

A proposed approach to assessing the Water-Food-Energy-Ecosystems Nexus under the UNECE Water Convention

Discussion paper

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I. INTRODUCTION

This discussion paper has been developed as an input to the First Meeting of the Task Force on the Water-Food-Energy-Ecosystems Nexus to be held in Geneva from 8 to 9 April 2013.

This document:

1. summarizes objectives of the nexus assessment which is to be carried out under the UNECE Water Convention from 2013 to 2015,
2. puts forward a set of questions to explore the scope and objectives of the assessment by the relevant stakeholders,
3. presents a possible approach to the nexus assessment as basis for discussion, and
4. serves as an input to agree on next steps to deliver the task, including basins to assess, resources and information needs.

II. BACKGROUND TO THE ASSESSMENT

The Second Assessment of Transboundary Rivers, Lakes and Groundwaters¹, prepared under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) and published in 2011, provides a comprehensive overview of the status of transboundary waters in the region of the United Nations Economic Commission for Europe (UNECE). It assesses main pressures exerted on them, measures implemented and current trends. Among the findings of the Second Assessment are that in many transboundary basins frictions or conflicts exist among different uses, and that policy integration and coherence remain weak across the UNECE region. It is difficult to achieve these in practice and there are painful trade-offs involved.

Hence meeting the growing water demand in different sectors without compromising sustainability is a rising challenge in the context of growing population and under the pressure of climate change impacts. It is therefore crucial to better understand the interactions between water, food, energy and water-related ecosystems in river basins, in order to strengthen synergies and policy coherence between water, agriculture, energy and land management sectors.

The assessment of interdependencies between different sectors is pertinent in transboundary basins. If these interdependencies between sectors are tackled, synergies can be achieved and solutions identified that can help reducing trade-offs and potential conflicts enhancing sustainability.

¹ http://www.unece.org/env/water/publications/pub/second_assessment.html

The proposal of the “special edition” assessment on the water-food-energy-ecosystems nexus was developed based on the recommendations of the Bureau of the Water Convention. The initial concept came from a “Strategic Workshop on the Future Work under the United Nations Economic Commission for Europe Water Convention: Building on the Findings of the Second Assessment and Other Results Achieved” (Geneva, 14–15 February 2012).

Subsequently the proposal was advanced to reflect the comments made during the joint meeting of the Working Group on Monitoring and Assessment and the Working Group on Integrated Water Resources Management (Geneva, 3–4 July 2012). Inputs were received during consultation with potential partners and comments were made at the sixth session of the Meeting of the Parties to the Water Convention (Rome, 28-30 November). At the sixth session, the Meeting of the Parties endorsed the concept for assessment of the water-food-energy-ecosystems nexus in selected transboundary basins in the work plan for 2013 to 2015², recognising the importance of the nexus challenge. The Parties invited countries and joint bodies sharing transboundary basins to indicate their interest in participating in the assessment by the end of January 2013. Proposals to assess different basins were received and are summarized in the annex of this document.

The Meeting of the Parties established the Task Force on the Water-Food-Energy-Ecosystem Nexus to overview and guide the assessment’s preparation.

The assessment concept included an estimate of the resource requirements to carry it out. While some contributions and pledges have already been received, not all financial commitments to carry out the assessment are yet in place.

III. OVERARCHING OBJECTIVES, KEY PRINCIPLES AND LIMITATIONS

The general aims of the nexus assessment as stated in the Water Convention’s programme of work for 2013-2015 adopted by the Meeting of the Parties are the following:

- provide a picture of the interdependencies (or their understanding) across water, ecosystems, energy, food and other areas, such as climate change and biodiversity, in terms of uses, needs, economic and social benefits and potential synergies, as well as conflicts and trade-offs;
- present the suite of sectoral policies together with an analysis of their integration, coherence and capacity to positively address the water, energy and food security nexus and improve water, energy and food security, taking into account linkages between water and land management.

Detailing these further, in order to develop an approach making the assessment relevant and beneficial to the participating countries, the following objectives are proposed to be set for it:

- Characterize the influence of individual sector-policies (e.g., agriculture, energy, land planning, etc.) on the other sectors within and across countries of a transboundary water system (a river, lake or an aquifer).
- Demonstrate the benefits of cooperation through optimization of interdependent energy, food and ecosystem goods and services’ policies leading to increased gain in food, water and energy security across transboundary water systems.
- Identify jointly with the riparian countries and the different sectors’ representatives barriers and opportunities to cooperation which generates additional benefits from stronger integration of policies and planning across sectors, and promotes equitable sharing of these benefits.

