CARBON MECHANISMS REVIEW

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Paving the Way

How Article 6 supports African countries transitioning to the Paris world

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editorial

Dear Reader!

The Paris Agreement heralded a seachange in international climate policy. All Parties have committed to contributing to efforts to mitigate climate change. At the same time, Article 6 of the Agreement offers new mechanisms for voluntary international cooperation in achieving climate policy goals.

African countries in particular have voiced interest in using Article 6 in shaping the transition from the old CDM world. For the cover feature of this Carbon Mechanisms Review, we have thus compiled a number of articles that present a selection of market-based mitigation initiatives in that region.

First, we present an initiative that pilots Article 6 activities in Sub-Saharan countries which focus on reactive power compensation and technical losses. Second, we look at Tunisia, which recently signed a Statement of Undertaking with the Nitric Acid Action Group. Third, we review the latest developments concerning methodology development and present the new concept of forward-looking baselines for results-based financing, based on data from the South African Power Pool. Last but not least, we examine the current status of the NAMA pipeline and present an example from Uganda on integrating market mechanisms and NAMA finance.

Similar articles will follow in later editions in the course of this year.

Also in this issue, we report on the recent decisions of the ICAO Council and their repercussions in shaping the ICAO's CORSIA offsetting scheme. Finally, we review the events and outcomes of *Innovate4Climate* 2018.

On behalf of the editorial team, I wish you an interesting and informative read.

Christof Arens

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 Activities

Sub-Saharan African power transmission and distribution: Developing pilot programs for the reduction of technical losses

by Martin Burian, GFA Consulting Group | Francis Masawi, Energy and Information Logistics Group | Joachim Schnurr, GFA Consulting Group | Washington Zhakata, Ministry of Environment, Water and Climate, Zimbabwe | Peter Zhou, EECG Consultants | Francis Yamba, CEEEZ | Samuel Zaranyika, Zimbabwe Energy Regulatory Authority | Jonathan First, Development Bank of Southern Africa

In implementing the Paris Agreement, one decisive factor involves identifying economically viable abatement potential. Focusing on interventions characterized by negative marginal abatement allows for reductions in both GHG emissions and overall expenditure[1]. In practice, however, such abatement potentials are often hampered by a lack of appropriate policy incentives and financing barriers.

The cooperative approaches enshrined in Article 6.2 of the Paris Agreement offer a unique opportunity to explore sectoral baselines and targets, which could be combined with results-based carbon financing instruments and could in turn foster beneficial power sector policy amendments. This article shares initial experience gained in a pilot activity conducted in four Sub-Saharan African (SSA) countries resulting in energy efficiency and emission reductions due to Reactive Power Compensation (RPC) at commercial and industrial facilities.

We propose practical options for applying Article 6.2 to assist developing countries in funding the achievement of their Nationally Determined Commitment (NDC) and longterm climate goals under the Paris Agreement. The work included consultations with key stakeholders in Mozambique, Uganda, Zambia and Zimbabwe in developing the proposed pilot program for reducing technical transmission and distribution losses.

The Concept of Reactive Power Compensation

- Reactive power is an integral part of the electricity system and is needed, for example, to power electric motors. However, it is does not deliver actual work and as such oscillates within the distribution and transmission system, causing system inefficiencies and technical losses.
- In Sub-Saharan Africa, the development of transmission and distribution (TD) systems has not always kept up with the growth in electricity demand. This has led to suboptimal system design, significant load shedding and outages. Consequently, many SSA countries are confronted with high technical transmission and distribution losses.
- Moreover, a widespread lack of cost-reflective tariffs renders some utilities weak as regards their financial standing, which in turn further hampers much needed TD infrastructure investment. Consequently, many SSA countries are burdened with high technical TD losses.
- Reactive power compensation could serve as a mitigation measure which could store reactive power locally at the load/end customer and hence avoid related losses in the TD system. This in turn reduces the equivalent amount of power needed to meet demand, thus reducing related GHG emissions.

1 Negative marginal abatement costs are defined as interventions which, when compared to the business as usual option, allow cost savings to be made over the lifetime of the investment while reducing GHG emissions. For our analysis, we considered a social discount rate suggested for energy infrastructure investments in SSA (6%) which is substantially below the commercial lending rates in the four study countries (15.5% to 24.5% p.a.).

Stakeholder Meeting in Maputo

Approach for Stakeholder Involvement

The study's implementation was guided by the understanding that GHG reduction programs in the electricity sector need to be deeply rooted in sector planning processes. Consequently, the study brought together key stakeholders from i) climate change focal points, ii) energy ministries, iii) energy regulators and iv) power utilities or transmission/distribution companies (depending on the degree of unbundling) to discuss reactive power compensation and related energy savings.

The stakeholders from all four study countries joined workshops in Maputo, Mozambique and in Livingstone, Zambia to discuss the methodology, exchange views on the different approaches for maximum demand (MD) charges[2] and analyze the barriers for broad RPC uptake. This allowed the group to develop the scope of the financing instrument and discuss the possible inclusion of the RPC subsector in NDC targets (provided funding for an appropriate financing instrument is available).

Evaluation of Abatement Potentials and Related Policies

In order to estimate the abatement potentials, the following work steps were conducted:

- A methodology to estimate baseline emissions and emission reductions was developed building on the existing CDM methodology AMS-II.T: Emission reduction through reactive power compensation in power distribution network (version 1.0). The methodology was used to assess energy savings (see data analysis below) to establish a GHG crediting baseline for the power subsector using

2 Large electricity customers (customers with a peak demand of above 300 kVA) operate under an MD tariff. This tariff foresees payments for i) power consumed (kWh/month) and ii) a maximum demand charge which is typically related to the highest power offtake (in kVA) over a 30-minute period during one month. Some countries have applied differentiated MD payment schemes which also foresee rewards and penalties for reactive power (e.g. Uganda) or charge reactive power (Mozambique).

an Approved Standardized Baseline (ASB1 and ASB6). These elements may help to build a bridge between the achievements of the CDM and the design needs of Article 6 activities.

- Detailed analysis of maximum demand customer (MD) datasets comprising 748,550 data points for 439 customers connected to the transmission system, and 13,821 customers connected to the distribution system (covering 100% of MD customers in the four countries corresponding to 46% of the countries' total electricity demand). This allowed estimates to be made of the load-dependent technical losses incurred by each customer, as well as assessments in respect of intervention design, investment cost, reductions in electricity bills, payback periods (PBP) and GHG abatement.
- In line with the overall objective of the study, we did not consider the total theoretical abatement potential, but solely interventions which in principle make economic sense. An intervention is defined as economically viable if the RPC investment results in net savings for the customer over the equipment lifetime of 15 years.
- Discussion of conditional/unconditional NDC targets as well as the breakdown of ambition to this subsector.
- Modelling of policy amendments and their impact on electricity consumers' investments in energy efficiency equipment.

Development of a Carbon Finance Instrument

Lenders in the four study countries face prime lending rates ranging from 15.5% to 24.5% per annum, rendering RPC interventions financially unviable if the PBP exceeds 4-5 years (i.e. without cost of finance). Hence, work on the carbon finance instrument had the dual objective to:

A) Reduce the interest payment for energy efficiency investments by the private sector

B) Pursue a cost effective carbon finance instrument (taking the shortfalls of the CDM into account) which offers carbon payments only where needed.

Table 1: Prime Lending Rates

Country	*Prime Lending Rate*
Mozambique	24.50%
Uganda	21.00%
Zambia	15.75%
Zimbabwe	19.40%
Average	20.16%

Source: Data reported by utilities/transmission and distribution companies

To develop an effective carbon finance mechanism, a two-phased approach was applied:

- In a first step, Export Credit Agency (ECA) cover is provided which enables significant reductions in interest rates. Following consultations with the German ECA, Euler Hermes, ECA cover covers up to 85% of the total loan volume and comes with an annual interest rate of 4.42% for the study countries. Moreover, there is a onetime ECA fee of 9.83%. However, ECA cover should not be used for long term lending and a payback period of 6 years was foreseen.
- The remaining 15% not covered by the ECA may be provided by a development finance institution, such as the Development Bank of Southern Africa (DBSA), with interest rates in the range of 13% per annum complemented by a one time payment of 1.5%.
- This results in an overall lending rate of 8.38% without carbon finance, which enables significant reductions in financing costs compared to the non-ECA covered prime lending rates.
- In a next step, we determined the payback periods for all economically viable interventions, including cost of finance. No carbon finance is provided if the payback period of an intervention including these costs is less than 6 years. If the payback period including these costs is more

Table 2: Possible Impact of Carbon Finance Mechanism

Country	*No. Customers*	*Investment Needed (in USD)*	*MD Payment Reduction (in USD/yr)*	*Reduction of Technical Losses (in MWh/yr)*	*ERs (in tCO2/yr)*	*ERs in Total over 15 years*	*One-time Carbon Payment (in USD)*
Mozambique	3 [4]	1,909,562	345,082	152,496	144,734	2,171,009	1,054,029
Uganda	583	25,892,565	7,414,212	92,726	47,615	714,220	2,478,782
Zambia	535	24,937,200	12,164,358	103,222	97,968	1,469,515	2,246,103
Zimbabwe	333	15,302,485	4,879,872	174,776	165,880	2,488,194	3,261,791
Total	**1,454**	**68,041,812**	**24,803,524**	**523,219**	**456,196**	**6,842,938**	**9,040,705**

than 6 years, the amount of carbon revenue is determined that reduces the payback period to 6 years[3].

Discussion of Results

The above approach enables identification of the economically viable abatement potential, private sector investment and reduction of electricity bills. The approach also allows an estimate to be made of the carbon finance required to leverage commercial finance, as follows:

The one-time carbon payment shown above amounts to USD 9.04 million. To facilitate investment, it is proposed that this payment be made at the time of investment (i.e. frontloaded). However, the rollout of the intervention is expected to be achieved over a period of 5 years, thus requiring disbursement of upfront investments over the period 2019 to 2023.

The carbon program will trigger an overall abatement potential of approximately 6.8 million tCO2 over 15 years for all four study countries. The average ER price amounts to 1.32 USD/tCO2, which is a result of i) combining ECA cover with carbon finance, and ii) pursuing a carbon finance approach which offers customer-specific carbon payments aligned with the customer's marginal abatement cost.

The private sector leverage factor allows an assessment to be made regarding the extent to which a financing instrument

Table 3: Carbon Price Analysis

Emission Reductions (in tCO2)	6,842,938
Carbon Payment (in USD)	9,040,705
Average ER Price (in USD)	1.32

Table 4: Leverage Factor Analysis

Total Investment (in USD)	68,041,812
Carbon Payment (in USD)	9,040,705
Private Sector Leverage Factor	7.53

3 Moreover, we considered specific circumstances in Zambia. Due to the broad application of MD tariffs in Zambia, the abatement potential is distributed among a large number of small customers with above-average payback periods. To address the specific circumstances for Zambia, we determined the cost of one emission reduction per customer and selected those interventions which show cost of less than 7.5 USD/tCO2. This enables selection of only those customers for which carbon finance has the highest impact in terms of emission reductions per USD invested.

