some clarity provided in the PA, as well as in the subsequent negotiations. For instance, Article 6.4. draws on governance design features established in the Kyoto era, including a multilateral governing body, designated national authorities as well as designated operational entities (third-party auditors). Yet, the roles of these stakeholders need to be redefined when operational-

Source: World Bank/Community Development Carbon Fund

Early PoA success: This World Bank programme in rural Bangladesh supplied solar energy to around 200,000 households, rural businesses, enterprises and public institutions.

izing Article 6.4, as they will need to meet requirements that emerge from the broader context of the Paris Agreement rulebook, i.e. the interface between Article 6 and transparency requirements of reporting on NDCs achievements. This requires, unlike in the Kyoto Protocol, to consider host country policies and measures for determining additionality.

Having said that, the consolidated body of PoA-related CDM rules already offers a substantial body of experience, regulatory guidance and methodological tools. These lessons from programmatic approaches should be harnessed, while ensuring that rules are adjusted to reflect the new global context. The COP 21 decision related to Article 6 also refers to building existing experience. Indeed, the draft negotiation texts for the rules, modalities and procedures for Article 6.4. clearly indicate that programmes are very likely to be part of the scope of the mechanism. At the same time, there is very little detail on specific features relevant for operationalizing programmatic approaches, including to which extent the existing elements described above will be taken into account. It is worth noting, however, that policy crediting – the most innovative element of the potential future scope of the 6.4. mechanism – also has some similarity with programmatic approaches when it comes to matching mitigation outcomes with results-based payments, as that will require a demarcation of the scales of the activities supported by the respective policy.

Programmatic approaches have also been explored by financing institutions such as the GCF. Results-based climate finance could directly build on programmatic crediting mechanisms by procuring mitigation outcomes that are then retired, and therefore accounted to the NDC of the host country. Moreover, results-based climate finance can also draw on individual elements such as MRV standards and institutional design.

Alignment of programmatic approaches with NDCs

It is worth noting that even in the absence of a finalized rulebook, Article 6 piloting has begun to move out of negotiation rooms. This includes multilateral Art. 6 initiatives such as the World Bank's Standardized Crediting Framework (SCF) and Transformative Carbon Asset Facility as well as the bilateral activities of the Swiss Foundation for Climate Protection and Carbon Offset (KliK) and the Swedish Energy Agency. First buyer countries (e.g. Sweden, Switzerland, Canada) and MDBs (World Bank, African Development Bank, Asian Development Bank) have therefore begun to initiate bilateral cooperation at comparatively small scales that seek to generate practical experience with Article 6 transfers.

The emerging documentation in all Article 6 pilots states explicitly how the supported activities will contribute to the host country's NDC objectives, as well as on how to avoid double counting through corresponding adjustments in anticipation of the PA's (currently incomplete) transparency requirements (Greiner et al 2019).

This early practical experience can also inform multilateral rule-making. While these pilots remain small, these and new practical Article 6 initiatives can be expected to gather steam significantly once UNFCCC rules have been clarified and the NDC implementation period starting in 2021 approaches. A case study for the potential to deliver large-scale mitigation action based on tapping into the replication potential of programmatic approaches as well the integration into domestic policies and the NDC from Ethiopia is provided in Box 2Box 2.

These early stage observations clearly show that anticipated NDCs accounting rules, notably the need for corresponding adjustments in both the buyer and seller NDC goal achievement, have already begun to fundamentally change the nature of the emerging international carbon market. While Article 6 invites cooperation, the need to link ITMO transfers to NDC goals means that emission reductions need to be shared between seller and buyer countries while avoiding double counting. This has fundamental implications on a large number of technical issues that still need to be resolved by the PA rulebook. Specific technical issues relating to anchoring programmatic approaches in Article 6 may therefore include at least the following priorities, compared to currently existing approaches generated under the Kyoto mechanisms:

- Relationships of activities supported by programmatic approaches with the NDC (conditional vs. unconditional elements), baselines and additionality in light of sectoral policies, as well as the length of future crediting periods
- MRV and reporting requirements specifically related to the programmatic aggregation level
- Accounting issues, in particular agreements on how to share mitigation outcomes and corresponding adjustments, but also relationships to domestic emissions inventories
- Questions arising on which elements of existing programmatic structures may be eligible for a partial transition to Article 6
- Integration with results-based climate finance

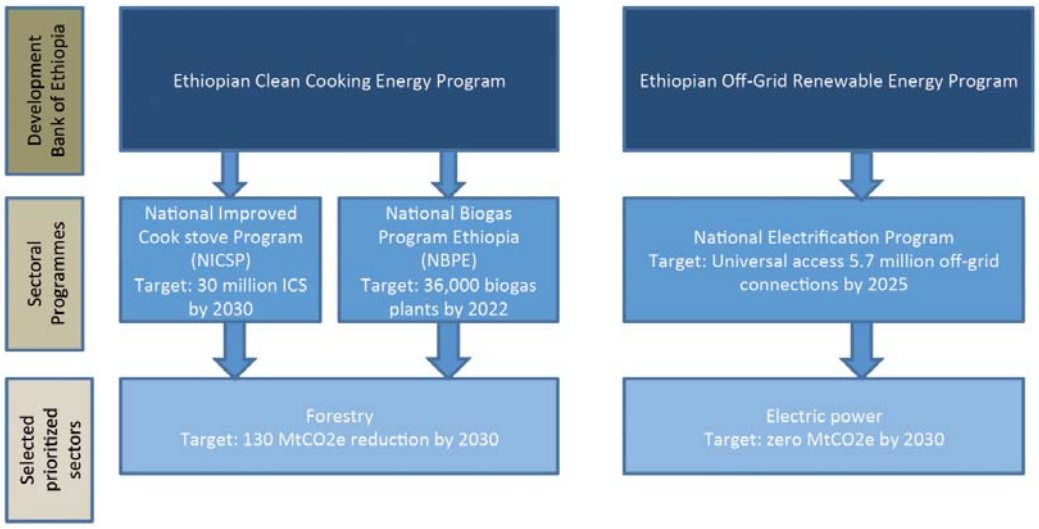
While a finalized Art. 6 rulebook should provide orientation for how to address such questions, defining multilateral rules and guidance is likely to be resolved only over the next years, as solutions evolve in a learning-by-doing manner.

Outlook

Establishing programmatic approaches has been a key success among the reforms of the Kyoto Mechanisms, which have diffused into some, but not all, emerging carbon market initiatives and pilot activitities that aim at becoming part of the Article 6 generation of carbon market instruments. There is a need for a systematic analysis of which elements of the rules and portfolio related to programmatic approaches continue to be relevant for contributing to NDC goal achievement through Article 6. Fleshing out Article 6 rules would benefit from a continuous structured dialogue among key stakeholders with an interest and expertise in programmatic approaches. Such an initiative would ensure that a diversity of practical experience can be made available to inform the ongoing rule-making and piloting efforts.

Box 2: NDC integration of CDM PoAs for sustainable energy access in Ethiopia

Despite hosting only three CDM projects, Ethiopia hosts seven CDM PoAs (6 improved cook stoves, 1 off-grid electrification), which include a total of 16 CPAs. Two PoAs are managed by the public Development Bank of Ethiopia (DBE) and have been explicitly designed to support national policies in line with NDC priorities (see figure). These PoAs have a theoretical emission reduction potential of up to 4,400 ktCO2 by 2020 (UNEP DTU 2019). The World Bank has been providing technical assistance through its Carbon Initiative for Development (Ci-Dev) and has entered an emissions reduction purchase agreement (ERPA) with DBE for about 800,000 and 1.1 million CERs from the EOG PoA and NBPE for circa $20 million until the end of 2024 respectively (Ci-Dev 2016).



