Horizon 2020 Societal challenge 5
Climate action, environment, resource
Efficiency and raw materials

D2.1
WATER-LAND-ENERGY-FOOD-CLIMATE NEXUS: POLICIES AND POLICY COHERENCE AT EUROPEAN AND INTERNATIONAL SCALE

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Version 4 of the report follows from the comments of the project reviewers, received on 12 October 2017. The table below illustrates how the comments have been addressed.

Review comments 12/10/2017	Adjustments in report
The inclusion of two summaries in the deliverables deserves some thoughts: one more technical (scientific or technical audience) and one less technical (non-technical audience, policy makers).	The 'short summary of results' on page 7 was adjusted to better address the general public.
In the executive summary conflicting policy objectives are well elaborated, while synergies are only called "more prominent", but not elaborated with the same level of detail (to focus not only on the negative aspects but also on the positive ones). It would be useful to add key-synergies identified in this analysis.	The executive summary now contains a paragraph highlighting the synergies. More synergies were also added to the conclusions in section 7.3.1.
Policies related to air pollution, energy poverty are not mentioned. The reasons were well explained, it would be useful just to mention it in the report.	Energy poverty was added to table 5 and air pollution to table 6. Furthermore, the reasons why these policies are not part of the coherence analysis are explained on page 27.
Table 2 focuses a lot on supply. Behaviours should be better covered.	The consumption perspective, education, awareness, attitudes and lifestyle were added to Table 2.
Table 2 should mention the ecological status of water and land, which are key concerns of and addressed in several regulations and policies and SDGs. Climate is addressed in a very generic fashion and clear links of adaptation/mitigation to the nexus domains are lacking. Please revise and be more specific.	Ecological status was included in Table 2 and adaptation and mitigation were better specified in the same table. More explanation is also provided on page 27-28.
Figure 2 displays multilateral relations, but calls them bilateral. This discrepancy should be clarified.	The caption of Figure 2 was adjusted, and a clarifying sentence was added to section 2.3.

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Executive summary

This deliverable identifies and reviews the policies at international and European scale that are relevant to the water-land-energy-food-climate nexus (WLEFC-nexus). Besides the policies directly aiming at these five nexus domains, other policies are relevant, especially in the context of strategies for a resource efficient and low-carbon economy in Europe. These are policies in the domains of economy, investment, R&D and innovation, ecosystems and environment, EU regions, development, risk & vulnerability and trade. Other policies may also be relevant, depending on the issues at stake, e.g. policies for economic sectors that have a key role in the SIM4NEXUS cases.

At international scale, two key policy documents are leading for the WLEFC-nexus:

- the UN 2030 Agenda for Sustainable Development;
- the UN Framework Convention on Climate Change (and related Kyoto Protocol and Paris Agreement).

Around the goals set by these documents numerous objectives have been formulated and many instruments exist to achieve them. Often, these are soft means, but there are also economic instruments that parties can use to achieve the goals such as emission trading, Joint Implementation and Clean Development Mechanisms in the context of the UNFCCC. In the food and climate sector, investment in developing countries is an important instrument.

European policies concerning the WLEFC-nexus are established by directives, regulations, decisions, road maps, plans and programmes. Coherently with the international policy arena, the EU policies integrate two key goals, namely sustainable development and resilient human and natural systems.

Synergies are more prominent than conflicts among European policy objectives that are relevant for the WLEFC-nexus. There are numerous objectives showing a high density of positive interactions with other objectives in the WLEFC-nexus. These are in general related to the sustainable use of resources, provision of ecosystem services and climate change resilience. If pursued with cross-sectoral, integrated policies, progress in the achievement of these objectives could have a cascade of positive, synergist effects in the whole WLEFC-nexus. For example, the objectives 'Ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy and the environment' and 'Restore degraded soils to a level of functionality consistent with at least current and intended use' and 'Prevent soil degradation' reinforce each other, serve production of energy, facilitate climate change adaptation, reduce greenhouse gas emissions, and may help increase farm incomes and support rural areas economy. Furthermore, in the agricultural sector, if the greening and cross-compliance mechanisms are fulfilled, the objective 'Contribute to farm incomes' supports the achievement of water, land and climate objectives. Finally, the objective 'Promote resource efficiency in the agriculture, food and forestry sectors' supports water and energy efficiency and water availability, may prevent land degradation and indirect land use change, and supports the development and uptake of low-carbon technology.

Synergies among European policy objectives may reveal coherence problems when specific objectives and measures are articulated and implemented at national and regional scale. For this reason, the next step of the SIM4NEXUS policy analysis will focus on the implementation of WLEFC-nexus policies in 10 case studies at national and regional scale.

There are also policy objectives that are in conflict with most other EU policy objectives in the WLEFC-nexus. These are 'Increase of biofuel production', 'Increase hydro-energy production', 'Improve competitiveness of agricultural sector' and 'Support the development and uptake of safe CCS

technology'. Policy-makers should be aware that progress in achieving these objectives come at the expenses of other objectives in the nexus.

Two EU policy objectives showing high density of interactions and high relevance to the SIM4NEXUS case studies were assessed in more detail. These are: 'Increase of biofuel production' and 'Ensure sufficient supply of good quality water for people's needs, the economy and environment'. Direct and indirect interactions, coherence between policy means and vertical coherence with international policies were investigated for these two objectives. Also, the recognition of the interactions among policy objectives in policy documents, reflected by the presence (and quality) of references that policy documents make to other policy domains, was assessed. Some conclusions drawn from this analyses are:

- Potential conflicts that biofuel production may have with water quality are tackled in the European common agricultural policy (CAP). Conflicts with water quantity within the EU and water quality outside the EU are addressed in the EU renewable energy policy through voluntary reporting schemes. As a result, compliance of biofuel production to water related standards depends on strong water management at the production location and on the willingness of actors in the supply chain to reduce impacts on water resources. Potential conflicts caused by biofuel production with land use objectives are well addressed in the EU policy.
- Negative effects of hydropower on aquatic ecosystems, water quality and water quantity are not addressed in EU policies for renewable energy.
- EU policies for biofuels are generally coherent with international policies, except for the food security and affordable food prices goals in the context of poverty reduction, central issues in international food policy and in the Sustainable Development Goals (SDGs). The effects of biofuel production on these goals are weakly addressed in EU policies. According to the EU policies for renewable energy, the EC will monitor effects of biofuel production on food prices and security, but no concrete actions are mentioned if unwanted effects would be observed.
- The international objective 'Fully consider water and ecosystem footprints of alternative climate change mitigation measures' is not referred to in EU energy and climate policies, nor in international climate policies.

Interesting opportunities to share the SIM4NEXUS results at EU level are represented by the review of the EU energy package, the Water Framework Directive, the Common Agricultural Policy, the EU strategy on adaptation, the EU structural and development funds and the EU LIFE Programme. Identifying and seizing key windows of opportunity over the coming years to share the SIM4NEXUS results in the discussion of these policies is an important follow-up activity of the policy analysis.

Changes with respect to the DoA

No changes to the DoA

Dissemination and uptake

This deliverable is targeted at the general public, stakeholders in the global and European policy fields related to water, land, energy, food and climate, participants in the SIM4NEXUS project.

Short Summary of results

Water, land, energy, food and climate are interconnected, and European policy objectives in these sectors may interact with one another as well as with policies in other sectors. In this study we found that synergies are more prominent than conflicts among European policy objectives in the water, land, energy, food and agriculture, and climate sectors. Synergies can be found among objectives that

pursue the sustainable use of resources, provision of ecosystem services and climate change resilience. However, conflicts in these domains may start to manifest when more specific objectives and measures are articulated and implemented at national and regional scale. There are also European policy objectives that are in conflict with the achievement of many others. These include increasing biofuel and hydro-energy production, improving the competitiveness of the agricultural sector and supporting the development and uptake of safe carbon capture and storage technology. Finally, the European water, land, energy, food and climate policies are generally coherent with global policies, with the exception of the European biofuel policy that is not fully aligned to international food security and food price policies related to poverty reduction. The upcoming review of the EU water policy, EU agricultural policy, EU climate adaptation policy, EU regional funds policy and EU environmental policy (LIFE programme) offer the opportunity to share these results, thus contributing to policy change discussion.

Evidence of accomplishment

Submission of report. Publication of report on SIM4NEXUS website.

Glossary / Acronyms

Acronyms

CAP	Common Agricultural Policy
CCS	Carbon Capture and Storage
DG	Directorate General
EC	European Commission
EU ETS	European Emission Trading System
EU	European Union
FAO	Food and Agriculture Organization
GHG	Green House Gas
IWRM	Integrated Water Resource Management
MS	Member State
NCO	Nexus Critical Objective
NCS	Nexus Critical System
OECD	Organisation for Economic Co-operation and Development
SDG	Sustainable Development Goal
UN	United Nations
UNFCCC	United Nation Framework Convention on Climate Change
WEF	Water-Energy-Food
WFD	Water Framework Directive
WLEFC	Water-Land-Energy-Food-Climate

Glossary of terms

Policy goals	Policy goals are the basic aims and expectations that governments have when deciding to pursue some course of actions. They can range from abstract general goals (e.g. attaining sustainable development) to a set of less abstract objectives (e.g. increase energy efficiency) which may then be concretized in a set of specific targets and measures (e.g. achieve 10% renewable energy share).
Policy means	Policy means are the techniques/mechanisms/tools that governments use to attain policy goals. Similarly to goals, means range from highly abstract preferences for specific forms of policy implementation (e.g. preference for the use of market instruments to attain policy goals); to more concrete governing tools (e.g. regulation, information campaigns, subsidies); to specific decisions/measures about how those tools should be calibrated in practice to achieve policy targets (e.g. a specific level of subsidy in the renewable energy sector).
Policy process/ policy cycle	the policy process, often referred to as policy-cycle, is a set of interrelated stages through which policy issues and deliberations flow from inputs (problems) to outputs (policies). A typical model of the policy process includes: *agenda-setting* (problem recognition by the government); *policy formulation* (proposal for solution in the government); *decision-making* (process of selection of solution); *policy implementation* (how government puts solution into effect); *policy evaluation* (monitoring results, which may lead to reconceptualization of problems and solutions).
Policy interactions	Cause-effect relationship between policies and occurs when the content of one policy (goals, means, implementation practices) influences the performance of another policy such as the achievement of its objectives or the implementation of its instruments. Type of interactions between policy objectives:

	• Cancelling: Progress in one objective makes it impossible to reach another objective and possibly leads to a deteriorating state of the second. A choice has to be made between the two (trade-off). • Counter-acting: The pursuit of one objective counteracts another objective. • Constraining: The pursuit of one objective sets a condition or a constraint on the achievement of another objective. • Consistent: There is no significant interaction between two objectives. • Enabling: The pursuit of one objective enables the achievement of another objective. • Reinforcing: One objective directly creates conditions that lead to the achievement of another objective. • Indivisible: One objective is inextricably linked to the achievement of another objective.
Policy conflict and related trade-offs	Policy conflicts manifest when goals and instruments of one policy are in contrast with goals and instruments of another policy. When conflicts arise, choices should be made about the related t*rade-offs.* This implies choosing to reduce or postpone one or more desirable outcomes in exchange for increasing or obtaining other desirable outcomes in return. This choice requires political compromise.
Policy synergies	Policy synergies manifest when the combined efforts of two or more policies can accomplish more than the sum of the results of each single policy separately. Policies reinforce each other.
Policy coherence	An attribute of policy referring to the systematic effort to reduce conflicts and promote synergies within and across individual policy areas at different administrative/spatial scales.
Nexus as analytical approach	A systematic process of inquiry that explicitly accounts for water, land, energy, food and climate interactions in both quantitative and qualitative terms with the aim of better understanding their relationships and providing more integrated knowledge for planning and decision making in these domains.
Nexus as governance approach	As governance approach, the WLEFC-nexus approach provides guidance for policy decisions through an explicit focus on interactions between water, land, energy, food and climate policy goals and instruments in order to enhance cross-sectoral collaboration and policy coherence, and ultimately promote resource efficiency and the transition to a low carbon economy.
Nexus as a discourse	As emerging discourse, the WLEFC-nexus approach emphasizes the synergies, conflicts and related trade-offs emerging from the water, land, energy, food and climate interactions at bio-physical, socio-economic, and policy and governance level, and encourages agents to cross their sectoral and disciplinary boundaries.
Nexus approach	A systematic process of scientific investigation and design of coherent policy goals and instruments that focuses on synergies, conflicts and related trade-offs emerging in the interactions between water, land, energy, food and climate at bio-physical, socio-economic, and governance level
Nexus Critical Objective (NCO)	It is the policy objective that shows high (potentially the highest) number of interactions with other objectives in the WLEFC-nexus (issue density) and that is most relevant to achieve resource efficiency and low carbon economy in Europe in the long-term.
Nexus Critical System (NCS) or hotspot	A nexus critical system includes a nexus critical objective and the policy objectives that directly interact with it (meaning only first order interactions) as well as the policy means for the achievement of the NCO and of the other objectives directly interacting with it. It is the node in the WLEFC-nexus with a

	high density of interactions, where trade-offs and synergies are likely to coexist, and for which an integrated approach for the identification of nexus compliant solutions is required.
Nexus compliant solutions	Nexus compliant solutions and policies are those managing trade-offs and exploiting synergies.
Serious Gaming	Serious gaming is a method for exploring high-stake problems in which key uncertainties depend on people's choices and actions. The main purpose is education and training where users' learning goals are established. Serious games are experi(m)ent(i)al, rule-based, interactive environments, where players learn by taking actions and by experiencing their effects through feed-back mechanisms that are deliberately built into and around the game. Serious games can be computer based.

1 Introduction

1.1 Objectives of Task 2.1

Policy analysis is a leitmotiv in the Horizon 2020 SIM4NEXUS project, complementary to the modelling of interlinkages between the Nexus sectors. Policies will feed into the models and will be the switches of the Serious Game. Work package 2 makes an inventory of policies that are relevant for the water-land-energy-food-climate (WLEFC) nexus and analyses policy coherence at different scales and different phases of planning and implementation. It does so for policies directly targeted at the five nexus domains and policies that indirectly influence or are influenced by the nexus domains.
This deliverable is the result of Task 2.1 of Work package 2. The objectives of this task are, according to the Grand Agreement:

- To identify and review the most important policy areas for the nexus and the relevant policy interactions between sectors connected to the nexus domains. Bilateral biophysical and socioeconomic interactions between the nexus domains were investigated in Task 1.1;
- To gather current information on policies relevant to the nexus at European scale and on related policies at global scale;
- Analyse interactions, coherence and conflicts between these policies, their degree of 'nexus compliance' and support of a resource efficient Europe;
- Detect windows of opportunity to influence European policy making relevant for the nexus.
- Make a database of summarised relevant policy documents at EU and global scale.

1.2 Disclaimer and follow up

The analysis described in this report is based on desk study, with a small input from experts in the scoring of policy coherence between objectives, described in Chapter 6. The conclusions of the coherence analysis are based on policy goals, objectives and means described in policy documents. In the next phase of the project, these results and conclusions will be verified with stakeholders, policy makers, policy target groups and experts of the WLEFC domains. The implementation of policies, when incoherence becomes manifest, will be investigated in the national and regional case studies of the SIM4NEXUS project. Here, a bottom-up approach will be applied. First, the synergies and conflicts that exist between the nexus domains in practice will be investigated. Second, the connections with regional and national policies will be mapped. National and regional WLEFC policies are mainly based on EU policies, so at these levels the top-down approach described in this report and the bottom-up approach in the cases will come together.

2 Defining the 'nexus'

2.1 The emergence of the nexus

Nexus is the 'new' popular buzz word. Present in the sustainable development discourse for nearly three decades, the concept is not new (Boas and Biermann, 2015; Allouche et al., 2014). However, it has gained momentum in the scientific, policy and political circles only over the last ten years, especially in relation to the water-energy-food (WEF) domains under the increasing pressure of population growth and climate change. It has also reached the scientific agenda because of its potential to operationalize the planetary boundaries concept (Steffen et al., 2015) by providing integrated assessments and holistic approaches to multi-agent and multi-scale problems.

A commonly acknowledged ground breaking moment of the nexus discourse is the 2008 World Economic Forum and the subsequent book on the interlinkages between the WEF and climate domains (WEF, 2011). Acknowledging the problem of resource scarcity and allocation, the World Economic Forum has formulated the nexus as an approach to improve resource efficiency and in turn resource security (Allouche et al., 2014). Since then, in the run up of the Rio+20 conference on sustainable development, the nexus as an approach to address water, energy and food security has found its way into global negotiations through a number of initiatives and publications (see Leck et al. 2015 for a synthesis of the most relevant initiatives occurred between 2009 and 2014). One important event framing the nexus thinking has been the 2011 Bonn conference on the WEF nexus, whose background paper (Hoff, 2011) and the conference policy recommendations (2011) paved the way to further elaboration of the nexus discourse. Although the Rio+20 failed to formally pick up the nexus language, the discussion remained nevertheless alive in the academic and political arenas in the subsequent years. The most recent example of the relevance granted to the nexus is found in the implementation of the 2030 agenda for sustainable development, where a nexus approach is deemed necessary for policy makers to develop coherent policies to achieve the SDGs in a sustainable manner. The discussion in this context focuses on tools and approaches to assess the interaction among the SDGs to identify potential conflicts (and related trade-offs) and synergies. This is meant to help policy makers to devise policies and strategies aiming to minimize trade-offs and exploit synergies (Nilsson et al. 2016a; Nilsson et al., 2016b; Weitz et al. 2014).

The nexus concept is related to the increasing recognition that different sectors are inherently interconnected and must be investigated and governed in an integrated, holistic manner (Hoff, 2011). Accordingly, the nexus literature emphasizes the complexity of interactions occurring across sectors and the need to overcome silo approaches in knowledge generation, and resource management and governance. A nexus approach is deemed necessary to highlight interdependences, exploit potential synergies, and identify critical trade-offs to be negotiated among the affected parties (Hoff, 2011; Allan et al., 2015). The ultimate goal is to improve resource efficiency and thereby ensure a sustainable management of scarce resources.