4 Please note, Mozambique's current regulatory framework does not provide any incentive for PF improvement in the distribution customer segment. Out of the 12 transmission customers, only three electricity consumers would require carbon subsidies.

contributes to crowding in private sector funding. We estimate that USD 9.0 million of carbon payment will facilitate USD 68.0 million of private sector investment, resulting in a leverage factor of 7.5.

The dataset indicates substantial further potentials for energy policy amendments. A cost-efficient policy framework would provide incentives, so that the cost of generating one additional unit of electricity corresponds to the cost of saving one additional unit of electricity.

Based on the recently-approved expansion plan of the Southern African Power Pool (SAPP, 2017), we determined the costs of electricity generation from new power plants included in the expansion plan up to 2040. The electricity costs per technology range from 8.57 USDc/KWh to 14.73 USDc/kWh. However, the weighted average for the cost of electricity savings per county range from 0.62 USDc/kWh in Mozambique to 2.27 USDc/kWh in Uganda. This highlights the potential for introducing a cost-effective policy framework in Sub-Saharan Africa.

Discussion of Benefits

The figure below illustrates the expected benefits and co-benefits that may occur due to power factor correction measures by stakeholder categories.

The improvement of the power factor in the facilities of MD customers is embedded in the following economic framework:

Reduction of GHG Emissions

The reduction of technical losses allows power utilities to produce and supply the same amount of

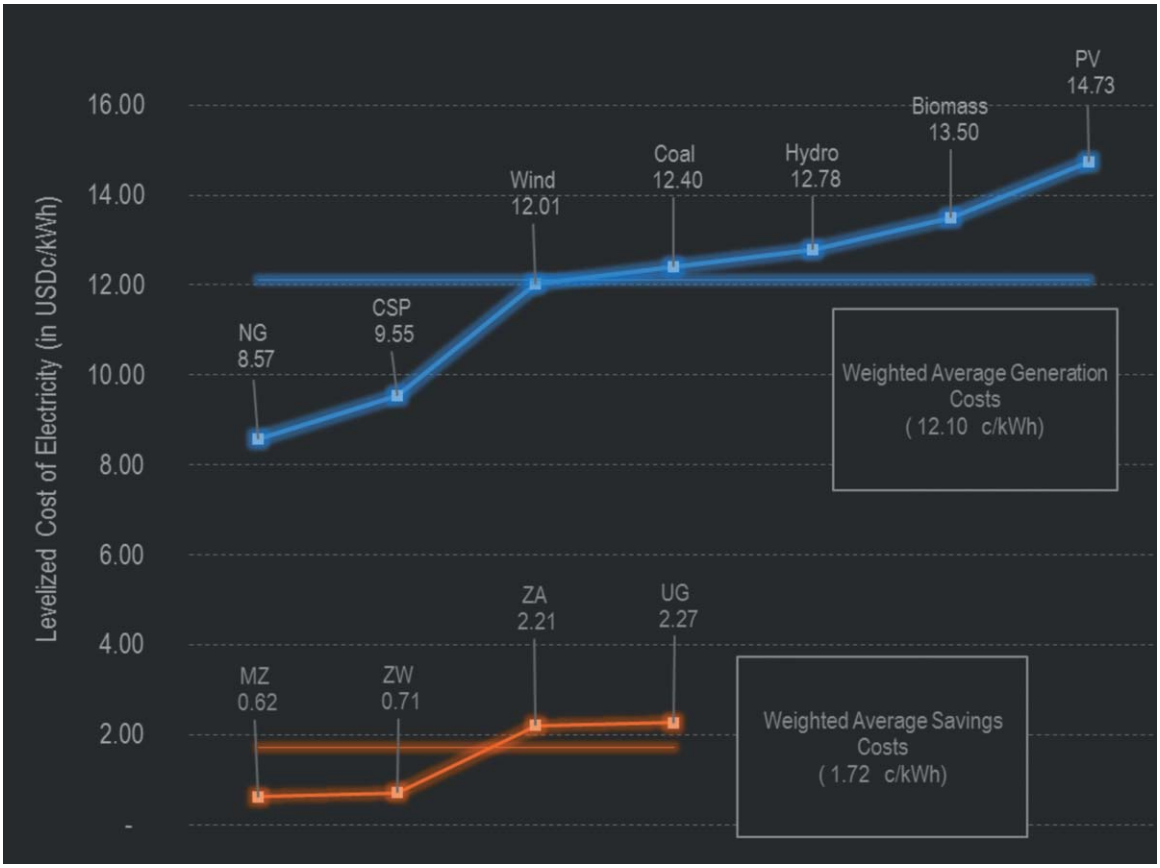


Figure 2: Electricity Generation Costs versus Electricity Saving Costs

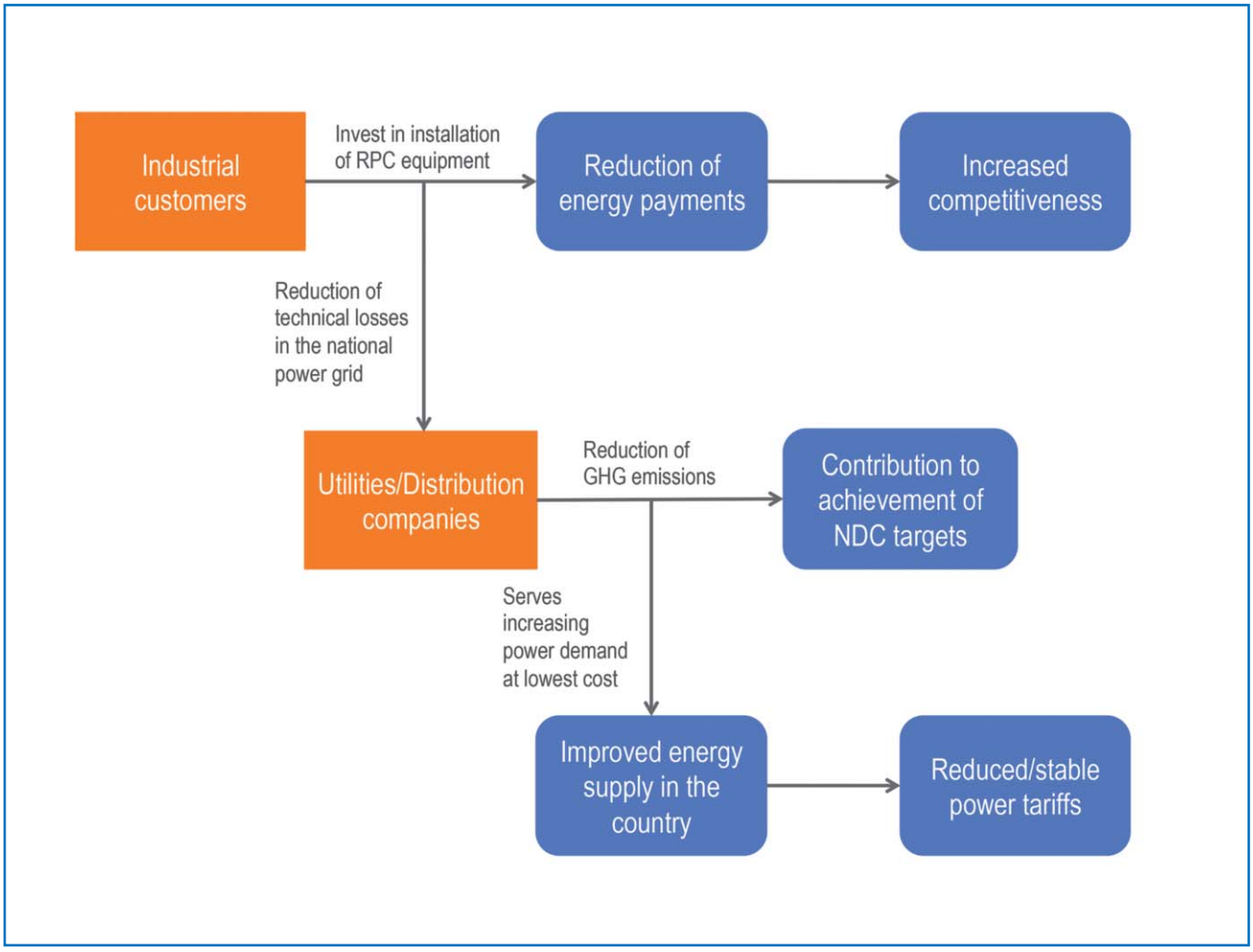


Figure 3: Overall Benefits for Stakeholders from RPC Equipment in the Pilot Countries

power to its final customers while using less fossil fuels – or in the case of suppressed demand/load shedding, to supply more power while burning the same amount of fossil fuels. This leads to a reduction in greenhouse gas (GHG) in the electricity sector in the amount of 456.20 ktCO2/year, corresponding to 6.84 million tCO2 over the lifetime of the equipment. RPC interventions will support the countries in achieving their national NDC targets or may lead to an increase of ambition.

Reduction of Energy Payments and Increased Competitiveness

RPC interventions improve the power factor (PF) and hence reduce the peak demand, measured in kVA. This reduces the maximum demand payments of electricity consumers operating under an MD charge, leading ultimately to a reduction in the electricity bill without affecting the actual load (kWh). A reduction in electricity costs increases the economic competitiveness of small and mediumsized enterprises (SMEs) in the study countries.

The four countries studied assess the economically viable abatement potential and indicate an aggregated investment need of USD 64,04 million (without cost of finance), resulting in an aggregated reduction of USD 372,05 million over 15 years[5].

Improved Energy Supply and Reduced Tariffs

Technical losses in the transmission and distribution systems of the study countries range between 16.00% and 19.36%. A lack of cost-reflective tariffs and the resulting weak financial standing of the power utilities in the region results in barriers which prevent utilities from investing in efficient transmission and distribution infrastructure. The program addresses this issue by incentivizing MD customers to invest instead, with a resultant positive impact for the entire power system in the form of a reduction of load-dependent technical losses in transmission and distribution.

The results of the four country studies indicate that the economically viable RPC potential would lead to a reduction in technical, load-dependent losses in the amount of 523.22 GWh/year. This enables the utilities to sell more power using the same generation assets and the same amount of fuel. In the short run, this may help power utilities/power distribution companies to return to profitability. However, most study countries have tariff methodologies in place which determine the electricity cost by taking account of system losses (among other things). Hence, the reduction in technical losses could in the mid-term reduce the costs of electricity or avoid an increase in electricity tariffs.

Conclusions and Next Steps

- A sectoral crediting instrument combined with innovative financing for the private sector would be needed to overcome unique barriers in investing in transmission and distribution infrastructure in Africa.
- The financing instrument requires commercial banks (as the operators for ECA cover) as well as a development bank for operation. Consultations with five regional commercial banks, Euler Hermes and DBSA were conducted, who all confirmed their interest in participating in the financing program.
- Currently, different financing agencies and donors are assessing their interest in funding/co-funding an Article 6 pilot program. Provided funding is secured, Article 6 pilot projects may be implemented prior to 2020. The agreements between the study and donor countries need to be negotiated in respect of various issues, such as accounting of emission reductions generated from the program and its consideration in the reporting requirements to UNFCCC (e.g. Biennial Update Report, National Communication).

