

# DIALOGUE PAPER

## Climate Protection in the Production and Use of Chemicals: Learning Experiences and Recommendations Concerning Developing Countries and Emerging Economies

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### About this paper

This paper highlights the interlinkages between sustainable chemicals management and climate change (with a focus on realistic greenhouse gas (GHG) mitigation pathways) in the production and use of chemicals, particularly in developing countries and emerging economies. It includes the learning experiences of the **Climate Action Programme for the Chemical Industry (CAPCI)**, written comments from cooperating experts and results of an online workshop with representatives from public and private sector, academia and civil society organisations from selected partner countries and international institutions and projects, held on 23 August 2023.

The key messages of these discussions were presented in a side event at the **5<sup>th</sup> Session of the International Conference on Chemicals Management (ICCM5)** that took place from 25 to 29 September 2023 in Bonn. The present version of the paper incorporates some additional points and feedback received at the ICCM5 and in its aftermath. It is published on the CAPCI website within the homepage of the **International Sustainable Chemistry Collaborative Centre (ISC3)** as a contribution for clarifying the interlinkages between sustainable chemicals management and climate change [1].

The responsibility for the final editing of this paper corresponds to the CAPCI project team that wishes to express its profoundest thanks to all experts involved for the valuable and substantial contributions received. The authors want to acknowledge specifically the contributions of Christopher Gordon from the University of Ghana that helped to improve the logical structure, language and clarity of the paper. Furthermore, we thank Christopher Blum from the German Federal Environment Agency, who made crucial suggestions on key aspects of the paper, including a better reflection of workshop results in the final conclusions and recommendations.

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[1] [isc3.org/page/capci](https://isc3.org/page/capci)

## Introduction

The chemical industry is a vital pillar of modern life and the global economy with more than 95 % of all manufacturing industries and production processes relying on chemical products and substances. It is also essential to address the "global grand challenge" of climate change successfully. On the one hand, the chemical industry is an important consumer of fossil energy and, hence, a major source of greenhouse gas emissions that additionally comprise significant portions of non-energy related GHGs. On the other hand, the chemical industry also has immense potential for developing and providing innovative solutions and products for climate protection in other sectors.

Products from the chemical industry are needed in all areas of manufacturing, agriculture, pharmaceuticals, and our daily lives. Correspondingly, there are tens of thousands of chemicals for commercial use with a broad spectrum of properties; many of them need special care because they are associated with potential risks or hazards for human health, the environment or the climate. "Pollution" through poor management of chemicals and waste, together with climate change and biodiversity loss, is qualified as one of three fundamental emergencies that threaten the ecological basis of life on our planet (the so-called "triple crisis" according to UNEP, 2021[2]).

Internationally, risks and hazards of defined groups of chemicals are addressed by multilateral environmental agreements (MEAs) such as the Basel, Rotterdam, Stockholm, and Minamata conventions, as well as the Montreal Protocol for ozone-depleting substances (ODS) with its Kigali Amendment that also regulates defined substances with a high global warming potential (GWP). In addition to these specific international agreements, the **Strategic Approach to International Chemicals Management (SAICM)** offers a holistic framework that goes beyond defined groups of chemicals.

The further development of SAICM was discussed in the Fifth Meeting of the International Conference on Chemicals Management (ICCM5) in Bonn at the end of September 2023. The main outcomes are summarized as follows by the SAICM secretariat [3]:

[2] Making Peace With Nature | UNEP - UN Environment Programme  
[3] <https://www.saicm.org>

"The fifth session of the International Conference on Chemicals Management (ICCM5) finished in the morning of 30 September 2023 in Bonn, Germany, with **a historic and successful outcome**, adopting:

- **Global Framework for Chemicals** – for a Planet Free of Harm from Chemicals and Waste,
- **Bonn Declaration** – for a Planet Free of Harm from Chemicals and Waste,
- **Global Framework for Chemicals Fund**, and
- **a set of other Conference resolutions** focused on the implementation of the framework."

These documents will provide guidance for enhancing sustainability in the production and use of chemicals, thereby addressing the pollution crisis and its interlinkages with climate change and biodiversity loss. They are based on the 2030 **Agenda for Sustainable Development and the Sustainable Development Goals (SDGs)** that give overarching orientation on chemicals management and climate protection among several other goals. The recent adoption of the "**Global Framework for Chemicals**" constitutes a decisive step concretely tackling the pollution crisis while taking care of its interlinkages with climate change and biodiversity loss. Nevertheless, it should be recognized that developing countries and emerging economies face unique challenges to simultaneously implement effective chemical policies as well as formulate ambitious climate policies and respective **Nationally Determined Contributions (NDCs)** according to the **UN Framework Convention on Climate Change (UNFCCC)** and the **Paris Agreement**.