Many scholars, however, emphasize the lack of agreed definitions and conceptual clarity about the nexus (Benson et al., 2015; Wichelns, 2017). There seems to be in the literature two lines of thought: one that views the nexus as a research and policy analysis approach for resource management and governance (e.g. Boas and Biermann, 2015); and the other one that sees the nexus as a number of strongly interrelated sectors which need to be managed in an integrated fashion (e.g. Hoff, 2011). The difference bears implications, especially from a governance perspective. In fact, depending on how the nexus is defined, different governance strategies may apply. For example, if the nexus concerns a number of strongly interrelated sectors (e.g. water-energy-food) needing to be treated as one integrated sector, from a governance perspective this may entail the creation of *ad hoc* governance structures such as for example a supra-ministry of water-energy-food. In contrast, if the nexus is an

analytical tool to disclose critical interconnections in selected systems, then solutions may not require major institutional changes, but rather only more coordinated action among existing institutions and agents. Hence, clearly establishing what the nexus is and what are its boundaries is crucial.

The analytical and practical usefulness of the nexus concept has recently begun to attract some criticism (see e.g. Smajgl et al., 2016; Foran, 2015; Wichelns, 2017). First, according to Wichelns (2017), the selection of the boundaries of the nexus is somewhat arbitrary. While the vast majority of the literature is concerned with WEF as the nexus par excellence, there are also studies emphasizing other critical interrelations such as for example water-soil-waste (see e.g. Kurian and Ardakanian, 2015) or energy-water-soil-food (Subramanian and Manjunatha, 2014). Furthermore, increasingly the WEF nexus has been extended to also comprehend climate change. By drawing the boundary of the investigation, all these different definitions of the nexus arbitrarily cut out many important variables and interactions. Secondly, although in theory one of the distinguishing features of the nexus is the equal footing that is given to all sectors (Wichelns, 2017), in practice, water is often taken as entry point in WEF frameworks (Allouche, 2014), thus making the nexus not dissimilar to integrated water management. This observation resonates with the recurring criticism that if the nexus is about integrated, holistic management of multiple interconnected sectors, it is not clear how it is different from other integrative approaches (Smajgl et al., 2016). Thirdly, Foran (2015) argues that the existing nexus conceptualizations fail to acknowledge the politics of decisions and in particular the power and interest structure of stakeholders in decision-making processes (in Smajgl et al., 2016). Fourthly, Dupar and Oates (2012) warn that a simplistic reading of nexus thinking may lead to the commodification of resources and overlooking of long-term environmental externalities, such as biodiversity protection, pollution or climate change. Finally, Wichelns (2017) contend that the nexus approach may not always be appropriate as there may be instances in which a sharp research focus is required, there may be sectors where there is little need of interdisciplinary interaction, or contexts lacking institutional capacity, human capital or the finance to support inter-sectoral policy discussions. Related to this latter point is the fact that integrated policy making can increase complexity of processes to the point that decisions are delayed and slowed, finally resulting in inertia (Mitchell et al., 2015).

Besides the scepticism, the literature also reveals a number of distinguishing features of the nexus and provides useful insights for consolidating its conceptualization. Based on this literature, the next section illustrates the SIM4NEXUS conceptualization of the nexus.

2.2 Towards a conceptual definition of the nexus

In line with Keskinen and colleagues (2016) we believe three different perspectives on the nexus can be recognized in the literature: an analytical, a governance and a discourse perspective. Accordingly, the definition of the WLEFC-nexus in the SIM4NEXUS project is provided in Table 1.

Table 1. Definition of the WLEFC-nexus in the SIM4NEXUS project

Perspective	Definition
Analytical	As **analytical approach**, the WLEFC-nexus approach is a systematic process of inquiry that explicitly accounts for water, land, energy, food and climate interactions in both quantitative and qualitative terms with the aim of better understanding their relationships and providing more integrated knowledge for planning and decision making in these domains.
Governance	As **governance approach**, the WLEFC-nexus approach provides guidance for policy decisions through an explicit focus on interactions between water, land, energy, food and climate policy goals and instruments in order to enhance cross-sectoral collaboration and policy coherence, and ultimately promote resource efficiency and the transition to a low carbon economy.
Discourse	As **emerging discourse**, the WLEFC-nexus approach emphasizes the synergies, conflicts and related trade-offs emerging from the water, land, energy, food and climate interactions at bio-physical, socio-economic, and policy and governance level, and encourages agents to cross their sectoral and disciplinary boundaries. In this regard, the WLEFC-nexus acts as a boundary concept (Leigh Star and Griesemer, 1989). Evidence of it is the SIM4NEXUS project itself which brings together a wide range of disciplines from natural to political science and informatics and has a strong focus on stakeholder co-design of tools and solutions.

Source: adapted from Keskinen et al., 2016

The SIM4NEXUS project integrates these three perspectives (as recommended by Keskinen et al., 2016). Accordingly, the analytical framework of the WLEFC-nexus approach adopted in the SIM4NEXUS project is depicted in Figure 1 and is described as:

> *a systematic process of* ***scientific investigation*** *and de****sign of coherent policy goals and instruments*** *that focuses on* ***synergies, conflicts and related trade-offs*** *emerging in the interactions between water, land, energy, food and climate at bio-physical, socio-economic, and governance level.*

Defining and distinguishing **features of a WLEFC-nexus approach** are:

- equal weight given to all sectors in the nexus;
- focus on relationships:
  - relationships are bilateral (A → B interaction is different from B → A interaction);
  - relationships can be synergistic or conflicting and thus generate trade-offs;
- focus on interdisciplinary knowledge generation;
- focus on cross-sectoral governance decisions.

Scientific investigation generates quantitative, model-driven assessments that help identify bio-physical and socio-economic interconnections. Policy and governance analysis identify relevant key stakeholders, policies and legislative frameworks as well as the politics of decision making processes, i.e. the power and interest structure that steer decisions. Such analysis reveals nexus critical systems or **hotspots** defined as the nodes in the WLEFC-nexus with a high density of interactions, where trade-

offs and synergies are likely to coexist, and for which an integrated approach for the identification of nexus compliant solutions is required. **Nexus compliant solutions and policies** are those managing trade-offs and exploiting synergies.

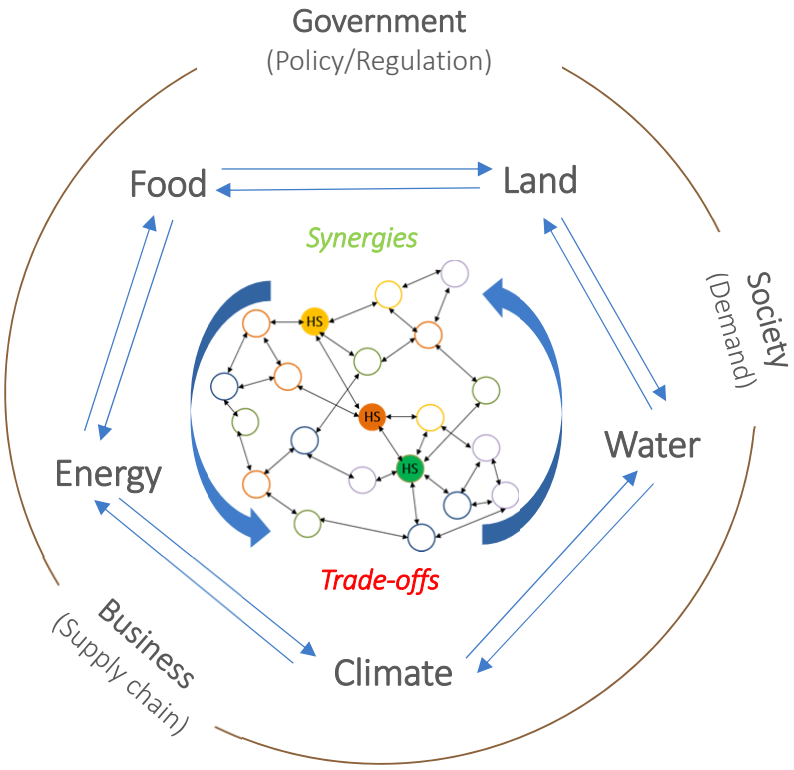


Figure 1. WLEFC-nexus framework in the SIM4NEXUS project (adapted from Mohtar and Daher, 2016)

2.3 The SIM4NEXUS WLEFC-nexus

The Water-Land-Energy-Food-Climate system, abbreviated as 'WLEFC-nexus', is the object of study in this research project. The WLEFC-nexus was defined as study object because of the strong interlinkages between the five domains in this nexus and their relevance for a resource efficient and low-carbon economy in Europe. An integrated approach for the WLEFC policies is assumed necessary to reach these goals.

Water, land, energy, food and climate are catch-all terms. Laspidou et al. (2017) defined these terms in more detail and analysed the bilateral biophysical and socio-economic interlinkages between these domains. The term 'bilateral' is used because relations between two domains have two directions, the influence of domain X on domain Y differs from the influence of domain Y on domain X. Knowledge about these bilateral linkages is important input for the coherence analysis of policies, described in Chapter 6. In addition to knowledge about the bilateral linkages, it is relevant to know how the nexus domains are related to each other in consumption and production systems. Supply chains are important socio-economic networks and the processes connected to them create linkages between the nexus domains that are relevant for policies. For example, agricultural policies affect food security via the supply chain and food policies affect the use of water, land and energy. From the viewpoint of

production, consumption and supply chains, the bilateral connections between nexus components are part of more complex systems with multiple relations. Figure 2 illustrates this.

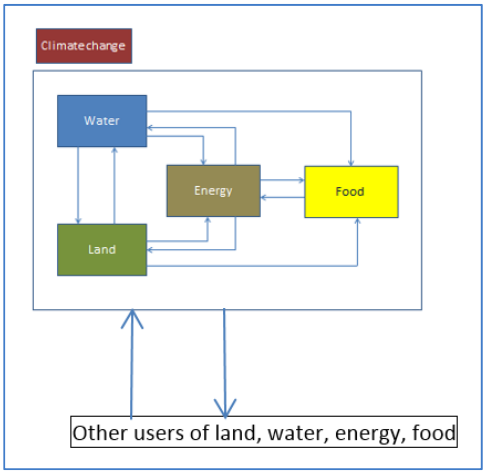


Figure 2. Bilateral relations between WLEFC-nexus components, constituting the complex production and consumption system with its multiples relations.

The definitions of water, land, energy, food and climate given in Laspidou et al. (2017) describe different aspects of and perspectives on these domains. These in turn are connected to different areas of special interest for policies, see Table 2. The interest areas were the base to make the inventory of relevant policy domains for the WLEFC-nexus described in section 3.2.3.

Table 2. Perspectives on WLEFC domains and connected interest areas for policy

Nexus domain	Perspectives	Interest areas for policy
Water	Water system	Aquatic ecosystems and ecological status, hydrological cycle, drainage basin
	Natural resource	Services, withdrawal and use, consumption, efficiency, footprint, IWRM
	'Dustbin'	Emissions
	Spatial phenomenon	Room for activities, spatial planning, transport
	Water consumption	Water saving, water efficiency, life styles, awareness of water consumption patterns and implications
Land	Land and soil system	Terrestrial ecosystems and ecological status, soil fertility, soil biodiversity
	Natural resource	Services, carbon sequestration, land use, degradation.
	Space	Spatial planning, room for activities, landscape
	Property	Land tenure
	Consumption	Recreational use, no-littering behaviour
Energy	Supply chains	Fossil and renewable energy, primary and secondary production and consumption, efficiency, technology and innovation, market and trade, energy security
	Consumption	Energy saving, energy efficiency, informed choice of energy supplier, awareness of energy consumption patterns and implications, life styles

Food	Supply chains	Agriculture, food industry, retail, consumption, efficiency and waste, market and trade, food security
	Consumption	Dietary preferences, food waste
Climate	Temperature Long term weather patterns	Adaptation of water infrastructure and management practice, land-use practice, agricultural practice, energy production and consumption, risk prevention - preparedness - response concerning droughts, floods and other weather disasters
	GHGs	Mitigation: emission reduction in industry, energy, transport, waste, housing, agriculture, forestry, land use (REDD+, LULUCF), , climate friendly products, climate friendly behaviour

3 Policy coherence in the WLEFC-nexus

3.1 What is policy coherence?

Policy coherence is a key feature of a WLEFC-nexus approach. Unfortunately, the literature is not consistent in definition of terms that suggest similar concepts such as coherence, integration, and consistency (den Hertog and Stross, 2011; Nilsson et al 2012). Much work exists on policy integration (for a review see Jordan and Lenschow, 2010) and policy interactions (e.g. Oberthur and Gehring 2006) in the environmental domain. The focus of this scholarship is on the upstream policy making processes and the associated institutional arrangements. In this context, Oberthur and Gehring (2006) define policy interaction as a causal relationship between two policies in which one policy exerts influence on the other either intentionally or unintentionally. Other scholars suggest an increasing degree of policy coherence along the continuum cooperation-coordination-integration where cooperation pursues more efficient sectoral policies, coordination adjusts sectoral policies to deliver coherent and consistent outcomes, and integration jointly designs policy goals and instruments (Stead and Meijers, 2009).

Another line of inquiry has focused on procedural aspects of policy making (see section 3.2 on the distinction between procedural and substantive elements of policy). Most notably the OECD (2002) has identified criteria such as stakeholder involvement, knowledge management, commitment and leadership as criteria in the policy-making process to attain better policy coherence. In this vein, the OECD (2015) defines policy coherence in the context of development as an approach and policy tool for integrating the economic, social, environmental and governance dimensions of sustainable development at all stages of domestic and international policy making in order to foster synergies across economic, social and environmental policy areas; identify trade-offs and reconcile domestic policy objectives with internationally agreed objectives; and address the spill-overs of domestic policies.

In contrast, other studies have taken a more substantive approach by focusing on the content of the policy (e.g. den Hertog and Stross, 2011; Nilsson et al 2012). These studies tend to define policy coherence as an attribute of policy or a systematic activity aimed at reducing conflicts and promoting synergies between and within individual policy areas to achieve jointly agreed policy objectives (Nilsson et al, 2012; den Hertog and Stross, 2011).

In the following section, we illustrate the definition and the boundaries of policy coherence analysis in the SIM4NEXUS project.

3.2 Policy coherence analysis in the SIM4NEXUS project

Policies can be viewed from a **substantive** and **procedural** perspective. A substantive perspective focuses on the content of policies; whereas a procedural perspective is concerned with the processes through which policies are made. From a substantive/content perspective, public policies are composed of policy goals and policy means which are articulated at different level of abstraction (Lasswell, 1958; Howlett, 2011). **Policy goals** are the basic aims and expectations that governments have when deciding to pursue some course of actions. They can range from abstract general goals (e.g. attaining sustainable development) to a set of less abstract objectives (e.g. increase energy efficiency) which may then be concretized in a set of specific targets and measures (e.g. achieve 10% renewable energy share). **Policy means** are the techniques/mechanisms/tools that governments use to attain policy goals. Similarly to goals, means range from highly abstract preferences for specific forms of policy implementation (e.g. preference for the use of market instruments to attain policy goals); to more concrete governing tools (e.g. regulation, information campaigns, subsidies); to specific decisions/measures about how those tools should be calibrated in practice to achieve policy targets (e.g. a specific level of subsidy in the renewable energy sector).

From a procedural perspective, a number of different models of the policy-making process exist. In short, the **policy process**, often referred to as **policy-cycle,** is a set of interrelated stages through which policy issues and deliberations flow from inputs (problems) to outputs (policies). A typical model of the policy process includes five stages (Howlett, 2011): *agenda-setting* (problem recognition by the government); *policy formulation* (proposal for solution in the government); *decision-making* (process of selection of solution); *policy implementation* (how government puts solution into effect); *policy evaluation* (monitoring results, which may lead to reconceptualization of problems and solutions). From the standpoint of policy-making as a social and political process (as opposed to a rational-technical process), goals are defined at different stages including the policy formulation, policy-making and policy-implementation stage, whereas means include activities located in all stages of the policy process.

The investigation of policy coherence in the SIM4NEXUS project focuses on the analysis of the substantive aspects of the policies in the nexus. When looking at a typical policy framework with policy inputs, processes, content, implementation, outcomes and impacts (see Figure 3), the policy coherence in the SIM4NEXUS analysis concerns the policy content – where policy goals and instruments are substantiated in policy documents – and the policy implementation in practice. In general, efforts in the policy processes domain to integrate goals and instruments are expected to result in higher policy coherence; hence recommendations to improve coherence should address this dimension. In turn, the degree of coherence between two or more policies is expected to affect outcomes and impacts. Policy outcomes and impacts then influence the design and re-design of policy goals and instruments. Changes in contextual factors and unexpected events can influence both the policy process (and in turn the policy content and implementation) as well as outcomes and impacts. The coherence of international and European policies is assessed at the level of goals and instruments whilst the project case studies at regional and national scale will investigate the coherence also at the level of implementation practices, which is where conflicts are more likely to arise.

Focusing the coherence analysis on the substantive aspects of the policies in the nexus has two advantages. Firstly, it provides relevant information for the development of the SIM4NEXUS Serious Game. Information about policy trade-offs and synergies are necessary for the development of the game as one of the characteristics of the game is to provide the players information about the consequence of the policy choices that they make while playing. Secondly, identifying synergies and conflicts among policy goals and instruments across sectors is necessary for the implementation of a nexus governance approach to policy-making.