The proposed financing instrument could allow leverage of the sectoral energy saving and GHG abatement potentials in Mozambique, Uganda, Zambia and Zimbabwe. Successful implementation could serve as a test case for a larger-scale regional approach to address cost-efficient abatement potential in Sub-Saharan Africa – estimated at 9.07 million tCO_2 per year.

5 Please note, this refers to undiscounted savings, assuming peak demand and MD tariffs remain the same.

Getting Started

Tunisia: First country eligible for funding under the Nitric Acid Climate Action Group

by Anne Gläser, GIZ

In its Nationally Determined Contribution (NDC), Tunisia sets out an unconditional target of reducing the carbon intensity of its economy by 13% between 2010 and 2030. The NDC further includes a conditional target of reducing the carbon intensity by 41% in the same time span. Tunisia estimates that achieving the conditional target would require the mobilization of USD 17 billion by 2030.

In terms of greenhouse gas emissions, the chemical industry is an important sector of the Tunisian economy. One high-emitting industry is the nitric acid producing industry where the most relevant emitted greenhouse gas is nitrous oxide (N_2O). Operated by the Tunisian Chemical Group (Groupe Chemique Tunisien, GCT) and located in Gabès, Tunisia's only nitric acid plant produces 257,000 t of nitric acid per year. Its estimated annual GHG emissions amount to 0.3 – 0.5 $MtCO_2e$.

Stakes in the future: Tunisian and German representatives at the signing of the NACAG Statement of Undertaking.

In order to scale up its climate action, Tunisia has now decided to reduce the N2O emissions from nitric acid production. This move is supported by the Nitric Acid Climate Action Group. The Nitric Acid Climate Action Group (NACAG) is a climate initiative of the German government that facilitates the phasing out of nitrous oxide emissions from nitric acid production, cp. CMR I4C Special 2018. NACAG aims to incentivise the installation of abatement technology in nitric acid production plants in order to reduce N2O emissions, thereby contributing to climate change mitigation. To this end, the action group is providing grant financing for the installation and operation of abatement technology until the end of 2020.

This financial support is subject to one condition: Partner countries have to commit to taking full responsibility for the mitigation activities after 2020. Tunisia is the first country to make this commitment and hence to formally join NACAG. On 28th of February 2018, the Tunisian Minister for the Environment, Mr. Riadh Mouakher, signed the official Statement of Undertaking of the Nitric Acid Climate Action Group in Tunis. By signing this document, Tunisia agrees to phase out nitrous oxide emissions from nitric acid production and to permanently ensure the use of abatement technology. The signature renders Tunisia (as the first country globally) eligible for receiving financial assistance from NACAG.

After Tunisia's formal accession to NACAG, the GCT was able to apply for financial support from the NACAG Secretariat. In order to be able to provide financial assistance, the NACAG Secretariat operated by GIZ has to carry out both a commercial and a technical due diligence assessment. In the framework of this evaluation, GIZ is assessing the technical, legal, financial and operational capacity of the GCT. Moreover, it is evaluating whether there are sufficient environmental, social, health and gender safeguards and policy guarantees in place. The NACAG Secretariat conducted the commercial due diligence assessment in June. A technical due diligence will follow later this year.

If the outcome of both due diligence assessments is positive, the NACAG Secretariat will issue a finance agreement, which will allow GCT to obtain grant financing. The grant will cover all costs related to the purchase, shipping, installation and maintenance of both emissions reduction technology and monitoring equipment until 2020. The next step would then be for GCT to issue an invitation to tender for the technology. The NACAG Secretariat, meanwhile, is providing technical assistance during the entire process, from advice regarding the choice of technology to guidance concerning the installation and operation of abatement and monitoring technology.

Tunisia's engagement with NACAG is an example of successful international cooperation, demonstrating how climate finance can incentivize a long-term transformation and achieve real and measurable results. While Tunisia's NDC target is economywide, the NDC does not explicitly mention the nitric acid sector. NACAG is paving the way for Tunisia to explicitly include the nitric acid sector in its NDC. In that way, the initiative is helping Tunisia to access an

NACAG at a glance

The Nitric Acid Climate Action Group (NACAG) was launched by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in 2015. The initiative aims to assure global abatement of N2O emissions from nitric acid production by 2020. It provides all governments and plant operators with guidance and information on technological and regulatory issues regarding N2O abatement.

Moreover, NACAG makes available financial support for the installation and operation of abatement technology. This financial support is subject to the condition that partner countries take full responsibility for the mitigation activities after 2020 – for example in the context of their Nationally Determined Contributions (NDCs).

Jordan, Tunisia, Mexico as well as the Federation of Bosnia and Herzegovina have already joined NACAG by signing the Declaration in support of NACAG's vision. Numerous other countries have expressed their interest in the initiative. Tunisia is the first country to have signed a Statement of Undertaking, confirming the continuation of abatement activities post 2020.

The Partnership for Market Readiness in Tunisia

Besides implementing measures to reduce nitrous oxide emissions in the chemical industry, Tunisia intends to use carbon pricing instruments, amongst others, to meet its NDC goals. As one of the 19 implementing countries of the Partnership for Market Readiness (PMR), Tunisia is receiving support for the development and application of carbon pricing policy measures. Tunisian stakeholders have identified three priority instruments:

- Introduction of a carbon tax to support the national Energy Transition Fund
- Introduction of a "results-based payments" system to support the development of renewable electricity facilities
- Experimentation and learning about the use of a carbon pricing system under the voluntary agreement framework with the cement industry

The PMR is supporting countries that want to use carbon market instruments to achieve cost-effective and innovative climate change mitigation. Established by the World Bank, the PMR is a global platform that provides grant funding for use in improving market readiness, pilots new concepts for market instruments, and facilitates South-South exchange and debate on new market instruments.

extremely cost effective mitigation option. The measures that will be implemented under the NACAG in Tunisia will result in the reduction of approximately 450,000 t CO_2eq per year. As the financial support is tied to the commitment by the Tunisian government to ensure longterm emission reductions after 2020, the sustainability of these emission savings will be guaranteed.

With the commitment to phase out nitrous oxide emissions being an integral part of NACAG's approach, Tunisia is now in the process of appraising a range of policy options to ensure permanent emission reductions. Amongst others, the government is considering both the development of an industry NAMA that encompasses N_2O emissions from nitric acid production and a domestic offsetting programme in the framework of a voluntary carbon market.

In Tunisia, the NACAG approach – combining financial and technical support to incentivize climate action in one specific sector – is clearly achieving success. One success factor is the longstanding cooperation between Germany and Tunisia built on mutual trust. Another important success factor is the dedication and commitment of all stakeholders involved – notably the GCT and the Tunisian government – to drive this programme forward. Last but not least, the success can be attributed to Tunisia's commitment to live up to the spirit of the Paris Agreement despite the challenges and obstacles involved. This is based on the realization that each and every country, region and municipality must play its part when it comes to fighting climate change.

The cooperation between Tunisia and NACAG demonstrates that international climate finance by donor countries can incentivize additional emission reductions and longterm action, leading to sustainable benefits for the atmosphere.

Further information on NACAG can be obtained at
www.nitricacidaction.org

Forward-looking Baselines for Results-based Financing

A new approach for measuring climate mitigation contributions in the power sector

by Massamba Thioyé, Janak Shrestha; UNFCCC Secretariat

Malte Krieger, Martin Burian, Joachim Schnurr; GFA Consulting Group

Several forms of market-based mechanisms, including emissions trading systems (ETSs), baseline and crediting mechanisms as well as bilateral offset schemes, are already being implemented in a range of developed and developing countries. In a baseline and crediting mechanism, credits are awarded if actual emissions are below a baseline level. This article discusses a new approach for measuring climate mitigation contributions in the power sector. The crediting baseline is determined using a combined margin approach where the weighted average of projected emission intensity (Build Margin) is represented by the most financially-attractive investment plan and the emission intensity of existing plants represents the Operating Margin. A similar approach is introduced to determine the baseline costs of electricity generation (benchmark). The baseline calculated in this way is forward-looking.

1. Calculating the Baseline Emissions

Baselines are the key elements of climate policy-making and are used to provide a benchmark for mitigation targets, estimate the mitigation impact and assess progress in implementation.

The units generated by a mitigation activity under a baseline and crediting mechanism, should ensure environmental integrity regardless of their intended purpose (compliance or cancellation). This requires a robust GHG accounting methodology, which provides guidance to objectively:

- Determine the baseline emissions that would have occurred in the absence of the incentive created by the mechanism.
- Quantify the emission reductions and ensure that they are long-term, measurable and verifiable.

1.1 Determining a forward-looking baseline emission factor for the power sector

The baseline emission factor of a power sector (tCO_2/MWh) is a critical piece of data used in assessing GHG mitigation activities, enhancing renewable energy share and improving energy efficiency. Once established, it can be used as a single default emission factor for the sector and serve as its performance benchmark. The standardized baselines developed for Southern and Western African Power Pools (SAPP and WAPP) under the CDM methodological framework are a fitting examples.

A forward-looking approach for baseline setting in the power sector, applicable to results-based financing schemes (RBF), is thus proposed. It sets the benchmark emission factor for the power sector as the most conservative between (i) the sector's future emissions factor based on the least-cost future investment plans[1] and (ii) the sector's emission

1 For example, countries' long-term least-cost electricity generation expansion plan would include government policies to meet their respective country's development prerogatives.

trajectory under the policy scenario, ensuring alignment with long-term power sector development and national policies.

The section below provides the steps involved in estimating a forward-looking baseline emission factor (tCO_2 per MWh of net electricity generation) for grid electricity systems.

1.2 Estimating a forward-looking baseline emission factor for grid electricity systems

Two approaches are considered in estimating the baseline emission factor: one using a combined margin method and one using average projected emissions.

Method 1: Using a Combined Margin Method

This method considers forward-looking features based on a country's/region's official long-term power sector development plan using least-cost principles and the merit order dispatch appraisal[2]. The baseline emission factor of the power grid is constructed using a Combined Margin (CM) that comprises an Operating Margin (OM) and a Build Margin (BM).

Determination of BM (tCO_2/MWh): The BM emission factor is calculated based on the projected emission intensity of the candidate/new plants in the baseline investment plan. The baseline investment plan is set using a least-cost generation expansion planning model covering the entire planning horizon for the grid system(s).