The Climate Action Programme for the Chemical Industry (CAPCI) is a project funded by the **German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** through the **International Climate Initiative (IKI)** which is an important part of the German government's international climate finance commitment. CAPCI aims to enhance capacities of key stakeholders for effective climate protection in the chemical sector in selected developing countries and emerging economies. Essential learning experiences of CAPCI rely on cooperation with partner countries such as Argentina, Ghana and Thailand, as well as Peru and Vietnam. Emphasis is placed on activities that ensure the broad involvement of relevant stakeholders from government and private sector, academia and civil society.

## Conceptual Approach

In line with the online workshop held in August 2023 and the side event at ICCM5 this paper has the following objectives:

- ▶ **To find synergies** in the relations between international chemicals management and international climate policies.
- ▶ **To analyse the specific challenges** developing countries and emerging economies are facing when it comes to the implementation of these policy frameworks, taking into account learning experiences from international cooperation (especially CAPCI).
- ▶ **To formulate lessons learned and recommendations** on the way forward, particularly regarding coherence and mainstreaming climate protection with sustainable management of chemical substances.

Using the experiential lessons of CAPCI from cooperation activities with its partner countries, guiding questions were co-designed and co-developed in order to structure the discussions and outcomes of the August 2023 workshop as well as the present update of this paper, along four main themes:

### I.

Identifying specific challenges for developing countries and emerging economies.

### II.

Assessing specific capacity gaps of developing countries and emerging economies.

### III.

Enabling systems to create policy frameworks and explore finance options.

### IV.

Envisioning innovative pathways and novel mitigation solutions based on the concept of a “Planet Free of Harm from Chemicals and Waste”.

## Major starting points and learning experiences from CAPCI

❖ **1.** Climate Change is an existential challenge to all humanity. Enormous efforts are needed to tackle its causes, to reduce greenhouse gas (GHG) emissions, and to adapt to its impacts.

❖ **2.** All stakeholders and sectors must contribute to tackle climate change successfully; the chemical industry is one of the key players because:

- a. The production of chemicals is a main source of GHG emissions with 7.4 % of the global GHG emissions (scope 1 and 2) stemming from chemical and petrochemical industries (IPCC, 2022 [4]).
- b. The chemical industry has enormous, partially untapped potential for innovation and providing products, materials and solutions needed for the “decarbonization” of other sectors.

❖ **3.** Value chains related with chemical products are often international, and a growing share of chemical production and use occurs in developing countries and emerging economies. These countries deserve particular attention when it comes to the needed transformation towards sustainable chemistry, particularly climate-friendly production and use of chemicals. Missing this trend would imply that these countries suffer disadvantages and the risk of losing competitiveness in global markets.

❖ **4.** Many developing countries and emerging economies have defined ambitious climate goals in the form of GHG emission reduction targets in their NDCs, and some have already committed to climate neutrality by 2050. The implementation of these ambitious NDCs relies on effective mitigation strategies for all relevant emission sectors.

❖ **5.** The role of the chemical industry has often been underestimated: One of the reasons was that most GHG emissions of the chemical sector are energy-related and attributed to the energy sector in national GHG inventories according to UNFCCC assessment methodology, while the “Industrial Processes and Product Use (IPPU)” sector only accounts for remaining GHGs and hence a relatively minor share in total emissions.

[4] AR6 Climate Change 2022: Mitigation of Climate Change – IPCC

❖ **6.** The Sixth IPCC assessment report (IPCC, 2022), however, reveals that industry is the sector with the highest share of GHG emissions and even more so when not only direct emissions (scope 1) are included in the balance but also indirect emissions under scope 2. Within the industrial sector, chemical production is among the most emission-intensive subsectors.

❖ **7.** The implementation of national mitigation strategies based on more detailed and in-depth analysis of emission sources in recent years has also yielded evidence that the chemical industry accounts for a significant share of GHG emissions in many countries.

❖ **8.** Globally, the chemical industry has become increasingly aware that it has a vital role to play in fighting climate change, by reducing its own emissions and facilitating climate protection in other sectors. CAPCI activities have contributed to the growing awareness in selected developing countries and emerging economies regarding the relevance of their chemical industries. Globally, there is a growing consensus among countries that climate change needs to be addressed immediately, to avoid being left behind and miss the benefits of a timely transformation.

❖ **9.** As transformation of the chemical sector towards sustainable and climate-friendly production is a complex challenge, financial mechanisms and incentives are needed, as well as information, technology transfer and capacity development.