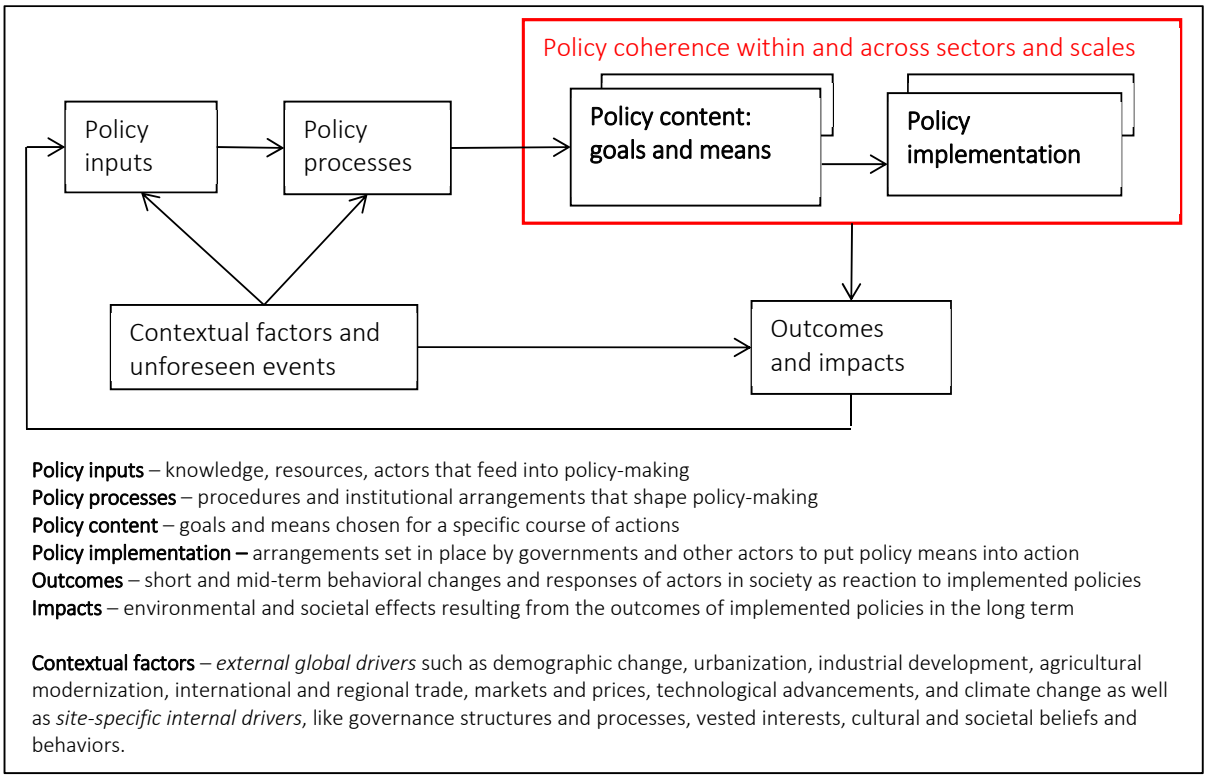
Exploiting synergies and managing trade-offs (thereby enhancing policy coherence) requires deliberation actions at the level of policy-making processes (see Figure 3). These include for example political bargaining, organizational arrangements and mandates, administrative procedures such as impact assessments. Windows of opportunity for improving policy coherence are for example policy reviews such as the review of the EU Water Framework Directive (WFD) by 2019 and of the EU common agricultural policy (CAP) by 2020. When critical synergies and trade-off are revealed, specific recommendations can be formulated about how policy-making processes could be changed to improve policy coherence.

Accordingly, drawing from the definition of Nilsson et al. (2012), in the SIM4NEXUS project policy coherence is defined as:

> *an attribute of policy referring to the systematic effort to reduce conflicts and promote synergies within and across individual policy areas at different administrative/spatial scales.*

Policy synergies manifest when the combined efforts of two or more policies can accomplish more than the sum of the results of each single policy separately. Policies reinforce each other. For example, the combination of investment in research and in pilot innovation projects, with a clear emission target, may give a boost to innovation and uptake of new clean technologies, whereas the investments without a clear target or a target without the investments would not have this effect.

Policy conflicts manifest when goals and instruments of one policy are in contrast with goals and instruments of another policy. When conflicts arise, choices should be made about the related t*rade-offs.* This implies choosing to reduce or postpone one or more desirable outcomes in exchange for increasing or obtaining other desirable outcomes in return. This choice requires political compromise.



Policy inputs – knowledge, resources, actors that feed into policy-making
Policy processes – procedures and institutional arrangements that shape policy-making
Policy content – goals and means chosen for a specific course of actions
Policy implementation – arrangements set in place by governments and other actors to put policy means into action
Outcomes – short and mid-term behavioral changes and responses of actors in society as reaction to implemented policies
Impacts – environmental and societal effects resulting from the outcomes of implemented policies in the long term

Contextual factors – *external global drivers* such as demographic change, urbanization, industrial development, agricultural modernization, international and regional trade, markets and prices, technological advancements, and climate change as well as *site-specific internal drivers*, like governance structures and processes, vested interests, cultural and societal beliefs and behaviors.

Figure 3. Boundaries of policy coherence analysis in the SIM4NEXUS project (adapted from Nilsson et al., 2012)

3.2.1 Policy interactions: definition and typologies

When investigating conflicts and synergies between policies one comes across the question of how policies interact. Policy interaction refers to a *cause-effect relationship between policies and occurs when the content of one policy (goals, means, implementation practices) influences the performance of another policy such as the achievement of its objectives or the implementation of its instruments*.

'Policy area A to policy area B' interactions are different from 'policy area B to policy area A' interactions. For example, in the water to food interaction, water is an input for food production and water scarcity represents a threat to food security; the other way around, i.e. the food to water interaction, the use of fertilizers and pesticides in food production generates water quality problems and the production of food crops subtracts water resource to other users.

Interactions take place within the context of external global drivers, such as demographic change, urbanization, industrial development, agricultural modernization, international and regional trade, markets and prices, technological advancements and climate change as well as more site-specific internal drivers, like governance structures and processes, vested interests, cultural and societal beliefs and behaviours.

Interactions can be studied within and across policy areas as well as within and across administrative/spatial scales (Nilsson et al, 2012). The combination of these options generates 4 types of interactions that can be investigated (see Table 3): horizontal/internal; horizontal/external; vertical/internal; and vertical/external coherence.

Table 3. Policy interactions at different levels

Policy area	Administrative/spatial scale	
	Horizontal	Vertical
Internal	e.g. EU climate mitigation targets vs EU carbon emission cap, or vs EU burden sharing or vs EU ETS	e.g. global climate policy vs EU climate policy
External	e.g. EU food production policy vs EU climate mitigation policy	e.g. global trade policy vs EU climate policy

Furthermore, interactions also occur across the different elements of the policy and in the implementation phase. For example, to facilitate the adoption of decisions, conflicts are often hidden at high levels of abstraction such as when formulating goals and objectives (Nilsson et al, 2012). These conflicts can then manifest in the selection and implementation of instruments. Regarding implementation, research has shown that administrators and bureaucrats tend to filter, interpret, distort, adapt formal policy sometimes to the point that outcomes may be different from the legislator intention (Pressman and Wildavsky, 1973; Nilsson et al, 2012). Similarly, potential for synergistic effects exist in all these levels as well. To capture these interactions, a multi-layered approach is adopted, following Nilsson et al., 2012 (see Figure 4). This layered approach allows to investigate interactions among two or more set of goals as well as among means and implementation practices against policy goals.

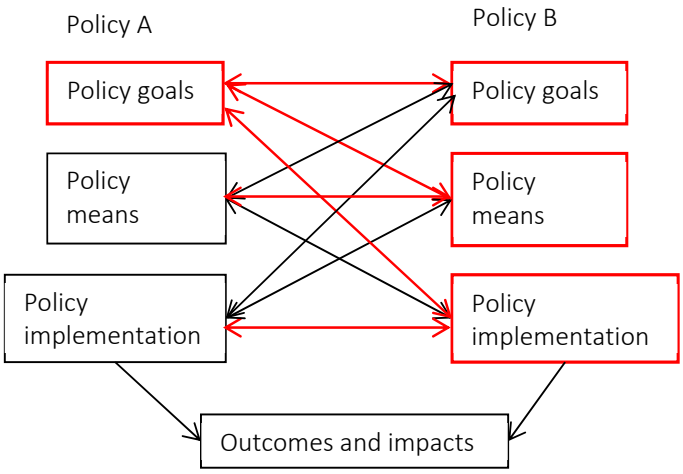


Figure 4. Interactions among elements of policy from goals to implementation (adapted from Nilsson et al, 2012)

The interplay of interactions across policy areas and scales and among policy elements leads to a complex reality to investigate. Specifically:

- The **horizontal/internal coherence analysis** investigates the interaction of goals, means and implementation practices within a policy area (e.g. objectives/instruments of EU energy policy; objectives/instruments/implementation practices of global nature conservation policy).
- The **horizontal/external coherence analysis** investigates the interaction of goals, means and implementation practices across multiple policy areas at the same administrative scale (e.g. water/food at EU level; water/energy/food at national level, etc.).

- The **vertical/internal coherence analysis** investigates the interaction of goals, means and implementation practices between one policy area across multiple administrative scales (e.g. global/EU climate policy; global/EU/national climate policy, etc.).
- The **vertical/external coherence analysis** investigates the interaction of goals, means and implementation practices across multiple policy areas across multiple administrative scales (e.g. global climate policy/EU energy policy; global climate policy/EU energy and transport policy, etc.).

The combination of these options with the WLEFC-nexus policy domains generates a multitude of potential interactions to investigate. However, not all interactions are equally important and the specificity of the context is likely to determine the level of relevance of different interactions. Consequently, it is possible to rank interactions according to their relevance in a specific context and select those that are worth in depth investigation. Furthermore, different typologies of interactions can be identified. Table 4 illustrates the typology of policy interactions used in this study.

Table 4. Typologies of policy interactions

Type of interaction	Description
Cancelling	Progress in one objective makes it impossible to reach another objective and possibly leads to a deteriorating state of the second. A choice has to be made between the two (trade-off).
Counter-acting	The pursuit of one objective counteracts another objective.
Constraining	The pursuit of one objective sets a condition or a constraint on the achievement of another objective.
Consistent	There is no significant interaction between two objectives.
Enabling	The pursuit of one objective enables the achievement of another objective.
Reinforcing	One objective directly creates conditions that lead to the achievement of another objective.
Indivisible	One objective is inextricably linked to the achievement of another objective.

Source: Nilsson et al. 2016a; Nilsson et al. 2016b

3.2.2 Defining nexus critical objectives (NCOs) and nexus critical systems (NCSs)

The goal of the SIM4NEXUS project is to deliver tools for policy makers to be able to make informed decisions about policies that can place Europe on the path of resource efficiency and low carbon economy. Not all interactions of policy objectives are equally important for the achievement of these goals. Furthermore, those objectives that manifest a high density of interactions with other objectives are the ones that could most likely manifest significant trade-offs and/or synergies in the WLEFC-nexus. Given the multidimensionality and complexity of the space of policy interactions, we defined nexus critical objectives and related nexus critical systems as unit of analysis of horizontal coherence among means and of vertical coherence between international and European policy objectives in the WLEFC-nexus.

A nexus critical objective (NCO) is defined as *the policy objective that shows high (potentially the highest) number of interactions with other objectives in the WLEFC-nexus (issue density) and that is most relevant to achieve resource efficiency and low carbon economy in Europe in the long-term*.

A **nexus critical system** (NCS) *includes a nexus critical objective and the policy objectives that directly interact with it (meaning only first order interactions) as well as the policy means for the achievement of the NCO and of the other objectives directly interacting with it*.

Figure 5 illustrates the two concepts.

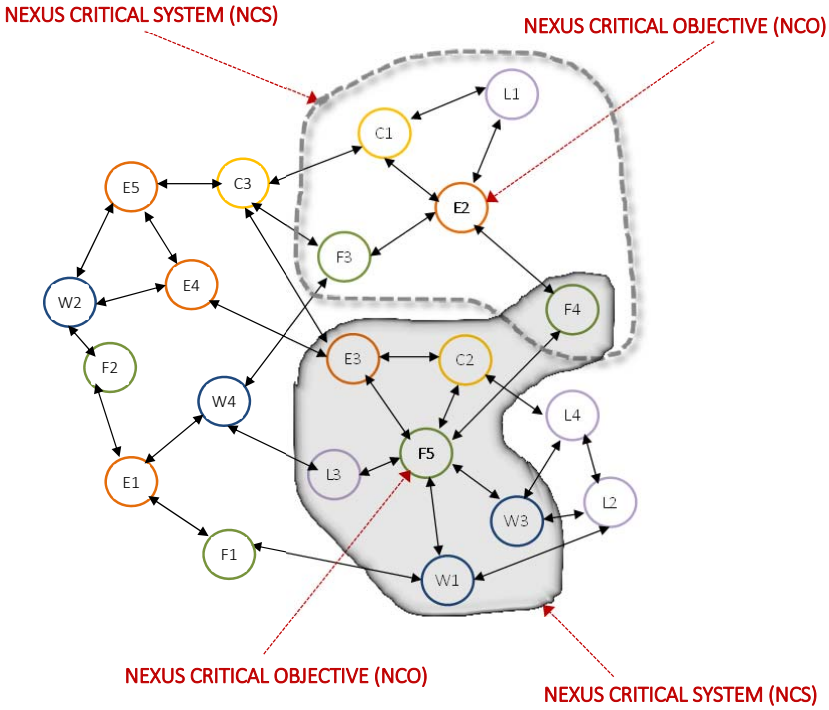


Figure 5. Representation of nexus critical objectives and nexus critical systems

3.2.3 Policies in the WLEFC-nexus and policies indirectly affecting the WLEFC-nexus

The definition of nexus in the nexus approach is context specific, depending on the issues, questions and problems at stake. 'Nexus' are defined parts of the socio-economic and biophysical system and do not have natural boundaries. According to Hoff (2011) 'the green economy itself is the nexus approach par excellence.' In our view the nexus scope is even broader, as a nexus approach also includes ecosystems, the services they deliver and the limits to their capacity to keep doing this under pressure. This means that the policy domains connected to a nexus are also context specific and depend on the issues at stake. For the WLEFC-nexus, we first focus on the policies that consciously aim at influencing the five nexus domains, as defined in Table 2 in section 2.3. In addition to these, policies directed at other domains may influence the nexus (see Figure 6). For example, OECD/IEA/NEA/ITF (2015) argue that the economy as a whole, and more specific policies for investment and finance, taxation, trade, and research and innovation, are important for the transition towards a low-carbon economy. A nexus approach is mentioned in connection to development policies and the SDGs (Weitz, 2014). The Bonn2011 Conference synopsis (Bonn2011, 2012) adds to these labour and product markets, security, environment and biodiversity as relevant policy domains connected to the water-energy-food security nexus.

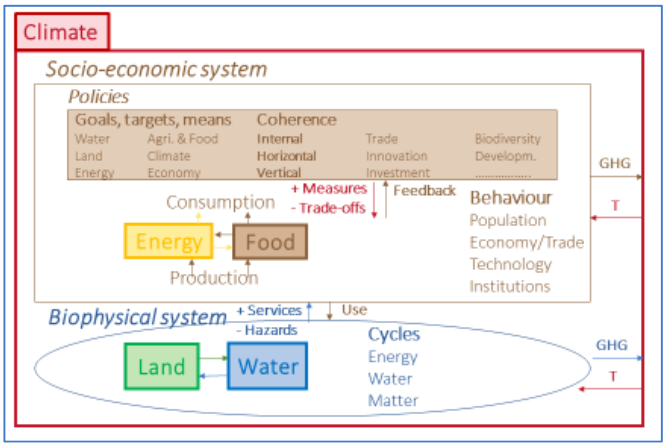


Figure 6. Policies aim at changing the socio-economic system in a desired direction, but may have unexpected trade-offs or may mutually interfere and influence each other's effectivity. Because the WLEFC-nexus is in many ways connected to the rest of the socio-economic and biophysical systems, policies not directly aimed at the nexus domains may nevertheless influence them.

3.2.3.1 Policy domains in the WLEFC-nexus at EU and Global level

In this study, we selected the following policy domains, because these policies consciously aim at influencing the WLEFC sectors. The overview of policy domains was constructed using information from the websites of governments and governmental organisations, e.g. DGs from the European Commission and UN departments and Assemblies, and by collecting policy documents and analysing a key selection of these documents (see Chapter 5).

Table 5. Policy domains at EU and Global level, within the WLEFC-nexus

WLEFC-nexus domain	Policy domains
Water	**EU policies** Ecological and chemical water quality Emissions to surface water and groundwater International agreements and protected areas Surface water and groundwater quantity, incl. water scarcity Sustainable water use, efficiency and re-use Flood risks and climate change adaptation **International policies** Water management, incl. water availability, water quality, water scarcity Drinking water and water related health Transboundary waters Sustainable water use and water efficiency Sanitation, wastewater treatment and re-use Freshwater ecosystems, incl. benefit sharing Climate change adaptation and mitigation
Land	**EU policies** Sustainable land use incl. indirect land use change (ILUC) Soil protection and sustainable use Forest management, incl. timber **International policies** Desertification

	Management of forests, incl. timber
Energy	**EU policies** Renewable sources of energy Energy efficiency Internal energy market and competitiveness Energy supply security Innovation and technology Energy poverty
Food and agriculture	**EU policies** Food production and security Natural resources and climate action Territorial development and regional funds Food supply chain, incl. food waste, consumption and food-related health **International policies** Food security Sustainable food consumption and production incl. food waste Food market and trade Climate change mitigation and adaptation
Climate	**EU policies** Greenhouse gas emissions in ETS sectors Greenhouse gas emissions in non-ETS sectors Low-carbon technology, incl. CCS Land use, incl. forestry and agriculture Climate change adaptation **International policies** Greenhouse gas emissions Financing Technology Capacity building Climate change adaptation

3.2.3.2 Policies indirectly affecting the WLEFC sectors

Table 6 lists the policy domains that are strongly linked to the WLEFC-nexus and that are strongly related to the goals of a resource efficient and low-carbon Europe with an economy that stays 'within the limits of the planet'. We are interested in whether these goals are incorporated in the policies for these domains, and whether these policies take the goals and objectives of WLEFC policies into account. Also, there may be interference between policy measures and instruments within and outside the WLEFC policy domains.

Policy documents for these 'external' policy domains (with the exception of air quality) have been collected and put into the database (Digital appendix). The analysis of these documents will be carried out in a next phase of this work package as part of the development of integrated strategies and approaches towards a resource efficient and low carbon Europe.

In this phase of the policy analysis, we focus on policies at European and global scale in the water, energy, food and agriculture, land and climate sectors. Concerning climate, our investigation is

inevitably more detailed on mitigation rather than adaptation policy, due to the fact that adaptation is an issue mostly dealt with at national scale while the EU only sets the general policy framework with the EU adaptation strategy (included in our analysis). In a similar vein, spatial planning and taxation are not the responsibility of the EU but of the member states and therefore are not included in this report.,. Other sectoral policies, such as those for industry, transport, building, tourism, will be addressed at the national and regional scale when relevant for the case studies. In these cases, policies will be investigated bottom-up, starting from the implementation in practice. Finally, air quality will not be investigated in this project as it is out of the nexus scope and it is not addressed by any of the project case studies.