Still, the current scale of these comprehensively designed PoAs remains small compared to the national targets for the technologies that they support. The NDC requires substantial financial support to distribute up to 30 million efficient cook stoves and reduce 51.2 MtCO2e. The same order of magnitude applies to offgrid electrification. Provided that sufficient resources are being made available, sectoral capacities are strengthened and the cooperation agreement would reflect NDC accounting requirements, these programmes could be rapidly scaled up. Thus, a potential Article 6 pilot could directly build on the registered PoA framework which is already aligned with the NDC.

Further reading:

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Mobilising the Potential

A regional carbon finance instrument to promote the uptake of renewable energy in southern Africa

by Stephen Dihwa and Johnson Maviya, Southern Africa Power Pool Coordination Centre
Grant Kirkman and Janak Shrestha
Joachim Schnurr and Martin Burian, GFA Consulting Group

The Southern African Power Pool (SAPP) is an association of 16 national power utilities from 12 member countries operating under the auspices of the Southern African Development Community (SADC). The member countries are Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. The SAPP region is characterised by low per capita electricity consumption and has created a common power grid and market for electricity trading, with the aim to increase access and reliability of electricity supply through coordinated planning and implementation thereby contributing to sustainable development priorities in the region. The main objectives of SAPP are pooling and sharing resources, which allows realizing technical and economic synergies. Nine member countries are physically interconnected forming the Operating Members of the SAPP grid. Three countries (Angola, Malawi and Tanzania) are known as Non-operating Members, for which interconnectors are planned or currently built.

The SAPP region is particularly vulnerable to climate change, and increased frequency of droughts is already negatively affecting existing energy systems. The energy sector, dominated by fossil fuel generation, has the leading share of CO_2 emissions in the SAPP member states while the region has untapped potential for renewable energy generation from diverse sources. While the present focus of the SADC is on mobilizing the large potential of hydroelectricity, the non-hydropower renewable energy resources such as wind and solar are estimated to be several orders of magnitude more important than the hydropower potential. As such, diversification of energy generation (RE) through integration of more solar, wind and other alternative renewable energy sources is a priority for SAPP member countries.

Clean Energy Fund for SAPP

The Clean Energy Fund for SAPP (CEF4SAPP) is a concept design for a regional carbon finance instrument recently submitted to the World Bank Transformative Carbon Asset Facility (TCAF) and preliminarily accepted as one of the promising candidates for further development under the TCAF programme. The CEF4SAPP concept was jointly developed by the SAPP Coordination Centre (CC) with technical assistance

provided by UNFCCC Secretariat and the GFA Consulting Group, with kind financial support provided by the German Federal Ministry for the Environment.

CEF4SAPP proposes to assist SAPP member countries in implementing their Nationally Determined Contributions (NDCs) by facilitating investments in the deployment of renewable energy technologies (RETs), in enabling implementation of the objectives of the Paris Agreement while executing the SAPP Pool Plan [1] (SAPP PP) covering the period up to 2040 in cost-effective manner to reduce the sectoral greenhouse emissions. The Pool Plan has been approved by SAPP Executive Committee (EXCO) and endorsed by SADC Ministers responsible for Energy in June 2018.

The CEF4CAPP goal is achieved by supporting i) the implementation of planned and ongoing RE investments contained in the current SAPP PP ; and ii) where feasible, beyond what is planned to be built under the current SAPP PP. It provides a technology specific (non-refundable) feed-in premium payment (top-up electricity price), which covers the incremental cost of choosing RETs against the other likely alternatives, which otherwise would have been implemented for a significant portion of the plan and build horizon, leading to high emission pathways. In doing so, CEF4SAPP supports the achievement of the unconditional (power sub-sector) NDC targets of SAPP member countries and reduces greenhouse gas (GHG) emissions below the unconditional NDC targets (see diagram 1 below).

In other words, the SAPP power sub-sector utilities or IPPs receive a portion of the conditional NDC funding needed to implement their countries NDC via a carbon finance backed instrument. In turn, donors purchase the emission mitigation units created from the operation of these RE investments in a cooperative approach assuring transparency, accountability and impact of the funding provided.

Box 1: The Transformative Carbon Asset Facility

TCAF is an international carbon finance facility, managed by World Bank, which offers results-based payments to support countries in NDC implementation and transition to low carbon economies. TCAF aims to:

- Support mitigation ambitions in developing countries, inter alia by helping developing countries to implement market based carbon pricing and sector wide mitigation measures and by leveraging public finance to create favorable framework conditions for private sector investments into mitigation actions.
- Provide inputs and practical experiences for shaping international carbon markets for a post-Kyoto era.

Find out more at https://tcaf.worldbank.org

Envisaged CEF4SAPP Design

Emission reductions are typically generated by reducing actual GHG emissions below an agreed, counterfactual baseline. The SAPP pool plan may be used to establish a trans-national regional crediting mechanism as an option, which is a cost-effective policy tool for achieving its members' NDCs. This, however, would require a harmonisation of the countries' national energy and climate change mitigation planning. The regional crediting mechanism further builds in-country technical capacity in the context of transparency under the Paris Agreement (for inventories and projections). Assuming willingness by SAPP member countries, the regional crediting mechanism will be a rate-based (indexed) crediting approach, where GHG emissions below a certain intensity level (e.g. per product output or per value of output (MWh) creates robust emission reduction credits).

Currently, no common regional NDC baseline and target setting exist for the energy sector of the member countries, but the SAPP PP may be used alternatively

[1] I.e. a regional expansion plan building on- and optimizing national integrated resource plans, for safeguarding the future power demand in the region.

to develop a forward looking baseline (cp. CMR 2/2018). The SAPP PP comprises three components and a high renewable energy scenario. The third component C is proposed to be endorsed and implemented by the governments of the member states.

- Component A ("Benchmark Case") – is a combination of country-by-country expansion plans based on national master plans extended to 2040 with a consistent set of assumptions. Power trade among the countries is limited by transmission interconnectors i.e., only existing and committed regional inter-connectors are included on the transmission side.

- Component B ("Full Integration Case") – is a full optimisation case whereby the region is treated as though it was a single country and a least cost sequence of generation and transmission expansion projects is derived. There are no constraints on regional trade and the full potential of regional power sector integration is realised. This component is not a SAPP option and hence was not considered further.

- Component C ("Realistic Integration Case") – is the recommended and SAPP Exco approved Pool Plan 2017. An intermediate integration case, where certain constraints are applied to Component B to ensure that each country fulfils minimum SAPP security and reliability conditions such that each country should have sufficient installed or firm import capacity to meet its maximum demand and reserve obligations. Besides, under this component, large thermal power plants should operate at or above minimum capacity factor levels, without which they would be mothballed or operated at unrealistically low load factors even when countries can import cheaper energy.

- SC4 ("High renewable scenario") – the "HRE" scenario assumes that SAPP countries would implement an energy policy matching the level of RE proposed by the International Renewable Energy Agency's report on prospects for Renewable Energy in the SAPP region (IRENA 2013). The test introduced renewable investment options which were not always included in the utility power master plans. Furthermore, to attain the levels of renewables in the IRENA report, renewable projects were treated as a being committed. The generation mix is therefore policy-driven and is not a chosen option for the SAPP EXCO.

In summary, considering GHG emissions and cost of generation, component A can be regarded as a proxy for a SAPP business-as-usual (BAU) energy sub-sector baseline; component C can be seen to be a proxy for an un-conditional sub-sector NDC target; and HRE can be defined as the proxy to conditional sub-sector NDC target setting.

This may offer a unique opportunity to establish a regional carbon-financing instrument, which uses a regional baseline and allows to support GHG emission reductions where they are most cost effective (e.g. wind may be more competitive in countries A and B, whereas PV is more competitive in countries C and D, etc.).

In the absence of a regional NDC target setting for the energy sub-sector, CEF4SAPP may be operated on project basis, if the electricity generation costs are above a certain threshold (see below) and if the project does not lead to any GHG emissions.