❖ **10.** Targeted capacity development is needed at different levels, including political and economic decision-makers and practitioners in companies or facilitators, experts and advisors that work with the chemical sector.

## Guiding questions to address the four themes

**I.** What are the specific challenges for developing countries and emerging economies concerning effective chemical policies and ambitious but realistic climate policies and the interrelations between both?

**II.** What are specific needs and demands of developing countries and emerging economies for targeted capacity development?

**III.** What are the crucial elements of enabling policy frameworks that integrate climate aspects and chemicals management?

**IV.** What do we know about effective and efficient technological pathways toward mitigation in the production and use of chemicals (especially in DC and EE)?

## Key findings and recommendations from the Workshop

### **I. Specific challenges for developing countries and emerging economies**

- All countries in the world must contribute to fighting climate change with commitments laid down in NDCs according to the philosophy of “shared but differentiated responsibilities”.
- Developing countries and emerging economies, have extra challenges to define an ambitious but feasible climate agenda.
- Political commitments e. g., to climate-neutrality sometimes prove to be very ambitious and are not always matched by coherent strategies and means of implementation, including policies, finance as well as human and institutional capacities.
- Developing countries and emerging economies tend to have gaps between regulatory framework and implementation on the ground.
- Reliable data, information flows and communication between different levels of administration are crucial

for informed decision-making - but often missing or incomplete due to insufficient capacities and funding, e. g., for sound GHG monitoring that is an important basis for effective mitigation strategies.

- Internal barriers often prevent functioning interministerial collaboration that is a necessary precondition for implementing effective and coherent policies for climate protection and the sound management of chemicals.

## **II. Specific capacity development needs of developing countries and emerging economies**

- Developing countries and emerging economies have strong needs for capacity development regarding climate protection and the sound management of chemicals and particularly their interlinkages. Domestic funding for this important task is usually limited, while access to external finance may be complicated.
- The needs for capacity building range from access to knowledge and best practices, South-South exchange and examples of low-hanging fruits to awareness creation, available technologies and reliable data, particularly through well-functioning GHG accounting and MRV (measurement, reporting and verification) systems.
- It is often difficult to find experts or advisory institutions who can provide integrated advice on both, climate change and sound chemicals management. Though some countries do already have a good basis of well-educated professionals, these are often not involved in policy making and implementation.
- Small and medium-sized enterprises generally need special support as they have little knowledge and expertise. At the same time, stakeholders and particularly the private sector must be sensitized and informed about available technology alternatives and possibilities to reduce the carbon footprints of their products.

## **III. Enabling policy frameworks, regulations and finance**

- At the national level, long-term political commitment is needed for implementing enabling policy frameworks that integrate climate aspects and chemicals management. Ownership by all political parties and relevant stakeholders is crucial.

- At government level, inter-ministerial coordination, for example in the form of thematic tables or commissions, is needed in order to ensure coherence particularly of climate and chemicals policies and to avoid potential trade-offs. It is strongly recommended to take the necessary time to develop and implement a comprehensive policy and regulatory framework, while focusing on issues that can be delivered, including feasible local solutions with potential for upscaling (“think globally and act locally”).
- The concepts of a circular economy and the product life cycle are considered an important orientation for defining country-specific pathways and measures.
- The institutional framework should guarantee transparent communication and multi stakeholder involvement.
- Funding is a key issue: Financial assistance and economic incentives from governments, but also international agencies and development banks (inter alia according to Art. 6 of the Paris Agreement), should be provided to state agencies in developing countries as well as the private sector, for facilitating investments into the introduction of environment- and climate-friendly technologies and the phase-out of obsolete equipment, technologies and defined hazardous or climate-damaging substances.
- Carbon-taxing can be a game-changer and effectively facilitate the introduction of new climate-friendly alternatives in many areas.

## **IV. Pathways and mitigation options**

- There is no blueprint or “one size fits all” pathway toward sustainable and climate-friendly production and use of chemicals. Establishing roadmaps with a step-by-step approach and different time horizons and degrees of complexity, adapted to the specific situation of a country’s chemical sector, is considered a very useful strategic approach.
- The range of available technological options is broad and may start with low-cost measures, including systematic loss reduction as well as energy and material efficiency. Circular economy approaches, e. g. reuse of waste heat and solid waste as a secondary raw material, often applied in chemical parks (“Verbundstandorte [5]”), are economically and environmentally beneficial.

