

Policy Brief: Water and Climate Mitigation Interdependencies

World Meteorological Organization (WMO)

This brief discusses the dependency of climate change mitigation measures on water availability and recommends specific ways for this to be considered under the Mitigation work programme (Decision 4/CMA.4), at COP 28 and in the IPCC 7th cycle work program.

1. The connection between water and climate change mitigation

Water is a feedstock for renewable fuels such as hydrogen and biofuels, is itself a source of clean energy (via hydropower) and is required for cooling of low emission thermal power plants (such as nuclear) and the production of rare earths for battery production. Water is also required for natural ecosystems such as wetlands, peatlands and forests to fulfill their carbon sequestration potential. Water use, storage and distribution can also be a source of emissions, particularly of methane from irrigated agriculture and poorly treated wastewater.

The climate mitigation targets of the Paris Agreement may be critically dependent on the availability of freshwater, yet these resources are themselves under pressure from increasing demand for food security, energy security, drinking water and sanitation and for economic development as well as being less predictable due to climate change. The [most recent UN reporting](#) shows that the implementation of global water goal SDG 6 is lagging far behind. Availability and access to water is seen as an enabler to achieve progress in achieving the most, if not all, other SDGs.

2. IPCC relevant findings

There is no comprehensive information on the water and climate change mitigation interdependencies and the implications of these for decision-making on emission reduction policies and on how water is allocated and used.

The IPCC 6th cycle assessments include many references to water-related risks to the viability of mitigation measures, however, without making any definite conclusions, for example:

"The viable speed and scope of a low-carbon energy system transition will depend on how well it can support SDGs and other societal objectives (high confidence). Energy systems are linked to a range of societal objectives, including energy access, air and water pollution, health, energy security, water security, food security, economic prosperity, international competitiveness, and employment. These linkages and their importance vary among regions." ([IPCC6 Mitigation Report Technical Summary](#))

The IPCC6 Synthesis Report includes more specific reference to water only in its discussion on afforestation and biomass cropping, pointing to risks while also saying mitigation measures generally align with the SDGs:

"Mitigation options often have synergies with other aspects of sustainable development, but some options can also have trade-offs. There are potential synergies between sustainable development and, for instance, energy efficiency and renewable energy."

Similarly, depending on the context, biological CDR methods like reforestation, improved forest management, soil carbon sequestration, peatland restoration and coastal blue carbon management can enhance biodiversity and ecosystem functions, employment and local livelihoods. However, afforestation or production of biomass crops can have adverse socio-economic and environmental impacts, including on biodiversity, food and water security, local livelihoods and the rights of Indigenous Peoples, especially if implemented at large scales and where land tenure is insecure". (IPCC6 SR SPM B.6.4)

The [IPCC6 Synthesis report](#) also acknowledges the need for 'trade-offs' with water access and the need for frameworks for integrated policy implementation:

"Integration of Near-Term Actions Across Sectors and Systems ...Trade-offs in terms of employment, water use, land-use competition and biodiversity, as well as access to, and the affordability of, energy, food, and water can be avoided by well-implemented land-based mitigation options, especially those that do not threaten existing sustainable land uses and land rights, with frameworks for integrated policy implementation (high confidence)"(IPCC6 SR4.9).

This could be understating the 'real-world' risk as few countries have 'frameworks for integrated policy implementation' as would allow these risks to be managed.

While there is much analysis and reporting of the wide range of water issues and risks in detailed technical reports (particularly the *Intergovernmental Panel on Climate Change* 6th Cycle (IPCC6) [Working Group III report on mitigation](#) and [IPCC6 Synthesis report](#), none of this is consolidated and the respective IPCC *Summaries for Policy Makers* make little reference to this analysis. As a result, there may be low awareness of these interdependencies in governments and societies and insufficient consideration in policy and decision making about climate actions.

3. Recent developments

To gain a better understanding of the issues, the UN-Water Expert Group on Water and Climate Change convened the [Technical Workshop on Water and Climate Mitigation Interdependencies](#) during the 2023 Bonn Climate Conference (June 2023). The workshop investigated what is known and not known about the dependency of Paris Agreement targets on the sustainable management of water resources with the aim of assisting UNFCCC parties to manage water-dependency issues in their Nationally Determined Contributions (NDCs) and in UNFCCC processes, and to decide whether there should be any further assessment of these issues by the IPCC in the IPCC 7th cycle work program.

The workshop was sponsored by the United Kingdom, Egypt and United Arab Emirates as the immediate past, current and next Presidencies of the UNFCCC Conference of the Parties (COP) respectively, and by Japan as the co-chair (with Egypt) of the Interactive Dialogue on Water for Climate, Resilience and Environment of the UN 2023 Water Conference.

The workshop was jointly organised by WMO, UNECE and UNESCO who took the following conclusions from the workshop, endorsed by participants and elaborated in the Annex:

1: Water is a necessary part of the climate solution: without considering freshwater in mitigation and adaptation, it will be difficult to achieve the Paris Agreement.