Determination of OM (tCO_2/MWh): This OM emission factor is calculated using the average emissions of the existing plants using the most recent historical information. The addition of more renewables as compared to the baseline investment plan would have an impact on the merit order dispatch of existing plants on the margin, hence on the OM emissions[4]. The following sets out the reasons why OM should be considered, even in the context of a forward-looking approach:

- The additional intermittent/variable renewable energy (VRE) generation would require more power capacity to displace the same effective energy from non-intermittent electricity generation (dispatchable)[5]. For example, to produce equivalent electricity from a 1 MW Combined Cycle Gas Turbine (CCGT) (85% capacity factor), 3 MW equivalent wind capacity (25% capacity factor) would be needed. This would mean that when operating, part of the wind capacity (say, 1 MW) would displace what would have been generated by the avoided investment in CCGT, but the remaining 2 MW capacity would either displace the dispatchable electricity generation or would cause overproduction depending on the load-demand situation.
- In addition, only a fraction of potential output of VRE will be available at times of peak demand. Thus, the more renewable energy we have on a grid, the more peak-load plants would be needed in the system to compensate for the lower contribution to adequacy and to maintain the targeted reliability level of the system (IEA, 2015). The figure below illustrates that a very small portion of power capacity can be replaced by the additional VRE due to its

Operating Margin versus Build Margin

The Operating Margin (OM) represents the average emission factor of the electricity generated by existing plants on the margin in the existing dispatch hierarchy, i.e. that will most likely be displaced by the electricity generated under new projects implemented between the date the OM is determined and the date of its next update[3]. The Build Margin (BM) is the average projected emission factor of new generation capacities from the least-cost investment plan that will be displaced by the actual investment plan and is hence the baseline investment plan. The OM and BM are combined to calculate the Combined Margin (CM). This approach is used as a simplified proxy to evaluate the impact of new electricity generation in the operation of the grid system and based on the merit order dispatch principle.

2 Under the merit order, typically the low-cost electricity generating units are dispatched first and the most expensive plants are dispatched last.
3 The average OM emission factor is determined across the plants at the margin and during the time between the date the OM is determined and the date of its next update.
4 Generation from low-cost must-run (renewables, nuclear) plants are excluded if their share in the total electricity generation is less than 50 per cent. The underlying assumption is that if the share of renewables is not significant, their generation would not be impacted by the addition of new capacity.
5 Dispatchable power plants and those that have controls that allow them to be dispatched (i.e. ramped up and down in response to real-time fluctuations in demand for electricity), meaning the power plants which in general produce a given output when required to by the operator (load dispatch centre).

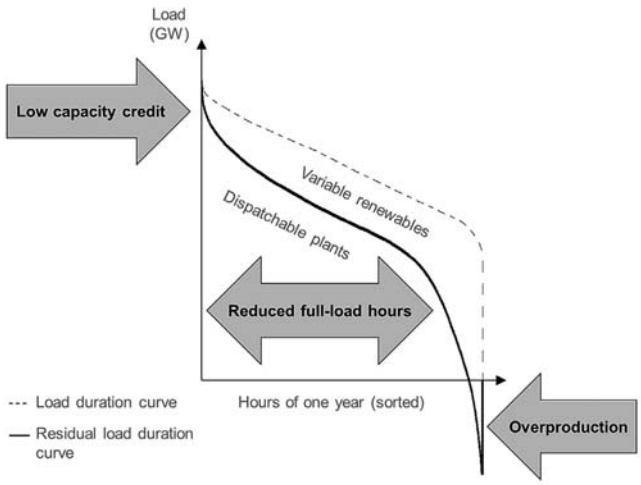


Figure 1: Impact of VRE on operating margin; Source: Ueckerdt (2013)

low capacity credit (proxy to BM effect), the full-load hours of conventional plants are reduced (proxy to OM effect). At higher shares, VRE supply exceeds load and may need to be curtailed.

Note: Residual load system is the non-VRE part of a power system which is total system load minus VRE supply. Thus, it encompasses other (residual) generation, grids, and system operation

Determination of Combined Margin: The CM emission factor is the weighted average OM and BM emission factors[6], applied for the entire life time of the renewable energy plants implemented under the RBF scheme:

a. For solar and wind, CM = 0.75 * OM + 0.25 * BM.

b. For other renewables and energy efficiency, use CM = 0.33 * OM+0.67 * BM

Validity and Update: The baseline emission factor could be updated every three years. The updated benchmark must integrate the newly projected power plants, including those that will be incentivized by the RBF scheme. Hence, the update would capture the progress in the implementation of domestic mitigation action and the increasing role of credited plants.

Method 2: Average projected emission factor

The average projected emission factor is estimated on an annual basis, and is the total projected emissions divided by the total projected electricity generation from existing and new plants in the given year. Electricity generation and GHG emissions from low-cost must-run plants are included. In this way, this method is equivalent to the Tier 3 approach contained in the IPCC 2006 Guidelines for estimating activity emissions in the power sector.

2. Determining the Benchmark Costs for Eligibility Assessment

The financial benchmark (USD/MWh) is critical in identifying electricity generation projects that would be eligible to receive financial support. It may serve as a reference value to rationalize the design of renewable energy support programs (e.g. feed-in premium for small-scale renewables involving solar and wind) and to evaluate their potential impact in terms of costs and emissions.

Levelized Cost of Electricity Generation (LCOE) involves the full life-cycle costs (fixed and variable) of a power generating technology per unit of electricity (MWh) and is often used as a metric to evaluate the cost of electricity generation technologies. However, the comparison of LCOE of variable/intermittent renewable technologies such as solar and wind with non-intermittent/dispatchable technologies would in some cases be misleading because of the intermittency that carries the temporal and spatial imprint of its resource, which is more modular than conventional technologies (IEA, 2015). The LCOE considers only direct input costs and implicitly assumes that the electricity generated from different sources has the same economic value (Joskow, 2011). If used as a measure of economic cost for a generation technology, the LCOE of the VRE would not reflect its true market value as it does not take the interactions

6 The weights are based on CDM Tool 07: Tool to calculate the emission factor for an electricity system (EB97, Annex 7)

between that power plant and the rest of the electricity system into account (see, for example IEA, 2015; Ueckerdt et al, 2013).

Different types of economic effects in a grid system due to the addition of variability/uncertainty of energy being produced by intermittent renewables are:

a) **Avoided Cost:** This generally includes reduced fuel costs and reduced externality cost related to emissions, among others.

b) **Incremental Cost (Grid Integration Cost):** This includes the cost of VRE deployment itself (LCOE) and other additional grid integration cost, for example for providing balancing services.

In the following, two approaches are considered that could serve as a proxy to estimate the economic effects described above, which inform the design of the benchmark for financing the mitigation activity.

2.1 Method 1: Avoided cost

This method is used to determine the financial benchmark using the weighted average levelized cost of electricity generation of marginal power plants (OM and BM) in the baseline. This is the same approach that was considered for determining the emission benchmark.

Levelized Cost of Operating Margin Plants: The levelized cost of electricity generation of operating margin plants (OM LCOE) represents operating expenditure (fuel, variable and fixed O&M cost) per unit of electricity produced (USD/MWh). The capital expenditure is not considered because it represents sunk cost. In selecting the operating margin technologies, all existing plants that are in operation are considered.

Levelized Cost of Build Margin Plants: The BM LCOE represents technology-specific investment and operating costs (fuel, variable and fixed O&M cost) per unit of electricity produced (USD/MWh). The BM power plants represent all the new/candidate plants in the baseline investment plan.

Plant-specific OM LCOEs and BM LCOEs are then used to determine specific LCOEs by technology. The weighted average electricity production by plant type and its share in the total generation mix over the planning timeline is estimated. LCOE of the plant types contained in the margin are weighted according to their share to determine the weighted average LCOE OM and LCOE BM separately.

The CM emission factor is the weighted average of LCOE OM and LCOE BM. The weights applied in determining emission benchmark are also applied:

a. For solar and wind: LCOECM = 0.75 * LCOEOM + 0.25 * LCOEBM

b. For other renewables: LCOECM = 0.33 * LCOEOM + 0.67 * LCOEBM

CM LCOEs using different weights for different technologies would imply the cost of electricity generation that new interventions may incur, arriving at a regional/country-specific financial benchmark for intermittent (e.g. solar and wind) and other renewable technologies (Hydro, Biomass).

Furthermore, the following assumptions were made in performing the LCOE analysis:

- Since the LCOE is highly sensitive to the discount rate, country-specific discount rates which approximately reflect the individual country risks on cost of capital are to be applied.
- International fuel prices are considered instead of country-specific fuel prices. This is conservative as potential fuel subsidies are neglected which would otherwise lower the baseline cost of electricity generation and thus result in higher incremental costs. Also, assuming international fuel prices allows the comparison of baseline cost on a level playing field across countries.

Results and Discussion (Method 1): The discussion below is based on the modelling results of the least-cost generation and transmission expansion study carried out for the South African Power Pool (SAPP Pool Plan, 2017) interconnected grid system.

The financial benchmark (CM LCOE) is determined selecting the scenario which is the most cost-effective among all the scenarios studied such that it would represent the most likely baseline investment plan.

The financial benchmark is determined at **49.79 USD/MWh** for intermittent renewable energy technologies and **57.47 USD/MWh** for other renewable energy technologies.

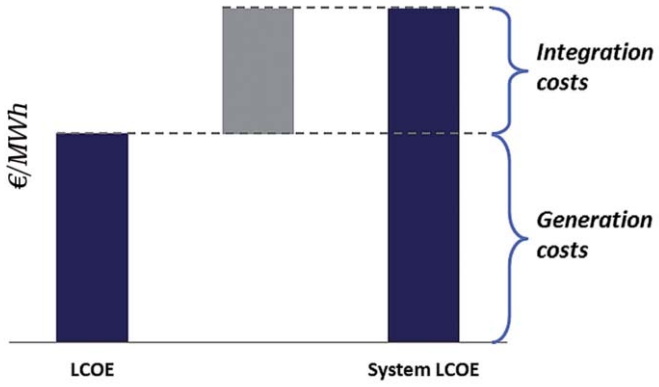


Figure 2: System LCOE of VRE (for illustration only) Source: Ueckerdt (2013)

The financial support for renewable energy projects would be determined based on this threshold. It is envisioned that potentially-supported renewable energy technologies will be first screened by means of a competitive bidding process. Project developers would submit bids, at which level they would consider electricity generation financially viable. The difference between the bid and the financial benchmark would then determine the size of the premium. For example, a solar PV project which offers a bid price of **70 USD /MWh** would be eligible for receiving **20.02 USD/MWh (70 – 49.79 USD/kWh)** as a feed-in premium to make the project financially competitive against the baseline average cost of electricity generation.

2.2 Method 2: Avoided cost with incremental cost/grid integration cost

This method is used to identify the system incremental cost due to the increase of renewables in the given grid as compared to the baseline. The benchmark is then determined by adding the integration cost on top of the benchmark determined using method 1.

