



JRC TECHNICAL REPORTS

POSITION PAPER ON WATER, ENERGY, FOOD AND ECOSYSTEMS (WEFE) NEXUS AND SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Editors:
Carmona-Moreno, C.
Dondéynaz, C.
Biedler, M.

2019

EUR 29509 EN

This publication is a Technical report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission and/or the organisations involved in this publication. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication.

Contact information

Name: César CARMONA-MORENO
Address: via Fermi, 2749 – TP 121 – I-21027 Ispra, Italy
Email: cesar.carmona-moreno@ec.europa.eu

EU Science Hub

<https://ec.europa.eu/jrc>

JRC114177

EUR 29509 EN

Print	ISBN 978-92-76-00159-1	ISSN 1018-5593	doi:10.2760/31812	KJ-NA-29509-EN-C
PDF	ISBN 978-92-79-98276-7	ISSN 1831-9424	doi:10.2760/5295	KJ-NA-29509-EN-N

Luxembourg: Publications Office of the European Union, 2019

© European Union, 2019

The reuse policy of the European Commission is implemented by Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Reuse is authorised, provided the source of the document is acknowledged and its original meaning or message is not distorted. The European Commission shall not be liable for any consequence stemming from the reuse. For any use or reproduction of photos or other material that is not owned by the EU, permission must be sought directly from the copyright holders.

How to cite: Position Paper on Water, Energy, Food, and Ecosystem (WEFE) Nexus and Sustainable development Goals (SDGs). Editors: C. Carmona-Moreno, C. Dondéynaz, M. Biedler, EUR 29509 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-79-98276-7, doi:10.2760/5295, JRC114177

All images © European Union, 2019 unless otherwise specified, except:

Cover page: © Digital Vision/Getty Images, © Image Source/Getty Images, © Kai Honkanen/PhotoAlto

Page 12, Source FAO, 2014, Figure 1 is published in The Water-Energy-Food Nexus. A new approach in support of food security and sustainable agriculture, 1–28. <http://www.fao.org/3/a-bl496e.pdf>

Page 19, © Marco Schmidt/Wikimedia/, September 2007, Burkina Faso

Page 20, © UNECE, Figures Published in “Reconciling Resource Uses in Transboundary Basins: Assessment of the Water-Food-Energy-Ecosystems Nexus”. New York and Geneva: United Nations, 2015.

JRC TECHNICAL REPORTS

POSITION PAPER ON WATER, ENERGY, FOOD AND ECOSYSTEMS (WEFE) NEXUS AND SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Editors:

Carmona-Moreno, C.
Dondéynaz, C.
Biedler, M.

2019

EUR 29509 EN

Contributors

Organised by:



With the participation of:



Centro de Investigaciones
Energéticas, Medioambientales
y Tecnológicas

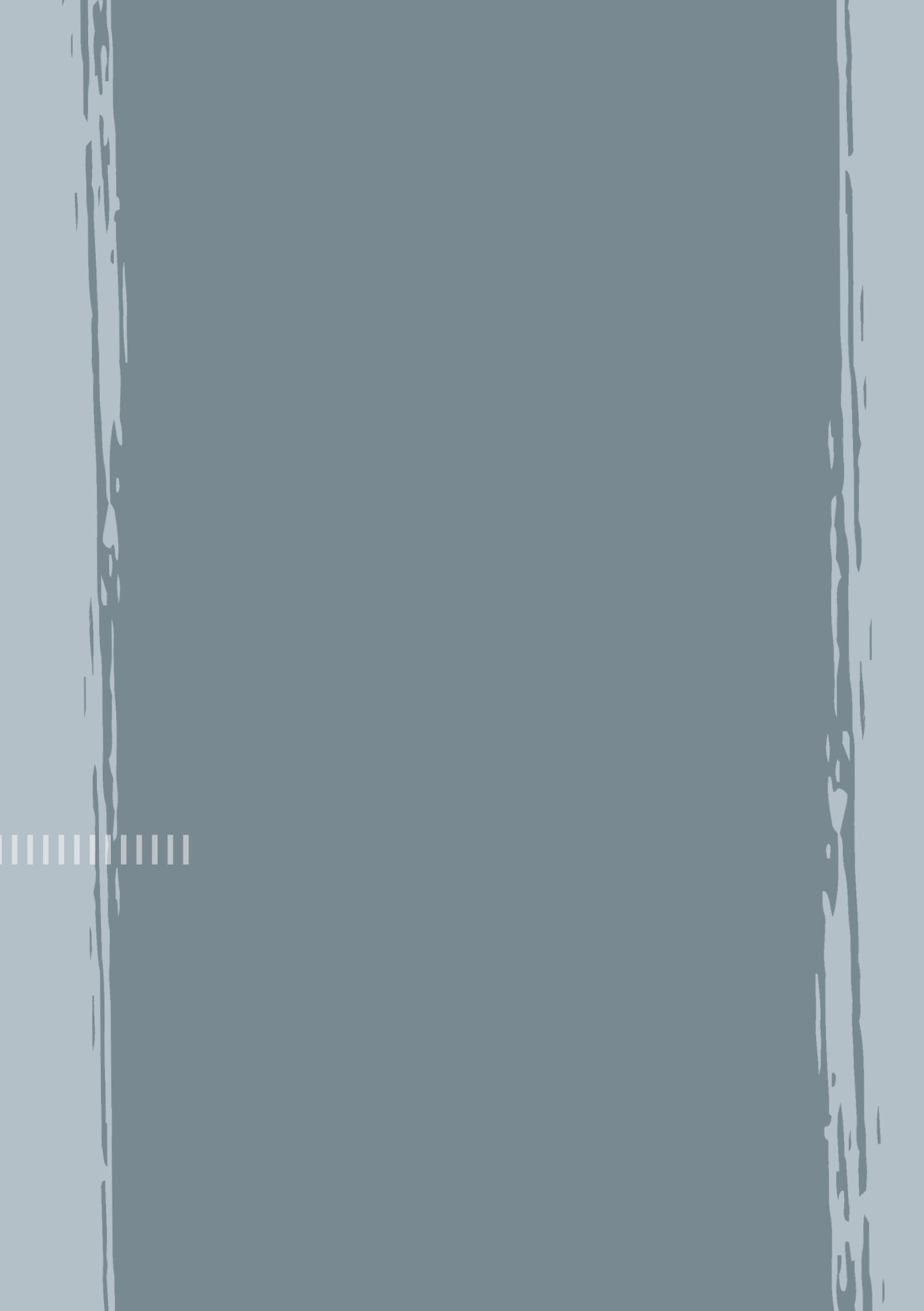


Faculty of Agricultural
and Food Sciences
Office of the Dean



Contents

FOREWORD	5
1. BACKGROUND, PURPOSE AND TARGET AUDIENCE	8
2. THE WEF Nexus IN BRIEF	12
2.1 The Nexus Defined	12
2.2 The Fundamental Principles	13
2.3 The Challenge	13
2.4 The Key Advantages	14
2.5 The Process	15
2.6 Cases	17
3. THE WEF Nexus IN THE CONTEXT OF EU DEVELOPMENT POLICY	24
4. SUBSTANTIVE POLICY FOCUS IN THE CONSENSUS RELEVANT TO THE WEF Nexus AND RELATED LINKS TO THE SDGs	29
5. THE WEF Nexus APPROACH IN THE CONTEXT OF CONSENSUS POLICY	35
6. FEEDBACK FROM NEXUS REGIONAL DIALOGUES	40
6.1 Applying Sustainable Technological Approaches and Solutions	40
6.2 Data, Nexus tools and models	40
6.3 Governance, Finance, Institutions and Cooperation Frameworks	42
7. UPSCALING	47
8. CONCLUSIONS	50
APPENDIX 1 – SELECTED KEY REFERENCE DOCUMENTS	53
APPENDIX 2 – LIST OF EXPERTS	55



FOREWORD

Natural resources are increasingly at risk due to factors such as climate change, demographic and economic growth, political instability and forced migration. With globalisation, these exacerbated risks place additional pressure on resources and, through them, on the economies of affected and neighbouring countries. The greatest challenges to development and cooperation include the identification of appropriate and timely adaptation measures in this continuously changing environment. Other challenges are the establishment of multi-sectorial interlinkages towards achieving the Sustainable Development Goals (SDGs) plus targets in line with the Paris Agreement and the Sendai Framework for Disaster Risk Reduction.

In addressing these challenges, the European Union (EU) has long recognised the importance of the nexus between water, energy, food and ecosystems (WEFE). The 2017 European Consensus on Development underlines the EU commitment to support an integrated approach that concretely addresses the most relevant interlinkages between land, food, water and energy. If appropriately taken into consideration, these interlinkages can increase efficiency, reducing trade-offs and building synergies while improving governance across sectors.

In 2015, the European Commission's Directorate-General for International Cooperation and Development

(DG DEVCO), together with the German Federal Ministry for Economic Cooperation and Development, launched the "Nexus Dialogues" programme. This aims to support the development of national and regional policy recommendations that take into account the links between the WEFE sectors. The European Commission's Joint Research Centre (JRC), which is strongly engaged in WEFE projects to inform the efficient implementation of sustainable growth measures, provides important scientific support to this programme.

One such support is this Position Paper, which is the result of discussions and experiences shared by universities, international organisations and European Commission experts on WEFE. It highlights the importance and advantages of the WEFE Nexus as an approach and methodology in EU development cooperation.

The studies presented (whose scope ranges from national to regional and transboundary levels, including rural and urban contexts), provide valuable examples to help the EU and our partners make informed decisions when operationalising the WEFE Nexus. They show that the Nexus approach ensures a more integrated and sustainable use of resources that goes beyond traditional silos and is applicable at different scales. This is particularly relevant in an increasingly globalised world where collaboration must be more than just a buzzword: it is a common need.

Ms Charlina VITCHEVA
Deputy Director General – JRC

Ms Marjeta JAGER
Deputy Director General – DEVCO

1.

BACKGROUND,
PURPOSE
AND TARGET
AUDIENCE





60W

60W

Solar TV

Solar TV

01

PCS
KGS
KGS

QTY:

N.W.

GW

MEAS. 58 X 24 X 26 CM

1. BACKGROUND, PURPOSE AND TARGET AUDIENCE

The Nexus concept has become widely used in the international development community in recent years, not least since the Bonn 2011 Nexus Conference. While the Millennium Development Goals did not include a goal on energy and had no focus on the WEFE Nexus, the global development policy context has significantly changed with the 2030 Agenda and its Sustainable Development Goals (SDGs, 2015), the Paris Agreement on Climate Change (2015), the Addis Ababa Action Agenda on Financing for Development (2015), and the New Urban Agenda (2016) that underline the importance of policy coherence and integrated approaches across traditional development sectors.

Current EU development policy provides a general framework and background that justifies a Nexus approach and methodology. Consequently, the New European Consensus on Development: "Our World, our Dignity, our Future" (June 2017) emphasises an integrated approach to development and strongly supports the 2030 Agenda with its 17 Sustainable Development Goals (SDGs) that were adopted in September 2015 as a global framework for sustainable development action. The 2030 Agenda itself emphasises an integrated approach that can facilitate a Nexus methodology. As stated by the DEVCO Director General Stefano Manservisi in an interview with DEVEX on 14 June 2018: **"The SDGs are obliging us to work in an integrated way and not in silos".**

As described in Section 2 of this document, the Nexus approach has evolved in recent years and can be defined in different ways. DG DEVCO supported work on the Nexus originally addressed the energy-water-food security (WEF) Nexus, but the ecosystems are increasingly recognised as important conditions for ensuring the sustainability of development solutions. Water, Energy, Food security relies on resources and services provided by healthy ecosystems. Therefore, the Water-Energy-Food-Ecosystems Nexus ("WEFE Nexus") is now the focus of the present Position Paper. In the following sections, the terms "WEFE Nexus" or "Nexus" in short refers to this concept unless otherwise stated.

The purpose of this Position paper is to outline the importance and advantages of the WEFE Nexus as an approach and methodology in EU development cooperation aimed at integrating governance and management across water, energy, and food security while attempting to balance different uses of ecosystem resources

and services. The document makes special reference to the EU policy framework for development cooperation, particularly the "New European Consensus on Development", to the relevant SDGs, as well as to the main conclusions of the WEFE Nexus specific workshop held in Brussels 25-26 January 2018 and jointly organised by JRC and DEVCO. This workshop was oriented towards implementing and operationalising the Nexus approach with the objective of improving the sustainability of the intervention projects and programmes involving water-energy-food security based on the experience of the NEXUS experts who attended the workshop.

The target audiences for this document are staff from: i) DG DEVCO and other European Commission Directories-General most directly involved in water, energy, food security development cooperation and the environment; ii) EU Delegations in developing countries and emerging economies in Africa, Asia, Latin America, and the EU neighbourhood (MENA) region working in these areas; and, iii) Cooperation Agencies of the EU Member States.