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http://www.unece.org/fileadmin/DAM/env/water/mop_6_Rome/Official_documents/ECE_MP.WAT_2012_L1_e.pdf

- Produce relevant information for regional, national and basin level policymakers and other stakeholders to support decision-making, transboundary cooperation, public participation and policy coherence.

Based on the experience with previous assessments and on the nature and aims of the work under the Water Convention, the approach to developing the nexus assessment will be based on the following key principles:

- 1) **Participatory process** i.e. involving a representative number of Parties and non-Parties, and representatives from the relevant sectors and interest groups through a process that supports ownership by the participating countries and organizations, and meaningful participation of various stakeholders;
- 2) **Knowledge mobilization** from the participating countries on the different sectors and resource uses and management, complemented by international expertise where relevant; and
- 3) **Capacity building - supporting mutual learning** across basins, sectors and State borders, thereby promoting exchange of experience and strengthening cooperation on the ground at the basin level.

The process and scope is constrained by the limited funding that is considered possible to mobilize (the estimated resource requirement is presented in ECE/MP.WAT/2012/2³). Therefore, potential synergies with other projects or additional resources identified through partners would increase the impact of the exercise.

IV. TIMELINE OF THE ASSESSMENT

To complete the nexus assessment by the seventh session of the Meeting of the Parties, the following time frame for its preparation is proposed:

- o preparatory phase January-October 2013, including definition of the scope and development of the methodology;
- o confirmation of the basins to be involved and of the funding (April-June 2013);
- o testing the agreed methodology on a pilot basin, including data collection, analyses and assessment of the basin, conclusions of the testing and finalization of the methodology (October-December 2013);
- o application of the methodology in agreed basins (January 2014- April 2015); and
- o synthesis of the findings and publication of the results (May-October 2015).

V. METHODOLOGICAL APPROACHES TO THE NEXUS ASSESSMENT

The water, energy and food sectors are so strongly interlinked that actions in one area commonly have impacts in one or both of the others; yet these sectors too often operate in isolation, and seeking security in one sector may compromise others. Conflicting uses and trade-offs call for concerted efforts to accommodate the different sectors needs and to promote synergies.

Water, energy and food security in a given transboundary context needs to be built within the framework of a macro-region and the constraints and opportunities provided by ecosystem services. A macro-region

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http://www.unece.org/fileadmin/DAM/env/water/mop_6_Rome/Official_documents/ECE_MP.WAT_2012_2_e.pdf

is defined as an area including territory from two or more countries associated with a transboundary freshwater system that experiences interlinked energy and food sectors because of the connective role of water (Granit and Joyce, 2013)⁴. To achieve security within a macro-region, market based transactions that add value needs to be identified. Transactions can occur at the bilateral level (e.g. flood protection and hydropower generation), at the region level (power and food trade), and at the global level addressing mitigation and adaptation to climate change through e.g. the deployment of renewable energy sources. Underpinning the nexus is the intermediary function that water provides in the above value chains.

The assessment approach will need to be flexible enough to accommodate the broad diversity of the basins:

- The basins will illustrate situations with the nexus in a significant range of socio-economic settings, climate and sector importance.
- All the basins to be assessed might not display a “full” energy-food-ecosystem nexus but rather a “partial” nexus between agricultural and hydropower use or energy and environment.

QUESTION FOR PARTICIPANTS:

Which are the basic policy questions that the assessment should provide an answer to?

a. An indicator based nexus assessment

The nexus can be assessed using different methodologies in a continuum from purely qualitative approaches to more data driven and quantitative modelling approaches. Examples of an assessment in this continuum could be based on index building using publicly available indicators across a core set of representative parameters in the nexus. The added value of such an approach is to identify key insecurities in the nexus that could be mitigated and/or turned towards becoming collaborative opportunities. In the early stages of the continuum a more in-depth assessment would be country surveys based on well-defined questionnaires that the riparian country representatives respond to using national data sets as well as descriptive/qualitative information. The response is analyzed by specialists providing a first level analysis of issues for consideration by the riparian countries, to be developed further and detailed with experts and officials of the riparian countries. Examples of assessments in the latter part of the continuum include data intensive modelling approaches such as the SEI integrated WEAP and LEAP model, hydro-economic modelling as implemented by SIWI, and Strategic Environmental Assessment (SEA) approaches which are spearheaded by the European Union and the World Bank coupled with in-depth stakeholder consultations at different stages.⁵ International legal basis for SEA is provided by the SEA Protocol of the UNECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) which ensures that individual State Parties integrate environmental assessment into their plans and programmes, and also provides for extensive public participation in the governmental decision-making process.