The integration costs of adding VRE such as solar and wind represent all additional investment and operational costs in the non-intermittent part (residual system) of the power system when VRE are introduced. In other words, the total LCOE from the grid system perspective (System LCOE) is the sum of LCOE of generation and integration cost (see figure below for illustration):

$$System\ LCOE\ \left(\frac{USD}{MWh}\right) = LCOE_{VRE} + \Delta$$

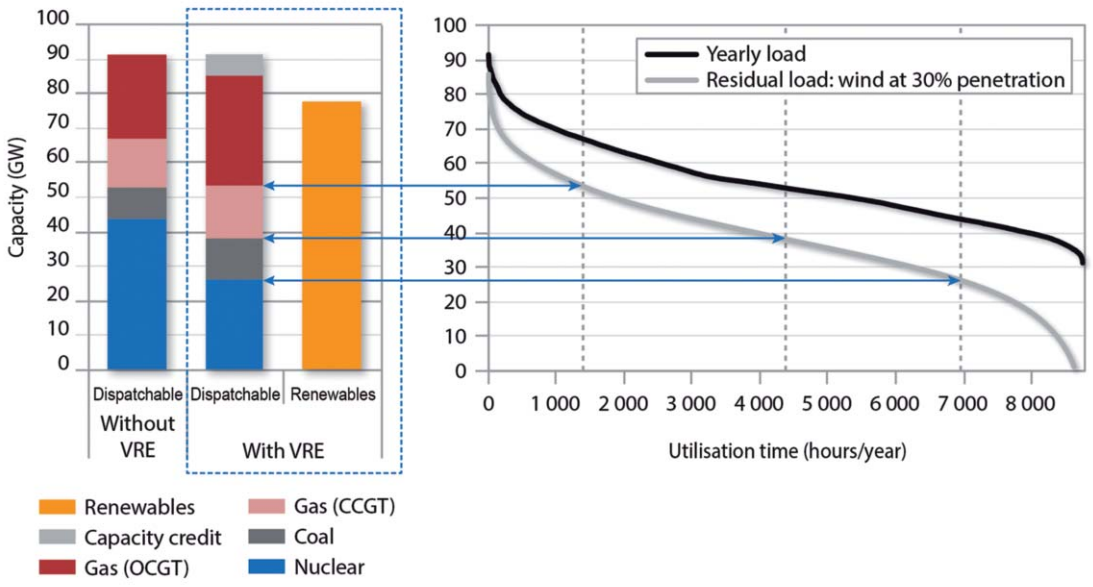
Δ Represents the increase in integration cost when marginally increasing VRE generation (USD/MWh)

In determining the portion of costs that are actually additional (i.e. attributable solely to integration cost), two power system states – with and without VRE – are compared. The illustrative example above shows the effect of high penetration of VRE on the residual demand and the consequent change in the long-term optimal generation mix.

Note: Residual load system is the non-VRE part of a power system which is total system load minus VRE supply. Thus, it encompasses other (residual) generation, grids, and system operation.

Since the integration costs of VRE are defined as not being part of the generation costs of VRE, the total discounted cost per unit of discounted energy of the residual load system costs with and without VRE is compared[7]. The data of the entire planning horizon is

7 The absolute difference in the corresponding residual power system costs contain not only integration costs, but also the value of VRE generation mainly due to fuel savings. Hence, a comparison of the absolute residual costs does not allow separating integration costs.



Note: Figure based on load data and wind profile for France 2011. Wind generation scaled to a penetration of 30%; scaling may overestimate the impact of variability. For illustration only.

Figure 3: Optimal long-term generation mix with and without VRE (for illustration only) Source: IEA (2015)

considered (2017-2040). The integration cost is calculated as the difference in specific costs (per MWh residual load) in the residual system times the residual load. For detailed methodological steps, please refer to Ueckerdt (2013).

Results and Discussion (Method 2): The international communities interested in enhancing the uptake of VRE may be interested to know the incremental cost of transformation towards a power system with high shares of variable renewables.

The analysis shows that in the "With VRE case", the specific residual costs increase as compared to the "Without VRE case". The integration cost is estimated at 8.13 USD/MWh (6.51 EURO/MWh).

This integration cost (8.13 USD/MWh) could be considered in the financial support for renewable energy projects and added to the benchmark (49.79 USD/MWh for intermittent renewable energy technologies and 57.47 USD/MWh for other renewable, energy technologies, as determined by Method 1).[8]

3. Final Remarks

This article discusses new methodological approaches for setting the benchmark for emissions (baseline grid emission factor) and for cost of electricity generation (financial benchmark, LCOE). It also describes how the benchmark may be used under an RBF scheme as a tool for determining:

a. Which technology should receive financial support

b. How much financial support should be offered to a specific technology

The emission benchmark based on a robust modelling exercise covering the given sector may address the needs of a strong procedure which ensures envi-

8 It must be noted that the integration cost may not be applied for non-intermittent/dispatchable renewable energy technologies such as hydropower and biomass as their effect on the power system is different compared to VRE technologies as discussed above.

Source: KfW Bildarchiv/ photothek.net

ronmental integrity and conformity with the development objectives and policies of the host countries.

Given the expected progress in the implementation of domestic mitigation polices/actions and the increasing role of crediting plants, the modelling exercised needs to be carried out at regular intervals and the crediting baseline must be updated as required. Modelling of the baseline on a long-term basis should minimize inherent uncertainties and take learning rates into account, thus leading to robust load demand forecasting.

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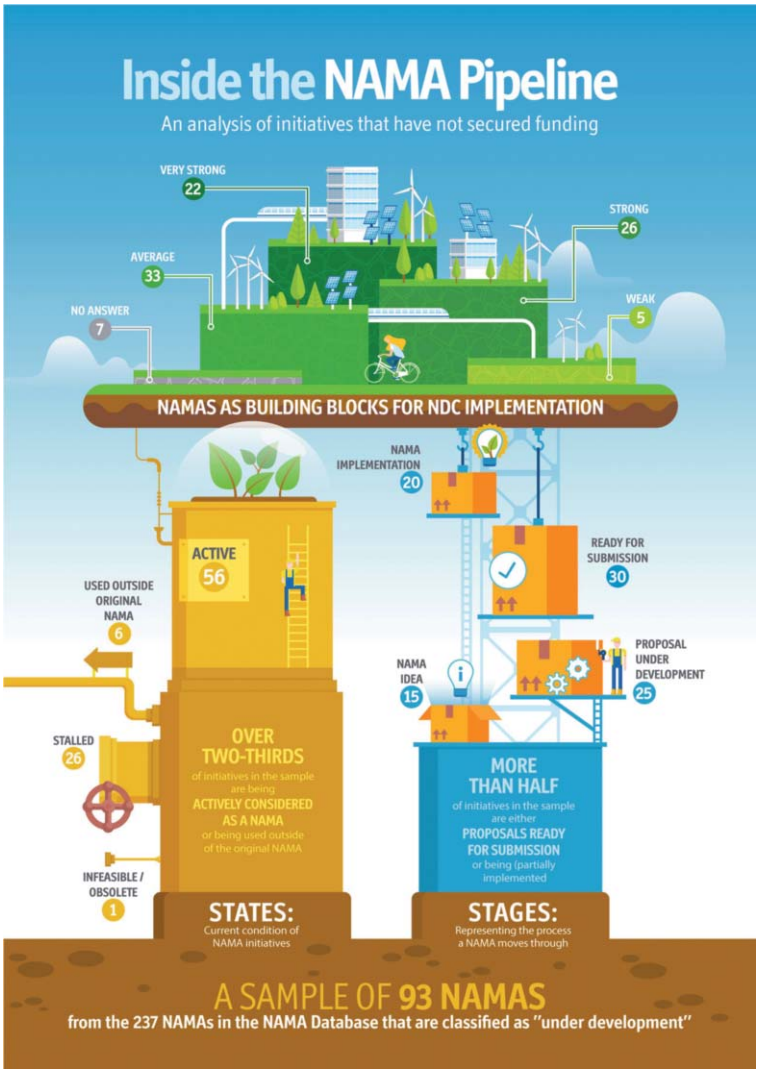
What Happenend to all the NAMAs?

Analysing initiatives that have not yet secured funding

by Matthew Halstead and Xander van Tilburg, Netherlands Organisation for Applied Scientific Research (TNO)

A recently published discussion paper explores the condition of the NAMA pipeline and the links between NAMAs and NDCs, and identifies lessons and experiences from NAMA development. This article summarises the contents of the discussion paper, which can inform practitioners and policy-makers who are working on the role that carbon market mechanisms can play in mitigation of GHG emissions.



Most existing analysis about Nationally Appropriate Mitigation Actions (NAMAs) focuses on those NAMAs that have managed to secure funding for implementation from the NAMA Facility, representing less than 10% of all NAMAs recorded in the NAMA Database[1]. The current status of more than 90% of NAMA initiatives remains vague. In our paper we look beyond this 90% statistic to begin to unveil the current condition of these NAMAs. We also explore the link between NAMAs and NDCs, and the role that NAMAs might play in NDC implementation. What we have observed so far is that there is diversity in the NAMA pipeline: many initiatives are under 'active' consideration – for example being redesigned for resubmission to the NAMA Facility or re-engineered to target alternative funding sources – and some are close to, or even already under implementation after securing finance from sources outside of the NAMA Facility. Perhaps inevitably, some have stalled and are not being actively pursued.

1 The NAMA Database contains information on Nationally Appropriate Mitigation Actions (NAMAs) happening around the world, collected from publicly available information on NAMA related activities. The database can be accessed via http://www.nama-database.org/index.php/Main_Page. NAMAs are categorised in the Database either as being 'under development or 'under implementation'. For a description of these categories see page 12 of the 2017 Annual Status Report on NAMAs: http://mitigationmomentum.org/downloads/Mitigation-Momentum-Status-Report-NOV2017.pdf.

We know that more than 90% of NAMAs have not secured implementation funding from the NAMA Facility, and our research looks behind this statistic to find out three things. First, what is the current condition of NAMAs in the pipeline? Second, how close are NAMAs to implementation and what will it take to move them to implementation? And finally, what are the links between NAMAs and NDCs?

Since COP 15 in Copenhagen, a community of practitioners and a substantial body of work on NAMAs has emerged. Moreover, significant public funds and political capital have been invested in developing NAMA proposals. Only showcasing the relatively small number that have secured funding might suggest that even though there could be a small (one in ten) chance that a proposal receives funding, there is the potential for them all or for many of them to be ignored. Learning from past and present experiences on NAMA development – and not only those showcased as successful – could help countries become more effective and efficient in designing policy packages to implement their NDC commitments.

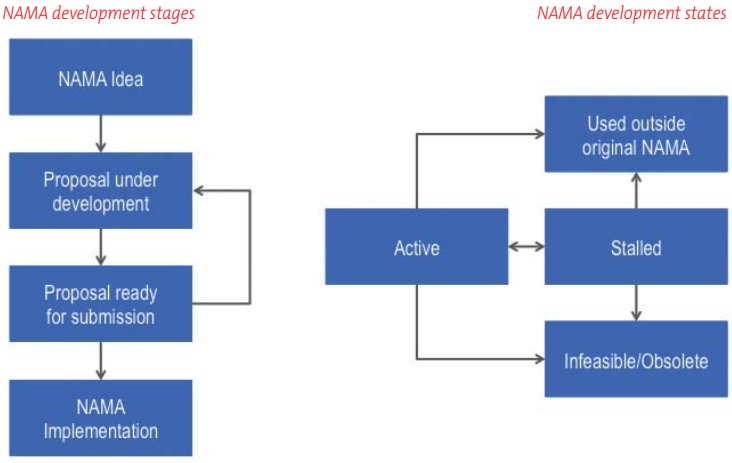


Figure 1: NAMA development 'stages' and 'states'.