The transnational crediting mechanisms will encompass utilities and IPP companies (or most of them) operating in the SAPP sector. The feed-in-premium paid on top of the market price of electricity production is differentiated by technology (e.g., solar, wind, biomass) and based on generation costs. It is paid to operators listed in an approved SAPP PP, which exceed a threshold price using a competitive bid process. A predetermined minimum and maximum level ("floor" and "cap") will be used, such that if market prices are higher than the threshold price, no Feed-In-Premium (FIP) is paid. RE plants not covered under the existing SAPP Pool Plan are also eligible. In return, plants cede their right to retain any claims to mitigation of GHGs.

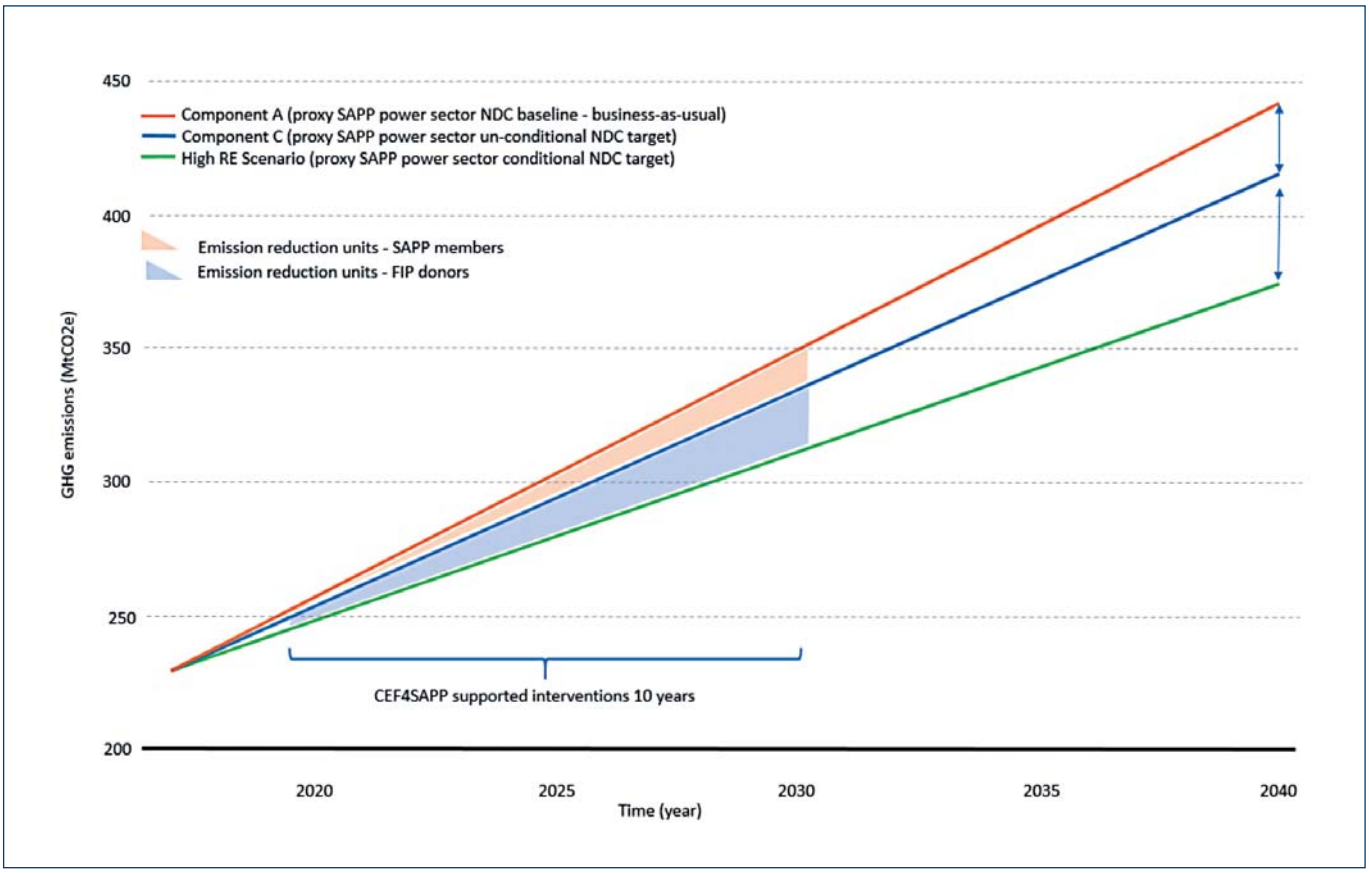


Diagram 1: Baseline, unconditional & conditional NDC targets of the SAPP power sub-sector, and the expected CEF4SAPP impact on GHG emissions

The first step in the origination of projects is competitive tenders (some experience with competitive bidding exists in the region particularly in South Africa and Zambia to achieve low cost RE generation). Interested power producers from all SAPP countries voluntarily compete against each other on price of power dispatched to the grid allowing to identify the least cost project proposals (following pre-defined quality standards) within the region, for a given technology. Bidding will be differentiated per technology, which will allow donors to support either the conventional RETs or and emerging RETs in the region (e.g. concentrated solar). Hydro projects will be restricted to 15 MW capacity considering the potential environmental issues associated with large hydro projects.

SAPP benchmark price - levelized cost of electricity	
Intermittent renewables (wind, solar, in USD/MWh)	49.8
Others (biomass, small hydro, in USD/MWh)	57.5

The above threshold prices have been determined using the SAPP PP. The thresholds were derived from all committed and new capacity extensions, differentiated by firm power (e.g. biomass, small hydro) and intermittent renewable power (e.g., solar, wind). Projects may benefit from a carbon-FIP if their generation costs are above the threshold price. The FIP will be provided in USD/MWh for up to 10 years as a grant-based carbon subsidy.

An accounting system will be managed and maintained by CEF4SAPP to ensure that the FIP always results into per unit funding cost of GHG emission reductions committed to by donor countries. This will be achieved by pooling low cost and high cost emission reductions and tenders that are stratified and planned accordingly.

Financial Arrangements

To evaluate the financial implications, we estimate the potential size of an FIP for each specific technology using historic data. The table below presents the Levelized Cost of Electricity (LCOEs) for the wind and PV solar (both classified as intermittent RE) as well as small scale hydro and biomass. Considering experience with RSA's Renewable Energy Independent Power Producer Procurement Program (REI4P) and using the LCOEs modeled by a WB study , the potential size of fund required for the CEF4SAPP based on the difference between LCOEs and the benchmark, for the SAPP Pool Plan was determined. The estimated viability gaps are proposed to be covered by the FIP.

Feed-in Premium payable to individual projects to make them financially viable are estimated based on the following:

- The average plant capacity/load factor of the above technologies which was taken from the SAPP PP;
- Annual electricity generated by projects (MW capacity) supported under CEF4SAPP;
- Related emission reductions based on the SAPP grid emission factor;

In terms of effective investment of carbon revenues, it is important to consider how much investment from the private sector may be facilitated by spending one USD for one ton of GHG emission reduction. The table below considers the average capital investment cost of specific technologies, determined based

Benchmark LCOE costs	LCOE (in USD/MWh)	Gap (in USD/MWh)	Data Source
Benchmark Price - Intermittent RE (USD/MWh)	49.78	N.A	SAPP PP
Benchmark Price - Other RE (USD/MWh)	57.46	N.A.	
Onshore Wind (USD/MWh)	53.66	3.89	REI4P
Solar Photovoltaic (USD/MWh)	55.97	6.20	REI4P
Small scale Hydro (USD/MWh)	59.24	1.78	ERC LCOE 2020
Biomass (USD/MWh)	103.23	45.77	ERC LCOE 2020

2 This is a benchmark price computed based on average cost of electricity generation of power plants on the margin using the scenario of SAPP PP which is the most cost-effective among all the scenarios studied such that it would represent the most likely baseline investment plan.
3 For example, a solar PV project which offers a bid price of 70.0 USD/MWh would be eligible for receiving 20.2 USD/MWh (70 – 49.8 USD/MWh) as a feed-in premium.
4 Implemented by Energy Research Centre (ERC) of Cape Town the potential size of fund required for the CEF4SAPP.