Given financial resource constraints and the ambition to apply a nexus assessment with a target of 7 to 10 transboundary river basins, a standard and consultative nexus methodology could be deployed as described in the initial phase of the continuum. Such an approach would encourage strong partnership from riparian countries in the macro-region.

It would build on a diagnostic framework (see below) using a set of indicators coupled with other information (including qualitative information), gathered both from publicly available data bases and

⁴ Granit, J., & Joyce, J. 2013, under development.

⁵ See eg: Purkey, D. (2012): Integrated water-energy-emissions analysis: Applying LEAP and WEAP together in California. Stockholm Environment Institute – Policy Brief; Granit, J. & Joyce, J. (2012). Options for cooperative action in the Euphrates and Tigris Region. Paper 20, Stockholm: SIWI.; Granit, J., King, R. M. & Noël, R. (2011). Strategic Environmental Assessment as a Tool to Develop Power in Transboundary Water Basin Settings. International Journal of Social Ecology and Sustainable Development. 2(4), 1-11, October-December 2011. IGI Publishing.

through questionnaires. Macro-region/basin stakeholder meetings would allow to jointly analyse such indicators and information, develop a joint assessment and explore alternative approaches to deal with trade-offs.

Such an approach would subsequently trigger collaboration and trust building by jointly identifying issues and barriers to cooperation in the nexus and possibly triggering efforts to towards more in-depth fact finding and detailed assessment in final phases of the continuum.

b. A diagnostic framework using an indicator approach to assess the nexus

The nexus assessment at the basin level is proposed to consist of four main parts, described below (A-D). Each part should contain both common indicators used consistently across basins as well as other data and information, as proposed below:

A. Description of the basin: overall setting

a. Macro-region political economy

- Sectoral aspects and policies at both national and macro-region level
 - Characterization of the major sectors
 - Relative importance of the different sectors of the economy
 - Macro-economic trends
 - Demographic trends: population & population growth, aging, urbanisation
 - Existing development policies and strategies in the different sectors (e.g. renewable energy objectives, agricultural policies, etc.) and their coherence⁶

A check list of questions could be developed for assessing the current policies in order to identify which policies impact on which sectors and how significantly (in relative terms).

The questions could include:

- Are some sectors subsidized in one way or another? What are the possible subsidies tied to in the different sectors (production volumes, some qualitative criteria, etc.)?)
- What is the pricing policy for water use/supply and for energy? Are different user groups paying different prices? Does the pricing give incentives for economizing resource use i.e. help to manage demand?
- Do the current emission targets or quotas significantly influence the attractiveness or profitability of different energy sources?
- Is there a strategy for adaptation to climate change either at national level or at the basin level? What targets or measures are envisaged for different sectors?
- What kind of policies are in place for protecting the quantity or quality of waters? Do they encourage reducing waste, limiting over-use, reduce release of pollutants to the environment etc.?
- If there are infrastructure plans for developing water storage or flow regulation, are the planned structures by design meant to serve different uses? Does the design take into account environmental needs i.e. a minimum flow, fish passage? Have “natural infrastructure” alternatives been considered?

b. Institutional and governance analysis in the nexus

⁶ Policy coherence is used to imply that the incentives and signals of different policies provide target groups with non-conflicting signals. Policy coordination and policy integration help to increase coherence, introducing processes and means that reduce coherence problems between sectors. For a review of the terms and some relevant literature, e.g. the following publication can be referred to: Per Mickwitz et al 2009, Climate Policy Integration, Coherence and Governance. Partnership for European Environmental Research.

- Institutional and governance set-up at the national level and mechanisms for intersectoral coordination
- Institutional and governance set-up at the macro region /transboundary basin level and mechanisms for intersectoral coordination
- c. Biophysical dimensions of the transboundary basin
 - Status (both quality and quantity) of water resources in the basin
 - Availability and variability of water resources
 - Climatic setting
 - Storage capacity, natural and built infrastructure
 - Degree to which water resources have been developed
- d. Climate change and variability: observations, predictions, vulnerability of different sectors

QUESTIONS FOR PARTICIPANTS:

Are the above components appropriate for the description of the basin and overall setting?
Is anything relevant missing?