Source: van Tilburg, 'A closer look at NAMA development', in the 2016 Annual Status Report on NAMAs

The starting point for our analysis is the framework shown in Figure 1, which presents "a simplified and stylised view of the different stages and states a NAMA concept can be in" (van Tilburg, 2016).

The results of our research are presented below. We conducted interviews with NAMA developers and sent out a short survey to NAMA country focal points to investigate the current status of NAMAs that have not (yet) secured funding for implementation. We make use of the framework in Figure 1 to classify 93 NAMAs into their state and stage of development, show how close these NAMAs are to implementation and highlight the links between NAMAs and NDCs.

Results

What is the current status of NAMAs in the NAMA pipeline?

The results show diversity in the state of NAMA initiatives across the sample. Some NAMAs are currently being prepared for submission or resubmission to the NAMA Facility, some have been re-engineered in order to try to meet the requirements of an alternative funder (such as the GCF), and others appear not be making any progress at all.

Over two-thirds of NAMA initiatives in our sample are considered to be either active or are reported as being used outside of the original NAMA. Respondents consider a further 26 NAMA initiatives to be stalled, and only one is reported as infeasible/obsolete.

Over half of NAMA initiatives in our sample are reportedly ready for submission or already under implementation. A further 40 NAMA initiatives remain at earlier stages of development: 15 are at the NAMA idea stage, and 25 are at the stage of proposal under development.

How close are NAMAs to implementation?

One-third of NAMA initiatives in our sample are reported to be either 'close' or 'very close' to implementation. A further 25% (23 NAMAs) are reported to be 'work in progress' (meaning that the NAMA concept or funding proposal is still under development and is not yet ready to be submitted to a potential funder), and 33 NAMA initiatives (35%) are 'not close' to implementation.

What are the links between NAMAs and NDCs?

Almost 80% of NAMA initiatives in our sample are included in the host country's NDC; these are either explicitly mentioned or implicitly included as part of the mitigation actions outlined in the NDC. In more than half of the NAMA initiatives, the link between the NAMA and the country's NDC is rated as either strong or very strong. One interviewee suggested that NAMAs were "the foundation of the country's NDC". The perhaps worrying implication is that for almost half of the cases, only an average or weak link is reported.

Lessons and experiences

We interviewed a number of experts and asked them to reflect on their experiences and lessons learned from developing NAMAs, and how these can be useful for NDC implementation. This section presents some of the insights from these interviews on what it might take to move NAMAs to implementation and on the links between NAMAs and NDCs.

What will it take to move NAMAs to implementation?

NAMAs that are underpinned by rigorous analysis and have a certain degree of design flexibility can be tailored to meet the requirements of alternative funders beyond the NAMA Facility. Funders of mitigation actions, for example the GCF, are open to receiving proposals for NAMAs, but have different, and often more stringent, requirements for submissions than the NAMA Facility. For example, the GCF requires a detailed feasibility study, a summary of the consultations with stakeholders, and an Environmental and Social Action Plan to be submitted as supporting documentation to a proposal (GCF, 2017). Furthermore, most other funders do not require submitters to use the NAMA label in proposals. There are examples of initiatives that started out being framed as a NAMA, because they targeted the NAMA Facility for funding, but have since dropped the label 'NAMA' because the initiative is seeking finance from alternative sources to the NAMA Facility.
A NAMA proposal should be designed to be flexible, with adequate background analysis and supporting evidence, so that it can be effectively and efficiently tailored to meet the requirements of alternative funders.

Tailor-made climate finance – the NAMA Facility

The NAMA Facility was jointly established by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Department for Business, Energy and Industrial Strategy (BEIS) of the United Kingdom (UK) in 2012 to support developing countries and emerging economies to implement ambitious NAMAs. The NAMA Facility provides tailor-made climate finance by funding the implementation of NAMA Support Projects, which are a combination of technical and financial measures covering the most ambitious parts of NAMAs. There are 21 NAMA Support Projects in total. The full list can be seen on the website of the NAMA Facility: http://www.nama-facility.org/projects/

Particularly in cases where the financial mechanism of a NAMA is complex and plays an important part, specialist financial and technical expertise needs to be dedicated to the design phase of the NAMA. Often NAMAs have been developed without adequate financial resources and technical or financial expertise, and in some cases there is no more funding available for expert support to further develop the NAMA concept. The development of NAMAs has largely been driven by small think-tanks and non-governmental organizations (NGOs) with very small amounts of financial resources (Cameron et al., 2015). Designing quality concepts and proposals for mitigation actions that can have a transformational impact is a complicated, time-consuming process that requires the application of specialist knowledge (technical and financial); sufficient resources thus need to be dedicated to the design phase of NAMA development.

The NAMA Facility has been supporting the early stages of NAMA implementation by providing mainly grant funding through their portfolio of NAMA Support Projects (NSP) . Each NSP receives approximately € 10-15 million of funding, which acts as a catalyst for NAMA implementation. The NAMA Facility has played a key role in supporting NAMA implementation, and can continue to do so in the future, but it cannot provide the scale of finance that is needed on its own. Public sector, and in particular private sector, financing is needed at a much larger scale to be able to carry out activities that can achieve

the ambitions and transformative change that characterise a successful NAMA.

Since its inception, the GCF has attracted a large amount of attention from developing country governments seeking international climate finance for the implementation of mitigation and adaptation projects, and from practitioners supporting these countries in trying to access this finance, including for NAMAs. The GCF is seen by some as a logical progression for those seeking finance for NAMA implementation, but it remains to be seen whether the GCF is a viable and sustainable source of funding for NAMAs.

Organisations with substantial financial resources and convening power need to be engaged in NAMA development, and from an early stage. Small think-tanks and NGOs, who supply only technical assistance for NAMA development and not financial resources for implementation, do not have the convening power to provide real impetus to NAMA development efforts. Instead this is more effectively done by larger organisations that are able to either supply the financial resources themselves or have the power to attract other financiers to fund NAMA implementation. There is a lack of scale and commitment behind NAMAs, without which it is difficult to change the status quo, which is often needed for NAMAs to move to implementation.

Strong government ownership and commitment towards NAMAs is needed to attract funding for NAMA implementation. Governments can attract financiers by providing clear signals that the NAMA has their full support, for example by providing co-funding for NAMA implementation from the domestic fiscal budget, letters of support for the NAMA from relevant ministries, capacity to undertake NAMA activities, and strengthening the institutional framework needed to implement the NAMA.

What are the links between NAMAs and NDCs?

At the time of writing, 169 countries have submitted their first NDC, which are in many cases identical to their earlier submitted INDC. Cameron et al. (2015) describe NAMAs and INDCs as "closely linked and have much to offer each other". If we understand NAMAs as bottom-up, government-led mitigation actions, they could be the building blocks that help countries to achieve economy-wide emissions reduction targets in their NDCs. They can make achieving NDC targets more tangible and provide a clear approach to NDC implementation. NAMAs might also be used as a tool to achieve sector mitigation targets that have been passed down from the national level (Cameron et al., 2015).

Our current analysis seems to support the suggestion that in a post-2020 climate regime, NAMAs could still play an important role. One NAMA expert commented that "the recent focus on NDCs may have led some countries to revisit NAMA development as a mechanism to achieve the mitigation targets they have pledged." The case study on NAMA development in Indonesia, which is presented in Box 3, shows how NAMAs are closely connected both to government action plans on GHG mitigation and the country's NDC, and as such are expected to remain relevant in an NDC world.

Conclusions

Behind the headline statistic that less than 10% of NAMAs have received funding from the NAMA Facility to start implementation hides a story of progress.

More than two-thirds of NAMA initiatives from the sample are under active consideration and many have already been catalysts for positive initiatives on mitigation, by providing conceptual ideas, background research and analysis, and bankable funding proposals. There are even a number of initiatives, additional to those that have previously been reported as being 'under implementation', that have (partially) secured funding for implementation. NAMAs are growing out of small, technical assistance projects into a wider field of climate finance, such as the GCF. There is a pipeline of over 200 NAMAs containing many ideas and concepts that are at different stages of maturity, many of which, with the right technical and financial backing, have the potential to evolve into or become part of other mitigation initiatives.

Many NAMA initiatives are reported to be ready for or close to implementation. Bottlenecks reported by respondents in shifting more of the NAMA pipeline into implementation include the need for genuine, high level domestic political buy-in, funding for implementation at scale, and sound financial expertise to improve the quality of NAMA proposals. Addressing these bottlenecks could shift more of the existing pipeline closer to implementation and create additional building blocks for NDCs.

Integrating market mechanisms and NAMA finance: The Green Schools NAMA Uganda

The NAMA on Integrated Sustainable Energy Solutions for Schools in Uganda – or Green Schools NAMA – focuses on providing sustainable energy for off-grid rural areas with solar energy, efficient cook stoves, and biogas technologies. In its 4th call, the NAMA Facility has selected the corresponding NAMA support project (NSP) for one component of this NAMA, focusing on institutionally improved cook stoves (IICS). With UNDP as lead applicant, the Ugandan Ministry of Energy and Mineral Development (MEMD) is currently finalizing the detailed preparation phase. This NSP will introduce IICS in more than 15,000 Ugandan schools (roughly 75 per cent of all Ugandan schools), thereby eventually reducing more than 760,000 tCO_2 per year. In order to overcome investment barriers, the main approach of the NSP will be to establish a Revolving Loan Fund at the Uganda Energy Credit Capitalisation Company (UECCC).

The Green Schools NAMA, however, is also unique in its approach to build on successfully established carbon market elements. First, the NAMA's MRV framework uses the UNFCCC-approved CDM Standardized Baseline for Institutional Cook Stoves in Uganda (ABS0016). This SB establishes a number of default values and therefore reduces the complexity of monitoring climate impacts. CDM baseline methodologies are the only UNFCCC-approved tools to measure emission reductions, and strengthen transparency, accountability and results orientation. These are important preconditions for harmonizing the accounting of climate impacts among actions that contribute to NDC goals.

Second, the NSP will also be the first one globally to buy and cancel Certified Emission Reductions (CERs) from Ugandan CDM projects and/or Programmes of Activities (PoAs) that support IICS in schools in Uganda. UECCC serves as the CER offtaker and ensures that all CERs will be cancelled in the cancellation account of the official CDM registry operated by the UNFCCC Secretariat. This approach ensures that all CERs procured through the NSP will be permanently removed from the carbon market and cannot be sold further. The robust ex-post verification of climate impacts through independent CDM auditors or DOEs (a precondition for issuing CERs) is often not applied in NAMA MRV frameworks. Finally, this cancellation will also enable Uganda to count the underlying emission reductions towards its own NDC achievements, while transparently avoiding double counting.