2: Water availability for climate mitigation purposes cannot be assumed: Water impacts need to be considered when selecting mitigation measures, especially in water-scarce regions.

3: Mitigation measures can be successfully co-implemented with SDG 6 and the other water related goals of Agenda 2030.

4: Filling the knowledge gaps identified by the workshop through IPCC assessments and having the role of water for mitigation better represented in climate discussions are important means of securing GHG emission reductions.

UN-Water has decided to follow up on the workshop results by supporting Member States to integrate water in UNFCCC processes on mitigation and adaptation activities and in the IPCC 7th cycle work program as well as to undertake a study on the potential water required to implement different mitigation measures.

4. Policy implications

While the implementation of climate change mitigation measures and decisions on the allocation of water resources required for such measures are national responsibilities, there is an important practical role for multilateral processes in providing procedures, direction, guidance and support to ensure the common purpose of the Paris Agreement is realised.

The Sharm el-Sheikh Implementation Plan (Decision 1/CP.27) section V), on mitigation, seeks to achieve this with actions which are all 'water-dependent':

- "Accelerate the development, deployment and dissemination of technologies, and the adoption of policies, to transition towards low-emission energy systems, including by rapidly scaling up the deployment of clean power generation and energy efficiency measures;" (para 16).
- "Consider further actions to reduce by 2030 noncarbon dioxide greenhouse gas emissions, including methane;" (para 17).
- Emphasize "the importance of protecting, conserving and restoring nature and ecosystems to achieve the Paris Agreement temperature goal, including through forests and other terrestrial and marine ecosystems acting as sinks and reservoirs of greenhouse gases and by protecting biodiversity, while ensuring social and environmental safeguards (para 18).
- Recognize "the importance of maximizing the positive and minimizing the negative economic and social impacts of the implementation of response measures..." (para 19).

Thus, water dependencies need to be integrated in this Implementation Plan if these elements are to be achieved.

For example, on the task of "maximizing the positive and minimizing the negative economic and social impacts of the implementation of response measure", increased demand for water for climate mitigation actions is likely to negatively affect other water-dependent objectives, such as food and drinking water security, particularly in water

scarce locations. As these trade-off judgements need to be made at the country /basin level in preparing and implementing their Nationally Determined Contributions, a country will not be able to deliver its contribution to the global climate project if its emission reduction actions fail due to unacceptable effects on other objectives. Due to the pervasive nature of the water dependencies, affecting so many key emission reduction actions, when scaled up to a global level, this is a risk to the whole Paris Agreement. In short, there is a real risk that the global climate cannot be stabilised if the NDCs cannot be implemented due to a failure to sustainably manage water trade-offs.

The solutions rest in integrated water resources management (IWRM) policies and practices that allow for these trade-offs to be managed in a peaceful and sustainable manner. However, due to the [slow progress](#) with achieving sustainable water management, many countries do not have the necessary instruments and policies in place.

There may be a role for international processes in assisting Governments to ensure water demands and trade-offs are fully considered in their clean energy and other climate mitigation policies.

5. The role of WMO services

National Meteorological and Hydrological Services (NMHSs) are key to assessing the interdependencies of water and climate mitigation. NMHSs own and operate most of the infrastructure that is needed for ensuring weather, climate, water and related environmental services. Observations and data gathered, processed, archived and shared and the development of products and implementation of services by NMHSs provide critical inputs for addressing international conventions and agreements such as the United Nations Framework Convention on Climate Change. The integration of such services into development policies and national planning is an essential element in reducing the risks of negative water related trade-offs and achieving mitigation targets.

WMO Members, the NMHSs, provide global leadership and expertise in fostering international cooperation to deliver and utilize high-quality weather, climate, hydrological and related environmental services. WMO is strategically positioned to spearhead the development of robust technical guidance aimed at facilitating the establishment of standardized national level assessments of water and climate change mitigation measures interdependencies. Policy makers can draw on such assessments to take informed decisions to sustainably manage different mitigation measures at the scale required to achieve the Paris Agreement targets.

Recommendations to UNFCCC Parties

Having the role of water for mitigation better represented in climate negotiations will be an important means of securing GHG emission reductions. At the national and river basin scale level, work to jointly achieve climate mitigation and water sustainability goals can be supported by these global processes. For example, it is open to UNFCCC parties to seek to include freshwater dependency as a specific subject area in relevant UNFCCC mitigation-related work programs, such as the Global Stocktake, joint work on implementation of climate action on agriculture and food security, and work on scaling up and impacts.

In particular, Party submissions under the mitigation work programme (Decision 4/CMA.4) (due on 1 February 2024) could call for water dependency to be a topic for a 2024 dialogue. WMO stands ready to support this process as appropriate.

It is also open to UNFCCC parties to call for a new work program on water that would support the preparation of principles and guidance to assist governments to identify and benefit from any possible synergies and where trade-offs are required, to weigh the relative emission reduction benefit of proposed measures against the other benefits that can be gained from the available freshwater (e.g., food and nutrition security, economic development, ecosystem services etc.).