B. Describing the nexus through its components

This section of the assessment will analyse the nexus through its components using both descriptive assessment and indicators. Illustrative indicators will be used for the sector characteristics and links with other sectors as well as constraints and opportunities in the nexus. A preliminary proposed list is provided below, which needs to be reviewed and developed further on the basis of inputs from partners and stakeholders. The descriptive assessment and other information will further illustrate and complement the indicators. A common set of core indicators needs to be selected which would be presented for all basins to be assessed. The preliminary list of possible indicators includes:

- Water insecurity/water component of the nexus
 - Total actual renewable water resources (TARWR) per capita
 - Storage capacity per person
 - Access to water supply and sanitation services
 - Intensity of use of actual water resources (percentage of withdrawals from TARWR)
 - Water use by different sectors
 - Indicators of flow variability, occurrence of extreme hydrological events
 - Energy-intensity of water provision (withdrawal, treatment, conveyance; special attention to the use of methods with high-energy requirements like desalination)
- Food insecurity⁷
 - Supply, access, stability, health, absorbing nutrients
 - Water use productivity in agriculture
 - Share of rain-fed agriculture, irrigated
 - Degree of cultivation of arable land
 - Energy-intensity of agriculture (reflecting mechanization etc.)
 - Crops & livestock
 - Excessive use of pesticides and fertilizers/nutrients (in relation to a threshold)
 - Prevalence of organic agriculture
- Energy insecurity
 - Primary energy mix
 - Energy dependence
 - Power sharing arrangements
 - Energy-intensity of production, industries etc.

⁷ A selection to be made using e.g. FAO's list of food security indicators (<http://www.fao.org/publications/sofi/food-security-indicators/en/>)

- Access to modern electricity
- Hydropower potential and level of development
- Ecosystems
 - Water quality, including eutrophication
 - Protected ecosystems in the basin
 - Main ecosystems services provided

QUESTION FOR PARTICIPANTS:

Are the above issues the appropriate ones for describing the nexus?
 Do they allow distinguishing the different ways in which the nexus plays out in the different basins, and reflecting the varying importance of different factors in the nexus?
 Are the listed indicators the relevant ones?
 Which ones should be the core indicators to be gathered for all basins?
 What sort of information needs to be also gathered to complement the indicators and further describe the nexus?

C. Analysis of the nexus/reconciling different uses: Opportunities and barriers

This section will be mostly developed cooperatively on the basis of the stakeholders meeting and will focus on the following issues:

- Identification of the links and processes in the nexus and assessing their relative importance (ranking)
- Trade-offs and their quantification
- Potential for efficiency improvements in all sectors
- Institutions, governance; gaps in the institutional and legal basis (agreements, joint bodies, customs unions etc.)
- Impacts of predicted climate change on the different sectors
- Potential options to overcome barriers and consultation on possible opportunities

The analysis and its cooperative development are proposed to be done taking into account the “nexus profiles” which consist of the indicators. The discussion for identification and description of the interdependencies could be facilitated by using flow charts or causal chains.

The objective of this section will be to explore how the countries in a macro-region sharing a transboundary basin could benefit from a nexus approach. The aim is to root the possible opportunities on the current policies. This part of the assessment would be based on the conclusions of the basin-level process, building on the ideas for improvements triggered by the joint identification of inter-linkages and trade-offs described above.

QUESTION FOR PARTICIPANTS:

How could the importance of the different interlinkages be assessed and ranked?
 Can at least some of the trade-offs be quantified? How could that be done?

D. Cooperative analysis, solutions and next steps

Despite the time and resources limitations, the wish to explore potential future development trends/scenarios, including deriving possible future measures to build resilience in the nexus within this exercise, has been expressed several times.

It is recognized that development options or scenarios could offer additional insights to the implications of different policies and plans. Furthermore, allowing comparisons through assessing several basins with the same tool would in a certain way add value to earlier exercises.

Based on a brief review of some available tools⁸, it seems that extensive and systematic application of modelling is not feasible from the point of view of resources expected to be available for the assessment.

The challenge is to find an approach applicable in all basins, simple enough to be carried out within the exercise and still meaningful.

Another approach would be a more “opportunistic” one, building basin by basin on efforts carried out in other frameworks; this would entail having different approaches for this part of the assessment.

In any case, if the countries engaging in the nexus assessment (or river commissions or other partners) are willing to invest additional resources into the data collection and analysis, they could take the assessment work further.