This Position Paper introduces the WEFE Nexus and its key advantages. It identifies key policy statements in the New European Consensus on Development that are particularly relevant for a WEFE Nexus approach, and it identifies links between these policy statements and the most relevant SDGs. Following this, it presents the lessons learnt and thoughts from the experts of the five regions and partner organizations that attended the Nexus workshop. Then conclusions and recommendations on how the EU may proceed in implementing the WEFE Nexus approach are presented. Lastly, a short appendix to this document lists selected background documents of relevance to the WEFE Nexus for the target audiences.

It must be stressed that this Position Paper: a) should be considered as a practical introduction to this key topic; b) is presented in non-technical language; c) for the most part does not make detailed references to the literature in the text; and d) does not address detail of the different EU development cooperation instruments and modalities (National Indicative Programmes, Regional Indicative Programmes, budget support, thematic programmes, etc.) nor how the target audiences may use these instruments and modalities to operationalise the WEFE Nexus approach in their work.



*Workshop on WEFE and SDGs
January 25-26, 2018
Brussels (Belgium)*

2.

THE WEFE NEXUS IN BRIEF





2. THE WEFE NEXUS IN BRIEF

2.1 The Nexus Defined

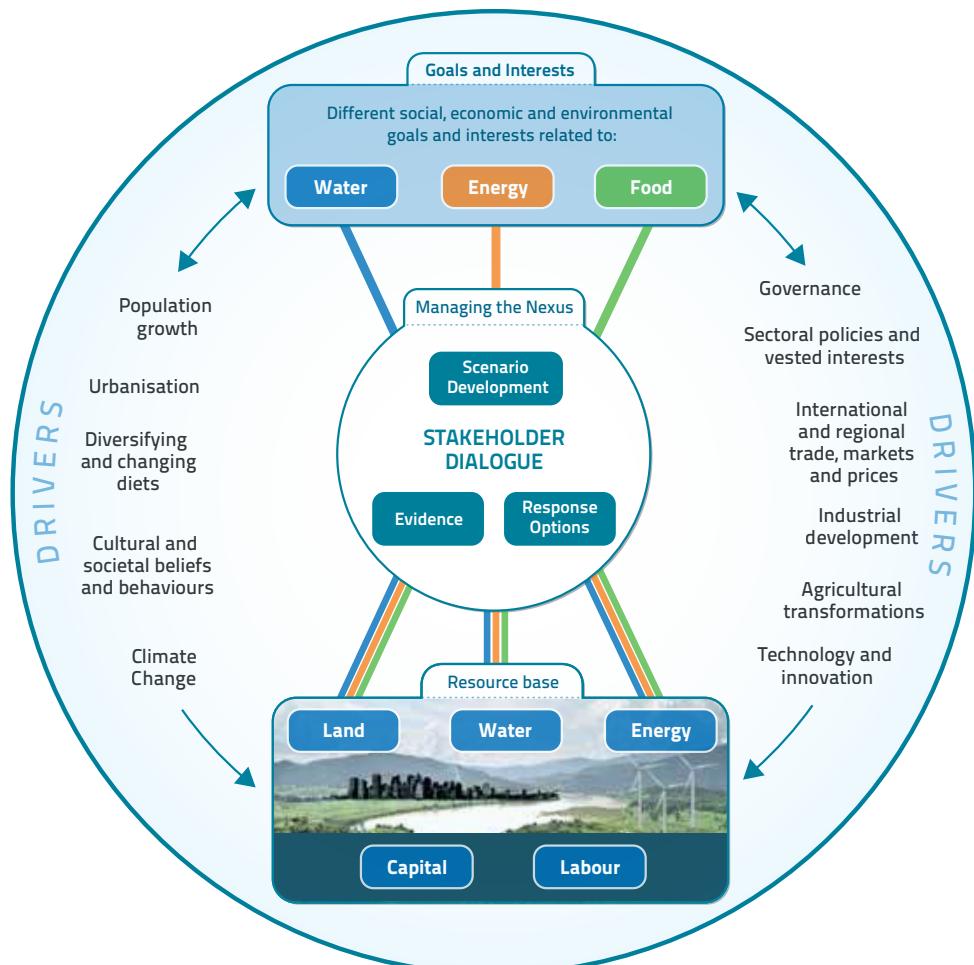
The WEFE Nexus is an approach that integrates management and governance across the multiple sectors of food, energy, water, and ecosystems. The Nexus corroborates the need to not view water, energy, food, and ecosystems as being separate entities, but rather as being complex and inextricably entwined. Globally as well as locally, there is a growing realisation of the interconnectedness between Water, Energy, Food Security, and Ecosystems. In simple terms, direct inputs of water are needed in the production of food and energy while energy is required for the storage and distribution of food as well as in water extraction, conveyance, and treatment. Natural resources and ecosystems services also underlie water, food, and energy security. Any limitation in one of the inputs would disturb the availability of one of the others. Applying the

WEFE Nexus approach helps to improve understanding of the interdependencies across sectors and the Ecosystems with a view to improving integrated solutions in the field that improve achievement of SDGs.

Using the Nexus approach means leaving previous single sector approaches in the past. Since 1992 the water sector has, pursued the IWRM principles and has made good progress, from a distinctly water sector perspective, in coordinating and optimising water use between different users. The Nexus approach does include many of the same basic principles as IWRM and expands them to include food and energy security as well as optimised use of natural resource.

The Nexus approach is a way of ensuring more integrated and sustainable use of resources that both reaches beyond the traditional silos and can be applied at all scales.

Figure 1 FAO approach to the WEFE Nexus



This approach need not necessarily be managed by a “Nexus ministry”, but rather by a strong and binding coordination mechanism (allowing for Nexus Policy Dialogues) where key stakeholders can better identify and prioritise solutions together, benefitting from an overall Nexus perspective. **Under the Nexus paradigm, line ministries are oriented and guided to consider and integrate priorities of other line ministries, which may require compromise by sometimes accepting decisions that may not be optimal from a single sector policy perspective, but which give the overall trade-off solutions for all sectors involved or at least do no harm other sectors.** In these dialogue and negotiation processes, the direct involvement of the scientific-technical dimension is a supporting element because it provides scientific evidence for evidence-based policy making.

2.2 The Fundamental Principles

The Nexus can be seen as a step beyond single sector planning towards a more holistic approach to planning. On an operational level, a complete holistic approach which recognises that everything is influenced by everything else is intricate and difficult to implement. However, choosing to work on Water, Energy, and Food security is a workable scale and includes the associated ecosystem services. Nevertheless, planning for up to 4 components is far more complex than single sector planning. An intermediate operational step would be to plan for up to 2 components without harming or at least minimising the impacts on the other two. Although it will still take years of research and test-implementation before reaching a fully mainstreamed into cross-sectorial planning processes, multi-sectorial dialogues leading to intervention projects successfully addressing concrete multi-sectorial issues and needs are already a reality.

The key principles of the WEFE Nexus are now summarized as follows:

- **Understand the interdependence of resources within a system across space and time** and focus on the whole system's efficiency rather than the productivity of individual components. This will provide integrated solutions that contribute to the sustainability of water, energy, food security policy objectives and to maintaining healthy ecosystems.
- **Recognize the interdependence between water, energy, food and ecosystems** and promote rational and inclusive dialogue and decision-making processes and efficient use of these resources in an environmentally responsible way.
- **Identify integrated policy solutions to optimise trade-offs and maximise synergies across sectors**

and encourage mutually beneficial responses that enhance the potential for cooperation between all components, and public-private partnership at multiple scales.

- **Ensure coordination across sectors and stakeholders** to enable synergies and increase solution sustainability.
- **Value the natural capital of land, water, energy sources and ecosystems** and encourage governments and business to support the transition to sustainability, e.g., using nature-based solutions.

2.3 The Challenge

The planet's natural resources are increasingly coming under pressure and suffering depletion with impacts on ecosystems in many places. Approximately 1.06 billion people, predominantly rural dwellers, still function without electricity in 2017. Half of those people live in sub-Saharan Africa; about 793 million people in the world are still undernourished in 2016; 2.4 billion have no access to improved sanitation; and ecosystems are affected, for example, about one fifth of the Earth's land surface covered by vegetation showed persistent and declining trends in productivity from 1998 to 2013.

The core threats to the resources are: Population Growth; Economic Development; Urbanisation Development; Lack of Transboundary cooperation; Pollution; and, Climate Change/Variability. The environmental aspect is a reflection of these threats.

Population growth projections estimate that the global population will have grown up around to 9 billion by 2050 (7.3 billion in 2015). As a consequence, energy consumption is estimated to grow by 80% and food demand by 60% (IEA 2010, FAO 2012). Agriculture is already consuming 70% of all global freshwater abstractions (FAO, 2011a: The state of the world's land and water resources for food and agriculture).

While **economic development** continues to move people from poverty into middle income living, this is resulting in increased demand for water, food, and energy as a consequence of consumption patterns. Even if many people are lifted out of poverty, the poorest sector of the population is growing even faster and the actual number of poor people and inequalities are increasing. In an increasingly resource depleted planet, the poorest people will be the most vulnerable.

Increasing demand due to population growth and economic development combined with unsustainable production methods will put increased strain on the natural resources base that is unlikely to be reversed during the foreseeable future.

In addition, the **urbanisation** phenomena can also constrain WEF security and lead to ecosystem degradation as in the case of not well-managed urban development. The growth of urban population is estimated to add "2.5 billion to the world's urban population by 2050, with almost 90% of this growth happening in Africa and Asia".

Indeed, while regional level harmonization of policies and approaches is good, active coordination of plans across sectors and borders is also needed. Otherwise there are risks from unilateral developments to countries with which resources are shared. Transboundary cooperation on the Nexus solutions can have benefits across sectors and basin commissions/organisations can play an important role.

Climate Change brings additional challenges to the Water, Energy and Food complex because it affects resource availability (quality and quantity) and ecosystems. Together with an exacerbated Climate Variability, their effects and impacts need to be integrated in resources planning because they affect short, medium, and long term management practises and production in the water-energy-food sectors.

Having appropriately skilled professionals to address these challenges, ones who understand the principles of Nexus, is required but even this often remains a challenge per se.

2.4 The Key Advantages

The WEFE Nexus aims to increase Water, Energy, and Food security without compromising ecosystems services. In practical terms, the WEFE Nexus helps to improve understanding and systematic analysis of the interactions between the natural environment and human activities in these three sectors. This will develop more coordinated and sustainable management of natural resources across sectors, levels, and scales.

Some key benefits arising from utilising the Nexus are:

1. Exploitation of co-benefits to improve overall performance by:

Increased resource productivity: Technological innovation, recycling of waste, waste reduction, and demand management can all contribute to improving utilisation of available resources.

Waste becomes a resource: In particular, waste and residues in Multi-Use systems can become inputs in the other systems. This is a sustainable alternative to a traditional linear economy (take, make, use, dispose) and so the Nexus approach should be considered to be compatible and contribute to a circular economic concept which

is restorative and generative (i.e. waste water to fertiliser, solid waste to fuel).

Demand management will be a natural outcome of WEFE Nexus analysis which will ensure security. Indeed, demand can be analysed and oriented towards more efficient optimisation of resources/waste through and across uses. Consequently, it also limits the pressure on ecosystems. Two examples are the use of wastewater in agriculture and the use of more adapted energy for pumping water for irrigation and domestic uses. The optimisation produced by the Nexus will also foster alternative practises to fulfil multi-sectorial needs or resolve issues.

Alternative practise: Wood Fuel can be optimised or replaced by other cooking methods to reduce the related demand for wood and limit impacts on the ecosystem but also on family health while providing families with the energy they need. Introducing sanitation protects water resources but can also increase the water demand in water-based sanitation. In this case, the Nexus approach can orient the selection of sanitation by considering non water-based sanitation facilities adapted to energy availability.

2. Streamlining development and improving resilience

Benefits from productive ecosystems: The Nexus approach also aims to maintain ecosystems which provide multiple services and increase overall benefits. In taking advantage of natural infrastructure and soft path solutions, Nexus based solutions complement human-made 'hard' infrastructure and end-of-pipe solutions because ecosystems per se can deliver certain services more efficiently (e.g. improved water quality).

Poverty alleviation: The Nexus integrative approach is more efficient at improving the basic services of water supply, modern energy, and food, and also helps to strengthen natural ecosystems and thus maintain a healthy environment. This benefits the poorest population, who often derive their livelihood directly from the local ecosystem.

Climate Change: As Climate Change and Variability Mitigation and Adaptation are included in the dialogues, the Nexus approach makes the necessary planning processes more transparent and easy for the stakeholder community to understand and accept because of the integrative nature of the dialogues. The Nexus approach contributes to enhancing resilience and to addressing disaster risk (for example, water floods can be stored in the dam and released for agricultural and energy production purposes later).

3. Stimulating policy coherence and multipurpose investments

Governance, institutions and policy coherence: The Nexus policy dialogues (consultation) embedded in the approach require a high degree of collaboration between sectors and associated institutions. As such, benefits can be achieved on social, economic, and environmental values because sustainable solutions and policy coherence improvements come from well-structured collaborations across the sectors that share objectives and resources. The existing institutional management frameworks such as transboundary or regional agencies are governance infrastructures that can support the Nexus processes and its implementation without additional effort. Such collaboration frameworks contribute towards minimising unilateral developments affecting shared natural resources and the people who depend on them.