Table 6. Policy domains relevant for the WLEFC-nexus

Policy domain	Relevance for WLEFC-nexus
Economy including circular economy and waste	Water, land, energy are key production factors and food is a key sector in a broader economy. Climate change has been and will be caused by production and consumption. Strategies and approaches towards a resource efficient and low carbon economy can only be investigated in the context of existing and planned policies for the economy.
Investment and financing	Several WLEFC policies mention steering of financial flows at all levels of investment in private and public sectors as key factor to reach a shift towards sustainability goals. There are policies and guidelines for investments of e.g. multinationals and investors like banks and funds to meet sustainability criteria. Do they take WLEFC linkages into account? The shift towards a resource efficient and low carbon economy needs investment in research, innovation and upscaling of alternatives to replace existing practices.
Innovation and research	In all WLEFC domains and in the total WLEFC-nexus, innovation and research play a key role to move on to goals.
Air quality	Nitrogen deposition pollutes land, water and ecosystems. Production of energy and food may emit other pollutants than greenhouse gases; policies to increase production efficiency and reduce GHG-emissions may also reduce emissions of these other pollutants into the air.
Ecosystems, biodiversity, nature and forestry	Ecosystems deliver key services to support humanity. Exploitation of and negative side effects on water and land, and climate change should stay within the boundaries of sustainable use.
Environment	Water and land are part of the broader environment. Environmental policies may address WLEFC issues.
Regional EU policies and funds	WLEFC policies are implemented in regions. Here all WLEFC policies come together in one area and here potential conflicts and synergies are encountered in practice.
Development	The water-energy-food nexus approach is often applied in development policy. Policy coherence is a prominent issue for the implementation of the SDGs in which the WLEFC domains are addressed.
Risk and vulnerability	Risk policies are relevant to address the consequences of climate change for the other WLEFC domains. Prevention, preparedness and response to risks in the WLEFC domains should take interlinkages between domains into account to be effective.
Trade	Trade barriers and protectionism may hinder the distribution of technologies and undermine investments in and uptake of new technologies.

4 Methodological approach

The analysis of policy coherence in the WLEFC-nexus was conducted with a mix method approach that included content analysis of primary policy documents, expert judgment of interactions of objectives and means in the WLEFC-nexus, and review of secondary literature about policy coherence in interactions in the WLEFC-nexus. Primary policy documents are for example the EU communications, roadmaps, regulations, directives, green and white papers, UN protocols, agreements, declarations, action plans. The research design anticipated a step-wise approach to the analysis which included the following steps:

1. Collection of primary and secondary documents per each nexus policy domain and other nexus relevant policy areas at international and EU level
2. Content analysis of primary documents: mapping of the key policy goals and means per each WLEFC-nexus policy sectors in other nexus relevant policy areas
3. Selection of the policy objectives to include in the assessment of interactions in the WLEFC-nexus at EU level
4. Assessment of the interactions of policy objectives across the WLEFC-nexus domains at EU level
5. Selection of nexus critical objectives (NCOs) and nexus critical systems (NCSs) for further investigation
6. Further investigation of NCOs and NCSs concerning:
    a. The horizontal coherence of objectives within the selected NCSs
    b. The horizontal coherence of means within the selected NCSs
    c. The level of integration in primary policy documents (prescriptive policies) of the synergies and conflicts identified in the NCSs
    d. The vertical coherence between international policy objectives in the WLEFC nexus and the NCSs.

The policy coherence analysis *per se* consisted of steps 4, 5 and 6.

In the following a detailed explanation of these steps is presented.

4.1 Inventory of policy goals and means in the WLEFC-nexus

Primary and secondary literature about the WLEFC-nexus and related policy areas at international and European scale was collected, organized per policy domain and stored in a shared on-line storage space.

Primary literature included binding and non-binding legislative (EU directives, EU regulations, international agreements, etc.) documents and other policy documents such as plans, programs, strategies, road maps, etc. released by governmental/intergovernmental authorities, as well as discussion documents concerning policies under review/preparation (e.g. EU green or white papers). The most up to date documents were selected, meaning the final approved, consolidated documents for approved legislation, and the most recent discussion documents for policies under review/preparation.

Secondary literature included documents assessing individual EU policies and global agreements (ex-ante and ex-post), and documents assessing policy interactions and policy coherence among different global and EU policies/levels in the WLEFC-nexus (either released by governmental organizations or other organizations including scientific literature). Examples include Impact Assessment studies, Integrated Assessment studies, Sustainability Assessment studies, assessment of interaction of multiple policies in the nexus, scientific literature on nexus interaction or on policy coherence, etc.. 131 primary policy documents concerning 13 policy domains were selected (for the list of the policy domains see section 3.2.3). A content analysis of these documents was performed. An excel template was first created for the storing of relevant information which included: policy goals, policy means, policy horizon, financing, reference in the document to other nexus domains, expected revision of the policy and meta-data about the document.

This database formed the basis for developing the inventory of policy goals and means in the WLEFC-nexus presented in Appendix I. Information stored in the database was also used to analyze the level of integration of synergies and conflicts in the NCSs and to identify windows of opportunity to address critical trade-offs and potential synergies.
Information stored in the excel database complemented with information retrieved from the websites of official institutions (e.g. European Commission, UN, WTO, OECD, etc.) was used to reconstruct the structure of the policy domains in the WLEFC-nexus and to build the inventory of policy goals and means.

Figure 7 shows the structure of the policy domains and the level at which the coherence analysis was conducted. Per each nexus policy domain, the main policy sub-systems and issue areas were identified. Then key policy goals were identified at the level of policy domain, overarching objectives at the level of policy sub-systems and objectives at the level of issue area. The analysis of coherence was performed at the level of issue area among objectives and means identified in the WLEFC-nexus.

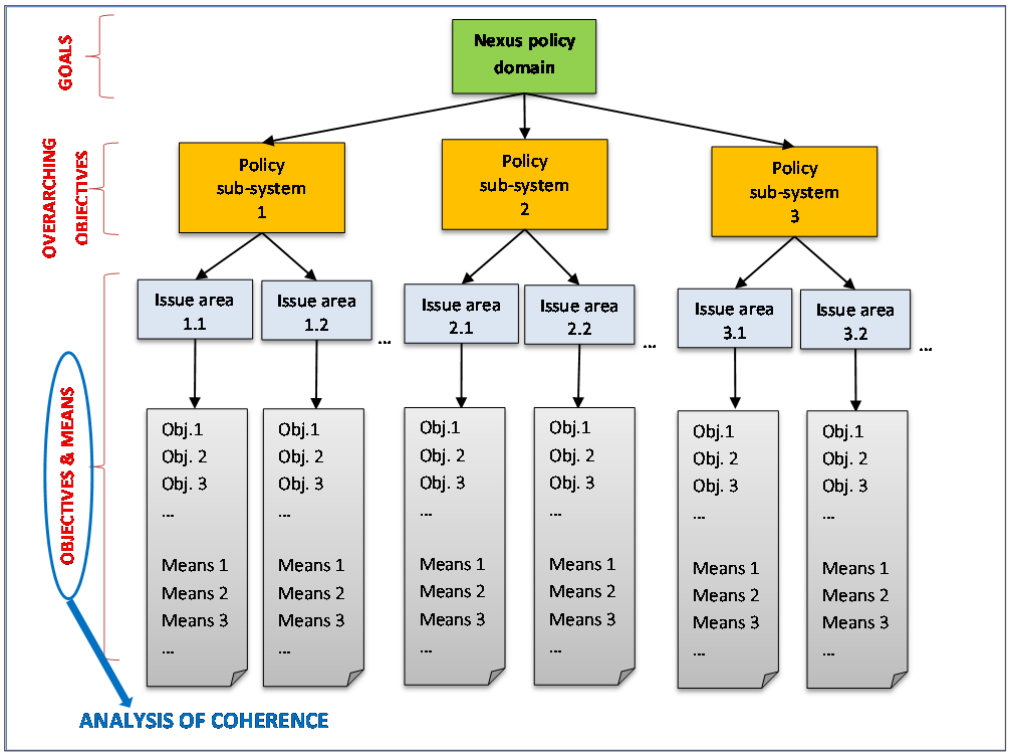


Figure 7. Schematic representation of the structure of the policy domains and the level at which the coherence assessment was conducted

Once the inventory was completed, we selected the objectives to include in the coherence assessment. Given the multitude of potential interactions among policy objectives, choices had to be made to keep the assessment manageable. Accordingly, only a sub-set of all identified objectives was selected for the coherence assessment. The selection was guided by the following criteria:

- Relevance of the objectives to the SIM4NEXUS project: this led to prioritize the assessment at EU scale since SIM4NEXUS is an EU funded project and to focus on those objectives that have relevance for the achievement of a low carbon and resource efficient Europe (the goal of the project).
- Potential of the objectives to have a high number of interactions, either positive or negative, in the WLEFC-nexus.
- Unambiguous and clear definition of the objectives. This implied rewording the objectives in a different way from the exact phrasing included in the primary documents. While rewording attention was paid in preserving the meaning of the objectives.

As a result of the selection process, we identified 33 objectives which are presented in Table 7.

Table 7. Selected policy objectives for the assessment of interactions in the WLEFC-nexus

EU WATER POLICY	
W1	Achieve good water quality status
W2	Ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy and the environment
W3	Increase water efficiency
W4	Reduce water consumption
W5	Assess and manage flood risk and mitigate flood effects
W6	Address and mitigate water scarcity and drought
EU ENERGY POLICY	
E1	Increase production of biofuel
E2	Increase consumption of biofuel
E3	Increase production of energy from biomass (excluding biofuel)
E4	Increase consumption of energy from biomass (excluding biofuel)
E5	Increase hydro-energy production
E6	Increase hydro-energy consumption
E7	Increase energy efficiency
E8	Reduce energy consumption
E9	Push forward important energy infrastructure projects (grid, network, interconnectors, etc.)
E10	Achieve energy supply security
EU LAND USE POLICY	
L1	Restoring degraded soils to a level of functionality consistent with at least current and intended use
L2	Prevent soil degradation
L3	Maintain and enhance forest cover
L4	Prevent indirect land use change from nature to productive use
EU FOOD AND AGRICULTURE POLICY	
F1	Contribute to farm incomes (if farmers respect rules on environment, land management, soil protection, water management, food safety, animal health and welfare - 'cross-compliance')
F2	Improve competitiveness of agricultural sector (including sector-specific support and international trade issues)
F3	Ensure provision of environmental public goods in the agriculture sector
F4	Support rural areas economy (employment, social fabric, local markets, diverse farming systems)
F5	Promote resource efficiency in the agriculture, food and forestry sectors

F6	Reduce and prevent food waste
F7	Reduce intake of animal protein in human diet (non-binding objective; expressed intention on a research phase)
EU CLIMATE POLICY	
C1	Reduce GHGs emissions to keep global temperature increase within 2 degrees
C2	Increase efficiency of the transport system
C3	Support the development and uptake of low-carbon technology
C4	Support the development and uptake of safe CCS technology
C5	Incentivize more climate-friendly land use
C6	Promote adaptation in key vulnerable EU sectors and in MSs

4.2 Assessment of the interaction of policy objectives in the WLEFC-nexus

To examine the extent to which the nexus policy domains are coherent in the EU policy landscape, we used the analytical framework proposed by Nilsson and colleagues (2012). The framework juxtaposes the nexus policy domains in a screening matrix where assessment of policy interactions is made for pairs of policy objectives.

A scoring scale was used to assess the interaction between pairs of objectives (see Figure 8). The scores are associated to the typology of interactions illustrated in Table 4. Negative scores identify conflicts between pairs of objectives; positive scores identify synergies between pairs of objectives. The score 0 indicates the absence of a significant interaction between pairs of objectives. A score of +3 indicates coherence between two objectives; a score of -3 indicates incoherence between two objectives. See Table 4 in section 3.2.1 for definitions of the terms used in Figure 8Figure 8. Each typology of interaction is unique.

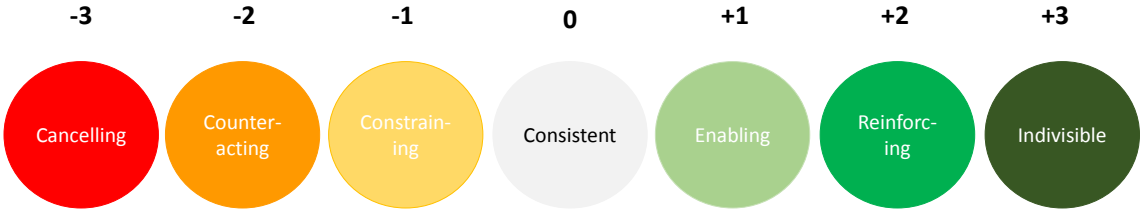


Figure 8. Scoring system for assessing the interaction of policy objectives

The scoring of interactions was performed in a step-wise, iterative fashion, using multiple sources of information. The approach consisted of the following steps:

1. Individual scoring of interactions conducted by two researchers with expertise in the nexus domains. Calibration of the assessment was ensured by extensive discussion between the two researchers about the meaning and the use of the scoring scale.
2. Comparison of the individual scoring. Whenever a difference in the scoring was detected, the two researchers discussed their scoring argument and agreed, providing motivation, on a score.
3. Discussion of the most controversial interactions in a team of PBL researchers with disciplinary expertise on water, energy, food and agriculture, land use and climate change. The group discussion led to the revision of several scores.

When scoring interactions, the researcher answered the following question: *What happens to objective X if we make progress on objective Y?* Furthermore, the scoring was guided by the following principles:

- Consideration of only direct interactions. Indirect interactions and re-bound effects were not included when scoring. Indirect interactions were expected to emerge from the network representation, which will be described in section 6.2.1.
- Consideration, whenever relevant, of to what extent the interactions are affecting the long-term objectives 'resource efficiency' and 'low carbon economy'.
- Consideration, when relevant, of the context; this implies that, for the same pair of objectives, the interaction can be different across different geographical, political, socio-economic, bio-physical domains. Therefore, clear specification of the context accompanied the assigned scores.
- Justification of scores for the most controversial interactions.

The scoring was based on the following sources of information:

- Expert knowledge: PBL researchers with expertise on policy, socio-economic and bio-physical interactions in the different nexus domains.
- When necessary, evidence or predictions of policy outcomes and policy interactions available in the secondary literature.
- When necessary, information on bio-physical and socio-economic interactions provided by SIM4NEXUS WP1.

As next step in the process of policy coherence analysis, we plan to discuss the screening matrix and the relative scores with a number of relevant stakeholders including European Commission and UN officers, NGOs and industry representatives in the different nexus domains.

4.3 Selected NCOs: assessment of horizontal coherence of objectives and means, of vertical coherence of objectives, and of level of integration in policy documents

The next step in the analysis consisted on identifying the nexus critical objectives and critical systems for further investigation of the horizontal and vertical coherence of objectives and means. The selection of the NCOs was based on two criteria:

1) high density of interactions in the WLEFC-nexus;
2) relevance of the objectives for the SIM4NEXUS project.

For the selected NCOs, the horizontal coherence of the objectives and of the means within the respective NCS was investigated. The assessment of the coherence among means was based on the information stored in the database of primary data as well as on additional information retrieved from the website of institutions. The coherence of means was assessed in a descriptive fashion and by scoring the interactions among pairs of means using the above described scoring system (see Figure 8).

As for the assessment of the vertical coherence between EU and international policies, we chose to use the SDGs and UN primary policy documents to collect reference objectives of international

policies in the WLEFC-nexus. The vertical coherence of objectives was assessed in a descriptive fashion.

Finally, the extent to which primary policy documents (prescriptive policies) account for the interactions of objectives identified in the NCSs was assessed using the information stored in the database of primary data. A scoring system was developed and used to assess the level of integration of WLEFC objectives in the EU policy documents. The scoring system is illustrated in Table 8.

Table 8. Scoring system for the assessment of the level of integration of WLEFC objectives in the EU policy documents

0 = no integration	1 = low integration	2 = moderate integration	3 = strong integration
The document does not refer to other nexus sectors.	The document generically mentions the need to coordinate/integrate its objectives and/or instruments with other nexus policies	The document prescribes the integration/coordination of its objectives and/or instruments with other nexus policies but there is no provision of how to do such integration	The document prescribes conditions of measures to take to minimize impacts or harness synergies in other policy sectors. *E.g. direct payment to farmers under the EU CAP is conditioned to the implementation of good environmental practices in agriculture*

4.4 Two challenges in the assessment of policy coherence

Two key challenges exist in the analysis of policy coherence. Both are not addressed in the literature.

The first challenge concerns **time frames** and specifically the problem of how to reconcile the timing of the investigation with the timing of the policies. In principle, the focus of the SIM4NEXUS project is on both existing policies and policies under political discussion. There is in general no problem when studying goals and instruments as the coherence analysis can capture both existing and under discussion policies in documents and legislation. However, when it comes to investigate coherence at the level of implementation practices, we are confronted with the time lag between policy adoption and policy implementation. This means that, for example, for more recently adopted policies we may not be able to investigate coherence at the implementation level in the case studies.

The second challenge concerns the i**nteractions between multiple policies**. This is a critical issue that has been recognized in the literature as central in policy analysis but for which there is not satisfying solution at present. Policy coherence studies are typically conducted for pairs of policy areas and there are no instances of structured, quantitative methods to study multiple interactions among policies. In our investigation, we tentatively addressed the whole range of interactions across the goals and instruments in the nexus critical systems in a descriptive fashion.

5 Inventory of goals and means in the WLEFC-nexus at international and EU level

In this chapter, a schematic illustration of the nexus policy domains at international and EU scale is presented. The colours in the scheme indicate the various levels of the policy space, namely the policy domain, the policy sub-systems and the issue areas. General goals were identified at the level of policy domain; overarching objectives at the level of policy sub-systems and objectives at the level of issue areas (see section 4.1 for the overall structure). Policy instruments were identified at the level of issue area. The main policy documents defining policy goals and instruments were identified.

5.1 International policies in the WLFC-nexus

In the following a short description of the policy space of the water, land, food and climate nexus domain is provided. Energy is excluded because there is not an international energy policy domain (beside some specific actions which however do not establish an international energy domain). Detailed information about policy goals, means and related policy documents can be found in the inventory of policy goals and means in Appendix I. For ease of use in the appendix tables, the different policy levels are represented with the same colour system used in the schemes below.

5.1.1 Water

At international level the water domain (Figure 9) is strongly linked to the development agenda. Water is in fact tackled by the UN Sustainable Development Goals, by the UN and UNEP water strategy documents, as well as by the 1992 Convention on the Protection and Use of Transboundary Watercourses and the related Protocol on Water and Health. Key goals in the international water policy domain include:

- SDG 6 Ensure availability and sustainable management of water and sanitation for all
- SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems (incl. inland freshwater ecosystems), sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss
- Well-managed, healthy freshwater systems supporting sustainable development and human well-being
- Protection of human health and well-being, both individual and collective, within a framework of sustainable development, through improving water management and through preventing, controlling and reducing water-related diseases
- Resilience to climate change.