The table below provides the details of the FIP payments:

Feed-in Premium payments to projects						
Technology	Installed Capacity *(MW)*	FIP *(USD/MWh)*	Load Factor *(%)*	Elec. Gen *(MWh/yr)*	ERs *(tCO2/yr)*	FIP Payments *(USD/yr)*
Onshore Wind	100	3.89	31%	271,730	242,630	1,056,319
Solar PV	75	6.20	24%	160,875	143,647	996,791
SSC Hydro	150	1.78	43%	563,369	399,972	1,003,473
Biomass	10	45.77	68%	59,935	42,552	2,743,365
Total / Average	**335**	**7.00**	**38%**	**1,055,908**	**828,801**	**5,799,948**

on the SAPP PP, showing expected leverage factor per technology.

The table above shows that CEF4SAPP may be scaled to generate either predominately emission reductions, or, alternatively, to introduce new technologies with higher marginal abatement costs.

Next Steps

- The CEF4SAPP concept was discussed during the SAPP Management Committee Meeting in 2018 in Zambia with all power utilities and key stakeholders in the region. Establishing transnational regional crediting mechanism is dependent on power sub-sector baselines and targets for all SAPP members countries, calibrated and submitted in unison.
- The CEF4SAPP will be further developed under the TCAF as approved by donors at its 30th January 2019 meeting with an estimated time to deployment (excluding dependencies) of 18 to 24 months.

Potential leverage factor by technology			
Technology	Inv. costs (USD/kW)	Total inv. costs (USD)	Private sector leverage factor
Onshore Wind	2,478	247,800,000	22.5
Solar PV	2,085	156,379,615	15.7
SSC Hydro	2,748	412,227,857	41.1
Biomass	3,681	36,812,833	1.3

A win-win for Ozone and Climate

The linkages between the Montreal Protocol and the Paris Agreement can be used to raise climate ambition

by Ulrika Raab, Swedish Environmental Protection Agency

Although short-lived greenhouse gases such as hydrofluorocarbons (HFCs) are not the main focus of the Paris Agreement, they are nonetheless important in the overall context of climate change. The Montreal Protocol on Substances that Deplete the Ozone Layer plays an important role – not only in protecting the ozone layer, but also in protecting the climate. Through targeted actions in areas such as accelerated phase-down of HFCs and improvements in the energy efficiency of equipment, much more could be achieved.

The model for international environmental treaties

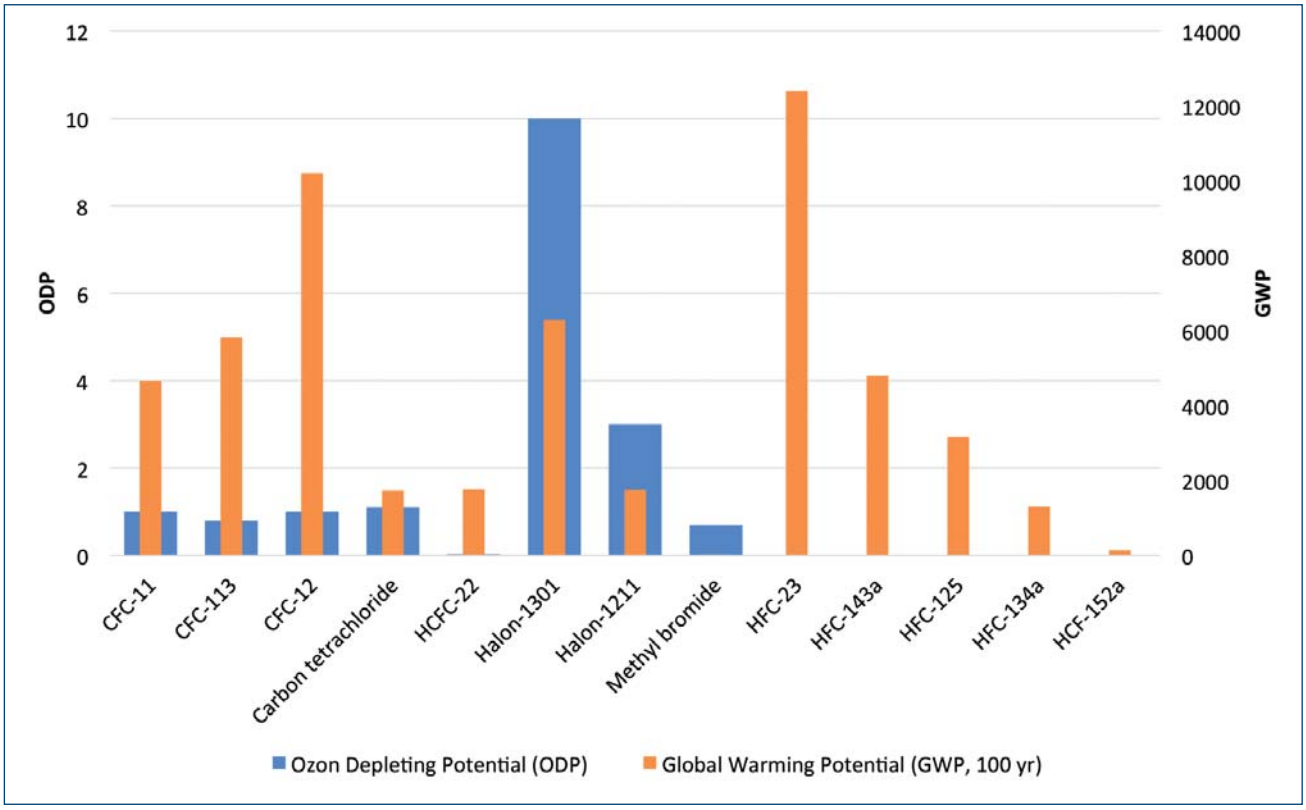
The Montreal Protocol to the Vienna Convention for the Protection of the Ozone Layer (Montreal Protocol), which came into force in 1989, aims to protect the ozone layer by phasing out the consumption and production of substances that cause ozone depletion. With 198 countries party to the original agreement, it is in many ways the blue print for international environmental treaties, and has been heralded as the most successful response to a global environmental problem ever. Some would argue that the ozone layer is relatively simple to fix compared with mitigating climate change, which is a far more complex challenge. But the treaty to save the ozone layer has, nonetheless, brought great climate-related benefits and will go on to achieve even more.

Many ozone depleting substances are also greenhouse gases

In addition to protecting the ozone layer, which shields the earth from the sun's harmful ultraviolet-B radiation, the Montreal Protocol has also played a key role in controlling and reducing emissions of greenhouse gases – many ozone-depleting substances are also potent greenhouse gases.

One fitting example involves chlorofluorocarbons (CFCs), which are both ozone-depleting substances and greenhouse gases with significant climate change impact. Since the inception of the Montreal Protocol, Parties have phased out the production and consumption of CFCs, which were used in refrigeration, air-conditioning

Ulrika Raab worked in international climate change policy on behalf of the Swedish Government for 20 years. She recently joined the Swedish Environmental Protection Agency, where she focuses on ozone issues and how the Kigali Amendment brings the two processes closer together.



Source: The author, based on Montreal Protocol data and IPCC AR 5.

Comparing the Ozone Depleting Potentials (ODPs) and Global Warming Potentials of the main products covered by the Montreal Protocol.

(including in cars), foam insulation, and technical and medical aerosols as well as methyl chloroform used for solvent cleaners. Carbon tetrachloride, which in the past was the main feedstock used to manufacture CFCs, has also been phased out with a few minor exemptions for process agents, laboratory and analytical uses, and in feedstock (in which case the product is converted to other substances). Methyl bromide used for crop protection has also been almost entirely phased out; only a few Parties have exemptions in place for certain critical uses. Significant progress has also been made in phasing out hydrochlorofluorocarbons (HCFCs), one of the main alternatives to CFCs, and a schedule is in place for their almost total phase-out in the future. The graph below shows some of the Ozone Depleting Potentials (ODPs) and Global Warming Potentials of the main products covered by the Montreal Protocol.