- Recycling of chemicals is still underdeveloped and should be increased in an environmentally sound manner, together with improved collection and separation practices. Renewable energies for electricity supply and heat production have huge potentials to reduce GHG emissions of the chemical industry, particularly in developing countries and emerging economies; appropriate locations should be identified, also to attract investors. With renewable energy, future-oriented green technology solutions for the production of basic chemicals, such as green ammonia, green methanol and green hydrogen become feasible.
- The use of alternative feedstocks such as biomass, plastic waste and CO<sub>2</sub> from industrial sources (through CCU – Carbon Capture and Utilization) are further options toward climate neutrality. In this sense, the chemical industry and chemical parks could also serve as a laboratory for testing and introducing new solutions and innovative technologies.
- The dominating supply-based approach should be replaced by demand-based business and, in consequence, alternative business models, e. g. benefit-based pricing within chemical leasing.
- In addition to direct and indirect emissions under scope 1 and 2, attention must also be given to emissions occurring in the supply chains, including material inputs (upstream) as well as products and by-products (downstream), e. g. introducing alternatives for substances with significant negative impacts on human health, environment and climate (phasing out and substituting substances with high global warming potential etc.).
- New design concepts for chemicals (“benign by design”) are also available and should be promoted, starting with the education of chemists and chemical engineers.

## Conclusions and recommendations

Based on cooperation experiences and expert discussions, key conclusions and recommendations on the interlinkages between sustainable chemicals management and climate protection were formulated, with special regard to the challenges that developing countries and emerging economies are facing. They are primarily meant for policy and decision-makers e.g. from government institutions responsible for climate and chemical policies as well as from private sector, industry and international cooperation.

The importance of the chemical sector for successfully tackling climate change is not yet always taken into consideration – neither on international nor on national level. On the other hand, interlinkages must be addressed more consequently: A sound management of chemicals is also beneficial for climate protection as well as for biodiversity.

The following 12 points were found to be of special importance:

### 1.

**Include** the chemical sector explicitly in sector plans and strategies for implementing Nationally Determined Contributions (NDCs) and make sure that political commitments are matched by coherent strategies and means of implementation.

### 2.

**Develop** roadmaps for the chemical industries as a helpful stepwise approach towards realistic mitigation pathways and the identification of benefits and synergies, including contributions to national climate policies. Roadmaps should be based on the concepts of circular economy and the product lifecycle; their design must respond to the specific situation and needs of the respective industries.

### 3.

**Avoid** trade-offs between chemicals management and climate protection, whereas synergies should be identified and used systematically at the policy level and in production processes.

[5] The German term „Verbundstandorte“ refers to chemical parks, where plants and companies are interlinked and synergies are identified and used systematically, e.g. joint infrastructure, use of waste heat and residual materials from one company as secondary raw materials in other companies (among many other options). See CAPCI Factsheet “The Verbund in Chemical Parks: Promoting net-zero targets in the chemical industry” ([www.isc3.org/page/capci](http://www.isc3.org/page/capci))



4.

**Support** the establishment of policy and regulatory frameworks that enable the sector's transformation towards sustainable chemistry and GHG mitigation, including inter alia functioning cooperation mechanisms between different ministries and between different levels of administration (national – regional – local).

5.

**Encourage** cooperation between governmental and private sector stakeholders ideally with the involvement of academia and civil society. Broad dialogue and societal support are essential for a successful transformation towards a climate-friendly and sustainable chemical sector.

6.

**Provide** financial and economic incentives for encouraging mitigation efforts and private sector investments into new climate-friendly technologies, incl. the use of mechanisms according to Art. 6 of the Paris Agreement, for developing such roadmaps and implementing successful measures for GHG mitigation in the chemical sector.

7.

**Realize** training and capacity building programmes, in order to qualify the relevant target groups, including professionals, managers as well as technicians, in all areas needed for designing and implementing effective climate action while promoting interdisciplinarity and taking care of sustainable management of resources, chemicals and waste.

8.

**Address** using international cooperation and knowledge-sharing networks and facilitate specific South-South exchange, as mitigation in the chemical industry is still new for many developing countries and emerging economies.

9.

**Explore** the broad range of available mitigation options and innovative technologies, particularly the big potentials for cost-effective mitigation in developing countries and emerging economies through loss reduction, energy and resource efficiency.

10.

**Promote** the use of significant synergies between plants and companies, e.g. through circular economy and renewable energy solutions, particularly in well-organised industrial areas and chemical parks (“Verbundstandorte”) that can also serve as a laboratory for developing innovative technologies, including green hydrogen or Power-to-Chemicals (PtC).

11.

**Organise** technical support for small and medium-sized companies, including access to information, knowledge sharing, advice, capacity building and finance.

12.

**Use** existing structures and networks related with the production and use of chemicals, such as for instance the well-established Responsible Care Programme of the chemical industry as well as public-private initiatives that could be used for amplifying climate-related issues in the chemical sector.



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