These goals revolve around four main water policy sub-systems, namely: water supply and quality; water sanitation; freshwater ecosystems; water and climate change. As for water supply and quality, key issue areas comprise drinking water and health, water scarcity (which links to the Desertification Convention), water quality, transboundary waters (essentially through the 1992 Convention on Transboundary Waters) and water use. Sanitation is linked to SDG 6 and deals essentially with access and waste water treatment and re-use, whereas the freshwater ecosystem issues are linked to SDG 15 and concern protection, invasive species migration, illegal trading of protected species and fair sharing of benefits deriving from the use of genetic resources. Finally, international water policy is concerned with the relation between climate change and water, particularly with adaptation (key objective is building resilience to climate change) and mitigation (key objective is considering water and ecosystem footprints of alternative climate change mitigation measures).

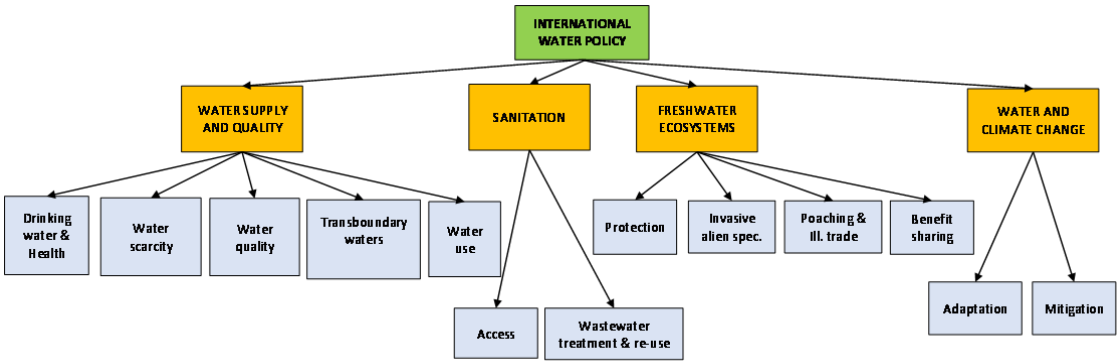


Figure 9. Schematic representation of the international water policy space

5.1.2 Land

International land use policy (Figure 10) revolves around two main policy sub-systems: desertification and forestry. Desertification policy is essentially covered by the UN Desertification Convention signed in 1994. The Convention aims to combat desertification and to mitigate the effects of drought in countries experiencing serious drought and/or desertification. To achieve these objectives, the Convention focuses on two main issue areas: droughts, and land and soil productivity with a number of soft instruments including cooperation among parties, promotion of multi-lateral institutions and financial mechanisms among affected parties.

As for forestry, the overarching objective 'sustainable management of forests and trees' is pursued with action from the UN and the FAO which have developed strategies for forestry management, an international agreement on tropical timber and several non-legally binding instruments. The key issue areas addressed by these documents are tropical timber, use of forest and illegal forest activities.

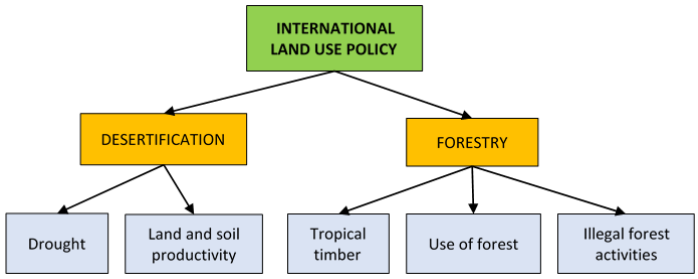


Figure 10. Schematic representation of the international land use policy space

5.1.3 Agriculture and food

Similarly to water, food and agriculture policy at international level (Figure 11) is linked to the development agenda and in particular to the SDGs. Other relevant documents include the UN FAO 2009 Declaration of the World Summit on Food Security and the UN FAO 1996 World Food Summit Plan of Action, the International Treaty on Plant Genetic Resources for Food and Agriculture, and the OECD FAO 2016 Guidance for responsible agricultural supply.
The main goals laid down in these documents are:

- SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- SDG 12: Ensure sustainable consumption and production patterns

- Pursue resilient agricultural practices that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters
- Pursue mitigation in agriculture

The key policy sub-systems that are delineated by these documents and goals are: food security, food production and consumption, and the relation between food and climate change. As for food security, relevant issue areas include: hunger and malnutrition (end it by 2030); food production, especially agriculture productivity and income of small-scale food producers; and genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species. Production and consumption is concerned with sustainability issues, food waste, consumption patterns (essentially information and awareness), and market and trade (in particular to limit food price volatility). Finally, mitigation and adaptation focus on implementation of resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

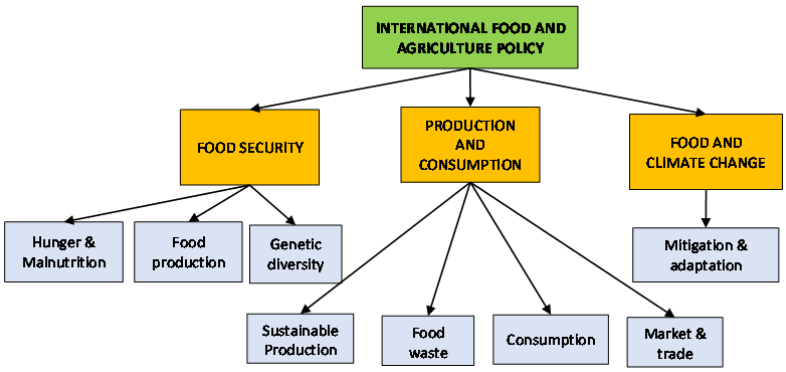


Figure 11. Schematic representation of the international food and agriculture policy space

5.1.4 Climate

Climate change at international level (Figure 12) is regulated by the UN Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol (now in its second phase 2013-2020) along with the numerous agreements reached by the Conference of the Parties (COP), the last of which being the Paris Agreement signed in 2015. The goal of the UNFCCC is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. To this purpose, the Kyoto Protocol, as amended by the Doha Amendment, established new national emission reduction targets that should achieve the overarching objective of reducing GHGs emissions by 18% below 1990 levels between 2013 and 2020. Next to it, in 2016 in Paris, the Convention parties agreed to take action to keep the global temperature well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.

The climate change international agreements regulate 5 main policy sub-systems: GHGs emission; financial support to developing countries for climate change mitigation and adaptation; technology development and transfer; capacity building actions to enhance the ability of individuals, organizations and institutions in developing countries and in countries with economies in transition to identify, plan and implement ways to mitigate and adapt to climate change. Emission reduction is pursued through national emission targets and economic instruments including emission trading, joint implementation

and clean development mechanisms. Next to it, other two important issue areas that are regulated are forestry and agriculture in developing countries (REDD+) and developed countries (LULUCF).

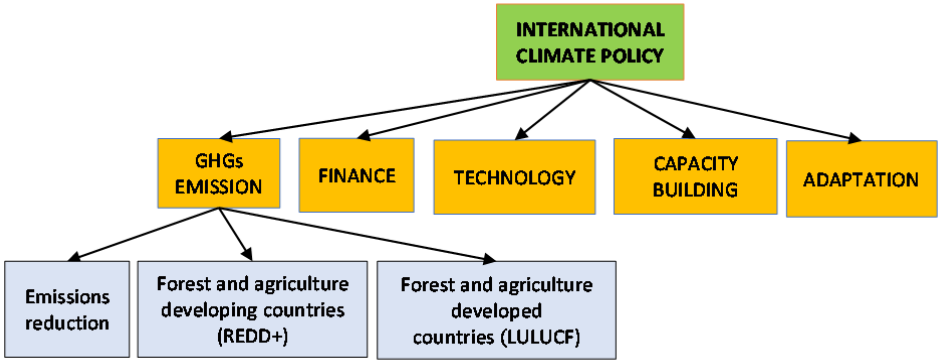


Figure 12. Schematic representation of the international climate policy space

5.2 European policies in the WLEFC-nexus

5.2.1 Water

Several European directives, action plans and strategy documents regulate 4 key policy sub-systems in the water domain, namely: water quality, water quantity, water use and flood risk (Figure 13). The EU water framework directive and the groundwater directive regulate the water status by establishing the objective of 'good water quality' for both surface water and groundwater. These directives together with the urban waste water directive and the EU action plan for circular economy also regulate substances released in water bodies by defining list and standards for priority substances and hazardous substances and for waste water treatment and re-use. The water framework directive also integrated in the EU legislation the international water agreements such as the agreement on transnational waters and the one on the protection of the marine waters.

As for water quantity, the objective of ensuring a sufficient quantity of good quality water for people's needs, the economy and the environment throughout the EU is addressed in three issue areas: actions for safeguarding water resources, actions for ensuring groundwater quantity and actions to tackle water scarcity.

Issue areas related to water uses are efficiency and re-use through measures such as guidance on the integration of water reuse in water planning and management, best practices, support to innovation (through the European Innovation Partnership and Horizon 2020), and legislative proposal on minimum quality standards for water reuse in agricultural irrigation and aquifer recharge.

The flood risk directive, the 2016 Action Plan on the Sendai Framework for Disaster Risk Reduction and the EU Parliament and Council decision on Union Civil Protection Mechanism are concerned with flood risk, prevention, preparedness and response through measures aimed at assessing and managing flood risk and measures for enhancing disaster preparedness and response.

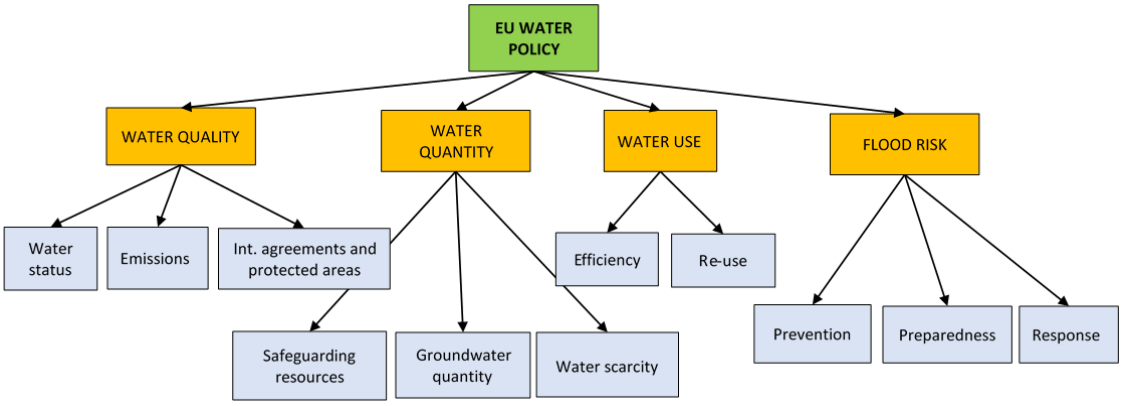


Figure 13. Schematic representation of the European water policy space

5.2.2 Land

Sustainable land use is the goal of the European land use policy (Figure 14). This goal is pursued through actions in three main policy sub-systems: forestry, soil and land use change. Sustainable forest management and the multifunctional role of forest is pursued through actions combating illegal timber logging in the EU (2003 EU Forest law enforcement governance and trade action plan) and with rules for sustainable use of forest resources (EU forest strategy).

Protection and sustainable use of soil is concerned with soil damage and soil protection. In particular, the EU land use policy aims to reduce quantitative and qualitative soil damage, prevent further soil degradation and restore degraded soils to a level of functionality consistent at least with current and intended use.

Limiting indirect land use change is a key issue of the EU land use policy. Actions in this area are laid down in the Renewable Energy Directive, the Fuel Quality Directive, and the Directive to reduce indirect land use change for biofuels and bioliquids.

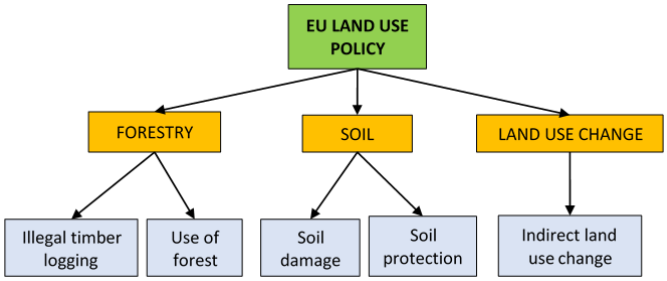


Figure 14. Schematic representation of the European land use policy space

5.2.3 Energy

The EU energy policy (Figure 15) is strongly interlinked with the EU climate policy and it is regulated by several EU directives, road maps, action plans and strategy documents. Key policy-subsystems are renewable sources, efficiency, internal market and competitiveness, supply security and innovation and technology.

Renewable sources include general rules, as well as rules for biofuels and biomass. General provisions for renewable sources include the objectives of: reaching a 20% share of energy from renewable

sources in the EU by 2020; reaching at least a 27% share of renewable energy consumption by 2030; achieving national targets for raising the share of renewables in MSs energy consumption by 2020. Key biofuel policy aims to reach 10% of biofuel in the transport sector by 2020; reduce indirect land use change for biofuels and bioliquids; ensure sustainable supply of biofuels; and get the aviation industry to use 2 million tons of biofuels by 2020. Key biomass policy objectives revolve around removal of barriers, creation of market-based incentives and sustainable supply.

Energy efficiency is regulated by the energy efficiency directive which sets the target of increasing energy efficiency by 20% by 2020 and the 2030 energy package that establishes the target of increasing energy efficiency of at least 30% by 2030 in the EU. Other rules are established for efficiency in buildings, and in products and services and for electricity co-generation.

The internal market and competitiveness sub-system essentially establishes common rules for the completion and competitiveness of the EU energy market and it prioritizes important energy infrastructure projects including those that will lead to achieve an electricity interconnection target of 15% between EU countries by 2030.

Energy security is pursued with actions in the gas, oil and electricity areas and through general rules to ensure a stable and abundant supply of energy for European citizens and the economy.

Finally, innovation and technology is supported through R&D initiatives at EU level aimed at the development and deployment of clean energy technologies, the lowering of the costs of new technologies, and the cooperation amongst EU countries, companies, research institutions and the EU. Transfer of technology to developing countries is pursued through actions for mobilizing private investment in small-scale energy efficiency and renewable energy projects in developing countries.

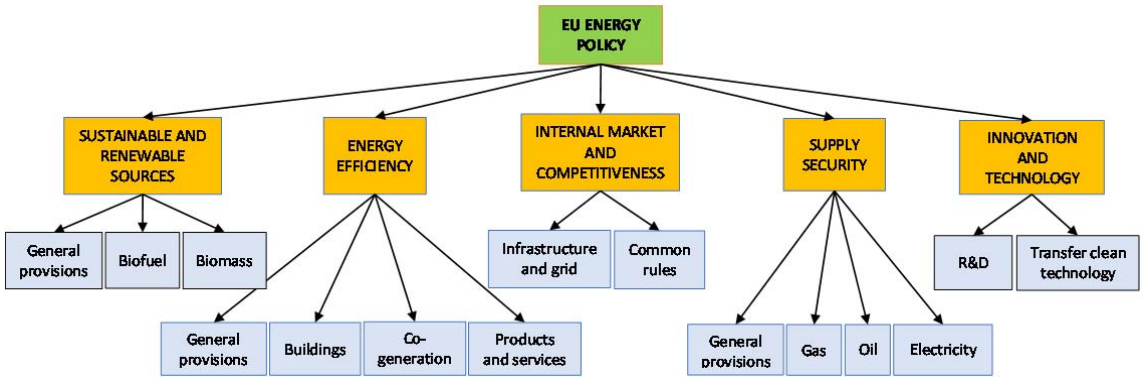


Figure 15. Schematic representation of the European energy policy space

5.2.4 Agriculture and food

The European food and agriculture policy (Figure 16) is regulated by numerous EU regulations, directives, action plans, and strategies. The key policy is the Common Agricultural Policy 2014-2020 which establishes three main goals that define three policy sub-systems: viable food production, sustainable management of natural resources and climate action, and balanced territorial development. Next to that, a fourth policy sub-system is supply chain. Food production and security revolves around two issue areas, namely farm income and farm competitiveness which are addressed with the allocation of financial resources through the first pillar of the CAP. Natural resources, climate action and territorial development are addressed with the allocation of financial resources through the second pillar of the CAP, i.e. rural development.

Functioning of the supply chain, food-related health issues in the supply chain, protein consumption, and food waste in the supply chain are the issue areas in the supply chain sub-system. Overarching objectives in this sub-system include: improve efficiency of food supply chain; fair trade practices; prevent diet-related diseases and deaths; address growing global demand for proteins; reduce and prevent food waste.

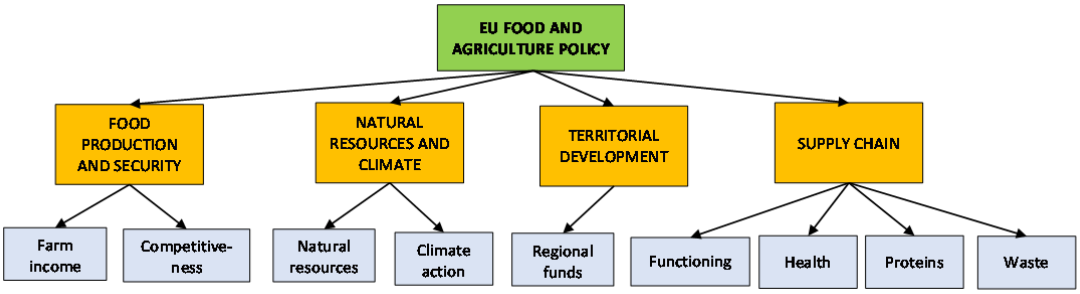


Figure 16. Schematic representation of the European food and agriculture policy space

5.2.5 Climate

The EU climate policy (Figure 17) is strongly interlinked with the EU energy policy and is regulated by several EU directives, road maps, action plans and strategy documents. Key policy-subsystems are identified: industry; housing, agriculture, waste and transport in member states; and transport; energy; low carbon technology; forest and agriculture; and adaptation at EU level.
Goals of the EU climate policy are: 20% GHGs emissions reduction (from 1990 levels) by 2020; 40% GHGs emissions reduction (from 1990 levels) by 2030; and 80-95% GHGs emissions reduction (from 1990 levels) by 2050. These goals are achieved through measures in different sectors at EU and member state level.