Replacements for CFCs solved one problem but added to another

Hydrofluorocarbons (HFCs) have been one of the main substitutes for CFCs and HCFCs in many applications in many industrial sectors. HFCs do not deplete ozone but are potent greenhouse gases and there has been concern for some years that the phase-out of ozone depleting substances with increased use of HFCs would lead to increased global warming. In October 2016, the Parties to the Montreal Protocol adopted the Kigali Amendment which starts the phase-down of HFCs and came into force on 1 January 2019.

By regulating HFCs under the Montreal Protocol's Kigali Amendment, governments selected a specific window in the broad climate change agenda where they believed focused action could produce important and rapid emissions reductions and climate

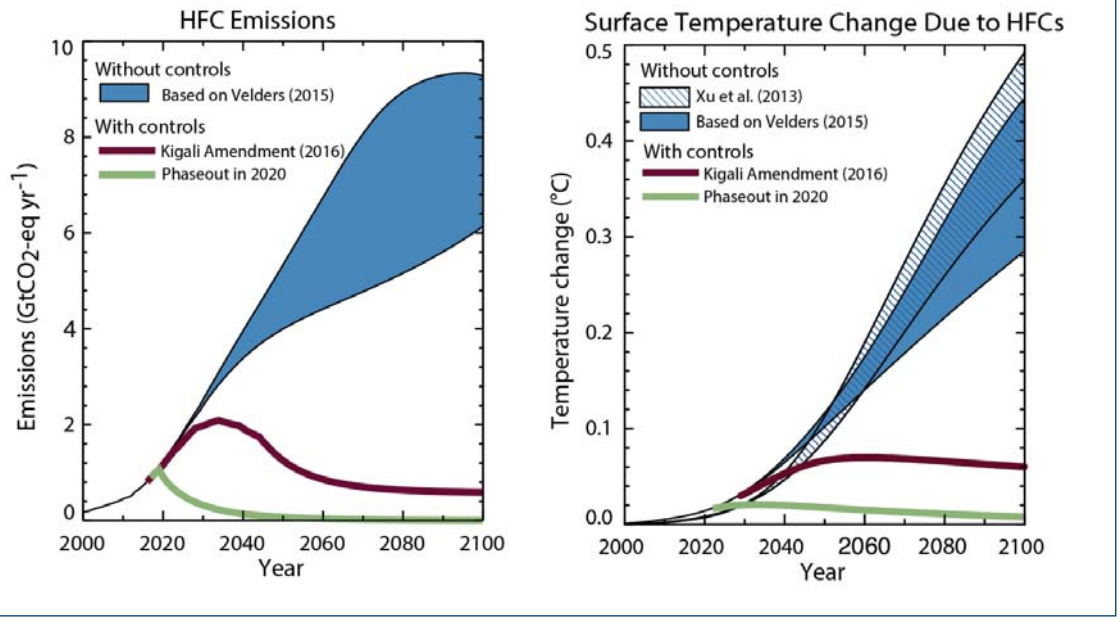
benefits based on the experience gained with ozone depleting substances. HFCs are included in the basket of gases controlled under the 1997 Kyoto Protocol to the UN Framework Convention on Climate Change and subsequent Paris Agreement. Some of the earliest projects conducted under the Kyoto Protocol's Clean Development Mechanism (CDM) aimed to reduce emissions of HFC-23 – a gas with a very high global warming potential (GWP) of 14,800 – which is co-produced with HCFC-22. HFC-23 destruction under the CDM spurred controversy, as the monetary reward for destroying it was at times far greater than the price obtained from the main product, HCFC-22. One lesson from the CDM experience, and an important aspect in designing financial tools to facilitate the phase-down of HFCs, is that they should not lead to windfall profits.

Why control HFCs under the Montreal Protocol?

With a growing concern over the impacts of climate change, a number of governments raised the issue of controlling the production and consumption of HFCs under the Montreal Protocol. A number of reasons were cited in the discussions held at the meetings of the Montreal Protocol Parties and working groups.

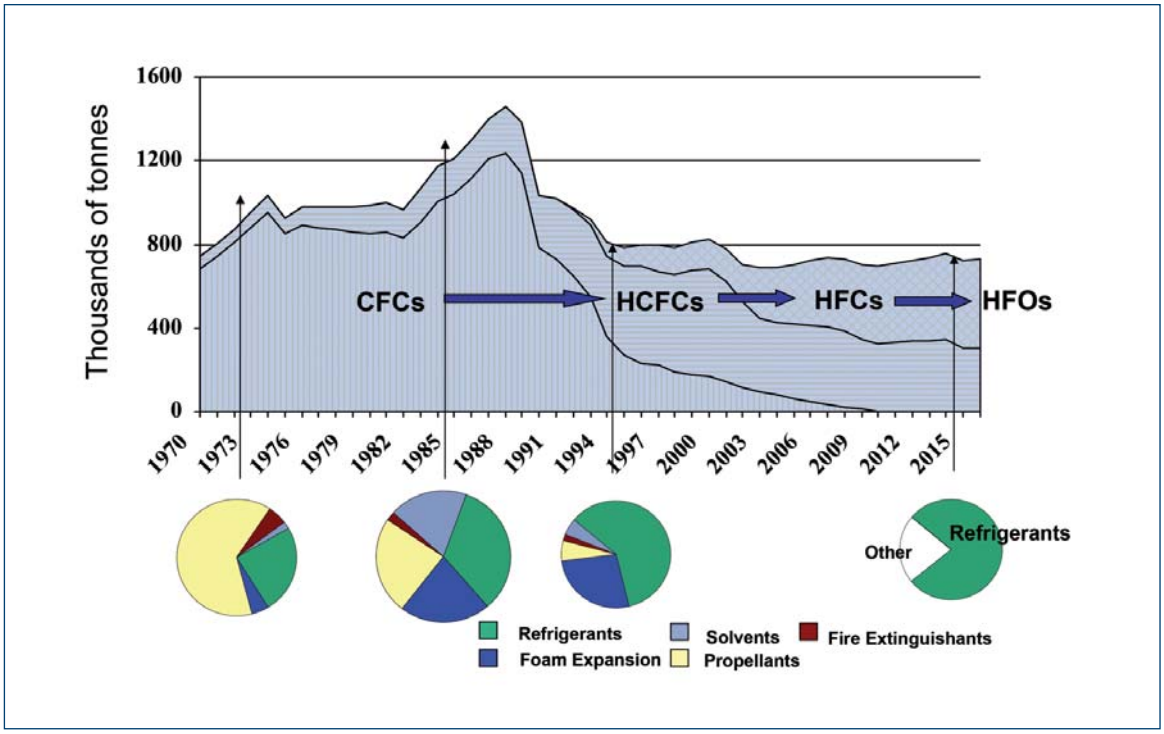
HFCs were introduced as replacements for many of the primary uses of CFCs and HCFCs. A number of scenarios postulated that emissions of HFCs could become a major contributor to man-made climate change through to the year 2100, as can be seen in the diagram below. As a result, many governments considered that the Montreal Protocol should "take responsibility" for this impact and reduce emissions of HFCs.

The Montreal Protocol had established scientific, environmental effects and technical panels to assist Parties in the phase-out of ozone depleting substances (ODS). These panels, a blend of government, academia, industry and NGOs from a mix of developed and developing countries, provide assessment reports every four years. Since 1999 (Decision XI/17), the Technology and Economic Assessment Panel (TEAP) and their five technical options committees (Refrigeration, Foams, Medical and Chemicals, Halons and Methyl Bromide) have provided annual progress reports on important new developments. These have



The contribution of HFCs to man-made climate change in different scenarios.

Source: WMO (2018): Executive Summary: 2018 Scientific Assessment of Ozone Depletion. Geneva.



Source: "Existing Replacements for CFC & HCFC Refrigerants and Future Low GWP Alternatives", Presentation by Dr. Frank Rinne, online at: https://slideplayer.com/slide/4500171/

Towards low GWP replacements for HFCs.

enabled the Montreal Protocol to quickly respond to the latest scientific and technical knowledge. It was believed that these panels could do valuable work to assist the phase-down of HFCs as the industry sectors were the same.