SDGs support. The NEXUS approach is highly relevant in terms of working towards the SDGs. A single sector approach will not achieve the SDGs. In contrast, the multi-sector approach embedded in the Nexus is a precondition for achieving the SDGs.

Stimulate development through multipurpose investment: The Nexus approach can help stimulate investment in sustainable infrastructure and help avoid preventing development by only investing in a single sector. Pricing of ecological services can also help direct

investment in more sustainable development projects by combining built and natural infrastructure.

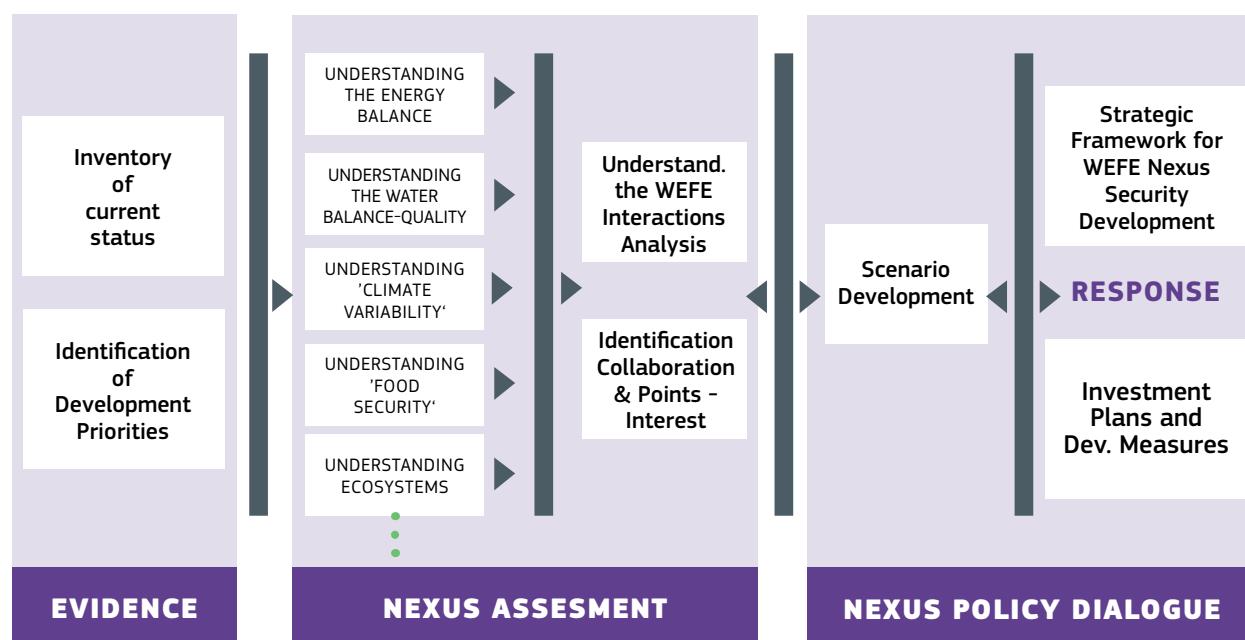
2.5 The Process

Managing the WEFE Nexus is a consultative process with key stakeholders contributing and agreeing to responses to the challenges being faced. Relevant stakeholder engagement is particularly crucial when implementing the WEFE Nexus because of the need to collaborate across traditional thematic silos. Consultation is a main vehicle for gathering stakeholders together and can:

- bring together stakeholders from different sectors, different spheres of government and countries, and different levels;
- link directly to ongoing and emerging processes;
- develop a shared understanding of issues, objectives, and scenarios; and,
- help develop a shared vision which can be moved towards more specific collaborative activities with the objective of concrete agreements on multi-sectorial and multi-scale strategies to arrive at concrete intervention projects/solutions in view of achieving the SDGs.

Key elements of managing the Nexus are:

Figure 2: NEXUS Process



Nexus Assessment: The Nexus assessment process will lead to improved understanding of the interactions between the different sectors and their potential impacts on the environment. Nexus assessment outputs shall be a concrete set of optimal solutions (recommendations) coming from the integrated and collaborative models and assessments. These scientifically and technically based outputs will then feed the policy dialogues concerning the predefined priorities and needs. What can be achieved in a Nexus assessment depends on various factors: the context, the issues, the actors, and the capacities involved, the constructiveness of the dialogue, the availability of information (data and knowledge ...), and the political will.

Evidence: Nexus Assessment initially requires data and knowledge collection to identify the linkages between the water, energy, and food systems, and the impact that changes to these systems can have on the ecosystems and livelihoods which will be at the base of the Nexus assessment. Data and knowledge collection includes natural resources, socio-economic information, and policies from relevant sectors. To simplify the complex field of applicability, they need to be adapted to the context, linked to the policy priorities and needs, and to the complexities and sustainability of the environment. The information can be both qualitative and quantitative depending on the case in point. The implementation of this task will consider: a) that there is often a lack of good, accurate, harmonised, and up-to-date knowledge, data, and information; b) asymmetrical access to information; c) that available data and knowledge in transboundary basins may differ greatly in terms of level of aggregation, scale, accuracy, reliability, etc. not only between countries sharing resources but also institutions. Sharing of information between Institutions involved in data and knowledge

collection and management needs to be encouraged as information on critical conditions in one sector impact the other Nexus components. This is particularly important in the case of transboundary waters.

Scenario Development: This shall identify short/medium/long term effects of possible Nexus intervention or the application of new policies on the natural environment and society at various time and spatial scales. It includes the estimation of potential benefits on the Nexus components and must highlight impacts on the socio-economic goals (SDGs), and lead to a shared vision of water, energy, and food security in a sustainable environment (healthy ecosystems). The scenario can be developed by applying the existing/validated/calibrated tools and models in the various sectors (for instance, life cycle assessment, energy or agro-hydrological modelling). These are applied to the different Nexus components by combining them. The outputs of one component/model can become inputs in another one within the framework of an iterative assessment process.

Response Options: Consensus will be reached on specific policy options and trade-offs that address planned interventions in an open, participatory, and inclusive dialogue during stakeholder consultation.

The response options need not be built on comprehensive quantitative and qualitative data collection but can be built on qualitative analysis immediately after the Evidence gathering phase.

These four elements need not be addressed in sequence but can be iterative with the objective of integrating new key issues or evidences arising out of the various phases.



2.6 CASES

A few examples are included here to show real situations where the WEFE Nexus can be applied and lead to more sustainable solutions than single sector ones:

ELECTRICITY SUBSIDIES FOR FARMERS IN PUNJAB

The effect of electricity subsidies for farmers in The Punjab during the last few decades is a well-known documented case study. Access to cheap electricity provided a benefit to farmers in the short term (increasing yields through pumped irrigation), but negatively impacted water quality and availability as well as soil quality due to agriculture intensification. The result is that farmers are struggling to maintain profits from agricultural production while at the same time they are over-exploiting natural resources.

THE ISSUE TO BE ADDRESSED

About 80 percent of the Punjab's geographical area is cultivated with a cropping intensity of more than 180 percent. Therefore, agriculture in the state is heavily dependent upon its requirement for water. The state's surface water resources are limited and, owing to an increase in population during the last 50 years, are fully utilized. Therefore, to meet the ever-growing demand for agriculture, industry, and the population, dependency on groundwater has been increasing enormously. Between 1970-71 and 2005-06, the number of tube wells has increased from 0.19 million to more than 1.15 million. As a result of over pumping groundwater coupled with declining average rainfall per year, the water table has declined in most parts of the state.

While the state of Punjab is now a leading producer of rice and wheat, this was not always the case. The shift from traditional crops, like cotton or barley, to the monoculture of the rice-wheat system was driven by forces such as price policy, technological change, market infrastructure, and low cost of irrigation. Subsidies in various agricultural inputs such as electricity, fertilizers and agricultural equipment acted as a catalyst for agricultural production. Subsidies have gradually increased in various parts of the state over the years. So it should be acknowledged that the shift from traditional diversified crops to wheat and rice was due to various food security policies and factors like subsidies and minimum support price and was not a response to the actual economic returns in the state.

The move from traditional crops to primarily rice and wheat in the Punjab has had a negative effect on groundwater level, especially since paddy fields are an extremely water intensive crop growing system. It could be argued that the present grim groundwater condition in the state is essentially the result of faulty production practices leading to irrational excessive use of water.

Other factors include restricted availability of surface water, and the heavily subsidized power supply to the agriculture sector resulting in disproportionate installation of tube wells by farmers.

WHAT AN INTEGRATED NEXUS ASSESSMENT HIGHLIGHTS

The situation in Punjab exemplifies the importance of the inter-linkages between water, energy, and food and the effect one sectorial policy can have on other sectors of the economy. This reinforces the need to take into account all three Nexus dimensions. Due to intensive farming over the last few decades, the yield per hectare of wheat and rice in the Punjab has increased many fold. However, the rising population in India poses a challenge to food security. Dropping water tables could further aggravate the challenge of providing food security as water and energy are intricately interlinked and required to guarantee food security. Consequently, a policy shift in one of the three areas can have a severe impact on the other as exemplified by the effect of energy subsidy on groundwater level in the Punjab. In the long run, energy subsidy will further reduce groundwater levels which in turn will severely impact grain production in Punjab.

To ensure faster and more sustainable agricultural development, it is essential to maintain groundwater balance. To this end, the role of subsidies becomes of paramount importance as they can distort the cropping pattern, the variations in inter-regional development, and agricultural inputs like water and energy. In addition, the heavily subsidised agriculture sector means less energy is available to the manufacturing and service sectors and costs more.

A clear assessment of the current state of natural resources, like water and soil quality as well as energy required in agriculture and their interrelationships would

be required in making informed policy decisions. As of now, the government of the Punjab is encouraging farmers to install solar powered water pumps by subsidizing their cost. The obvious benefit of this strategy is the reduction in energy used by submersible pumps and also a decrease in fossil fuel use since a large number of water pumps are run by diesel-based generators. However, while this strategy is good from a sustainable energy perspective, it has a minimal or no impact on groundwater extraction since the amount

of water being extracted remains the same. Furthermore, most farmers have continued growing wheat and rice since the government guarantees a minimum support price and marketing for these staples. A similar programme for other crops exists.

More: Alessandro Flammini, Manas Puri, Lucie Pluschke, Olivier Dubois : "Walking the Nexus Talk: Assessing the Wa-ter-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative" FAO , October 2014, Pages 77-83

PRIORITY NEXUS INTERCONNECTIONS IN THE LATIN AMERICAN REGION

Priorities/challenges in the Latin American context have been analysed by using specific Nexus interactions.

A) WATER-ENERGY: HYDROPOWER, HYDROCARBONS AND MINING

The exploitation of hydrocarbons, which are understood to be fossil fuels and minerals, requires low to very high quantities of water and energy, and can seriously affect the environment and the quality of water resources. This interconnection is highly relevant almost throughout the entire region, but especially in the Andean countries, Brazil, Mexico, Venezuela and some Central American countries. The impacts become

significant when hydraulic fracturing techniques are used. The use of water for energy purposes does not compare with water use for agriculture in quantity (except in arid or semiarid regions), but causes the most social unrest due to the displacement of people, the associated consequences of these displacements, and the impact on the quality of water resources.

B) ENERGY-WATER: WATER ABSTRACTION, USE AND DESALINATION

The largest energy cost in relation to water in the region occurs to the groundwater abstraction, conveyance, and use, which include irrigation. In fact, the growing dependence on groundwater for irrigation development is shared throughout the region, particularly in Central America, Mexico, and in the desert or semi-desert areas of Argentina, Brazil, Chile, Bolivia, Mexico, and Peru. Due to the level of subsidies granted for extraction, aquifer exploitation is also to be evaluated for the Nexus (food production, sustainable water use, and energy efficiency). The increasing overexploitation of aquifers is a key Nexus node that impacts i) WATER - water quality and quantity, ii) FOOD - land availability for production; and, iii) ENERGY - the energy costs of water extraction. Currently, energy consumption is not a significant factor in water treatment or seawater desalination, which remain confined to isolated areas and used for highly profitable activities (mainly in Chile, Mexico, Peru, and some Caribbean countries).

C) WATER-FOOD: AGRICULTURE

The importance of agriculture in the LAC should be understood in terms of regional specificities, namely large-scale production and its expansion, mainly for export. This type of agriculture has a direct relationship with deforestation, single crop growing, the subsequent increase of risks like diffuse pollution/sedimentation/erosion and flooding, the displacement of local population,



and an impact on household-based or subsistence agriculture, which is vital for sourcing food in the region. Agriculture is the biggest consumer of water resources and remains important in terms of share of the gross domestic product, employment forecasts, and so on.