The EU industry sector is subject to rules for the reduction of GHGs emissions. The objective is to reduce GHGs emissions from large-scale facilities in the power and industry sectors by 21% compared to 2005 by 2020. To this purpose an EU-wide Carbon Emission Trading System (ETS) has been established. Other rules regulate fluorinated GHGs emissions to achieve the objective of cutting EU's F-gas emissions by two-thirds compared with 2014 levels by 2030.

Member states must meet their annual national emission reduction targets (established by the EU burden sharing decision) in the non-ETS sectors (housing, agriculture, waste, transport). The goal is to achieve by 2020 a reduction of about 10% in total EU emissions compared with 2005 levels.

As for the EU transport sector, key issue areas include road transport, fuel, shipping and aviation. As for road transport, the EU aims to increase efficiency, speed up the deployment of low-emission alternative energy for transport, and remove obstacles to the electrification of transport. Concerning fuel, the EU aims to reduce the GHG intensity of the EU fuel mix by 6% by 2020 in comparison to 2010, improve fuel quality and remove inefficient fossil fuel subsidies. The shipping sector should cut emissions from maritime transport by at least 40% from 2005 levels by 2050, and if feasible by 50% (not binding). The international aviation sector should stabilise CO2 emissions at 2020 levels (EU aviation is included in the EU ETS).

Energy efficiency and renewable sources are discussed in the EU energy policy in section 5.2.3.

Carbon Capture and Storage (CCS) and clean energy technology are the key issue areas in the technology sub-system. Clean energy technology is discussed in section 5.2.3. As for CCS, the EU supports the uptake of innovative and safe CCS technology. The topic is controversial and research has only recently started. Only a few experiments are currently undergoing and the production of evidence about the safety of this technology is in progress.

As for forest and agriculture the EU complies with the provisions in the UNFCCC for land use change in developed countries (LULUCF) and carbon emission and storage in forest in developing countries (REDD+). Illustration of these issue areas can be found in section 5.1.4.

Finally, climate adaptation is a key policy sub-system in the EU climate policy regulated by the EU climate adaptation strategy. With this strategy, the EU aims to promote adaptation in key vulnerable EU sectors, ensure more resilient infrastructure in the EU, and address gaps in adaptation knowledge. MSs are required to develop national adaptation plans.

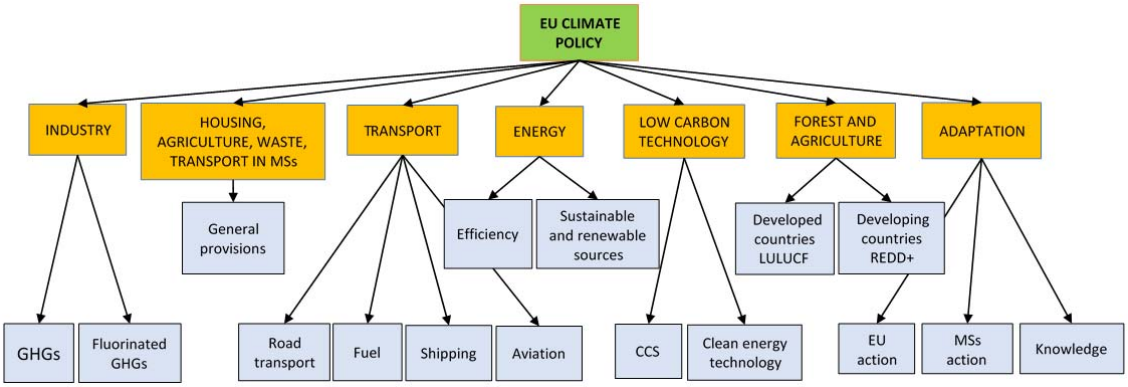


Figure 17. Schematic representation of the European climate policy space

6 Assessment of policy coherence in the WLEFC-nexus

6.1 Interaction of European policy objectives in the WLEFC-nexus: synergies and conflicts

This chapter illustrates the assessment of the interactions of the selected WLEFC European policy objectives. Ultimately, such assessment reveals the level of coherence between policy objectives in the nexus: highly synergistic interactions imply coherence between pairs of objectives whereas highly conflicting interactions imply incoherence between pairs of objectives. The description of the selected objectives and objective codes used in the tables in this section can be found in Table 7 in section 4.1.

Table 11 shows the scoring of the interactions for pairs of policy objectives in the WLEFC-nexus. Summary tables with the counting of the scores have been produced to facilitate the reading of the scoring table.

The first summary table (Table 9) shows the counting of the interactions per pairs of policy domains. In general, the highest density of interactions is found in the food/land (86%), food/water (79%) and land/water (71%) domains. Most of these interactions are synergistic. Specifically, progressing land use and water objectives have essentially only positive impacts in the nexus. Similarly, progressing objectives in the agriculture sector has also potential to act synergistically with the other objectives in the nexus, provided that the conditionality and the other instruments established by the common agricultural policy are properly functioning. Land/water are inextricably linked and progress in one domain benefit the other domain and the other way around.

Table 9. Frequency of interactions per pairs of policy domains

	Interactions			Synergies		Conflicts		Synergies & conflicts
	Actual interactions	Possible interactions	%	+	0/+	-	0/-	+/-
E → W	16	60	*27*	4	3	8	0	1
W → E	19	60	*32*	7	0	0	0	12
L → W	17	24	***71***	16	1	0	0	0
W → L	15	24	*63*	14	0	1	0	0
F → W	33	42	***79***	26	1	0	0	6
W → F	25	42	*60*	16	0	0	0	9
C → W	21	36	*58*	14	0	3	0	4
W → C	7	36	*19*	5	2	0	0	0
L → E	12	40	*30*	7	2	2	0	1
E → L	8	40	*20*	0	0	5	3	0
F → E	16	70	*23*	8	0	2	4	2
E → F	23	70	*33*	14	4	3	1	1
C → E	25	70	*36*	15	4	4	0	2
E → C	26	70	*37*	11	0	11	1	3
F → L	24	28	***86***	17	2	2	2	1
L → F	16	28	*57*	13	0	2	0	1
C → L	11	24	*46*	10	0	0	0	1
L → C	12	24	*50*	12	0	0	0	0
C → F	23	42	*55*	18	1	0	0	4
F → C	23	42	*55*	17	3	3	0	0

Table 10 shows the counting of the interactions per each objective. Looking at the density of interactions, the highest numbers are present in the climate, land and energy domains when objectives affect the WLEFC-nexus and in the water, agriculture and climate domains when objectives are affected by the WLEFC-nexus. Specifically, when affecting the WLEFC-nexus, biofuel production (E1), GHGs emission reduction (C1), climate adaptation (C6) and indirect land use change (L4) show the highest density of interactions. In particular, of all possible interactions, E1 has the highest number (74%) and most of them are negative. C1 and C6 have the second highest number (70%) and most of the interactions are positive. As for affected objectives, water supply (W2) shows the highest number of interactions (74%), along with GHGs emission reduction (C1; 74%) and farmers income (F1; 74%).

Turning now to the type of interaction, the first important result of the assessment is that synergies are more prominent than conflicts. For example, progress in all land use objectives may have positive, synergistic effects on all other nexus domains. Restoring degraded soils (L1) and preventing soil degradation (L2) could contribute to improve water quality (W1) and storage in the ground (W2), support agriculture productivity (F1, F2, F3, F4, F5) and contribute to store carbon and therefore reduce GHGs emissions (C1). Similarly, maintaining forest cover (L3) and preventing indirect land use change (L4) could contribute to improve water quality (W1) and storage in the ground (W2), provide biomass for energy production (E3), contribute to store carbon (C1), incentivize more climate friendly land use (C5) and support climate change adaptation (C6).

Progressing water objectives also act synergistically with most objectives in the nexus, especially with land (L1, L2, L3) and agriculture objectives (F1, F2, F3, F4, F5), although the impact may depend on the context conditions (hence numerous +/- scores). A typical example is the fact that improved water quality and quantity is positive for agriculture production if the newly available water is not diverted to other uses such as human consumption. The latter may happen for example in water scarce areas. In this case, agriculture would be penalized.

Another example of positive interactions is provided by objective W6. Addressing water scarcity and droughts (W6) acts synergistically with energy production (because water is needed to produce energy) and also with restoring and maintaining soil quality (L1, L2); it certainly enables agriculture productivity (F1, F2); and it is a necessary condition for the provision of ecosystem services in agri-environments (F3) and for climate adaptation (C6).

Increasing energy efficiency (E7) and reducing energy consumption (E8) work synergistically with water, agriculture and climate objectives. Without energy efficiency and reduced consumption, it is impossible to achieve GHGs emission reduction (C1) and efforts in this direction cannot take place without new low carbon technology (C3). Similarly, more efficiency and less use of energy create the conditions for a more viable agricultural sector (F1, F2, F5).

In the food and agriculture sector, synergistic interactions are conditioned to the proper functioning of the conditionality mechanism and of all other instruments established by the common agricultural policy to support rural development. When this is the case, progress in supporting farms' income (F1), in increasing ecosystem services in agriculture (F3), in supporting the rural economy (F4), and in promoting resource efficiency (F5) may enable the achievement of all water and land use objectives as well as climate objectives. Farm competitiveness (F2) is the only objective whose achievement may come at the expenses of water and land objectives, when competitiveness is pursued with intensification of agriculture production (hence with the use of more fertilizers, pesticides and intensive land use techniques).

As for conflicting interactions, the major trade-offs are found in the energy domain and, to a lesser extent, in the agriculture and climate domains. Interestingly, as noted above, biofuel production (E1) shows the highest density of interactions and, contrary to the rest of the objectives, most of these

interactions are conflicting with the other objectives in the WLEFC-nexus. It is important to note that although the EU policy concerns all types of biofuels, bioliquids and biomass (see Appendix I), biofuel production in this study includes only the first-generation biofuels made of food and feed crops. This was done to ensure unambiguous scores. EU policy aims at phasing out biofuels made from food and feed crops used in transport, but as technology for second and third-generation biofuels is still developing, we assume that in the years to come[1], biofuels will still be made of food and feed crops.

Looking at the scores, particularly negative is the impact of E1 on forest cover (L3) and indirect land use change (L4). Progress on E1 makes it impossible to simultaneously progress on L3 and L4, even with sustainable production of biofuels, because the amount of biofuel needed to significantly contribute to the reduction of GHGs is simply too high to not significantly impact land use. The reverse is also true, namely contrasting indirect land use change may occur at the expenses of biofuel production. Progress on E1 also counteracts progress on climate friendly land use (C5), on reduction of water consumption (W4), and on the provision of ecosystem services in agro-environments (F3). The vice-versa also applies as the provision of ecosystem services in agriculture may occur at the expenses of biofuel production.

Another significant trade-off exists between energy and water. Increase of hydro-energy production (E5) makes it impossible to simultaneously progress in water quality (W1) and may have negative impacts on water availability (W2). Hydro-power plants are in fact known for having negative effects on aquatic ecosystems and for subtracting water to other uses. However, if the hydro-power reservoirs act as a water buffer that stores water in wet seasons and supplies water in dry seasons, they may have a positive impact on water supply.

Finally, in the climate domain, supporting the development and uptake of carbon capture and storage (CCS) technology (C4) directly counteract the progression of the water quality (W1) and availability (W2) objectives as water is used in this technology.

[1] The new energy package proposed by the EC in 2016 states: "the contribution from biofuels and bioliquids, as well as from biomass fuels consumed in transport, if produced from food or feed crops, shall be no more than 7% of final consumption of energy in road and rail transport in that Member State. This limit shall be reduced to 3,8% in 2030.....Member States may set a lower limit...". This policy is still in the proposal phase. The aim is to progressively reduce the use of 1st generation biofuel in the transport sector.

Table 10. Counting of direct interactions per each policy objective (excluding interactions within the sector); in red, the first 2 highest number of interactions; % is calculated on the total number of possible interactions

	INFLUENCING What happens in the nexus if we make progress on objective X?							INFLUENCED What happens to objective X if we make progress on other objectives in the nexus?						
	Interac-tions	%	Synergies		Conflicts		Syn & Conf	Interac-tions		Synergies		Conflicts		Syn & Conf
Obj. X			+	0/+	-	0/-	+/-		%	+	0/+	-	0/-	+/-
W1	9	*33*	4	0	0	0	5	17	*63*	12	0	3	0	2
W2	14	*52*	7	0	1	0	6	20	*74*	15	1	2	0	2
W3	7	*26*	5	0	0	0	2	7	*26*	3	1	0	0	3
W4	11	*41*	5	0	0	0	5	16	*59*	8	2	3	0	3
W5	11	*41*	9	1	0	0	1	11	*41*	10	0	1	0	0
W6	14	*52*	11	1	0	0	2	16	*59*	12	1	1	0	2
E1	17	*74*	2	0	13	1	1	15	*65*	4	1	4	0	6
E2	3	*13*	0	0	2	0	1	2	*9*	1	0	1	0	0
E3	11	*48*	5	0	1	4	1	10	*43*	5	3	2	0	0
E4	2	*9*	1	0	1	0	0	1	*4*	1	0	0	0	0
E5	9	*39*	2	0	5	0	2	10	*43*	6	0	0	1	3
E6	2	*9*	1	0	1	0	0	0	*0*	0	0	0	0	0
E7	10	*43*	8	2	0	0	0	10	*43*	5	1	1	1	2
E8	9	*39*	9	0	0	0	0	15	*65*	7	1	0	1	6
E9	3	*13*	1	1	0	0	1	1	*4*	0	0	0	1	0
E10	7	*30*	0	4	3	0	0	8	*35*	8	0	0	0	0
L1	14	*48*	14	0	0	0	0	15	*52*	11	1	2	1	0
L2	14	*48*	14	0	0	0	0	16	*55*	12	1	2	1	0
L3	12	*41*	10	0	1	0	1	16	*55*	12	0	2	2	0
L4	17	*59*	10	3	3	0	1	11	*38*	6	0	2	1	2
F1	16	*62*	13	1	0	2	0	19	*73*	12	1	1	0	5
F2	15	*58*	2	0	5	2	6	18	*69*	11	1	1	0	5
F3	15	*58*	11	0	2	2	0	14	*54*	12	0	1	0	1
F4	14	*54*	10	2	0	0	2	17	*65*	12	2	0	0	3
F5	14	*54*	11	3	0	0	0	17	*65*	13	1	2	0	1
F6	11	*42*	11	0	0	0	0	2	*8*	1	0	0	1	0
F7	11	*42*	10	0	0	0	1	0	*0*	0	0	0	0	0
C1	19	*70*	15	0	2	0	2	20	*74*	15	0	2	0	3
C2	8	*30*	7	0	1	0	0	6	*22*	2	1	2	1	0
C3	12	*44*	10	0	0	0	2	12	*44*	5	1	6	0	0
C4	6	*22*	0	2	4	0	0	0	*0*	0	0	0	0	0
C5	16	*60*	11	1	0	0	4	15	*55*	10	2	3	0	0
C6	19	*70*	14	2	0	0	3	15	*55*	13	1	1	0	0

What happens to objective x → **(affected)**
If we make progress on objective y ↓**(affecting)**

Table 11. Screening matrix of coherence among policy objectives in the WLEFC-nexus domains