This pioneering approach of integrating carbon market elements into more comprehensive NAMA frameworks with sectoral approaches and complementary financial instruments could serve as a precedent for similar efforts in a range of sectors with both NAMAs and carbon market activities.

More information on the Green Schools NAMA can be found on the NAMA Facility website: http://www.nama-facility.org/projects/revolving-loan-fund-for-the-uptake-of-improved-institutional-cook-stoves-iics-in-schools/

Stephan Hoch, Perspectives Climate Group

All photos: GIZ

More than half of the NAMA initiatives from the sample have a strong or very strong link to the country's NDC. What we should take from NAMA development to an NDC world is experience, expertise and concrete initiatives that can help support countries to achieve the mitigation ambitions they have committed to in their NDCs. Indonesia is an example of a country where NAMAs are strongly connected to existing climate plans and the sectoral scope of the country's NDC, and are relevant for achieving the GHG targets and in ratcheting up NDC ambition. It seems likely that NAMAs will play an important role in NDC implementation.

There is much more to learn about the development of NAMAs, and there are experiences, expertise, and concrete initiatives to build on, than the headline statistic of less than 10% of NAMAs under implementation suggests. Taking a closer look at the NAMA pipeline, and not only focusing on those that have already secured funding for implementation, has led to some interesting observations. We are not underestimating the work that needs to be done, but there is much to reflect on and build upon from work that has already been undertaken on NAMAs.

We feel there are several questions on NAMA development which merit further analysis: where can the momentum behind NAMAs be supported and by whom? How can the scale and diversity of funding for NAMA implementation be increased? What role can NAMAs play in helping countries to 'ratchet up' their NDC ambition? We think it is important to continue to monitor and analyse the evolution of the NAMA pipeline in order to try to answer some of these important questions. We are convinced that there is much to gain by maximising the lessons learned from NAMA development. Given the suggested links between NAMAs and NDCs, these lessons can also be useful for NDC implementation.

Further information:

The full discussion paper can be downloaded at:
http://mitigationmomentum.org/downloads/What_happened_to_all_the_NAMAs_March_2018.pdf

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Progress Being Made on CORSIA

Some severe risks, but also opportunities to deliver in time

by Thomas Forth, Advisor to BMU

The International Civil Aviation Organisation (ICAO) is making progress in implementing its airline offsetting scheme CORSIA. At their recent session in Montreal in June, the ICAO Council members adopted key international standards for CORSIA. The Standards and Recommended Practices (SARPs) document agreed now contains provisions on monitoring, reporting and verification (MRV) of international aviation CO2 emissions, a simplified MRV tool for small operators ('CERT') and specifics for a CORSIA Central Registry (CCR).

However, decisions on the evaluation of carbon market programmes against a set of robust criteria, the determination of eligible emissions units, and agreements on which aviation fuels will meet the CORSIA Sustainability Criteria have been postponed until the next ICAO council meeting in November this year.

What do the Council conclusions mean for the development of CORSIA's offsetting procedures?

Formally, the results achieved during the Council meeting enable things to stay on track with regard to the remaining implementation elements for CORSIA. Especially for the offsetting part, the application phase for providing schemes could still start in 2019. It goes without saying that the timing largely depends on achieving a broad consensus among the Council members in the next five months.

Taking an optimistic view, the postponement is even more acceptable, because the work of the programme testing group (PTG) can be fully taken into account. The PTG is currently working on offsetting schemes which have been selected for in-depth consideration. These include the UNFCCC's CDM, the Chinese CCER scheme as a potential domestic supply scheme, voluntary market schemes and the FCPF (REDDplus). None of these will be approved formally at the end of the programme testing phase – the objective is to define the appropriate way of accepting applications from schemes, as intended from 2019 onwards.

This could lead to an enhancement of the PTG's programme testing process. PTG reporting is currently expected in September ahead of the meeting of ICAO's environmental committee (CAEP) in October. The timing would allow ICAO member states to reflect on the PTG results and bring their assessment findings and recommendations into the next and final "state letter process", which informs the ICAO institutions CAEP and Council.

Unfortunately, the ICAO – established in 1944 and one of the oldest UN regimes – cultivates an outmoded and non-transparent negotiation style, where all negotiators and experts are sworn to secrecy. The only legal way out is to arrange for public domestic and international forums and discussions on the technicalities, which in the end are politically-driven and should influence country representatives' positioning in the ICAO Council when fleshing out the details. And in the event that no real progress is made, countries should register their principal reservations to prevent any premature decisions being made.

Looking at the events of recent weeks, we have seen reports in specialist publications that some ICAO member countries find the CORSIA process critical. When it comes to the assessment of and decision on eligible schemes for offsetting, we may face the same concerns as those that came up during the contro-

Will the CORSIA negotiations be concluded in time?

versial process of defining alternative fuels[1]. Therefore, the current work of the PTG is crucial in reaching a consensus decision on the offsetting part of CORSIA. Also, the PTG's work might be considered of higher value considering the lack of concrete guidance in the SARPs agreed in Montreal. While the direction and the objectives of the SARPs are acceptable, we face a lack of operationalisation.

The PTG must compensate for these shortcomings. That does not mean that this small group should re-open the recently-agreed SARPs arrangements. Instead, the PTG should carefully analyse and review every emission reduction supply scheme: this addresses the functioning of the schemes and how they try to address the objectives and requirements of both the Paris Agreement and CORSIA. It might be easy to expect that schemes are inherently conclusive; however, the schemes were designed as stand-alone mechanisms before the advent of the Paris Agreement and are thus not required to consider host country contributions.

Let me give an example: the avoidance of double counting has been accepted after intense discussions and negotiations regarding ICAO Assembly Resolution A39-3 (2016). However, no technical ruling has been seen in ICAO institutions so far. At the Carbon Market Workshop held in Montreal in February 2018, representatives of supply schemes addressed the question by showing how double counting could be avoided: each of the schemes operate a registry system. While this is a relevant first step, it is still not enough. There are two more issues involved:

A) Within CORSIA there should be a procedure that checks independently and immediately that all emission reduction units are used only once.
B) Any emission reduction units used under CORSIA have to be reported simultaneously with the transfer of the mitigation outcome that the host country has performed a corresponding adjustment.

For the Article 6.4 mechanism of the Paris Agreement, keep Article 6.5 at hand, which ultimately ensures that Article 6.4

1 For more information on the alternative fuels controversy, see, for example, https://www.transportenvironment.org/press/eu-commission-surrenders-united-nations'-icao-aviation-biofuels.

mitigation outcomes are not used by the host country after being transferred. Regarding other supply schemes, the host country should provide similar assurance.

For the potential acceptance of REDDplus under CORSIA, progress depends on the implementation rules for the Paris Agreement. There are several challenges that need to be overcome: a) the coherence between Article 5 and Article 6; b) accounting; and c) coverage of the NDC.

All these points are requests for environmental integrity, i.e. robust accounting and the avoidance of double counting as well as additionality and host country's ambition beyond "business as usual". In the event that the Paris Rule Book and subsequent UNFCCC decisions are not able to match CORSIA's requirements at the time, CORSIA could provide either substitutes for host country contributions or provisional regulations. This door is open only if CORSIA's offsetting governance is sufficiently strong. However, the potential need for this additional CORSIA provision is not foreseen in ICAO's CORSIA agenda so far – thus indicating the weak understanding of technical details for the interaction between UNFCCC and ICAO. Both UN organizations have time to address the technical gateways between the two regimes, thus maximizing the climate impact.

These are the main implications of only one example. However, CORSIA's programme testing is already up and running and the group of experts has only limited time to act. The importance of this work is evident, and it would be appropriate for the ICAO to decide on public access to the PTG results ahead of CAEP and the Council meeting to be held later this year.

Essentials for further reflection ahead of the November Council meeting

1. Unit quality

Ensuring that criteria allow only supply schemes generating real mitigation outcomes to become eligible. Schemes should demonstrate how they provide information concerning the TACCC principles (transparency, accuracy, consistency, comparability, completeness), showing that traded mitigation outcomes are actually additional and corresponding adjustments will be made. The link to the host country's GHG inventory is needed when transfers are mirrored in the emissions balance, which provides the basis for environmental integrity and subsequently for the avoidance of double counting. Both dimensions are separate issues. The rationale behind linking them here is that schemes should be allowed to provide units for offsetting and on the aggregated level of the host country inventory. The schemes must provide regulation for this and then, on the unit level, further checks on transfers could be considered as obsolete.

2. Avoidance of double counting

The avoidance of double counting cannot be guaranteed by the registries of single schemes. This would be a scattered system, where control will face technical loopholes. Only a unified global registry system, established over time, would bring the affirmative relief. In the interim period, provisional regulation is needed in the absence of a global registry. This could be a kind of mandatory authorization letter by the host country, comparable to the CDM approval letter. As already said above, single supply schemes could not solve this issue. To this end, binding rules under CORSIA are needed which host countries must accept. This task should be decided by the next ICAO Assembly in 2019.

3. Other implications of using Article 6 for CORSIA

The Paris Agreement brought huge change to the Kyoto world: all countries are asked to contribute to the Long-term Goal (LTG) contained in the Agreement's Article 4. In the past, the KP's flexible mechanisms served primarily developed countries (Annex I) by providing for huge cost savings. In exchange, developing countries (Non- Annex I) received support for their sustainable development through the mitigation activity.

Under the Paris Agreement, flexibility is still the incentive for buyers to engage in Article 6, but the transfer of mitigation outcomes is associated with raising ambition above the current NDC of the selling country. CORSIA should handle this in a clear-sighted manner and should restrict the use of emission reduction units issued pre-2020, because they do not have an ambition-raising component and would not compensate for GHG emissions during the CORSIA pilot phase. We should all

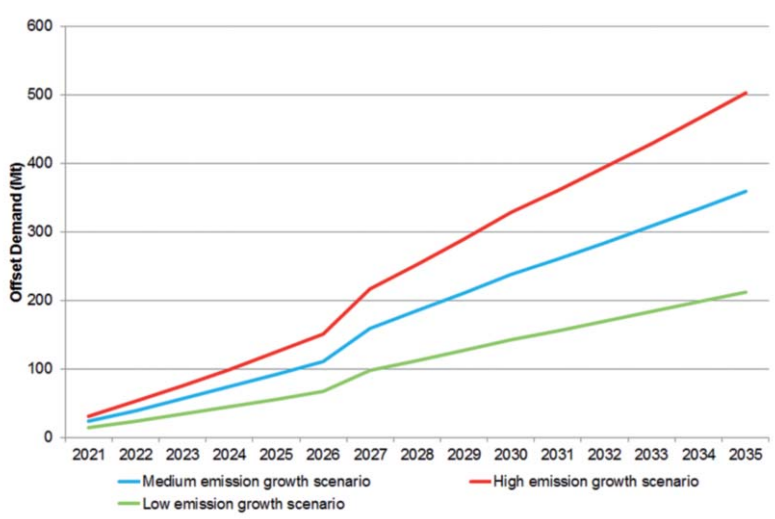


Figure 1: Scenarios for the development of CORSIA's offset demand.
Source: Healy, Sean: CORSIA: Quantification of the Offset Demand, Presentation held at BMU CTI-Workshop 28th - 30th June 2017, Download at www.carbon-mechanisms.de/en/cti_corsia

be aware that these units do not contribute to carbon-neutral growth, which is CORSIA's objective.