D) WATER-ENERGY-FOOD: BIOFUELS, PUMPING, IRRIGATION MODERNIZATION AND URBAN NEXUS

A special Nexus link is observed in the case of biofuel production. Indeed, Biofuels consume water for specific crop production (colza, soja....), are used to produce energy, and can affect food production because of land competition. Agriculture for bioenergy production, especially biofuels, combines both the impacts of large-scale agriculture and the considerable effect on food availability and prices. The development of biofuels is particularly noted in Argentina, Brazil, Paraguay and, to a lesser extent, Peru, Colombia, and Central American

countries such as Costa Rica. Other three-way relationship between Nexus sectors are also relevant in Latin America: i) irrigation modernization requires more energy and greater water consumption but more food production is expected, ii) with the setup of policy for subsidizing electricity (discounted tariffs), aquifer overexploitation is fostered and results in additional water abstraction, therefore potentially impacting crop yields. Finally, the WEF Nexus adopts a particular shape in the urban context which affects this continent very much: very high rates of urban population (80% in 2017), nearly 8 current megalopolises lacking full water supply and sanitation coverage, food and energy supply to be taken to cities. The Nexus approach could be applied and favoured synergies obtained in this concentrated space.

More: Embid A., Martin L. "Defining priority interconnections in Latin America and the Caribbean", Proceedings of EC workshop on WEF Nexus, 15-16 Jan 2018, Brussels.

IMPLEMENTATION OF THE NEXUS IN THE MEKROU RIVER BASIN

During the definition of the Strategic Development Plan in the MEKROU river basin (MEKROU project funded by the EC), the transboundary dialogues naturally gave rise to the Nexus approach (Benin, Burkina Faso, Niger). This hinged on key priorities identified by stakeholders to foster sustainable development. The Nexus assessment methodology included: a) the state of the art of the socio-economic and biophysical issues in the Mekrou river basin; b) identification of the key issues and priorities for development by local-national stakeholders; c) identification of interactions between the different sectors; d) the development of NEXUS analysis tools (E-NEXUS) to simulate stakeholder objectives/priorities/solutions with local scientific and technical partners; and finally, e) running models and optimisation analysis to test development scenarios and feed the policy maker dialogues.



Climate Change and Variability analyses were integrated into the development scenarios because of the strong regional variability of the precipitation and temperature and the climate change impacts on natural resources. The interaction between science and policy, including local institutions, was crucial in this process identifying sustainable development solutions compatible with the availability of the current and future natural resources and the sustainability of the biodiversity (W-Park).

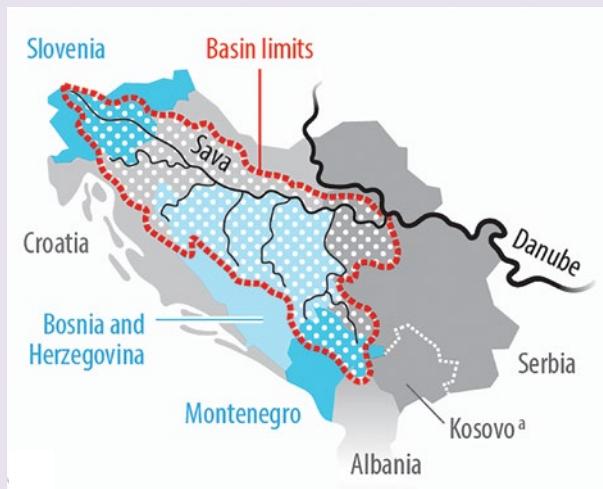
The priorities identified were: i) WATER – water management to satisfy multiple uses; ii) FOOD – crop and livestock production to generate income and cover food needs; iii) ecosystems preservation (W-Park and Upstream part) to ensure services (energy-water supply, etc.) and tourism.

Therefore, Water-Energy-Food-Ecosystems (WEFE) Nexus became a very relevant approach for the Mekrou river basin to agree on a strategy for sustainable development as well as finding trade-offs between the different uses of resources versus the objectives set at Horizon 2025 by the governments sharing the river basin. The project combined and applied local knowledge from surveys with analytical tools to provide information (e-NEXUS) to decision makers and allow optimal development scenarios for the WEFE Nexus interactions to be developed at river basin scale.

More: Dondéynaz C., Pastori M., Ameztoy I., Carmona-Moreno C. "Assessing the WEFE Nexus and finding optimal solutions in the Mekrou transboundary river basin", Proceedings of EC workshop on WEFE Nexus, 15-16 Jan 2018, Brussels.

NEXUS ASSESSMENT IN THE SAVA RIVER BASIN

The Sava Basin is a key basin in the Western Balkans. It covers considerable parts of Bosnia and Herzegovina, Croatia, Montenegro, Serbia, Slovenia, and a very small part of Albania. Indeed, a large part of the riparian population lives in the basin: 75 per cent in Bosnia and Herzegovina, 61 per cent in Slovenia, close to 50 per cent in Croatia, over 30 per cent in Montenegro and close to 25 per cent in Serbia. A significant share of water, hydropower, land area, and economic activity is based in or derived from the basin – for example 53 per cent of the riparian countries' electricity generation capacity is located within the basin.

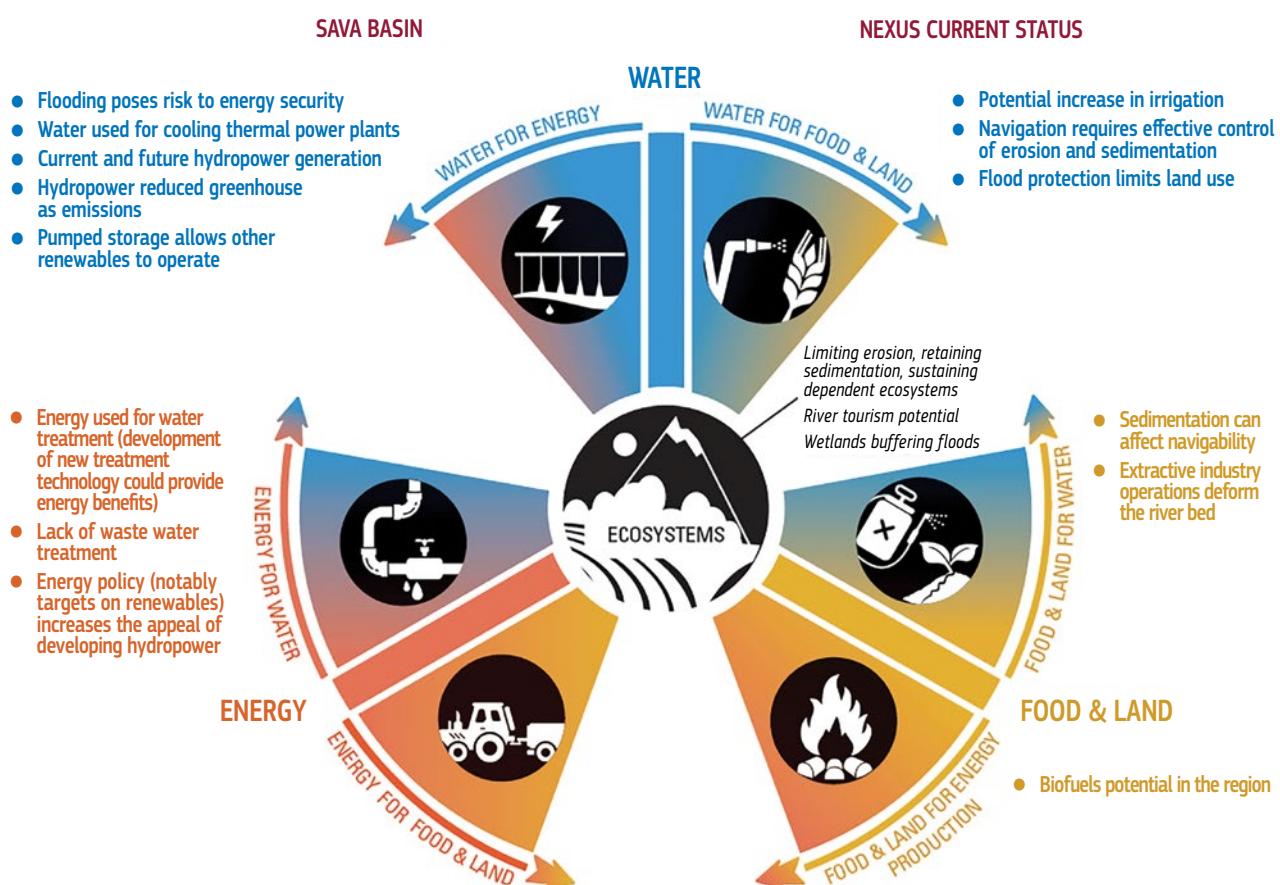


^(a) United Nations administered territory under Security Council Resolution 1244 (1999)

The assessment of the water-food-energy-ecosystems Nexus in the Sava River Basin aims to support transboundary cooperation by Sava countries in the areas of water, energy, food, and environmental policies by strengthening the knowledge base for integrated policy development and decision making.

Energy, water and land resources as well as ecosystem services are closely linked in the Sava Basin.

The current status of the Nexus linkages in the Sava basin are shown in the following diagram:



The Sava Nexus assessment used multi-stakeholder approach involving representatives from the different sector ministries and various interest groups affected by the Nexus from five Sava countries: Slovenia, Croatia, Bosnia and Herzegovina, Serbia, and Montenegro.

The findings of the dialogue workshop highlighted that the need for irrigation will grow as will investments in the energy sector. At the same time, extreme weather events pose risks and might damage infrastructure. Furthermore, investments should be made in new land reclamation strategies. Links between these developments were identified and the related trade-offs discussed in the workshop.

The assessment exercise in the Sava Basin is contributing to further integration of water policy with other policies and further dialogue with the key sectorial stakeholders as specific objectives in river basin management defined in the Strategy on Implementation of the Framework Agreement on the Sava River Basin. The process helps to broaden stakeholder involvement in the framework of the International Sava River Basin Commission (ISRBC).

The assessment illustrates the value of transboundary cooperation for balancing between increasing energy generation, the ambitious regional climate and energy policy targets, and maintaining a good status of shared waters. A more systematic use of policy instruments, reliable data and information gathering as well as coordination of investments into infrastructure, and promoting multiple and flexible use of infrastructure were among the key recommendations. Furthermore, using ISRBC as a platform to discuss all of the relevant basin resources and for a consultation process to review the impact of national and sectorial development strategies was also recommended.

Source: Policy Brief: Increasing welfare in the Sava countries through a transboundary nexus approach (UNECE, 2017). Available from: <https://www.unece.org/index.php?id=46028>

More information: <http://www.unece.org/env/water/Nexus>



3.

THE WEFE
NEXUS IN
THE CONTEXT
OF EU
DEVELOPMENT
POLICY





3. THE WEFE NEXUS IN THE CONTEXT OF EU DEVELOPMENT POLICY

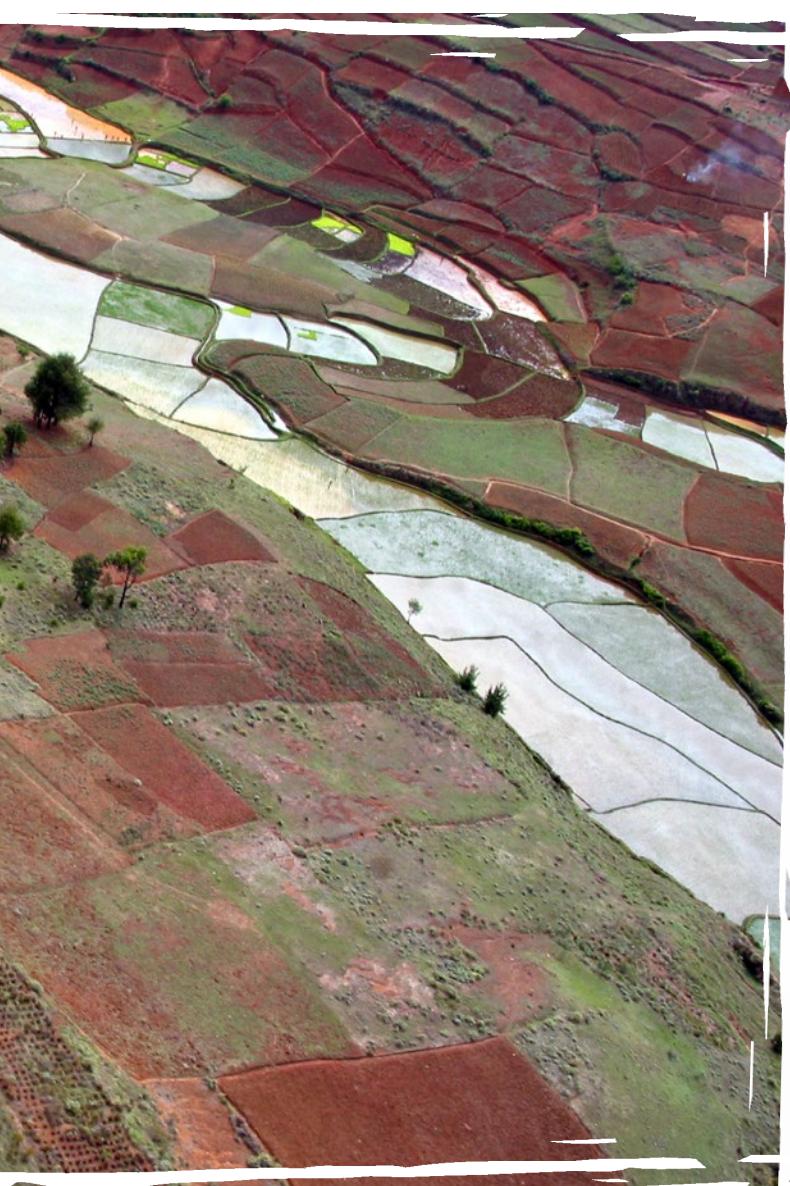
Recent key EU development policy framework documents include "An Agenda for Change (2011)", the "New European Consensus on Development (2017)", the EU External Investment Plan (2016), "A Global Strategy for the European Union's Foreign And Security Policy" (2016), and various sector development policies. For example, the DEVCO water Nexus policy¹ states that: "...challenges.....can be addressed through ensuring a better management of linked resources. One example is to reconcile the competing needs of water for energy and water for agriculture while securing needs for underpinning ecosystems. This needs to be done in an integrated, transboundary and equitable manner, and enhancing cooperation across borders. Especially in the context of the holistic approach adopted by the post-2015 agenda, the EU will need to have goals and targets in specific areas while at the same time ensuring that it does not create a "set of silos" of completely separate goals." A presentation on the EU water development policy (2012) explicitly mentions the water-energy-food security Nexus under its framework for action. The DEVCO Sustainable Energy Handbook (2016) has a specific Module 2.4 on the Water-Energy-Food Nexus.