The Montreal Protocol has a financial mechanism for funding the transition away from ozone depleting substances (ODS) and towards alternatives. This financial mechanism, the Multilateral Fund (MLF), was established in 1990 and, based on predetermined criteria, provides project funding for the incremental costs of the transition to alternatives. These criteria have been developed by an Executive Committee made up of developed and developing countries (known as non-Article 5 and Article 5 countries under the Montreal Protocol). Since its onset, the MLF has provided 3.5 billion US dollars in funding. It operates through four implementing agencies – UNEP, UNDP, UNIDO and the World Bank – who can to use their networks, in-depth knowledge and local expertise when implementing MLF projects.

It was agreed by the Parties to the Montreal Protocol that the scope of the MLF would be extended to include the phase-down of HFCs and could work alongside the major funding initiatives in place for climate change, for example the Green Climate Fund (GCF). The guidelines for the financing of the HFC phase-down are currently being developed.

Links to national energy emissions

Refrigeration, air-conditioning and foam insulation can have a major impact on a nation's energy emissions. There has been considerable discussion about the requirement that future alternatives to HFCs maintain the energy efficiency improvements that had been made by replacing CFCs and HCFCs with HFCs. This latter point can be seen as one of the major linkages with the Paris Agreement. In fact, where electricity is provided though fossil resources, roughly 80% of the climate impact from air conditioning units using HFCs is from the energy use in their operation and 20% from emissions from the refrigerant itself.

After much discussion, as well as a number of technical studies by the TEAP, agreement was reached in Kigali and the Kigali Amendment to the Montreal Protocol adopted. This entered into force on 1 January 2019 and as of 25 April 2019, has been ratified by 70 governments. The goal is to achieve over 80% reduction in HFC consumption by 2047.

The main challenge ahead is for countries to bypass HFCs when phasing out HCFCs – that is, to "leapfrog" into more sustainable options. Examples of non-ozone depleting substance alternatives are "natural refrigerants" like ammonia, hydrocarbons and carbon dioxide, or the "fourth generation" hydrofluoro-olefins (HFOs). Leapfrogging could also mean bypassing the stand-alone units completely and meeting air conditioning needs through the use of district cooling systems, which much better energy efficiency.

The linkages between the Montreal Protocol and the Paris Agreement can be used to raise climate ambition

The 2015 Paris Agreement is very different from its predecessor, the 1997 Kyoto Protocol. The latter can be seen as a "top-down" agreement that imposes quantified emissions reduction on individual nations whereas the former is "bottom-up". The Paris Agreement is based on Nationally Determined Contributions (NDCs), in which a government specifies both the actions it intends to take and the predicted outcomes. Six governments (including the US) have included actions on HFCs in their NDCs, another six have specified quantified outcomes. All Parties have the opportunity to communicate new or updated NDCs by 2020.

With the inclusion of HFCs, the Montreal Protocol and the Paris Agreement are two multilateral treaties working indirectly and directly towards the same goal of protecting the climate. Their linkage will enable governments to evaluate how they can raise their ambition under the Paris Agreement by focusing on specific actions on HFCs as well as the energy efficiency of equipment using HFCs or other refrigerants. Such actions can include the early replacement of HFCs in targeted applications as well as leapfrogging HFCs during the replacement of HCFCs. The Technology Panels of the Montreal Protocol are available to assist governments in the transition, whilst ensuring the continuation of essential societal needs such as refrigeration, air-conditioning and building insulation, alongside the implementing agencies and financing mechanisms of the Montreal Protocol Multilateral Fund. The pieces are in place to ensure continued protection of the ozone layer with the added benefit of assisting climate protection.

Mobilizing green cooling through Article 6

Enhancing synergies between the Kigali Amendment and the Paris Agreement

by Axel Michaelowa (Perspectives), Bernhard Siegele (GIZ), Matthias Krey (Perspectives), Aglaja Espelage (Perspectives)

Cooling, including refrigeration as well as comfort-cooling or air-conditioning, is possibly one of the most critical blind spots in today's climate and energy and development debate. Growing demand for cooling is driven by economic and population growth as well as urbanisation, in particular in the hottest parts of the world. Of the almost 3 billion inhabitants of the hot parts of the world today only 8 % have an air-conditioner. About 2 billion additional middle-income consumers are expected in hot regions, in particular in Asia by 2030 – with the top priority investments of a refrigerator and an air-conditioner (next to light, television and mobile phone).

Productivity, education and thermal comfort are interrelated and by 2050, heat-related work-hour losses in some Asian and African countries could be as high as 12% - worth billions of US dollars in lost productivity.

Cooling is also essential for food security and global health: often, 30% to 50% of food produced is lost between harvest and market in developing economies. Each year, more than 1.5 million children die of a vaccine-preventable disease and 19 million are unable to receive basic immunisation. This could be significantly improved through adequate cold chains.

It is projected that at least 19 new cooling appliances will be sold every second for the next 30 years. However, even at this rate of deployment, by 2050 only two-thirds of the cooling demand worldwide would be met. In 2050, the world would demand about 14 billion pieces of cooling devices resulting in about 19,000 TWh of energy consumption. The current climate impact of ~ 4 billion t CO2eq (about 10% of total GHG emissions) would increase to ~9 billion t CO2eq (about 12% of total GHG emissions in 2050 in a business as usual scenario). The Kigali Amendment phasing down HFC consumption and production generates cumulative mitigation of 80 billion t CO2eq between start of the phasedown and 2050. [1]

Cooling is related to a number of the Sustainable Development Goals (SDGs), such as poverty reduction, the eradication of hunger and food security, economic growth and better infrastructure, health, quality education, gender equality, sustainable production and consumption as well as the access to affordable and clean energy. To be sustainable, cooling needs to focus on decarbonising the energy input, increasing the energy-efficiency of appliances as well as phasing-in natural refrigerants in a comprehensive manner. This must be addressed in a comprehensive manner promoting the interactions between the UNFCCC, the Montreal Protocol (MP) as well as the Agenda 2030.

The Kigali Amendment and its role in achieving the objectives of the Paris Agreement

The trade-off between the ozone protecting features of hydrofluorocarbons (HFCs) and their contribution of HFCs has traditionally had been viewed as a barrier to implementation of both the UNFCCC and the MP, when countries felt forced to

1 Figures cited here were presented at "The 2nd Clean Cooling Congress - Cooling for all ... without over-heating the planet", 24– 25 April 2019, London, hosted by the Dept. of Business, Energy and Industrial Strategy and the World Bank Group in collaboration with University of Birmingham

Mixed success: CDM HFC Decomposition Project in Ulsan, Republic of Korea

prioritize between their obligations to comply with reduction targets under the MP and GHG mitigation.

In 2016, with the adoption of the Kigali Amendment (KA) to the MP, this trade-off was addressed, cp. article 'A win-win for Ozone and Climate' elsewhere in this issue, as the KA established a phase-down regime for the production and consumption of 18 HFCs. For HFC-23, a by-product of HCFC-22 production, Parties must ensure from 2020 onwards destruction to the extent practicable. For all other HFCs, the KA determines different baseline years and phase-down schedules for four groups of countries - developing (Article 5 countries) and industrialized Parties, selected "high-ambient temperature countries" and selected former Soviet Union countries in transition. By the late 2040s, production and consumption of HFCs shall be phased-down by 85% compared to the levels in the respective baseline years in all countries.

Compared to a business-as-usual situation, the full implementation of the KA will annually mitigate 2.8-4.1 billion t CO_2e annually by 2050, and prevent up to 0.4°C temperature increase by 2100. It entered into force in 2019, obligating Parties to introduce mandatory national HFC import and export licensing systems. As already 70 countries have ratified the KA, a ban on trade with non-Parties will enter into force from 2033 onwards. The mandatory phase-down regime can therefore play an important role in achieving the objectives of the Paris Agreement, driven by bottom-up formulated pledges.