- (1) Countries may also seek to fill knowledge gaps about water requirements of climate mitigation measures through their own national science capability, and through international science coordination facilities such as the World Climate Research Programme (WCRP). Any new science knowledge in this area will also enable the Intergovernmental Panel on Climate Change 7th cycle work program to include the latest and best estimates of the role of water in achieving emission reduction goals.

CONCLUSIONS FROM THE TECHNICAL WORKSHOP ON WATER AND CLIMATE MITIGATION INTERDEPENDENCIES

Conclusion 1: Water is a necessary part of the climate solution: without considering freshwater in mitigation and adaptation, it will be difficult to achieve the Paris Agreement.

- Many key mitigation measures, necessary to achieve the 1.5 degree and 2-degree objectives of the Paris Agreement require the availability and effective management of freshwater resources. If there is not sufficient freshwater available, or the water that is available is not well enough managed to assure supply, then it will be more difficult for these measures to achieve their emission reduction objectives.
- Water dependent measures encompass the principal measures for achieving the transition to clean energy, for reducing methane and other emissions from wastewater and water treatment, distribution and other managed water resources, and for maintaining or improving the sequestration of greenhouse gases such as from afforestation and wetland restoration, including from biosphere reserves and natural heritage and coastal blue carbon ecosystems.
- The energy transition requires support with water demand reduction; water efficiency and use in homes, including energy used for hot water heating is a key interaction. A recognition that energy sufficiency is linked to water sufficiency will support energy sector decarbonisation through demand reduction and at the same time safeguard existing freshwater resources through reduced consumption.

Conclusion 2: Water availability for climate mitigation purposes cannot be assumed: Water impacts need to be considered when selecting mitigation measures, especially in water-scarce regions.

- The IPCC has assessed that ensuring water availability for some of the above purposes (particularly biofuels and afforestation) may require trade-offs with food security and possibly other objectives requiring the same water (IPCC6 SR para IPCC6 MR para). Furthermore, many mitigation measures including Carbon Dioxide Removals (CDR) approaches and technologies have considerable water footprint (high confidence) (IPCC WGII).
- In water scarce locations, where demand for freshwater already exceeds sustainable supplies, 'trade-offs' will be required for all new demands, including for climate mitigation objectives.
- Trade-offs in water are difficult as each water demand has its own social and economic priority, and the environment must itself retain enough water to provide sustainable supplies. Making freshwater through desalination is generally feasible only in coastal areas and for the highest value water uses, but itself is a high energy process and has environmental impacts. Managing water trade-offs in conditions of water scarcity requires well developed water management and water allocation policies and practices, yet many countries face water scarcity now (Water Scarcity | UN-Water) and integrated water resource management is only 54 percent implemented globally (SDG 6 Indicator 5.1). The UNFCCC parties should have a deep interest in the achievement of SDG 6 as that may be a key to unlocking progress with emission reduction goals. Also, as with all climate matters,

while solutions must be found at the country level, there is an important practical role for multilateral processes in providing procedures, direction, guidance and support to ensure the common purpose is realised.

Conclusion 3: Mitigation measures can be successfully co-implemented with SDG 6 and the other water related goals of Agenda 2030.

- Through innovation in demand management, water use efficiency and infrastructure design, it should be possible to secure water for mitigation purposes without limiting other sectors.
- For example:
 - Changing irrigation practices to reduce standing water can free up water for other uses while reducing emissions from these fields and while not reducing farm productivity;
 - Modifying currently single purpose dams to provide for multiple services, such as clean energy (hydro-electricity), water security, irrigation and flood mitigation; and
 - Improved water and land management practices at the catchment level can result in more sequestration (through soil organic carbon), improved soil and water quality for other purposes and can reduce climate impacts of fertiliser use through water and nutrient management.

Conclusion 4: Filling the knowledge gaps identified by the workshop through IPCC assessments and having the role of water for mitigation better represented in climate discussions are important means of securing GHG emission reductions.

- GHG emission reductions will be better secured if all parties consider the freshwater implications of their proposed mitigation measures and in particular:
 - how to ensure the supply of water for these measures along with their other water-dependent priorities, such as food security, economic development, public health, biodiversity conservation and blue carbon ecosystems; and
 - scope for measures that can jointly achieve climate mitigation and water sustainability goals.
- It would support national efforts if UNFCCC parties:
 - include freshwater dependency as a specific subject area in all relevant UNFCCC work programs (such as the Global Stocktake, joint work on implementation of climate action on agriculture and food security, and work on scaling up and impacts);
 - support the preparation of principles and guidance to assist governments to identify and benefit from any possible synergies and where trade-offs are required, to weigh the relative emission reduction benefit of proposed measures against the other benefits that can be gained from the available freshwater.
- The IPCC 7th cycle work program is recommended to include more detailed assessments of these dependencies, to give the latest and best estimates of the emission saving potential and water requirements, the consequences of each mitigation measure and the broader interdependence of water management, including assisting governments to work out any trade-offs required.