The above-mentioned New European Consensus on Development "Our World, Our Dignity, Our Future" is a Joint Statement by the Council and the Representatives of the Governments of the Member States meeting within the Council, the European Parliament, and the European Commission. It serves as the overarching EU development policy framework and from now onwards is referred to as the "Consensus" for short. The Council of Europe Press Release Joint Statement on the adoption of the Consensus states that: *"Our new approach to development is based on the 'five Ps' of the 2030 Agenda: People, Planet, Prosperity, Peace, and Partnerships. Recognising the interlinkages between the SDGs, we will pay attention to actions that meet multiple goals in a coherent way. We will work across policies and sectors to boost synergies addressing a range of cross-cutting elements to accelerate transformation. Based on the principle of policy coherence for development, development objectives will be fully*



taken into account across EU policies that are likely to affect developing countries. Policy coherence will be ensured to contribute to the achievement of the SDGs by partner countries".

¹ https://ec.europa.eu/europeaid/sectors/infrastructure/water-and-sanitation/water-Nexus_en



Paragraph 19 of the Consensus document states: “*The implementation of the 2030 Agenda requires comprehensive national sustainable development strategies that factor in the SDGs and their interlinkages. When planning and implementing development cooperation, the EU and its Member States will pay particular attention to such interlinkages and to integrated actions that can create co-benefits and meet multiple objectives in a coherent way*”. This and many other key policy statements in the Consensus directly or indirectly provide the EU policy context for a WEFE Nexus approach in EU development cooperation.

It is also noted that the July 2018 UN High Level Political Forum (HLPF²) focussed on the themes in SDGs 6, 7, 11, 12, 15, and 17 which was highly relevant from a WEFE Nexus perspective. Related to its participation and contributions to the HLPF, the European Commission stated³ that “Investment in these SDGs will yield significant co-benefits for the whole 2030 Agenda, which will only be achieved through an integrated, holistic approach”. The Ministerial Declaration from the HLPF stated that: “While our 2018 review emphasizes Sustainable Development Goals 6, 7, 11, 12, 15, and 17, the integrated, indivisible, and universal nature of the Goals makes it essential that we pay particular attention to leveraging synergies and co-benefits across all dimensions of sustainable development”. The HLPF President’s summary⁴ contains a reference to the “land-food-water-energy-climate Nexus” and mentions that many HLPF speakers expressed their increased understanding of how progress could be leveraged through addressing the many interlinkages between the SDGs. In connection with the HLPF, the European Commission stated⁵ that it, together with its member States, will prepare a Joint Synthesis Report on the implementation of the European Consensus on Development for the 2019 session of the HLPF, and that it has established a high level multi-stakeholder platform⁶ on the implementation of the Sustainable Development Goals.

² The theme of the overall HLPF was “Transformation towards sustainable and resilient societies” and the specific focus was SDG 6 (water), SDG 7 (sustainable energy), SDG 11 (urban development), SDG 12 (sustainable consumption and production patterns), SDG 15 (ecosystems), and SDG 17 (partnerships).

³ The EC DEVCO statement re HLPF: https://ec.europa.eu/europeaid/news-and-events/un-high-level-political-forum-eu-and-un-review-progress-towards-achieving-2030_en also noted that the voluntary national reviews (VNRs - a mechanism designed to assess the progress of each UN Member State in achieving the SDGs) would be considered at the HLPF. The 153 available VNRs can be found in the VNR database. The updated 2018 VNR guidelines emphasise examining policy coherence and interlinkages between SDGs, but many VNRs have limited focus on these aspects.

⁴ https://sustainabledevelopment.un.org/content/documents/205432018_HLPF_Presidents_summary_FINAL.pdf

⁵ <http://sdg.iisd.org/news/stakeholders-launch-sdg-report-outlining-vnr-best-practices-and-recommendations/>

⁶ https://ec.europa.eu/info/strategy/international-strategies/global-topics/sustainable-development-goals/multi-stakeholder-platform-sdgs_en

4.

SUBSTANTIVE
POLICY
FOCUS IN THE
CONSENSUS
RELEVANT
TO THE WEFE
NEXUS AND
RELATED LINKS
TO THE SDGS





4. SUBSTANTIVE POLICY FOCUS IN THE CONSENSUS RELEVANT TO THE WEFE NEXUS AND RELATED LINKS TO THE SDGs

The table below identifies key areas of policy emphasis in the Consensus that are relevant to the WEFE Nexus - structured according to the 5 Ps. For each of the highlighted Consensus policy quotes, reference is made to the relevant SDGs, illustrated by the relevant SDG icons. To facilitate an

overview, many of the quotes from the Consensus are not given as full sentences - but paragraph numbers (para no.) are used to indicate the location of the full text in the Consensus document.

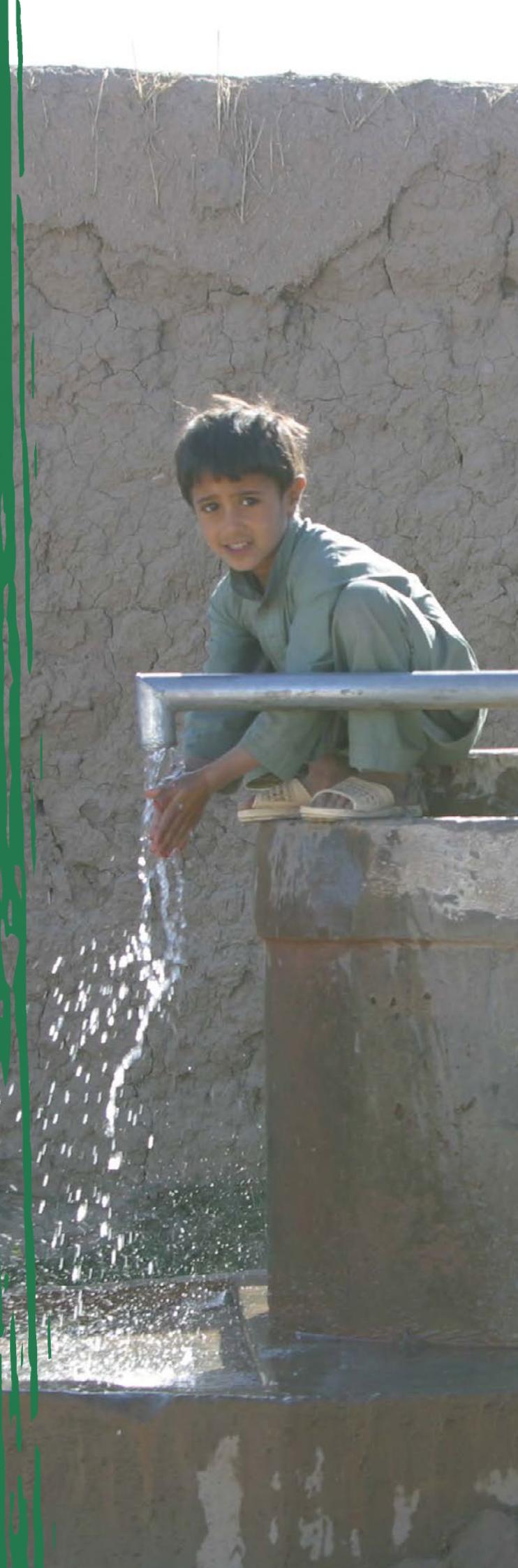


EU policy emphasis relevant to a WEFE Nexus approach	Para No.	Consensus policy quote	Related SDGs
People:			
The policy of supporting interventions addressing food security .	24	<p>“....make coordinated, accelerated and cross-sectoral efforts to end hunger, increase the capacity for diversified local and regional food production, ensure food security and nutrition and enhance the resilience of the most vulnerable...”; and “addressing all forms of malnutrition...through support for basic services in health, nutrition, water, sanitation and hygiene, and social protection”.</p>	 
EU policy of supporting access to land, food, water and energy .	25	<p>The EU and its Member States will support the poorest communities in improving access for all to land, food, water, and clean, affordable, and sustainable energy while avoiding any damaging effects on the environment. They will promote policy initiatives and support partner countries in planning and implementing an integrated approach to concretely address the most relevant interlinkages between land, food, water, and energy.”</p>	    
EU policy on integrated water management .	26	<p>“... support sustainable and integrated water management, as well as more efficient use of water and water recycling, including a more strategic approach to regional development and integration”.</p>	 
EU policy on migration .	40	<p>“Addressing migration cuts across many policy areas, including development, good governance, security, human rights, employment, health, education, agriculture, food security, social protection and environment, including climate change. Through the Partnership Framework approach the EU and its Member States will address in a comprehensive manner the multiple aspects of migration and forced displacement...”.</p>	     
Planet:			
EU policy emphasis on environmental sustainability .	43	<p>The EU and its Member States will promote resource efficiency and sustainable consumption and production, including the sustainable management of chemicals and waste, with a view to decoupling economic growth from environmental degradation and enabling the transition to a circular economy, and“help to build capacity to mainstream environmental sustainability, climate change objectives and the pursuit of the green growth into national and local development strategies”. And para#44: “The EU and its Member States will promote the use of natural capital accounting”.</p>	     
EU policy on climate change indicates cross-sectorial and co-ordinated action.	45	<p>“.... will implement the 2030 Agenda and the Paris Climate Change Agreement through coordinated and coherent action and will maximise synergies. They will support national strategies, including cross-government planning and programming, which promote resilience, reduce climate risk and contribute to emission reduction, consistent with the implementation of Nationally Determined Contributions (NDCs), taking into account the challenges faced by developing countries, particularly Least Developed Countries (LDCs) and Small Island Developing States (SIDS)... including by supporting multi-stakeholder platforms. The legally binding character of the Paris Agreement and the requirement to prepare NDCs can also give impetus to national development planning in the context of the 2030 Agenda”.</p>	  
EU policy on sustainable energy .	the box after para. 5	<p>“Investment in sustainable energy can ensure and increase access to clean water, clean cooking, education, and healthcare, and can also create jobs and support local businesses in an environmentally friendly manner. The EU and its Member States will pursue three interlinked key objectives: addressing the lack of energy access; increasing energy efficiency and renewable energy generation to achieve a sustainable balance between energy production and consumption; and contributing to the global fight against climate change in line with the Paris Agreement....”.</p>	    