Financing green cooling through Article 6 of the Paris Agreement

The Multilateral Fund for the Implementation of the Montreal Protocol (MLF) assists developing countries with meeting their MP commitments, focussing on the incremental cost of compliance. Financing under the MLF is limited to activities directly related to compliance; financing beyond the coverage of compliance costs is particularly needed to:

- spread technological advances and incentivize the direct switch to natural and low-GWP refrigerants;
- ensure that the switch to alternative refrigerants is accompanied by an enhancement of energy efficiency;
- combine the switch to green cooling with proper management and waste disposal of old appliances, as improper waste disposal of cooling appliances leads to GHG emissions through leakage.

The relevance of the HFC-phase down for achieving the mitigation objectives of the Paris Agreement explains the poten-

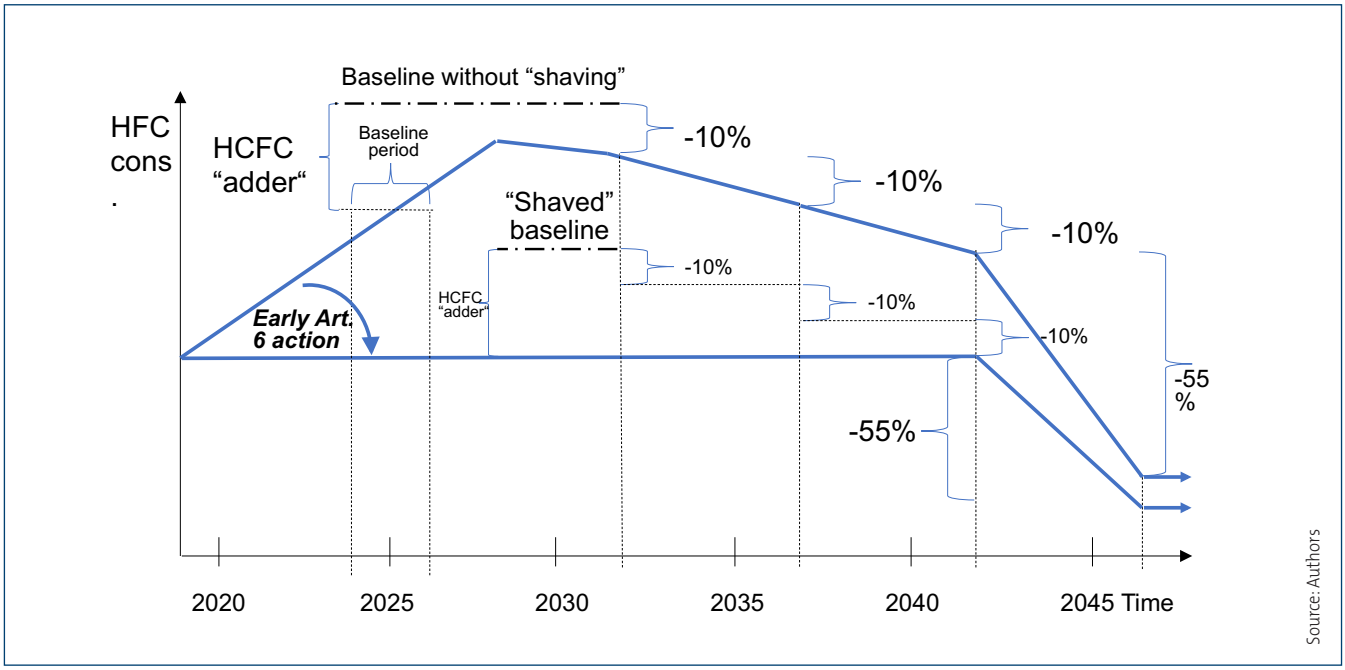


Figure 1: The KA „baseline shaving effect" of early HFC mitigation action under Article 6 of the PA

tial of securing additional resources through Article 6 of the PA. Ideally, an integrated financing landscape for HFC mitigation would emerge: Public climate finance to cover public goods linked to HFC mitigation such as the establishment of MRV systems, safety training for new refrigerants and the reform of the policy framework and associated institutional capacities needed to prepare the partner countries for the use of new cooling technologies. Market mechanisms would be used to engage the private sector to drive investments in technologies with low marginal abatement costs.

Shaving Kigali Amendment production and consumption baselines

Given the fact that HFC emissions are rising strongly while the Kigali Amendment HFC-phase down path for most Article 5 countries (cp. preceding article) takes effect only from 2029 onwards (with a freeze date for consumption and production levels in 2024)[2], using Article 6 to finance early HFC mitigation action would be a contribution to enhance ambition of climate action.

The HFC phase-down path will be fixed for every country based on their consumption and production of HFCs in "baseline years". For developing countries this means that their mitigation pathway will depend on their emissions in the years 2020-2022. In consequence, early action through Art. 6 can lower the baselines for the HFC phase-down schedule for developing countries under the KA, thus triggering long-term HFC mitigation through baseline "shaving" as shown in Figure 1 above. Baseline levels of production and consumption will be lower in the respective countries and the higher level of ambition will be locked-in permanently as the phase-down path of the KA will remain below the path that would have been applied had the baseline levels been higher.

Note: The HCFC "adder" relates to an increase of the baseline levels due to the replacement of HCFCs by HFCs that occurs over time.

2 A small group of countries with high ambient temperatures (HAT) (Bahrain, India, Iran, Iraq, Kuwait, Oman, Pakistan, Qatar, Saudi Arabia, United Arab Emirates) has a later freeze date (2028), start of the phase-down schedule (2032) and also later baseline years (2024-2026).

However, to harness this effect, Article 6 activities on HFC need to be developed and implemented to generate emission reduction before 2022/before 2026. Therefore, HFC mitigation activities should be prioritized when piloting Article 6-based forms of international cooperation.

Conceptualising Article 6 activities in green cooling

When conceptualising Article 6 activities for the promotion of green cooling, the experiences with HFC mitigation under the Clean Development Mechanism (CDM) should be taken into account. As HFC mitigation has been eligible under the CDM, five methodologies have been developed for large-scale and small-scale production as well as on the consumption side. Furthermore, the CDM Executive Board developed a methodological tool for the determination of standardized baselines for energy efficient refrigerators and air conditioners.

The application of the methodology on thermal destruction of HFC-23 destruction should no longer be eligible under Article 6 of the PA, as the destruction of HFC-23 will be a mandatory activity under the KA. All other HFC mitigation activities that can prove their general additionality, taking into account NDC as well as MP/KA commitments, should be eligible, as they are targeting a sector with high sustainable development co-benefits and can generate improvements in energy efficiency. In developing their activities, Parties should build also on the lessons learned with approaches to reduce transaction costs while maintaining environmental integrity, i.e. programmes of activities and standardized baselines, cp. article 'Advancing programmatic crediting in Article 6' elsewhere in this issue.

Possible activities to generate HFC mitigation results could be:

- Policy instruments that provide incentives to convert cooling equipment production lines to promote the switch to natural refrigerants
- Policy instruments that promote the destruction of old equipment containing CFCs/HCFCs and HFCs to avoid the piling-up banks of ozone depleting substances and emissions through leakage

Cooling a key factor in food security and global health: Green energy project in Bhutan.

- The introduction of cap-and-trade systems for HFC manufacturing linked to import regulations (here, also regional implementation is possible)
- Policy instruments to incentivise the purchase and installation of low-GWP cooling appliances/ natural refrigerants in domestic and commercial sectors (coupled with destruction programmes for the replaced equipment).

However, further safeguards should be introduced in the design of Article 6 activities in order to ensure that synergies are exploited and potential perverse incentives ruled out. First, accounting for mitigation activities pursued under Article 6 must be linked to the implementation of national HFC management plans and the phase-down schedule must be included in baselines and considered in the additionality assessment. Second, the additionality assessment should be harmonized with the MLF guidance on the incremental costs of HFC reductions, but take into account the specific cost structures of countries regarding HFC mitigation. And third, baseline setting for HFC projects should be regularly revised to reflect on technical innovations and assessments of the technology and economic assessment panel (TEAP) of the Montreal Protocol. This body has been tasked to regularly assess and report on costs and availability of low-GWP technologies and equipment that maintain and enhance energy efficiency.