	W1	W2	W3	W4	W5	W6	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	L1	L2	L3	L4	F1	F2	F3	F4	F5	F6	F7	C1	C2	C3	C4	C5	C6
W1		+2	0	-1/0	+1	+1	-1/+1	0	0	0	-1/+1	0	0	0	0	0	+1	+1	+1	0	-1/+1	-1/+1	+2	-1/+2	0	0	0	0	0	0	0	0	0
W2	+2		-1	-1	0	+3	-1/+2	0	0	0	+3	0	0	-1/+1	0	+2	+1	+1	+1	-1	-1/+2	-1/+2	+2	-1/+2	-1/+1	0	0	0	0	0	0	0	+1
W3	0	0		+3	0	+2	+1	0	0	0	0	0	-1/+1	-1/+1	0	0	0	0	0	0	+1	+2	0	0	+3	0	0	0	0	0	0	0	+3
W4	+1	+3	+2		0	+2	-1/+1	0	0	0	-1/+1	0	-1/+1	+2	0	0	+1	+1	0	0	-1/+1	-1/+1	+1	0	+2	0	0	0	0	0	0	0	+1
W5	-1/+1	-1/+1	0	0		0/+1	-1/+1	0	0	0	0	0	0	0	0	+2	+1	+1	+1	0	+1	+1	+1	+1	0	0	0	0	0	0	0	0/+1	+3
W6	+1	+3	+2	+3	0		-1/+1	0	0	0	+1	0	0	-1/+1	0	+2	+1	+1	+1	0	+1	+1	+3	+1	+1	0	0	0	0	0	0	0/+1	+3
E1	-1	-1	0	-2	-1	-1		+3	0	0	0	0	0	0	0	+1	-1	-1	-3	-3	+2	0	-2	+1	-1	0	0	-1/+2	-1/0	-2	0	-2	0
E2	0	0	0	0	0	0	+3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1/+2	-1	-1	0	0	0
E3	0	0	0	0	0	0	0	0		+3	0	0	0	0	0	+1	-1/0	-1/0	-1/0	0	+1	+1	-1/+1	+1	+1	-1/0	0	+2	0	-2	0	0	0
E4	0	0	0	0	0	0	0	0	+3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+2	0	-1	0	0	0
E5	-3	-2/+1	0	-1	0	-2/+2	0	0	0	0		+3	0	0	+1	+1	0	0	-1	0	0	0	0	0	0	0	0	+2	0	-1	0	-1	+1
E6	0	0	0	0	0	0	0	0	0	0	+3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+2	0	-1	0	0	0
E7	0	+1	0/+2	0/+2	0	0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0		+3	0	+1	0	0	0	0	+2	+2	0	+1	+3	0	0	+3	+1	+3	0	0	0
E8	+1	+1	0	+2	0	0	-1	-1	-1	-1	-1	-1	+3		-1	+1	0	0	0	0	+2	+2	0	0	+3	0	0	+3	+1	+2	0	0	0
E9	0	0	0	0	0	0	0	0	0	0	+1	+1	-1	-1		+2	0	0	0	0	0	0	0	0/+1	+2	0	0	-1/+1	0	0	0	0	0
E10	0	0/+1	0	0	0	0	-1	0	-1	0	-1	0	-1	-1	+1		0	0	0	0	0/+1	0/+1	0	0/+2	-2	0	0	-1	-1	0	0	0	0
L1	+3	+2	0	0	+2	+2	+1	0	+1	0	0	0	0	0	0	0		0	+2	+1	+1	+1	+2	+1	+2	0	0	+2	0	0	0	+2	+2
L2	+3	+2	0	0	+2	+2	+1	0	+1	0	0	0	0	0	0	0	0		+1	+2	+1	+1	+2	+1	+2	0	0	+2	0	0	0	+2	+2
L3	+1	+2	0	0	+1	+2	-1	0	+1	0	-1/+1	0	0	0	0	0	+1	+2		-1/+2	0	0	+1	+1	0	0	0	+3	0	0	0	+3	+2
L4	+1	+1	0	0/+1	+1	+1	-2	0	+1	0	+1	0	0/+1	0/+1	0	0	+1	+2	+3		-1	-1	+2	-1/+1	0	0	0	+2	0	+1	0	+1	0
F1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	-1/0	-1/0	0	0	+2	+2	+2	+2		-1/+1	+1	+1	-1/+1	0	0	+1	0	0/+1	0	+1	+1
F2	-1/+1	-1/+1	-1/+1	-1/+1	0	-1/+1	0	0	0	0	0	0	+1	-1/+1	0	0	-1	-1	-1/0	-1/0	+2		-1	+1	+2	0	0	-1	0	+1	0	-1	-1
F3	+3	+3	0	0	+1	+2	-2	0	-2	0	-1/0	0	0	0	-1/0	0	+3	+3	+2	+2	-1/+1	-1/+1		+1	0	0	0	+1	0	0	0	+2	+2
F4	-1/+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	+1	-1/+1	0	0	0/+1	0/+1	+1	+1	+1	+1	+1		+1	0	0	0	0	0	0	+1	+1
F5	0	+1	+3	+2	0	0/+1	0	0	0	0	0	0	+3	+3	0	+1	0	+1	0	+1	+1	+1	+1	+1		+1	0	+3	0/+1	+3	0	+1	0/+1
F6	+1	+1	0	+2	0	+1	0	0	0	0	0	0	0	+2	0	+1	0	0	+1	+1	-1	0	0	-1	+2		0	+2	0	0	0	+1	+1
F7	+1	+1	0	+2	0	+1	0	0	0	0	0	0	0	+2	0	0	+1	+1	+2	-2/+2	-2	0	-1/+1	-1	+2	+1		+3	0	0	0	+1	0
C1	+2	+2	0	+2	+2	+2	-1	0	-1	0	+1	0	0	+1	0	+1	+1	+2	+1	0	-1/+1	-1/+1	+1	+1	+1	+1	0		+3	+3	+3	+3	0
C2	0	0	0	0	0	0	0	-1	0	0	0	0	+3	+3	0	+2	0	0	0	0	+1	+1	0	+1	+3	0	0	+3		+2	0	0	0
C3	0	0	-1/+1	-1/+1	0	0	+2	+2	+2	+2	+2	0	+3	+2	0	0	0	0	0	0	+1	+2	0	0	+3	0	0	+3	+3		+3	0	0
C4	-2	-2	0	-1	0	0	0/+1	0	0/+1	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+3	0	+3		0	0
C5	+1	+1	0	+1	+1	+2	-1/+1	0	0/+1	0	0	0	0	0	0	0	+1	+1	+1	-1/+1	-1/+1	-1/+1	+3	+1	+1	0	0	+3	0	0	0		+1
C6	+1	+2	-1/+1	-1/+1	+3	+3	0	0	0/+1	0	+1	0	0	-2/+2	0	+3	+1	+1	+2	+1	+2	+2	+2	+1	0/+1	0	0	0	0	0	0	+1	

6.2 Biofuel production and water supply: examples of nexus critical objectives

In this section, we illustrate the in-depth investigation of the horizontal and vertical coherence of objectives and means for two critical nexus objectives that have been selected based on the assessment of interactions and the relevance to the SIM4NEXUS project.

The two selected objectives are E1: Increase of biofuel production; W2: Ensure sufficient supply of good quality water for people's needs, the economy and the environment. These two objectives were selected, according to our methodological approach, for two main reasons: 1) high number of interactions in the WLEFC-nexus (see Table 10); and 2) relevance of the objectives for the SIM4NEXUS project. Specifically, increasing biofuel production directly *affects* 18 objectives (other than energy) in the WLEFC-nexus. This is the second highest number of interactions in the WLEFC-nexus after GHGs emissions and includes almost all water objectives and all land use objectives. As for the objective of sufficient water supply, this is *affected* by 20 objectives (other than water) in the WLEFC-nexus. Furthermore, both water supply and biofuel production are key issues in several of the SIM4NEXUS case studies as well as important for the overall project objective of resource efficiency and low carbon economy. Overall, E1 and W2 represent an interesting example of nexus *problématique* and therefore are considered a good example for testing and illustrating the policy coherence analysis methodology developed in this study.

The following sub-sections illustrate the results of the horizontal coherence analysis conducted at the level of policy objectives and means across the WLEFC-nexus domains and the results of the vertical coherence analysis of these objectives with international policies in the WLEFC-nexus. Furthermore, the level of integration of these objectives in the WLEFC-nexus policies is also presented. For this purpose, we looked at biofuel policy as affecting policy and at water supply as affected policy. We screened if and how EU policy documents for biofuels refer to the other nexus domains and conversely if and how policy documents for the WLEFC domains refer to water supply. For this analysis, we used the data in the excel database with sampled information of 131 policy documents (see Digital Appendix).

6.2.1 Coherence of the objectives 'Increase biofuel production' and 'Water supply' in the WLEFC-nexus

The interaction of the two nexus critical objectives E1 and W2 in the WLEFC-nexus is illustrated in Figure 18. The figure represents the network of interactions for the two objectives, including the direct interactions of each objective in the nexus and the indirect interactions between the two objectives. The arrows represent the direction of the interaction, whereas the numbers represent the strength of the interaction and whether it is a potential synergy or a potential conflict. Representing the coherence assessment in a network gives the possibility to visualize not only the direct but also the indirect interactions between the selected nexus critical objectives. These indirect interactions are represented by the green arrows. The numbers, however, do not express the strength of the indirect interaction but only that of the direct interaction. The sign of the combination of two direct interactions follows the mathematical law in the sense that if both direct interactions are positive or both are negative, the combined indirect interaction is positive. But if one is positive and the other negative, the combined indirect interaction is negative.

Interlinkages between two objectives have two directions, e.g. E1 influencing W2 and vice versa, W2 influencing E1. The coherence score in one direction may differ from the score in the other direction. In the coherence analysis described in section 6.1, the influence of objective E1 on objective W2 is

'constraining' (score -1), which means that progress in E1 sets conditions or constraints to the achievement of W2. It is assumed that increase of biofuel production needs water and may cause pollution of water, and thus puts constraints on sufficient water supply of good quality for all water users. The other way round, the influence of objective W2 on objective E1 is either constraining (score -1) or reinforcing (score +2), the latter meaning that progress on W2 directly creates conditions that reinforce the achievement of E1. The score depends on the context. If water is scarce, there may be constraints on the availability to produce biofuels if other users – e.g. food production, drinking water, industry - have priority. If water supply is sufficient, it creates a favourable condition to produce biofuels.

6.2.1.1 Linkages between objective E1 'Increase biofuel production' with other WLEFC objectives

In general, Figure 18 and Table 12 show how an increase of biofuel production may have substantial negative impact in the WLEFC-nexus (13 out of 17 interactions are negative). It is worth notice that, in spite the overall general observation that there are more synergies than conflicts in the nexus (see section 6.1), objective E1 shows a remarkably high number of negative interactions. In particular, if not sustainably pursued, the increase of biofuel production may: constrain or even counteract the achievement of almost all water objectives; constrain the achievement of soil quality objectives; make it impossible to maintain forest cover and reduce indirect land use change; counteract the provision of environmental goods and services in agriculture; constrain resource efficiency in agriculture; and even constrain the progress of climate change objectives, which should be the primary goal of biofuel production. On this latter point, the impact of more biofuel production on GHGs emission reduction is still controversial in the literature (hence the score -1/+2). Its contribution to the efficiency of the transport system is also debatable: it may be negligible but it may also prove limiting as more biofuel in the market may push back research for greater efficiency because emissions reduction would already be achieved via the biofuel production. The underlying logic of this chain of events is that if the GHGs emission problem were to be largely addressed by more biofuel production, investment in other low carbon sectors would be pushed back. In the same vein, more biofuel production could also counteract the objective of supporting low carbon technology and of incentivizing more climate friendly land use.

Most of these direct negative impacts can have an indirect effect on the other nexus critical objective, i.e. the water supply objective (W2). For example, the negative impact of biofuel production on soil quality, especially when intensive biofuel crop production is practiced, may in turn negatively affect the supply of water as good quality soil plays an important role in water retention. Similarly, a negative impact of biofuel production on GHGs emission reduction may in turn affect the supply of water as more droughts may occur due to climate change. Water supply can also be negatively affected via the reduced environmental services produced in an agricultural sector that practices intensive biofuel production.

Looking at the positive direct impact that E1 may have in the nexus, this is limited to 2 nexus objectives in the food and agriculture sector. Essentially, a policy supporting biofuel production may play an important role in sustaining farm income and the economy of rural areas.

When it comes to being affected, we can observe that E1 could essentially either positively or negatively be affected by water quality, supply, efficiency and consumption depending on the conditions of the specific context. For example, an increase of water efficiency can be positive as it may make more water resources available for crop irrigation; at the same time these newly available good quality water resources could be directed to different, more valuable uses such as human consumption.

Availability of good quality soil may have a positive impact on biofuel production as it may increase productivity. Consequently, progress in restoring degraded soil (L1) and in preserving soil quality (L2) may have a positive effect on biofuel production. Similarly, incentivising climate friendly land use (C5) can also enable soil productivity and therefore biofuel production. At the same time, however, a climate friendly land use practice can be reducing intensive agriculture which may result in less biofuel production (hence the score -1/+1 in C5 → E1).

Supporting the provision of environmental goods and services in agriculture (F3) may also counteract biofuel production if this is practiced in the form of intensive agriculture. In the land use domain, maintaining and enhancing forest cover (L3) and preventing indirect land use change (L4) may directly constrain or even counter act biofuel production as more land is needed for biofuel production and this creates a competition for land.

Finally, progress in water supply can have both direct and indirect positive effects on biofuel production. Biofuel crop is water demanding, hence more water supply certainly directly creates conditions for more biofuel production. However, depending on the context, more water available does not necessarily mean that this water goes for irrigation as other more important uses can be privileged (hence the score -1/+2 on W2 → E1). Also, more water available can enable progress on soil quality which in turn may have a positive effect on soil productivity and therefore biofuel production. In the agriculture domain, more water supply may support farm production and indirectly also biofuel production. However, more water available may also have a negative impact resource efficiency as farmers may over use water. This in turn may result in a negative impact on biofuel production.

6.2.1.2 Linkages between objective W2 'Water supply' with other WLEFC objectives

Looking at what Figure 18 and Table 12 show about W2, we can observe that there are more interactions in the direction of water supply being affected and that most of these interactions are potentially synergistic (15 out of 20). Specifically, furthering all agriculture objectives either enables or creates conditions for progressing the water supply objective. This may sound counterintuitive as water is a natural resource that is heavily exploited in agriculture. The reason lays in the fact that the EU common agricultural policy takes into consideration the impact of agriculture on water by for example establishing conditionality rules for good environmental practices to farmers' direct payment and by supporting environmental friendly agriculture in rural development. Hence, on paper potential synergies are created. However, it is also known that these synergies may fail to materialize in practice.

Conditions for improving water supply are also created in the land domain. As mentioned above, improving and maintaining soil quality (L1, L2), contrasting indirect land use change (L4) and maintaining forest cover (L3) have positive effects on water availability. The reason of the existence of these synergies is however different from the agriculture domain. Differently from agriculture objectives, land use objectives are by definition pro-environment and may have multiple direct and indirect effects including improving water supply. As for the climate domain, emissions reduction (C1), climate friendly land use (C5) and adaptation (C6) all enable or create conditions for improving water supply.

In contrast, CCS (C4) may be water demanding and therefore act negatively on water supply. Finally, given that energy production is water-consuming, relevant negative direct impacts on water availability come from hydropower production (E5) and from biofuel production (E1), whereas the positive interactions are found on increasing energy efficiency (E7) and reducing energy consumption (E8). Indirect negative effects on water availability, occur for example via land use in the production of biofuels as intensive production of biofuel may degrade soil and reduce forest cover which indirectly affect water availability. Other indirect effects are found via agriculture in the production of biofuel.

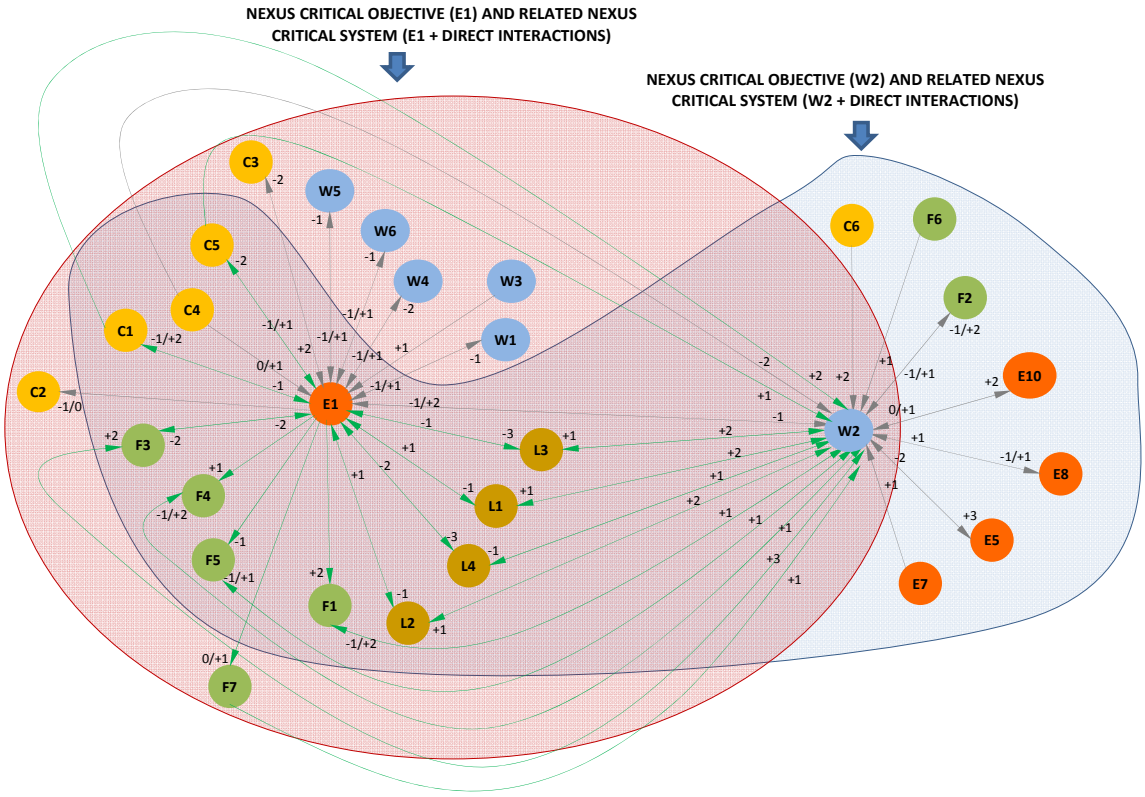


Figure 18. Representation of the network of interactions for the NCOs E1 and W2 (green arrows represent the path of indirect interactions)

Table 12. Counting of interactions for the nexus critical objectives E1 and W2

	Interactions			Potential synergies		Potential conflicts		Synergies & conflicts
	Actual interactions	Possible interactions	%	+	0/+	-	0/-	+/-
E1 influencing	17	23	*74*	2	0	13	1	1
E1 influenced	15	23	*65*	4	1	4	0	6
W2 influencing	14	27	*52*	7	0	1	0	6
W2 influenced	20	27	*74*	15	1	3	0	1

6.2.2 Level of integration of biofuel and water supply objectives in the EU WLEFC policy documents

EU policies take the linkages with other policy domains into account. Impact assessments, for example, are an instrument to investigate these external linkages. Policy documents can refer to other policy domains in different degrees.

We examined the references to other WLEFC domains in the EU policy documents for objective E1, 'Increase biofuel production' and scored them according to the scoring scale described in Table 8 in section 4.3: 0 = no integration; 1 = low integration; 2 = moderate integration; 3 = strong integration. Here again, we looked at objective E1 from the viewpoint of an influencing policy on other policy domains. The other way round, we investigated the references to W2 'Ensure sufficient supply of good quality water for people's needs, the economy and environment' in EU policy documents for other

WLEFC domains than water, looking at W2 from the viewpoint of an influenced policy objective. The results of this assessment are presented in Table 13 and Table 18.

6.2.2.1 References to WLFC policy domains in documents about renewable energy (E1)

Objective E1 'Increase biofuel production' is part of the policies for renewable energy in the EU. The question is if incoherence in these policies with policies for the WLFC domains is addressed in the policy documents, and if opportunities for win-win actions are seized.