EU policy emphasis relevant to a WEFE Nexus approach	Para No.	Consensus policy quote	Related SDGs
Prosperity:			
EU policy on inclusive and sustainable growth and its emphasis on value chains .	52	<p><i>"The EU and its Member States will promote inclusive and sustainable economic growth and help developing countries adopt growth models that take account of resource scarcity and climate change action. This includes promoting sustainable value chains...."</i></p>	
EU policy emphasis on the private sector's role .	53	<p><i>..promoting private sector accountability, in areas with significant transformation potential for sustainable development. This includes sustainable agriculture, safe and clean energy, integrated water resource management, resilient infrastructure, health, sustainable tourism, green and circular economy....".</i></p>	
EU policy on sustainable agriculture clearly indicates the importance of the links with water and ecosystems.	55	<p><i>The EU and its Member States will support improvements in governance relating to sustainable forest management, participatory rangeland management, and to equitable access to land tenure, particularly for women, respecting the rights of local populations and of indigenous peoples, including customary land use and access to water". And Para #56: "...support agro-ecological practices and actions to reduce post-harvest losses and food waste, as well as to protect soils, conserve water resources, halt, prevent and reverse deforestation, and maintain biodiversity and healthy ecosystems".</i></p>	
EU policy on sustainable urbanisation .	60	<p><i>The EU and its Member States will seek to boost the potential of cities as hubs for sustainable and inclusive growth and innovation, taking account of their wider rural communities and of balanced regional development"; "...promote inclusive, balanced, integrated territorial and urban policies, and multi-level governmental coordination, forging stronger links between rural and urban areas.... build cities' resilience to shocks and harness opportunities for a low-emission and climate-resilient economy".</i></p>	
Peace:			
EU policy related to conflict and fragility underlines the importance of an integrated approach to poverty eradication .	64 & 65	<p><i>Poverty, conflict, fragility, and forced displacement are deeply interlinked and must be addressed in a coherent and comprehensive way including as part of the humanitarian-development Nexus. The EU and its Member States will address their root causes at all levels, ranging from exclusion, inequality, food insecurity, human rights violations and abuses, impunity, and the absence of the rule of law to environmental degradation and climate change". "The prime focus of development cooperation remains poverty eradication in all its dimensions, and there will be no diversion of efforts from that goal".</i></p>	
EU policy on climate change resilience and adaptation and the related needs for gap analyses.	70	<p><i>The EU and its Member States will increase their efforts to build resilience and adaptability to change consistent with, inter alia, the Sendai Framework for Disaster Risk Reduction 2015- 2030 and the Paris Agreement on Climate Change.... Will build risk assessments and gap analysis into their development cooperation programmes".</i></p>	
Partnership:			
EU development policy underlines working more closely with all other relevant actors in the implementation of the 2030 Agenda.	83	<p><i>Stronger partnerships are at the heart of the EU's approach to SDG implementation. The EU and its Member States will work more closely with all other relevant actors to promote the implementation of the 2030 Agenda". And para. 87: "The successful implementation of the 2030 Agenda also requires forging stronger partnerships beyond governments. The EU and its Member States will expand partnerships with the private sector, civil society, including trade unions and employers organisations, multilateral and regional organisations, academia, diasporas. and other relevant stakeholders."</i></p>	

5.

THE WEFE NEXUS APPROACH IN THE CONTEXT OF CONSENSUS POLICY





5. THE WEFE NEXUS APPROACH IN THE CONTEXT OF CONSENSUS POLICY

The New EU Consensus on Development document sets out strategic approaches to improve EU impact in the implementation of the 2030 Agenda. Some of these Consensus policy statements point to concrete actions that can be entry points for facilitating the implementation of a WEFE Nexus approach at a strategic level. This Section briefly identifies

these key policy statements by presenting an overview of them in a table format as in Chapter 4 but without reference to SDGs in order to simplify the format. It does not address the EU methods in detail nor the instruments for the concrete operationalisation which needs to be further developed.

Entry point for enabling a WEFE Nexus approach	Para No.	Consensus policy quote
Using the SDGs to catalyse policy coherence in implementing the EU's Global Strategy ⁷ that provides an overall vision for the EU's engagement with the world.	9	<i>"The EU Global Strategy sets out a vision for the EU's engagement in the world, through a range of policies. It highlights the important role of the 2030 Agenda, which has the potential to trigger the necessary transformation in support of EU values and the objectives of EU external action. The SDGs will be a cross-cutting dimension of all the work to implement the EU Global Strategy."</i>
Apply the EU's development effectiveness principles ⁸ : the EU and its Member States could address the WEFE Nexus in relevant policy and development cooperation forums to ensure that this approach is implemented in a coherent manner where relevant: in joint programming, public-private engagement, in the efforts to "leave no-one behind" and in the transparency of development cooperation.	73	<i>"...This includes improving effectiveness and impact through greater coordination and coherence, by applying the development effectiveness principles, and by delivering development cooperation as one part of the overall internal and external action to promote the implementation of the 2030 Agenda".</i>
More specifically, use opportunities to address the Nexus in joint analyses and joint interventions in order to enhance Joint Programming at country level.	75	<i>"... The EU and its Member States will work together to develop strategic responses grounded in shared knowledge, added value, lessons learned and joint analysis of the country context, including poverty and sustainability..." and in parag. 76: "This approach will help pool resources, reduce fragmentation and boost effectiveness" and in parag. 77: Joint implementation is a way of promoting more coherent, effective, and coordinated EU support based on shared objectives in selected sectors or on specific cross-sectorial themes tailored to the country contexts".</i>
Make use of opportunities for strategic policy dialogue about the benefits of a Nexus approach in preparing and implementing EU budget support .	81	<i>"Budget support, when applicable and with those willing to participate, will be used to strengthen partnership, political dialogue, country ownership and mutual accountability with developing countries..."</i>

⁷ This Strategy (explained in section 4) states that *"The Sustainable Development Goals also represent an opportunity to catalyse ... coherence. Implementing them will generate coherence between the internal and external dimensions of our policies and across financial instruments. It allows us to develop new ways of blending grants, loans, and public-private partnerships. The SDGs also encourage the expansion and application of the principle of policy coherence for development to other policy areas, and encourage joint analysis and engagement across Commission services, institutions, and Member States"* and *"We will also support governments in devising sustainable responses to food production and the use of water and energy through development, diplomacy, and scientific cooperation"*.

⁸ https://ec.europa.eu/europeaid/policies/eu-approach-aid-effectiveness_en

Entry point for enabling a WEFE Nexus approach	Para No.	Consensus policy quote
Take opportunities to advance a Nexus approach through the EU's major leverage in blending as a means to mobilise additional finance to implement the 2030 Agenda and when implementing the European External Investment Plan (EIP).	82	<i>"Blending grants and loans, as a way to leverage additional private finance, is another important means to implement the 2030 Agenda. Blending covers all regions of EU external cooperation in sectors including energy, transport and water infrastructure, support for small and medium enterprises, social sectors and the environment. Blending is a major component of the European External Investment Plan".</i>
Advance the Nexus thinking in capacity development efforts as EU engages more closely with all relevant national partners, recognising the important role of support for comprehensive and inclusive planning rooted in national and sub-national development strategy programmes and budgets and the related national monitoring frameworks. Support for strengthening of the aforementioned national voluntary reviews (NVRs) of SDG implementation could be a priority.	85	<i>"The EU and its Member States will support capacity building for nationally owned monitoring frameworks, quality data collection, disaggregation and analysis, including through digital monitoring tools and for policy coherence for sustainable development".</i>
Use opportunities for more concerted multilateral action on advancing a Nexus approach because the EU is strengthening its partnerships with other multilateral organisations . The above-mentioned UN HLPF annual events may offer good opportunities for demonstrating the advantages of a Nexus approach in the implementation of the SDGs, and the HLPFs are good opportunities to assess the NVRs in a multilateral setting with national high-level delegations and multilateral development partners. The European Development Days (EDDs) and similar events attended by the wider international development community may also provide opportunities to advance concerted Nexus action.	90	<i>"The EU and its Member States will strengthen their partnerships with multilateral organisations, including the United Nations system, the International Monetary Fund, the World Bank Group, regional development banks, the G7, the G20, the OECD and other regional and multilateral institutions. They will encourage them to align their strategic planning and operational activities with the 2030 Agenda and foster mutual and coordinated support in implementation thereof, in full alignment with national sustainable development strategies".</i>
Take opportunities to demonstrate innovation and examples of the advantages that a Nexus approach can offer as the EU places emphasis on fostering innovative engagement with more advanced developing countries . Facilitating the exchange of the lessons, best practices from emerging economies, and using the "power of the example" could have strong influence on weaker developing economies and fragile countries, and there may be opportunities for "leapfrogging" to apply solutions that benefit from Nexus approaches. This could also involve new partnerships with centres of excellence that have demonstrated successful Nexus solutions.	Box after para. 95	<i>"The EU and its Member States will develop new partnerships with more advanced developing countries in order to promote the implementation of the 2030 Agenda through a broader range of cooperation... These new partnerships will promote the exchange of best practices, technical assistance, and knowledge sharing... will work with these countries to promote South-South and triangular cooperation".</i>
Work with partner countries to enhance the enabling environment for a Nexus approach as the EU will work with partner countries to promote sound policy environments for implementing the 2030 Agenda . It is widely recognised and well-documented that the SDGs are interconnected and that working closely with all relevant stakeholders is beneficial. This includes the private sector, which is key to achieving the SDGs. This will also include a "whole of government approach" working across traditional development sectors to strengthen the enabling environment for more concerted action.	99	<i>"... will promote policies linking public and private pro-development action and an enabling environment for inclusive sustainable growth and its equitable distribution through national budgets. They will plan their development cooperation around strengthening countries' own capacities to implement the 2030 Agenda".</i>
Support a Nexus/cross-sectorial approach in pursuing policy coherence for development (PCD), which is key to achieving the SDGs. The PCD is a key element of EU Consensus policy and there are many opportunities for Nexus thinking in the dynamic policy environment for development cooperation and in strategic policy dialogue with partner countries. This is the case, for example, in budget support and programmes related to thematic areas such as climate change that cut across traditional sector policy areas.	109	<i>"The EU and its Member States reaffirm their commitment to Policy Coherence for Development... The 2030 Agenda provides new impetus for the EU and its Member States to formulate and implement mutually reinforcing policies". And para#110: "The Consensus will guide efforts in applying PCD across all policies and all areas covered by the 2030 Agenda, seeking synergies, notably on trade, finance, environment and climate change, food security, migration and security". And para#112: "The EU and its Member States will moreover strengthen their dialogue with partner countries on policy coherence and support partner countries in their own efforts to put in place enabling frameworks for policy coherence for sustainable development".</i>

Entry point for enabling a WEFE Nexus approach	Para No.	Consensus policy quote
Pursue Nexus thinking in value chains and other approaches that link public and private actors at different levels of governance in development programmes, recognising that cross-sectorial and more holistic “whole of government” approaches are needed to achieve interconnected SDGs.	111	<i>“Sustainable development requires a holistic and cross-sector policy approach and is ultimately an issue of governance...the EU and its Member States will therefore promote whole-of-government approaches and ensure political oversight and coordination efforts at all levels for SDG implementation. Ongoing EU action towards sustainable global supply chains, such as in the timber and garment sectors, illustrate the added value of pursuing a coherent approach”.</i>
Facilitate a Nexus approach by aligning the theory of change of EU development cooperation and its results frameworks with SDG indicators. It is EU policy that the EU's reporting systems will be made consistent with the 2030 Agenda indicators, and as described in the foregoing, coordinated, cross-sectorial approaches are inherent in the SDGs. Consequently, this can be an effective means of supporting a Nexus approach.	119	<i>“The EU and its Member States will integrate the 2030 Agenda and support the use of SDG indicators to measure development results at country level.”</i>
Make use of the planned joint synthesis reports on the Consensus to assess how the Consensus policy has facilitated a WEFE Nexus approach and where further actions is needed. As mentioned above the EU is planning to submit a joint synthesis report to the 2019 HLPF and this offers a very good opportunity to demonstrate where the Consensus has facilitated Nexus approaches and where further action is needed.	120	<i>“The EU and its Member States will produce a joint synthesis report on the Consensus on Development, including the impact of their actions in support of the 2030 Agenda in developing countries, as a contribution to EU reporting to the UN High Level Political Forum (HLPF) when meeting at Head-of-State level every four years”.</i>
Similarly, the EU should make use of the 2024 mid-term assessment of the Consensus to address progress on policy coherence and Nexus approaches. A plan of action could be developed to elicit examples and lessons learned over the coming years on how Consensus areas of policy emphasis and its (limited) emphasis on modalities has facilitated success stories on development outcomes and impact facilitated by a WEFE Nexus approach.	123	<i>“A mid-term assessment of the implementation of this Consensus will be carried out by 2024.”</i>



6.

FEEDBACK FROM THE NEXUS REGIONAL DIALOGUES





6. FEEDBACK FROM THE NEXUS REGIONAL DIALOGUES

In the frame of the NEXUS Regional Dialogues Programme⁹, NEXUS experts (see Appendix 2) from the geographical regions – Latin America and the Caribbean, the Middle East and North Africa (MENA), Central Asia and Africa (Southern Africa and the Niger Basin in Western Africa) – were consulted on the regional priorities during a workshop held in Brussels in early 2018. Experts at this meeting provided lessons learnt from experiences regarding the implementation of the Nexus approach in their respective geographical areas. The consultation was organised around a series of topics and debates on: 1) Applying Sustainable Technological Approaches and Solutions; 2) Data, Nexus tools and models; 3) Governance, Finance, Institutions, and Cooperation Frameworks. Furthermore, each of these topics was structured around a series of sub-themes previously agreed to feed the discussions.