Overcoming barriers to implementation

The aforementioned possible HFC mitigation actions face practical implementation barriers on the ground that broadly speaking depend on the scope of actions as well as the target user group of the technology and the particular barriers that prevent this group from adopting green cooling technology. For example, if the target group consists of agricultural cooperatives that aim to use the technology for cooling perishable food items, barriers will be higher compared to modern retail supermarkets that aim to keep the products fresh in their stores. The former group will need considerable financial support to implement the technology, while the latter group should be able to finance it on their own. As green cooling equipment often has a shorter payback period compared to conventional cooling technologies due to higher equipment efficiencies, the latter activities would not be deemed "additional" under Article 6. Green cooling technologies for agricultural cooperatives, however, could be subsidized by a carbon-credit supported fund in the context of a 'Programme of activities'.

In a large number of developing countries, a serious bottleneck to mass deployment of green cooling technology is the non-availability of equipment in domestic markets. Firstly, national regulators often have not yet defined appropriate national standards for allowing imports of green cooling equipment. Secondly, technology manufacturers may not yet offer their latest equipment in those markets and prefer to do business in emerging economies where they can scale their business faster. Creating a regulatory enabling environment for the uptake of green cooling technology in the market is therefore a critical success factor for Article 6 pilots targeting end user technologies. Here, the blending of market-based cooperation with climate finance would become relevant.

When it comes to operation of green cooling and destruction of replaced equipment, safe handling is an important aspect to consider as compressors contain flammable refrigerants. In the majority of developing countries, technicians need to be trained to service and decommission the equipment safely. These environmental and social safeguards must be properly considered and addressed in the design of Article 6 activities.

A key barrier for countries to develop, implement and account for market-based activities is data availability. Therefore, the establishment of MRV and accounting procedures both targeting PA and KA compliance is key. As soon as robust data is available, it is important to ensure that the cooling sector as well as the KA phase-down targets are included in the NDCs as a basis for proper accounting under the enhanced transparency framework of the PA. A further important barrier to participation in Article 6 mechanisms is the high transaction costs. These can be lowered through the development of standardized baselines as well as positive lists of some natural refrigerant technologies to ease the process of baseline setting and additionality assessment.

I4C side event: Linking Paris and Kigali

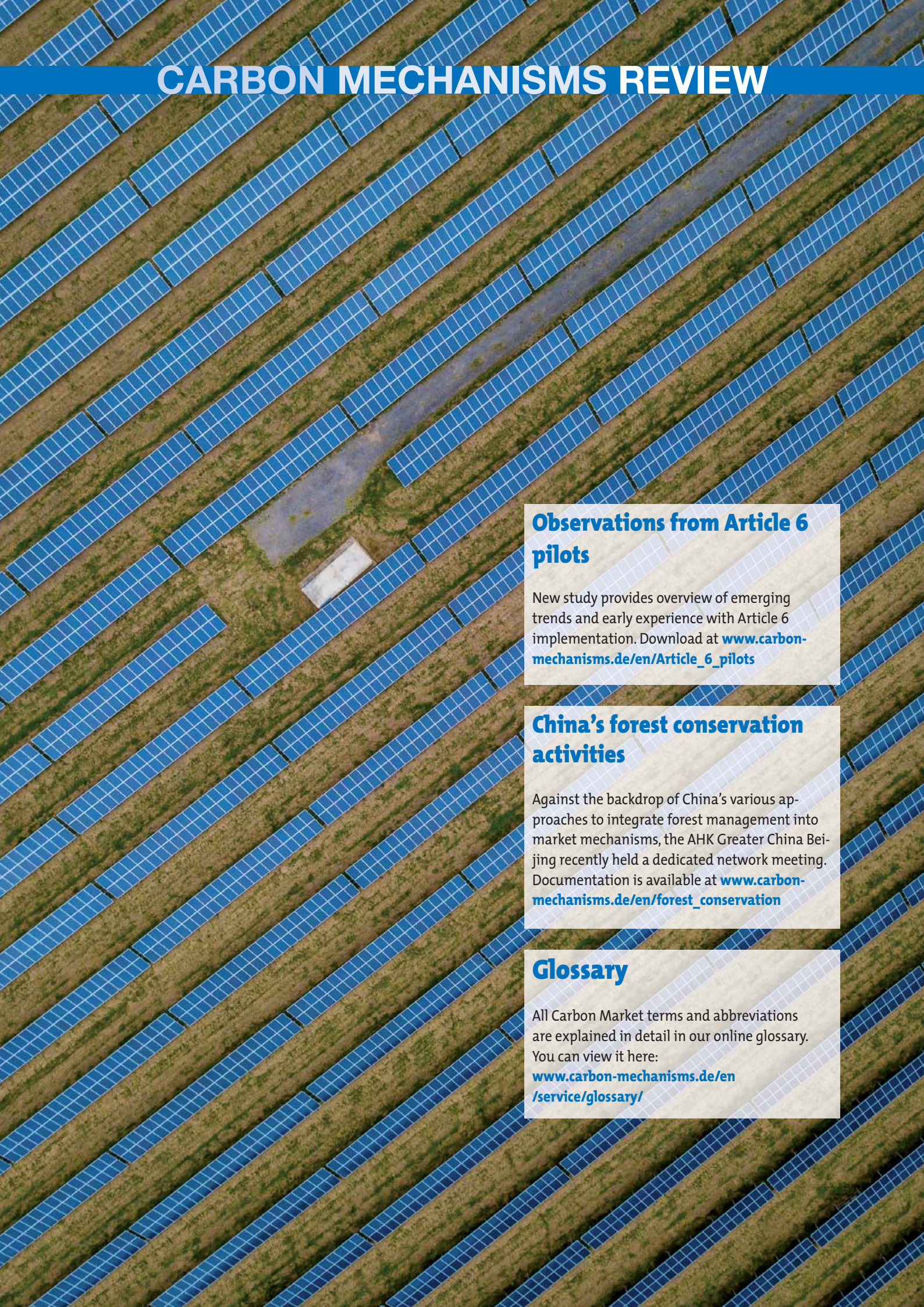
The authors invite all interested stakeholders participating in Innovate4Climate 2019 to engage in the discussion at the side event "Linking Paris and Kigali: Accelerating the transition to green cooling" on Tuesday June 4, 2019 at 12:00 in room Simpor Jr 4912.

Outlook

In climate change mitigation, synergies with broader sustainable development and the implementation of other multilateral environmental agreements should be pursued, while negative impacts should be prevented. Identifying synergies between the PA and the KA is only a first step - the next one is to identify concrete activities and develop methodologies that allow Parties and the private sector to take action rapidly. If harnessed quickly, market mechanisms under the PA will boost HFC reduction. They can mobilize financing beyond the volume provided by the MLF and push the KA baseline emission levels downwards, thus leading to long-term mitigation.

Further reading:

Michaelowa, Axel; Espelage, Aglaja; Hoch, Stephan; Acosta, Mariana (2018): Interaction between Art.6 of the Paris Agreement and the Montreal Protocol/Kigali Amendment, Discussion Paper, Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Eschborn.



Observations from Article 6 pilots

New study provides overview of emerging trends and early experience with Article 6 implementation. Download at **www.carbon-mechanisms.de/en/Article_6_pilots**

China's forest conservation activities

Against the backdrop of China's various approaches to integrate forest management into market mechanisms, the AHK Greater China Beijing recently held a dedicated network meeting. Documentation is available at **www.carbon-mechanisms.de/en/forest_conservation**

Glossary

All Carbon Market terms and abbreviations are explained in detail in our online glossary. You can view it here: **www.carbon-mechanisms.de/en/service/glossary/**