The challenge for CORSIA here is not so much one of significantly increasing costs, but of the readiness of host countries to decide strategically on sectoral areas, which they want to see addressed by CORSIA demand. For host countries today, there is not enough evidence regarding whether the transfer of mitigation outcomes could undermine their ambition under their notified NDC. They cannot accept transfers out of their promised NDC contribution for both economic and political reasons. This is not only about the costs, but about the capacity to establish domestic climate change policies. Crowding-out effects and the CDM cherry-picking approach should belong to the past.

Political focus should, therefore, concentrate on providing support for capacity and strategy-building to improve participation opportunities for countries everywhere. This could be a job for UNFCCC and for CORSIA too. I see a role for the UNFCCC secretariat, the RCCs, the World Bank and the MDBs. Efforts should be taken jointly with the financial and technical support of donor countries. No country should be left behind.

Having said that, the implementation rules of the Paris Agreement are crucial to CORSIA's climate impact. However, these implementing rules can also restrict areas for generating emission reduction units: in particular, the intense debate on coverage of the NDC, to distinguish in und outside NDC coverage, trying to exclude sectors and Parties from the use of Article 6.4 certified mitigation outcome will have negative repercussions for CORSIA. If these restrictions were to materialize, they would pose a tremendous setback for Article 6.4. Voluntary and domestic schemes would then have the potential to become the preferential mechanisms. Whether these schemes would apply corresponding adjustments is doubtful, however.

The expectations that the CORSIA effect will reanimate the carbon market are high. In the middle growth scenario, more than 2.5 gigatons of CO_2 equivalent are expected to be compensated for in the period up to 2035. This is higher than the CDM outcome up to today. However, with a view to the pilot phase, which runs from 2021 to 2023 and covers 75% of global aviation emissions, the demand will be less than 90 million in the maximum growth scenario. Decisions on CORSIA should thus be taken extremely carefully – knowledge that review and re-adjustments at the end of the pilot phase could be completed before CORSIA goes into effect will generate huge demand for a decade spanning 2026 to 2035.

Innovate4Climate Successfully Links Carbon Markets and Climate Finance

German institutions and businesses optimistic following Innovate4Climate in Frankfurt/Main

by Lydia Ondraczek, Advisor to BMU and Christopher Stolzenberg, adelphi

More and more states and subnational governments – currently seventy worldwide – are taking concrete action on carbon pricing. Only two weeks since the negotiations on international climate policy in Bonn, the World Bank announced this encouraging news at the start of *Innovate4Climate* 2018 in Frankfurt (22 to 24 May). The number of initiatives has tripled over the past ten years, said the World Bank in its annual report "State and Trends of Carbon Pricing 2018" published at the start of the largest international conference on carbon markets and climate finance. According to the report, the annual analysis of the status quo is promising and the outlook for the future is bright.

Nonetheless, the road to the achieving the ultimate climate action goal is a long one – one that calls for greater ambition and, more importantly, greater financial resources. The OECD currently estimates that around USD 90 trillion per year is needed if the climate target agreed by the international community is to be achieved. If funds in this amount could be raised and invested in climate-friendly projects, then the two-degree limit could be met.

Flasbarth: Financing streams are essential in achieving the Paris climate goals

Jochen Flasbarth, State Secretary at the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), opened this year's *Innovate4 Climate* conference with an encouraging observation: implementation of the Paris Agreement is progressing well and decarbonisation of the economy is already underway. What is still needed, however, is more ambition and greater speed in implementation, said Flasbarth, adding that international financing flows are an essential building block in achieving the Paris climate goals. Those flows must be well managed and are reliant both on strong incentives and the provision of a clear framework. This is where *Innovate4Climate* could serve as a central forum for in-depth dialogue and goal-oriented exchange, Flasbarth said.

In his opening speech at *Innovate4Climate* 2018, Norbert Barthle, Parliamentary State Secretary to the Federal Minister for Development, stated that industrialised countries have a special responsibility to implement the Paris climate goals: "Developing countries have the chance to leapfrog the age of fossil

"Financing streams are essential in achieving the Paris climate goals," said Jochen Flasbarth, State Secretary at the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), opening this year's I4C.

fuels. As the main cause of climate change, we industrialised countries have a responsibility to support developing countries on this path. Germany is already one of the world's largest climate financiers."

Innovate4Climate is a World Bank initiative and the 2018 edition was jointly hosted by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Ministry for Economic Cooperation and Development (BMZ) at the Kap Europa Congress Centre in the heart of Germany's financial district, Frankfurt am Main.

Spotlight on the private sector: A new target group

"Ongoing stakeholder dialogue has proven to be the key to the success in climate activities in recent years," says Tobias Hunzai of Climate Focus. Innovate4Climate increasingly fulfils its "hinge function" between official climate negotiation events and provides space for purposeful but informal exchange.

The space provided this year was particularly big: with 56 workshops and 46 other events, including the German Pavilion, *Innovate4Climate* offered more than ever before.

The round of talks with exhibitors and event organisers at the German Pavilion was also marked by private sector actors in 2018. New to the ever-popular German Pavilion at this year's *Innovate4Climate* event were the Agency for Economy & Development (AWE), Continental, DEG Invest, Finance in Motion, Kommunalkredit Public Consulting, the Frankfurt School-UNEP Collaborating Centre for Climate & Sustainable Energy Finance, KfW Development Bank and Navigant company Ecofys.

"At *Innovate4Climate*, at events large and small, we can forge the necessary links between the needs of policymakers, business and finance in a meaningful way," said Matthias Böhning from DEG Invest, summing up. Joined by experts from the Agency for Economy & Development (AWE) and tyre manufacturer Continental, he presented a successful project in

"Industrialised countries have a special responsibility to implement the Paris climate goals." – Norbert Barthle, Parliamentary State Secretary to the Federal Minister for Development.

which collaboration between development financers, consulting agencies and businesses had brought sustainable changes to Continental's Mexican supply chain.

German institutions bring pioneering topics to I4C

At the ten workshops hosted by BMU and BMZ, focus was placed on how the private sector can be better integrated into climate finance and climate action. What kind of business model do companies need to adopt in adapting to climate change? How can the Paris Agreement foster private sector involvement? What role does insurance play in financing climate action? And what networks need to be in place to support green bond markets? The experts discussed these and other issues along with key topics being addressed in international climate negotiations, among them the importance of partnerships in raising ambition and the impact of results-based NDCs.

In addition to the workshops it hosts, the German Pavilion has over the past few years become a valued network hub where exhibitors are keen to present and discuss innovations. At *Innovate4Climate* 2018, talks at the German Pavilion took in issues addressed at the current climate negotiations (including Article 6) as well as a number of practical examples such as DeveloPP, Climate Finance Readiness, and GETFiT Uganda.

Sustainable conference management a special focus

Another accent set by the Innovate4Climate conference comes from the fact that it is a sustainable, carbon-neutral event. With its ambitious "Towards Zero Impact" sustainability initiative, the World Bank was able to clearly demonstrate that conferences are environmentally sound events. Among other things, the initiative aims to define and implement concrete mitigation measures to reduce the environmental

Tremendous pull: The German Pavilion at the 2018 I4C

impact of mobility, energy, catering, waste, water management, communications and suppliers, and to calculate and offset all unavoidable greenhouse gas emissions.

What added to the success of the sustainability initiative was that the selected venue is one of the first convention centres to receive a platinum certificate from the German Sustainable Building Council.

Exhibitors looking forward to next *Innovate4Climate*

"Carbon market experts and climate finance specialists are increasingly joining forces thanks to *Innovate4Climate*," says Katja Eisbrenner of Navigant-owned Ecofys. "If market mechanisms for climate action and climate financing opportunities are better integrated in the future, the international community has a good chance of coming much closer to its climate commitments and goals. *Innovate4Climate* is an important platform in this regard," said Eisbrenner. "The more it attracts representatives from banks and the finance world, the more effective it will be."

Frank Wolke from the German Emissions Trading Authority at the Federal Environment Agency (DEHSt) agreed: "In 2018, the German Pavilion has again demonstrated tremendous pull, acting as a meeting place for the German commitment. It's exactly what an event like *Innovate4Climate* needs."

The outlook for the future is bright. Exhibitors at the German Pavilion were unanimous in their view that *Innovate4Climate* is attracting more and more experts from the carbon market and climate finance worlds, and has become an attractive venue for representatives from the financial and private sectors. By building once again on the efforts and processes in place, *Innovate4climate* 2019 is on track for continued success.

African carbon markets in focus: Discussions at the German Pavilion.

Further information

Innovate4Climate
www.innovate4climate.com

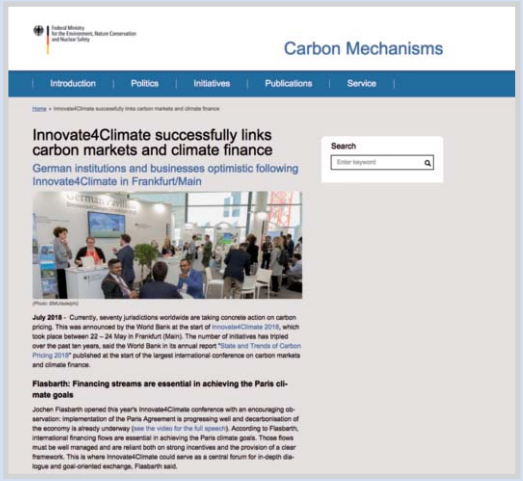
BMU Carbon Market Platform
www.bmu.de/en/topics/climate-energy/climate/international-climate-policy/carbon-market-platform/

BMZ „Klimafinanzierung“
www.bmz.de/en/issues/klimaschutz/climate-finance/index.html

Presentations for Download

Find all presentations held at the German Pavilion in BMU's Carbon Mechanisms Information Portal www.carbon-mechanisms.de.

Available at www.carbon-mechanisms.de/en/I4C_2018



Do no harm Options for Article 6

Safeguards preventing potential harm that mitigation activities may cause on the ground can constitute a minimal standard that project activities would have to fulfil. A new JIKO Policy Paper analyses and makes recommendations on what such a minimal standard for Article 6 could look like
www.carbon-mechanisms.de/en/no_harm

Linkages with national policies

A BMU side event held at the Asia Pacific Climate Week 2018 in Singapore explored emerging carbon market approaches in light of NDC implementation. Read the full report at
www.carbon-mechanisms.de/en/APCW_2018

Glossary

All Carbon Market terms and abbreviations are explained in detail in the glossary on the JIKO website. You can view the glossary here:
www.carbon-mechanisms.de/en/service/glossary/