6.1 Applying Sustainable Technological Approaches and Solutions

The sub-themes proposed were:

- **The role of off-grid solutions** e.g., for water pumping or desalination in breaking the fossil-fuel economic dependency, including as applied to food security;
- **From waste to resources:** opportunities to turn wastewater and agricultural waste into nutrients and energy, and associated risks;
- **The levels at which to apply a Nexus approach** to competency and capacity building to promote “Nexus thinking” and take action across sectors, countries, and areas of responsibility;

Several recommendations in this topic mainly revolve around technological innovations in the energy sector. Case knowledge indicates that the choice of hybrid technologies, for instance combining several sources (of energy and/or water), can fit local conditions and improve sustainability of energy/water sources for agricultural/ir-

igation purpose. Off-grid solutions to satisfy energy and water needs were also found to be cost effective at local scale (e.g. farm scale) even though there are still technological challenges with providing a steady supply and also storage for intermittent use of off-grid solutions. Furthermore, renewable energy-based off-grid solutions have a role in supplementing fossil fuel reliance rather than representing a generic alternative to them. They have the potential to reduce the amount of water used as well as increase food security and water availability in remote areas. The optimisation of national/regional grids and plants facilitates the deployment of additional energy capacities. This is supported by significantly efficient institutional and financial frameworks. For example, existing hydraulic infrastructure provides opportunity for additional low-carbon energy generation with minimal or no extra social and environmental costs.

Turning solid waste (from e.g. agriculture activities) into a resource appears to present fewer risks than wastewater. In particular, char made from crop residues or other wet agricultural waste like manure can substitute wood charcoal as energy carrier for cooking in rural areas and other local-level applications for food production (such as soil improving material), energy production (in combination with anaerobic digestion), or water production (as cleaned by filtering). Particularly at community level, implementing such solution implies capacity building and promotion of the Nexus solution. In this case, it needs to be practical and social acceptance constraints working against it need to be overcome.

A key conclusion for all sectors is the need for further development of inter-sectorial knowledge, understanding and collaboration. Training in applying the Nexus approach must specifically address the intervention level and its challenges (transboundary, national, regional, and local), and associated with capacity building actions especially in less developed regions/organised sectors. Professionals in each sector need to know more about and understand the thinking and methods applied in the other sectors. Moreover, collaboration between sectors needs to be very operational oriented.

9 <https://www.nexus-dialogue-programme.eu> and <https://www.water-energy-food.org>

6.2 Data, Nexus tools and models

The sub-themes proposed were:

- **The challenges** to integrate or link quantitative models focusing on multiple Nexus pillars and dimensions i.e. Water, Energy, Land, Climate Change, the Environment, and others;
- **The trade-off between the level of sophistication** of Nexus Decision Support Tools and the **level of integration across scales** for effective modelling and meaningful decision-making;
- The opportunities and risks of an open source approach to Nexus tools and data sharing as opposed to commercial packages and solutions;
- The importance of establishing a Nexus Cooperation Framework at multi-sectorial, country, or transboundary levels from assessment to resource- or benefit-sharing agreements.

In general, NEXUS experts found that the data available is generally insufficient for appropriate Nexus assessment. Consequently, there is a general need to improve data collection across the different sectors and scales. In the particular case of biophysical data where ground data is particularly lacking, remote sensing has been highlighted as a means of bridging and supplementing this gap, at least in certain thematic areas. Field surveys can also be used as ways of collecting local and traditional knowledge that would complement biophysical and socio-economic data and a way to concretise what the real issues are. This is key to supporting decision making in terms of food security, poverty reduction, sustainable basin management, and inclusive development.

Open-source models and open-access platforms combining spatial data have been well received in low- and middle-income countries where license costs and governmental authorisation may be difficult to overcome or obtain. However, insufficient data and models available should not be seen as a stumbling block or a reason for not using the Nexus approach until data and models are ideal.





The integration of different models and methods can tackle the inherent complexity of the Nexus and address its multi-disciplinary construction. However, fully holistic models are not necessarily required. A soft-coupling of models is preferable at the more practical level: the output of one sector model becomes an input to another sector model, and realistic solutions can be prepared and generated with a few iterations. It is also advisable not to focus entirely on the technical side of the resource reallocation problem. Because they are able to engage more thematic components than quantitative methods, qualitative modelling approaches can help map the WEFE system and locate priorities and trade-offs to be discussed and negotiated afterwards. The most important is that the users of data and models are sufficiently trained and experienced to be able to make an evaluation of results to proceed with a NEXUS assessment. They must also be able to understand that the resulting decisions are not only based on quantitative information, but also on qualitative judge-

ments. The latter is acceptable provided that it happens in an open and transparent process, that is, during the dialogue component included in the Nexus approach. In fact, even though not a pre-requisite to it, quantitative modelling can be a means of stimulating dialogue.

NEXUS assessments should start with the identification of specific issues where allocation of resources is at odds with their interconnected nature i.e. a Nexus hotspot. The Strategic Environmental Assessment (SEA) has been used for strategic country Nexus assessments for some years in many countries such as in Europe and South Africa and could support the practical implementation of the Nexus assessment.

The need for a Nexus approach often stems directly from local stakeholders raising interlinked priorities for the water, agriculture, food, energy, and environmental sectors during in-place national or transboundary dialogues. Applying the Nexus ap-

proach would still require creating collaborations between the multiple disciplines, institutions, and organizations involved in the different sectors. There is *a priori* more value from overarching frameworks such as regional economic commissions, river basin organizations, or inter-ministerial committees in a transboundary setting compared to the national context.

6.3 Governance, Finance, Institutions and Cooperation Frameworks

The sub-themes proposed were:

- The requirements for investment-ready Nexus projects with potentially conflicting objectives i.e., financial and economic vs. social and environmental in a portfolio approach to finance;
- The river basin scale as the most appropriate management framework for approaching and implementing the Nexus;
- The advantages of promoting a Nexus approach within the ongoing debates and actions surrounding Climate Change Mitigation and Adaptation;
- The operational aspects of the Nexus as a platform to guide sustainability efforts underpinned by the SDGs;
- The definition, utility, and use of a Nexus Project Toolkit for Inclusive Green Growth and Sustainable Development.

Many recommendations talk about finding financing for Nexus infrastructure and the consensus is that new innovative financing mechanisms are needed. In fact, when analysing and looking at investment decisions, attention is usually focused on two parameters: return on investment or simply profitability (i.e. measured investment efficiency) and risk (including in terms of impact on society and the environment). Risk is seen as particular important because Nexus projects include social elements that are not commercially viable. This is why projects need to be designed with the more easily bankable components associated with the less bankable components from the onset. As such, the whole programme can become viable and bankable if implemented under a blended finance approach. Public-Private Partnerships and Climate funds are mentioned as opportunities as well as investments oriented towards sustainable, socially responsible, ethical, green activities such as Green bonds. The most appropriate financing model will be determined on a case by case basis, and there is still a need to test various models.

From a governance point of view, the Nexus approach does not really need new institutional structures or major re-structuring. What is needed is comprehensive collaboration between entities such as working networks or platforms supported by multi sector policies, protocols, and procedures. Climate and Environmental actions and the Nexus approach can work hand in hand; the success in one is closely linked to success in the other. The NEXUS approach as Climate Change and Environment actions requires multi-sectorial thinking and the raising of awareness. For example, the urgency to deal with the effect of Climate Change offers an opportunity to push the Nexus approach to the forefront. This facilitates the development of National Adaptation Plans in an overall Nexus approach process. The National cooperation frameworks developed under climate change or on IWRM, if they exist in a country, can be easily reused within the NEXUS approach and governance structures could be appropriated to define and implement Nexus solutions. Transboundary cooperation framework or river basin institutions could also embed the Nexus dialogue and cooperation between WEFE stakeholders.

This highlights the need for connecting multiple sectors, analysis, and management at different scales. The national scale may be appropriated for target-setting as being the scale for the SDGs whilst municipality or watershed scales may drive most of the changes. *Cities can be also considered as an appropriate scale because this is where local and global resource constraints meet¹⁰.* Resource challenges are further exacerbated by the fast-expanding growth rates and inefficient infrastructure systems of developing cities in several regions of the world. It follows that the urban environment is an emerging context for applying a Nexus approach.

Considering the novelty of this approach, it appears that the definition, utility, and use of a Nexus Project Toolkit for Inclusive Green Growth and Sustainable Development could include quantitative analyses of the benefits of the approach in the individual sectors, implementation guidelines, and good experiences. Some good fit-for-purpose methodologies already exist (e.g. Strategic Environmental Assessment (SEA) or as developed by research projects¹¹) that can be adopted and/or adapted. NEXUS approach could learn from the SEA processes.

The upscaling of a pilot Nexus project to larger scale programmes should be part of the Toolkit. This should also cover processes to identify up-scalable project elements, steps to be followed when institutionalising the Nexus processes and dialogues, and finally pre-conditions to upscaling in terms of identifying financial and human resources.

¹⁰ Source http://www2.giz.de/wbf/4tDx9kw63gma/UrbanNEXUS_Publication_ICLEI-GIZ_2014_kl.pdf

¹¹ <https://www.sim4nexus.eu/> simulates policies based on the resource constraints of an area; <http://www.wefnexustool.org> quantifies the interrelations and trade-offs between the water, energy, and transportation sectors under different scenarios.

7.

UPSCALING







7. UPSCALING

Scaling up the Nexus approach is advisable as it has many aspects that will lead to more socially, economically, and ecologically sustainable projects. The Nexus can also be a strong support for reaching the SDGs. As for any innovation that needs to be up-scaled, it is important to consider a few questions in this context:

- **Identifying the good examples** that have the potential for upscaling. While there are many examples of nexus approaches in the literature, there is a need for a structured approach to further identification and documentation of nexus examples/case studies.
- **Scalable:** Are all elements of a given Nexus programme scalable? Programmes are always implemented in a specific economic, social, and physical context that will influence the implementation and may be different in the next programme. A Lessons Learned report can be used to identify the successful NEXUS elements that can be up-scaled.
- **Vertical upscaling:** This deals with the institutionalisation of the Nexus approach at different levels. This involves political will and capacity building at the relevant levels and establishing or uses semi-permanent collaborative/governance structures for relevant stakeholders. This requires that the relevant stakeholders are willing to participate in upscaling, and that there are some real Nexus programmes that such collaborative forums can implement. NEXUS experts emphasised the value of building NEXUS dialogues around existing governance frameworks rather than creating any specific NEXUS forums.
- **Horizontal upscaling:** This is about replication of the Nexus programme in another geographic or thematic context. In recent years Nexus pilot programs may have been implemented using external resources, both financial and human, but for an actual upscaling to take place, a greater degree of own funding and own human resources are needed. Peer-to-peer exchanges of successful examples and lessons learned are certainly helpful in horizontal upscaling.
- **Timing:** If upscaling is expected to be based on an ongoing or planned Nexus programme and impact on the 2030 Agenda for Sustainable Development, it would be very useful to plan for this as early as possible and align it to the relevant planning processes. Planning cycles in government structures at all levels and in the private sector need to be followed, and such cycles can easily be up to 18 months. Having upscaling in mind right from the start of a Nexus programme will also facilitate the monitoring and assessment of up-scalable programme elements.

8.

CONCLUSIONS





8. CONCLUSIONS

The EU and the international community are realising that Water, Energy, Food, and Ecosystems components are interlinked and require joint planning in order to meet the daunting global challenges of Water, Energy, and Food security while maintaining ecosystem health and consequently reach the SDGs. If not dealt with, the world will have difficulties to meet the demand for water, energy, and food in the not too distant future, and in any case, in a sustainable way. The strain on ecosystems resulting from unsustainable single-sector planning will lead to increasing poverty, inequality, and instability.

The Nexus approach is fully aligned with and supportive of the EU Consensus on Development. Key elements of the Consensus will require collaborative efforts across sectors in ways that can be supported/implemented by a Nexus approach. As a result, transparent and accountable decision-making involving the civil society is key and common to the European Consensus on Development and the Nexus approach.

The Nexus approach will support the implementation of the SDGs especially SDG 2 (Food), SDG 6 (Water), and SDG 7 (Energy), but most SDGs have elements linked to food, water, and energy in one or more ways, and will benefit from a Nexus approach. The SDGs are designed to be cross-cutting and to be implemented together, which is also reflected in a WEFE Nexus approach.

This approach offers a sustainable way of addressing the effects of Climate Change and increase resilience. The WEFE Nexus includes the main drivers of climate change (water, energy, and food security) and the main sectors affected (water and the environment). Decisions around policy, infrastructure, etc. developed on the basis of WEFE Nexus assessments will be suitable as elements of climate change mitigation and adaptation. In fact, it is difficult to imagine solutions to the climate change issue that are not built on a form of Nexus approach.

As examples in the literature demonstrate, this approach is already being implemented around the world. These examples together with more examples from the EU and member state development cooperation will help build experience that can be consolidated and become an important contribution to a Toolkit for WEFE Nexus Implementation. It appears from the expert discussions that because of the novelty of the approach, a Toolkit will be an important element in getting the Nexus approach accepted and widely used. This should build on experience from practical examples of NEXUS projects or



similar inter-sectorial collaboration projects, and there is already policy, regulation, and practical experience for institutions and countries to start applying this concept.