It would be informative to substantiate and quantify the implications of certain development scenarios, by building on the initial indicator framework and consultations to be carried out within the scope of this assessment. For example the following kinds of developments could be assessed quantitatively, when relevant for the case, for example:

- modification of flow regulation mode to better accommodate multiple uses
- increasing water use efficiency by a certain percentage and seeing how this would help responding to the predicted water needs in different sectors
- increasing the share of renewable energies in the energy mix to see what it would mean for water use for energy purposes
- Relieving pressure on the environment by increasing environment flow; from which sectoral uses could an additional water volume be most cost-effectively be released?
- If water flows are predicted to reduce by a certain percentage due to climate variability and change, what kind of measures in different sectors would allow adapting the current uses to such a reduction?

QUESTIONS FOR PARTICIPANTS, IN PARTICULAR FOR THE REPRESENTATIVES OF BASINS POTENTIALLY INVOLVED:

Are you interested in experimenting with scenarios or quantifying some development options or possible policies? Do you have resources available for this? Should the assessment include information on modelling done through other exercises? If yes, could differences in approaches be accepted?

Would it be necessary to assess in “your” basin an individual development scenario, i.e. looking at measures planned (in river basin management plans or sectoral development plans) and predictions for this particular basin? Is there an existing modelling tool which is applicable to quantifying some aspects of the nexus, is available and has been used on “your” basin?

Or would it be possible to agree on a limited number of general developments and assess what they would imply in the case of each basin? Could such development options be briefly described – e.g. “more storage/flow regulation”, “green the economy”, “more renewable energies”, “intensify agricultural production” etc.?

⁸ The Water Evaluation and Planning (WEAP) model, the Long range Energy Alternatives Planning (LEAP), Foreser, and for the Aral Sea Basin Economic Allocation Model (BEAM) and ASBmm (an integrated model for assessment of Aral Sea Basin development scenarios.

VI. PILOTING OF THE AGREED METHODOLOGY AND NEXT STEPS

The agreed method would be tested in the course of 2013 on a pilot basin to verify its applicability and possibly make adjustments, if necessary. The reason for this is that the scope of work is difficult to estimate considering the difference in scale of macro-regions, basins and stakeholders. As a result, the information requirements and the scope of work can be specified in detail. In the course of 2013, the exact level of funding and other resourcing gets confirmed, and the scoping can be refined accordingly.

After the refinement of the methodology, the assessment will be carried out in the other basins together with the different concerned national authorities and in close cooperation with relevant national and international partners.

QUESTION FOR PARTICIPANTS:

Which of the proposed basins could make an informative pilot basin?

The authorities behind basin proposals are invited to volunteer for this.

Which other basins should be part of the assessment, in particular taking into account the need for a strong commitment of all concerned stakeholders and the representativeness of the cases?

Proposals for basins to be assessed

River	Riparian countries	Proposed by
Sava	Albania, Croatia, Bosnia and Herzegovina, Montenegro, Slovenia	Sava River Commission
Narva	Estonia, Latvia, Russian Federation	Ministry of the Environment of Estonia
Dniester	Republic of Moldova, Ukraine	Moldovan Environment Ministry
Alazani	Azerbaijan, Georgia	State Agency for Water Resources under the Ministry of Emergency Situations of Azerbaijan
Araks	Armenia, Azerbaijan, the Islamic Republic of Iran, Turkey	State Agency for Water Resources under the Ministry of Emergency Situations of Azerbaijan
Ural	Kazakhstan, Russian Federation	Water Resources Committee
Chu and Talas	Kazakhstan, Kyrgyzstan	Water Resources Committee
Aral Sea Basin	Afghanistan, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan	Executive Committee of the International Fund for Saving the Aral Sea, Scientific Information Centre of the Interstate Committee for Water Coordination
Vakhsh, Pyanj, Kunduz (upper Amu Darya)	Afghanistan, Kyrgyzstan, Tajikistan	Ministry of Land Reclamation and Water Resources, Tajikistan

Mejerda	Algeria, Tunisia	Ministry of Agriculture, Tunisia
Niger	Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Guinea, Mali, Niger and Nigeria	Niger Basin Authority and the Wetlands International
Sesan, Srepok and Sekong rivers (Mekong)	Laos, Vietnam and Cambodia	Conservation International
Marowijne	Suriname, France (Department of French Guiana)	Conservation International