A fully developed WEFE Nexus approach is a comprehensive and far reaching methodology that requires awareness capacity and tools. The Nexus results can be achieved by taking a step by step approach. Some key recommendations arising out of NEXUS expert consultation include:

- Effective collaboration is at the core of WEFE Nexus implementation. The achievement of effective collaboration to deal with the Nexus is deemed to be more important than the establishment of an ad-hoc Nexus body. Collaboration can be triggered by key issues such as climate change, which have led to the formation of soft-type bodies such as national committees. There is also more value to be gained from overarching frame-



works such as regional economic commissions, river basin organizations, or inter-ministerial committees in a trans-boundary setting compared to the national context.

- The socially oriented components of a Nexus programme have limited commercial potential. However, the whole programme can become a viable Public-Private Partnership if implemented under a blended finance approach including investment finance from commercial funders and private investors, development capital from Development Finance Institutions, and grants from donors. The Nexus can increase a project's overall financial ability to cater for the less commercially viable components. This is why projects need to be designed with the more easily bankable components associated with the less bankable components from the onset. The co-benefit analysis and cost optimisation due to the Nexus approach is how projects are made Nexus projects and how Nexus projects are made fundable.

- The Nexus approach can be applied at different scales. Each scale accounts for a unique assortment of elements, processes, and actors, and all scales intersect. The national scale may be appropriate for target-setting while municipality or watershed scale may drive the most changes in the population living conditions. The landscape scale is important for uniting different needs including those of ecosystems while food security is affected by global issues such as export prices and global energy demand.

- The NEXUS approach does not give precedence to Water over other sectors, but explicitly addresses trade-offs and synergies between sectors and strongly promotes sustainability and security. Therefore, to address food security in a region would mean addressing water resources, their development and management, and also energy generation. Responding to pressures on water resources would then shift to responding to broader basin stress and socio-economic pressures such as agriculture and energy production linked to the development of populations. Combining natural and built infrastructure, i.e. nature-based solutions, is key to achieving the SDGs.

- Assessment and Modelling is an important aspect of the Nexus approach. Developing a fully integrated cross-sector model addressing all of the different potential NEXUS issues is a complex process. Therefore, it should go through processes where outputs from various existing models become inputs into other models through a “loose coupling” and for the purpose of addressing very concrete issues-priorities-needs.

- Some good fit-for-purpose methodologies already exist to assess impacts across sectors. Strategic Environmental Assessments (SEAs) seem to be one of the most suitable frameworks where Nexus can be addressed. The SEA identifies and prevents of possible environmental impacts in decision-making right from the start. Similarly, the Nexus process identifies inter-sectorial benefits and challenges including social and ecological ones.

- It is very important for a hypothetical NEXUS toolkit to provide relevant guidance for policy dialogue at a strategic level to ensure that decision-makers are made aware of the benefits of a nexus approach and can facilitate the required cross-sectorial coordination at the relevant levels of governance and strengthen the enabling framework for engaging the private sector and civil society.

APPENDICES

APPENDIX 1 – SELECTED KEY REFERENCE DOCUMENTS

There is a wide body of development policy and practise documentation, academic literature, guidance material etc. on Nexus approaches. This appendix lists 13 reference documents considered relevant by the Editors for this Position Paper.

Reference 1	The New European Consensus on Development “Our World, Our Dignity, Our Future”
<i>Description</i>	<i>Joint Statement 7 June 2017 by the Council and the Representatives of the Governments of the Member States meeting within the Council, the European Parliament, and the European Commission. The key document on EU development policy.</i>
Reference 2	Hoff, H. (2011). Understanding the Nexus. Background Paper for the Bonn 2011 Conference: The Water, Energy and Food Security Nexus. Stockholm Environment Institute, Stockholm.
<i>Description</i>	<i>This paper for the Bonn 2011 Conference presents initial evidence on how a Nexus approach can enhance water, energy, and food security by increasing efficiency, reducing trade-offs, building synergies, and improving governance across sectors. It also underpins policy recommendations, which are detailed in a separate paper.</i>
Reference 3	FAO (2014): The Water-Energy-Food Nexus. A new approach in support of food security and sustainable agriculture
<i>Description</i>	<i>The FAO paper detailing how the institution sees the Nexus concept in the light of Food Security in a global context. Introduction to the Nexus concept</i>
Reference 4	Koulias I., Szabó S., Scarlat N., Monforti F., Banja M., Bódis K., Moner-Girona M., Water-Energy-Food Nexus Interactions Assessment: Renewable energy sources to support water access and quality in West Africa, Luxembourg, European Commission, 2018, EUR 29196 EN, ISBN 978-92-79-84034-0, doi:10.2760/1796.
<i>Description</i>	<i>This JRC Technical Report examines the potential synergistic benefits to energy, water, and agricultural production practices in Africa from appropriate use of clean energy sources.</i>
Reference 5	FAO: Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative July 2014
<i>Description</i>	<i>This report proposes a way of carrying out a water-energy-food Nexus assessment approach in order to: a) understand the interactions between water, energy, and food systems in a given context, and b) evaluate the performance of a technical or policy intervention in this given context. The ultimate goal of the Water-Energy-Food (WEF) Nexus assessment is to inform Nexus-related responses in terms of strategies, policy measures, planning, and institutional set-up or interventions.</i>
Reference 6	Sustainable Energy Handbook - Module 2.4 - Water-Energy-Food Nexus
<i>Description</i>	<i>This handbook provides a brief overview of DEVCO activities on the water-energy-food Nexus and how this approach will be increasingly used and implemented across a number of thematic units. It is also designed to be a useful summary on the concept itself, with explanation on how it will not only be operationalised at a global level by DEVCO but also in conjunction with other EU Member States, international organisations, and NGOs.</i>

Reference 7	A Nexus Approach for The SDGs – Interlinkages between the goals and targets
<i>Description</i>	<i>A presentation on interlinkages between and among SDGs – part of the SDG TOOLKIT – an initiative co-funded by the EU to engage European NGOs at National and European level to participate in the Sustainable Development Goals.</i>
Reference 8	Nexus Message on Water-Energy-Food-Climate through an Urban Lens – Building Integrated Approaches into Implementing the Sustainable Development Goals
<i>Description</i>	<i>Outcome Message from the 2018 Nexus Conference, Water, Food, Energy, and Climate, Water Institute of the University of North Carolina at Chapel Hill, North Carolina, USA, April 2018</i>
Reference 9	Introduction to the Water-Energy-Food Security Nexus 5 June 2018
<i>Description</i>	<i>Training Module 1 “Introduction to the Water-Energy-Food Security Nexus” provides a theoretical introduction to the concept of the Water-Energy-Food (WEF) Security Nexus. The module has been developed by the GIZ Nexus Regional Dialogues Programme in cooperation with the Institute for Technology and Resources Management in the Tropics and Subtropics (ITT) of the Cologne University of Applied Sciences. Co-funded by the EU.</i>
Reference 10	Messages from the Bonn 2011 Conference: The Water, Energy, and Food Security Nexus – Solutions for a Green Economy
<i>Description</i>	<i>Summary document setting out the key messages from this landmark conference on Nexus opportunities, principles, and how to make it work.</i>
Reference 11	UNECE, 2015. Reconciling resource use in transboundary basins: assessment of the water-food-energy-ecosystems Nexus.
<i>Description</i>	<i>This report from UNECE describes the application of the Nexus approach and in particular how to perform the Nexus assessment in a transboundary river basin.</i>
Reference 12	UNECE, 2017. Deployment of Renewable Energy: The Water-Energy-Food-Ecosystem Nexus Approach to Support the Sustainable Development Goals
<i>Description</i>	<i>This report focuses on the interaction Nexus but concentrating on Renewable energies. It examines good practices from 3 cases studies in South-Eastern Europe and central Asia</i>
Reference 13	Angel Udias, Marco Pastori, Céline Dondeynaz, Cesar Carmona-Moreno, Abdou Ali, Luigi Cattaneo, Javier Cano. A decision support tool to enhance agricultural growth in the Mékrou river basin (West Africa)
<i>Description</i>	<i>The paper describes an operational decision support system (DSS) to help local managers assessing the WEFE NEXUS. The e-Water DSS has been applied in the transboundary MEKROU River Basin shared by Benin, Burkina Faso and Niger to support policy makers as part of the MEKROU's Strategic Development Plan by cross-checking development scenarios.</i>

APPENDIX 2 – LIST OF EXPERTS

This document is the result of collaborative work that began in January 2018 during a meeting of international NEXUS experts in Brussels. The Editors want to thank all the experts, those who participated since the beginning and those who joined us along the way. They understand that their work is not just about synthesising information, but also about making scientific and technical knowledge available to contribute to more sustainable development and, ultimately, to help create a better world. Special thanks to Ole and Jens for their contribution to this report.

Experts	Affiliation
ADAMOVIC M.	European Commission, JRC
AL-ZUBARI W.K.	Water Resources Management Program, Department of Environmental and Natural Resources, College of Graduate Studies, Arabian Gulf University
AMANI A.	UNESCO-IHP
AMEZTOY-ARAMENDI I.	European Commission, JRC
BACIGALUPI C.	European Commission, DEVCO
BARCHIESI S.	European Commission, JRC
BIEDLER M.	UNESCO-IHP
BISSELINK B.	European Commission, JRC
BODIS K.	European Commission, JRC
BOURAQUI F.	European Commission, JRC
CARMONA-MORENO C.	European Commission, JRC
CAUCCI S.	Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES)
DALTON J.	IUCN (International Union for Conservation of Nature)
DE ROO A.	European Commission, JRC
DONDEYN AZ C.	European Commission, JRC
DUDU H.	European Commission, JRC
DUPONT C.	IHE Delft Institute for Water Education
EL KHARRAZ J.	Middle East Desalination Research Center (MEDRC)
EMBID A.	University of Zaragoza
FARAJALLA N.	American University of Beirut
FERNANDEZ BLANCO R.	European Commission, JRC
FERRARI E.	European Commission, JRC
FERRINI L.	GIZ, Nexus Regional Dialogue in the Niger Basin
FILALI-MEKNASSI Y.	UNESCO-IHP
FRANCA M.J.	IHE Delft Institute for Water Education
GHAFFOUR N.	King Abdullah University of Science and Technology (KAUST), Water Desalination and Reuse Center (WDRC), Biological and Environmental Science and Engineering Division (BESE)
GIRARDI V.	European Commission, DEVCO
GRIZZETTI B.	European Commission, JRC
HANNAH, C.	Nicholas School of the Environment, Duke University
HIDALGO GONZALEZ I.	European Commission, JRC
HOUMØLLER O.	PEM Consult
JAEGER-WALDAU A.	European Commission, JRC
JIMENEZ CISNEROS B.	UNESCO-IHP
KAVVADIAS K.	European Commission, JRC
KOUGIAS I.	European Commission, JRC
LAAMRANI H.	League of Arab States
LEMESSA TESGERA S.	IHE Delft Institute for Water Education
LIEBAERTS A.	European Commission, DEVCO Expert

Experts	Affiliation
LIPPONEN A.	United Nations Economic Commission for Europe (UNECE)
LORENTZEN J.	PEM Consult
MAKARIGAKIS A.	UNESCO-IHP
MARENCE M.	IHE Delft Institute for Water Education
MARTIN L.	Facultad Regional Mendoza/CONICET, Universidad Tecnológica Nacional
MICHALENA, E.	University of the Sunshine Coast, Australia
MISHRA A.	UNESCO-IHP
MOHTAR R.H.	American University of Beirut
MONER GERONA M.	European Commission, JRC
MORENO-ABAT M.	European Commission, ENV
MPAKAMA Z.	Stockholm International Water Institute (SIWI), Africa Regional Centre
PASTORI M.	European Commission, JRC
PISTOCCHI A.	European Commission, JRC
SARTORI M.	European Commission, JRC
SCHMEIER S.	GIZ, Global Nexus Secretariat of the Nexus Regional Dialogues Programme
SCHMIDT-VOGT, D.	Freiburg University, Faculty of Environment and Natural Resources, Chair of Silviculture
SEHRING, J.	IHE Delft Institute for Water Education, Integrated Water Systems and Governance Department
SMAKHTIN V.	United Nations University - Institute for Water, Environment and Health (UNU-INWEH)
SZABO S.	European Commission, JRC
TAKAWIRA A.	GWP Southern Africa, Pretoria, South Africa
THIEM M.	GIZ, Global Nexus Secretariat of the Nexus Regional Dialogues Programme
TIRUNEH J.K.	GWP Southern Africa, Pretoria, South Africa
TSANI S.	Athens University of Economics and Business
VAN HULLEBUSCH E.d.	IHE Delft Institute for Water Education
VERBIST K.	UNESCO-IHP
XENARIOS S.	Nazarbayev University, Graduate School of Public Policy, Astana, Kazakhstan
ZARAGOZA G.	Centre for Energy, Environment and Technology (CIEMAT) - Plataforma Solar de Almería

The European Commission's
science and knowledge service
Joint Research Centre

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



EU Science Hub
ec.europa.eu/jrc



@EU_ScienceHub



EU Science Hub - Joint Research Centre



Joint Research Centre



EU Science Hub



Publications Office

doi:10.2760/5295

ISBN 978-92-79-98276-7