Table 13. References to WLFC domains in EU policy documents about renewables*

Policy domain	Reference in renewables policy documents	Score
Water Wetlands	Biofuel from food/feed crop produced within EU: comply with CAP environmental requirements for agriculture, including *protection of groundwater and surface water quality.* The EC may decide that voluntary national or international schemes setting standards contain accurate information on measures taken for *soil, water and air protection*, the restoration of degraded land, the *avoidance of excessive water consumption in areas where water is scarce*, …… Biofuels …….shall not be made from raw material obtained from land……..that had one of the following statuses in January 2008 and no longer has that status: (a) *wetlands*,…	2-3
Land ILUC Biodiversity	See above -….the need to ensure that the annex *does not create additional demand for land* while promoting the use of wastes and residue… -The commission shall monitor the origin of biofuels, bioliquids and biomass fuels consumed in the union and the impact of their production, *including impact as a result of displacement, on land use in the Union and the main third countries of supply.* - ….to present … a comprehensive proposal for a ….. post-2020 policy in order to create a long-term perspective for investment in sustainable biofuels with a *low risk of causing indirect land-use change.* -For the calculation of a member state's gross final consumption of energy from renewable energy sources, the contribution from biofuels and bioliquids, as well as from biomass fuels consumed in transport, if produced from food or feed crops, shall be no more than 7% of final consumption of energy in road and rail transport in that member state. This limit shall be reduced to 3,8% in 2030…..member states may set a lower limit ……. for instance by setting a lower limit for the contribution from food or feed crop based biofuels produced from oil crops, *taking into account indirect land use change.* -The increasing production of agricultural raw materials for biofuels, bioliquids and biomass fuels ….*should not have the effect of encouraging the destruction of biodiverse lands*. -Biofuels, bioliquids and biomass fuels produced from agricultural biomass……..*shall not be made from raw material obtained from land with high biodiversity value*, namely land that had one of the following statuses	3

Carbon stock Peatland Restoration of degraded land	in or after January 2008, whether or not the land continues to have that status:… -Biofuels, bioliquids and biomass fuels produced from agricultural biomass ……. *shall not be made from raw material obtained from land with high carbon stock*, namely land that had one of the following statuses in January 2008 and no longer has that status:……. -If land with high stocks of carbon in its soil or vegetation is converted for the cultivation of raw materials for biofuels or bioliquids, …..*ensure that the greenhouse gas emission saving calculation takes into account the totality of the carbon effects.* -Land should not be converted for the production of raw material for biofuels, bioliquids and biomass fuels *if its carbon stock loss upon conversion could not, within a reasonable period, taking into account the urgency of tackling climate change*, be compensated by the greenhouse gas emission saving resulting from the production and use of biofuels, bioliquids and biomass fuels. -It is appropriate for the commission to develop methodologies with a view to *assessing the impact of the drainage of peatlands on greenhouse gas emissions.* -*Agricultural feedstock from the production of biofuels, bioliquids and biomass fuels should not be produced on peatland* Biofuels, bioliquids and biomass fuels produced from agricultural biomass …….*shall not be made from raw material obtained from land that was peatland in january 2008.* -The sustainability scheme for bioliquids and biomass fuels should *promote the use of restored degraded land* because the promotion of biofuels, bioliquids and biomass fuels will contribute to the growth in demand for agricultural commodities.	
Food Food prices and security Agriculture	see above: *restrictions to production of agricultural biofuels, bioliquids and biomass, restoration of degraded land to provide for extra agricultural land* and *extending in time and reducing cap on % biofuels produced from food or feed crops used in transport*. The commission shall also monitor *the commodity price changes* associated with the use of biomass for energy and any associated positive and negative *effects on food security*. The commission shall…….pay particular attention to the *impact that biofuel and bioliquid production may have on food prices*. In the framework of the *CAP* union farmers should comply with a comprehensive set of environmental requirements in order to receive direct support. *Compliance with those requirements can be most effectively verified in the context of agricultural policy*. -In order to exploit the full potential of biomass to contribute to the decarbonisation of the economy through its uses for materials and energy, the *Union and the member states should promote greater sustainable mobilisation of existing timber and agricultural resources and the development of new forestry and agriculture production systems*. -*Agricultural crop residues are residues and not co-products.*	2-3

Climate GHGs	-*The greenhouse gas emission saving from the use of biofuels, bioliquids and biomass fuels... shall be*: (a) at least 50 % for biofuels and bioliquids produced in installations in operation on or before 5 October 2015; (b) at least 60 % for biofuels and bioliquids produced in installations starting operation from 5 October 2015; (c) at least 70 % for biofuels and bioliquids produced in installations starting operation after 1 January 2021; (d) at least 80 % for electricity, heating and cooling production from biomass fuels used in installations starting operation after 1 January 2021 and 85% for installations starting operation after 1 January 2026. -Land should not be converted for the production of agricultural raw material for biofuels, bioliquids and biomass if its carbon stock loss upon conversion could not, within a reasonable period, *taking into account the urgency of tackling climate change*, be *compensated by the greenhouse gas emission saving* resulting from the production and use of biofuels, bioliquids and biomass fuels. - ...*national system in place for reporting greenhouse gas emissions and removals from land use* including forestry and agriculture, which is *in accordance with the requirements set out in decisions adopted under the UNFCCC and the Paris agreement*. -In calculating the greenhouse gas impact of land conversion, economic operators should be able to use actual values for the carbon stocks associated with the reference land use and the land use after conversion. They should also be able to use standard values. *The work of the IPCC is the appropriate basis for such standard values*.	3

**) EC, 2016. Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast). Brussels, 30.11.2016 com(2016) 767 final 2016/0382 (cod).*
EC, 2009. Directive 2009/28/EC of 23 april 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing directives 2001/77/EC and 2003/30/EC.

If we compare the references to WLFC policy domains in the EU policy documents about renewables, with the results of the policy coherence analysis between WLEFC objectives described in section 6.1, we can draw the following conclusions.

Table 14. Coherence scores E1 > Water

Water	Coherence score E1 > W1, 2 …
W1 Achieve good water quality status	-1
W2 Ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy and the environment	-1
W3 Increase water efficiency	-2
W4 Reduce water consumption	-1
W5 Assess and manage flood risks and mitigate flood effects	-1
W6 Address and mitigate water scarcity and drought	-1

Coherence scores between objective E1 'Increase production of biofuels' and the Water objectives are all negative, meaning incoherence (Table 14). Biofuel production competes for water with other users and may worsen water scarcity. It may also be a source of pollution by pesticides and nutrients.

Negative effects on water quality from biofuel production within the EU are accounted for in the CAP and environmental legislation, but outside the EU this issue is addressed by weaker voluntary schemes. Effects on water quantity are also addressed by weaker voluntary schemes, inside and outside the EU. So, the prevention and mitigation of negative effects on water quantity and on water quality outside the EU, depend on the existence of good water management and strong institutions to protect the water system at the location of production and on the readiness to support sustainable production in the supply chain. Potential negative effects on water efficiency are not addressed in the policy documents.
If biofuel production causes deforestation, it may increase flood risks, an indirect effect. Deforestation and other land use changes are key issues addressed in the policy documents about renewables, see below.

Table 15. Coherence scores E1 > Land

Land	Coherence score E1 > L1, 2 …
L1 Restore degraded soils to a level of functionality consistent with at least current and intended use	-1
L2 prevent soil degradation	-1
L3 Maintain and enhance forest cover	-3
L4 Prevent ILUC	-3

The coherence scores between E1 'Increase biofuel production' and the objectives for Land use are all negative, meaning incoherence (Table 15**Error! Reference source not found.**). The EU policy documents about renewable energy address land issues in great detail by setting strict sustainability criteria to the effects of biofuel production on land, soil and land use change. Also, restoration of degraded land to produce biofuels is indicated. The most fundamental measure is the phasing out of 1st generation biofuels made from food and feed crops for use in transport. Thus, innovation to produce 2nd and 3rd generation biofuels with less negative impacts is an important issue. The crux of the sustainability policies for biofuels will be the implementation, enforcement and control. As in the case of water, success of the policies for sustainable production of biofuels regarding land use and soil fertility, depend on the existence of good land management and institutions at the location of production, and on support in the supply chain.

Table 16. Coherence scores E1 > Food and agriculture

Food and agriculture	Coherence score E1 > F1, 2 …
F1 Contribute to farm incomes, under conditions of cross-compliance and greening	+2
F3 Ensure provision of environmental public goods in agriculture sector	-2
F4 Support rural areas economy	+1
F5 Promote resource efficiency in agriculture, food and forestry sectors	-1

Biofuel production with public support may offer an opportunity for farm incomes and rural economic development in the short and mid-term, but in the long run EU policy strives to phase out biofuels from food and feed crops in transport (Table 16). The potential 'up and down' economic effects on farm incomes and rural areas are not addressed in the policy documents. However, in the documents is stated that 'the Union and member states should promote greater sustainable mobilisation of existing timber and agricultural resources and the development of new forestry and agriculture production systems'. Obviously, with this statement, the Commission aims at other feedstock than food and feed crops.

The potential incoherence between increase of biofuel production and provision of environmental public goods is addressed in the cross-compliance and greening conditions of the CAP.

Table 17. Coherence scores E1 > Climate

Climate	Coherence score E1 > C1, 2 …
C1 Reduce GHGs emissions	-1/+2
C2 Increase efficiency in transport system	-1/0
C3 Support development and uptake of low-carbon technology	-2
C5 Incentivize more climate-friendly land use	-2

The EU policy documents for renewables set strict criteria for the GHG reduction (Table 17) caused by using biofuels compared to fossil fuels, which is coherent with the objective of GHGs reduction. Nevertheless, an increase of the availability of biofuels may hinder the development of a more fundamental efficiency increase in transport. It may also hinder the development and uptake of other low-carbon techniques than the use of biofuels. On the other hand, striving for more biofuels combined with phasing out biofuels made from food and feed crops in transport will stimulate the development of 2nd and 3rd generation biofuels. Despite the strict sustainability criteria for land use change caused by biofuel production in the policy documents, more biofuel production is likely to be incoherent with the increase of more climate-friendly land use.

6.2.2.2 References to objective W2 'Water supply of good quality' in policy documents in the ELFC policy domains

How do policy documents for WLEFC policy domains refer to water objectives, more specifically the objective W2 'Ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy and the environment'? Is incoherence addressed and are opportunities for win-win processes seized?

Table 18. References to objective W2 'Ensure sufficient supply of good quality water for people's needs, the economy and environment' in EU policy documents for the LEFC domains.

Policy domain	References to WP2 in policy documents	Score
Land and soil	-*Soil is interlinked with water and air in such a way that it regulates their quality.* -*Soil functions enormously contribute to marine protection and coastal management*[1)] The Alpine soil shall be preserved in a sustainable manner to allow it to perform its natural functions as an integral part of the ecological balance, *especially with regard to its water and nutrient cycles*, and to perform its natural functions as a conversion and compensating medium to offset inputs of substances, especially due to its *filtering, buffering and storage qualities, in particular for the protection of groundwater.* The contracting parties: - undertake to *take account of the objectives of this protocol in their other policies as well*. In the alpine region, this applies specifically to regional planning, settlement and transport, energy management, agriculture and forestry, raw material extraction, trade and industry, tourism, nature conservation and landscape upkeep, *water and waste management*, and clean air;	1-2

	- should apply *measures to control water erosion*; -agree to *coordinate their national soil monitoring programmes with the environmental monitoring programmes for air, water, flora and fauna.* *In areas specifically designated as drinking water resources, the extraction of mineral resources shall be foregone*.[2)]	
Energy	-It is necessary to set transparent and unambiguous rules for calculating the share of energy from renewable sources and for defining those sources. In this context, *the energy present in oceans and other water bodies in the form of waves, marine currents, tides, ocean thermal energy gradients or salinity gradients should be included.* -…..*electricity produced in pumped storage units from water that has previously been pumped uphill should not be considered to be electricity produced from renewable energy sources.* -Where biofuels and bioliquids are made from raw material produced within the community, they should also comply with community environmental requirements for agriculture, including those concerning *the protection of groundwater and surface water quality* ……[3)] The commission may decide that those schemes contain accurate information on *measures taken for soil, water and air protection*, the restoration of degraded land, the *avoidance of excessive water consumption in areas where water is scarce*…… [4)] District heating' or 'district cooling' means the distribution of *thermal energy in the form of steam, hot water or chilled liquids*, from a central source of production through a network to multiple buildings or sites, for the use of space or process heating or cooling.[5)] Article 9 on metering and article 10 on billing are amended to make them applicable only to gas while complementing them with new, similar and clear provisions applicable only to heating, cooling and domestic hot water supplied from central sources.[6)]	2-3
Food and agriculture Pesticides	CAP: *cross compliance* conditions on good agricultural and environmental practices and the conditions of the *greening* payment.[8)] -The measures provided for in this directive should be *complementary to, and not affect*, measures laid down in directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a *framework for community action in the field of water policy.* -The aquatic environment is especially sensitive to pesticides. It is therefore necessary for *particular attention to be paid to avoiding pollution of surface water and groundwater* by taking appropriate measures, such as the establishment of buffer and safeguard zones or planting hedges along surface waters to reduce exposure of water bodies to spray drift, drain flow and run-off. ……. *Use of pesticides in areas for the abstraction of drinking water*, on or along transport routes, such as railway lines, or on sealed or very permeable surfaces can lead to *higher risks of pollution of the aquatic environment*. In such areas the pesticide use should, therefore, be reduced as far as possible, or eliminated, if appropriate. -*The terms 'surface water' and 'groundwater' have the same meaning as in directive 2000/60/EC.* -*Specific measures, described in detail, to protect the aquatic environment*	3

	and drinking water. -Member states shall ensure that *appropriate measures to protect the aquatic environment and drinking water supplies from the impact of pesticides* are adopted. -Further specified risks for water are part of *training of professional users of pesticides*. [9)]	
Climate adaptation	-*Changes in patterns of water availability.* -There will also be a need for *additional infrastructure*, dedicated to climate protection, such as improved sea defences and flood protection, *interconnections in water supply*, as well as retro-fitting to improve resilience of existing infrastructure. -Reductions in rainfall may affect the *availability and quality of water resources on which industrial assets depend*. -Challenges to operating infrastructure under changing climate conditions include, among others, coping with potentially higher operating temperatures during summer, protecting built environments against floods or *ensuring water and energy supply during consumption peaks* (e.g. cooling in "hotter" summers, heating in "colder" winters). -Apart from the physical destruction of (or damage to) infrastructure in risk zones, *in particular water cycles are expected to change significantly (e.g. increasing/decreasing water availability for hydropower generators*, impacts of climate change, such as an increased frequency of extreme weather events or *changing water and air temperatures have effects on energy* transmission, distribution, generation and demand). -The *generation* of electrical energy is affected by efficiency decreases due to climate change (e.g. *decreasing availability of cooling water for electricity generators*). -The EIB recognises that adaptation to climate change is necessary and aims to actively *promote climate resilience and adaptation in the projects it finances, a.o. water supply projects*. [11)] Furthermore, information on national adaptation actions and support is also important in the context of the integrated national energy and climate plans, especially as regards adaptation to those adverse effects of climate change related to the security of the union's energy supply such as the availability of cooling water for power plants... [7)] -Major utilities, such as energy and *water providers, are also affected.* -Climatic changes will have *consequences for the availability of basic natural resources (water, soil)* leading to significant changes in conditions for agriculture and industrial production in some areas. -… strong emphasis on incorporating win-win, low-cost and no-regret adaptation options. These include *sustainable water management* and early warning systems. Ecosystem-based approaches are usually cost effective under different scenarios. They are easily accessible and provide multiple benefits, such as reduced flood risk, less soil erosion, *improved water and air quality* -The commission will promote adaptation particularly in the following vulnerable areas: ...	1-2

	- mainstreaming adaptation into urban land use planning, building layouts and *natural resources management*; … - *sustainable management of water*; combating desertification and forest fires in drought-prone areas. Adaptation has already been mainstreamed in … *important policy instruments such as for inland water,* biodiversity…[10)]	

[1)] EC, 2006. COM: Thematic Strategy for Soil Protection.
[2)] EU, 2005. Protocol on the implementation of the Alpine Convention of 1991 in the field of soil conservation - Soil Conservation Protocol.
[3)] EU, 2009. Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.
[4)] *EC, 2016. Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast). Brussels, 30.11.2016 com(2016) 767 final 2016/0382 (cod).*
[5)] EU, 2010. Directive 2010/31/EU on the Energy Performance of Buildings.
[6)] EC, 2016. Proposal for a directive amending Directive 2012/27/EU on energy efficiency. COM(2016) 761 final.
[7)] EC, 2016. Proposal for a regulation on the Governance of the Energy Union. COM(2016) 759 final.
[8)] EU, 2013. Regulation No 1307/2013 establishing rules for direct payments to farmers under support schemes within the framework of the CAP.
[9)] EC, 2009. Directive 2009/128/EC of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides.
[10)] EC, 2013. An EU Strategy on adaptation to climate change. Brussels, 16.4.2013 COM(2013) 216 final.
[11)] EC, 2013. Adapting infrastructure to climate change, accompanying the document An EU Strategy on adaptation to climate change. Brussels, 16.4.2013, SWD(2013) 137 final. Commission staff working document.

Table 19. Coherence scores Land > W2

Land	Coherence score L1,2 … > W2
L1 Restore degraded soils to a level of functionality consistent with at least current and intended use	+1
L2 prevent soil degradation	+1
L3 Maintain and enhance forest cover	+2
L4 Prevent ILUC	+1

The Thematic Strategy for Soil Protection by the EC mentions the strong dependence of water supply and quality on good soil management, in a general and descriptive way. The Alpine Convention is more detailed and precise in describing the positive connections and more concrete in policy actions, e.g. preventing soil erosion. ILUC and its influence on water supply and quality are not mentioned in these documents.

Table 20. Coherence scores Energy > W2

Energy	Coherence score E1, 2 .. > W2
E1 Increase production of biofuels	-1
E5 Increase production of hydro-energy	-2/+1
E7 Increase energy efficiency	+1
E8 Reduce energy consumption	+1
E10 Achieve energy supply security	0/+1

Except for biofuels, bioliquids and biomass, the positive and negative linkages between energy and water policies are little explored and described in the documents. For example, the negative effects of hydropower on the aquatic ecosystem and natural discharge patterns, water supply and water quality, are not mentioned. There may also be a synergy of hydropower with water supply if the reservoir acts as a water buffer that stores water in wet seasons and supplies water in dry seasons.
Synergies between increase of energy efficiency and reduction of energy consumption on the one hand, and water efficiency and reduction of water consumption on the other hand, are not mentioned in the energy policy documents. In the context of the built environment, a connection between water and energy is mentioned, namely water used for distribution of heat and cooling. But the document fails in mentioning that less demand for heat and cooling means less demand for water.
Water is described as a potential source of renewable energy in the 2009 EC Directive on promotion of renewable energy, but no policy actions are formulated to stimulate this.

Table 21. Coherence scores Food and agriculture > W2

Food and agriculture	Coherence score F12.. >W2
F1 Contribute to farm incomes, under conditions of cross-compliance and greening	+1
F2 Improve competitiveness of agricultural sector	-1/+1
F3 Ensure provision of environmental public goods in agriculture sector	+3
F4 Support rural areas economy	+1
F5 Promote resource efficiency in agriculture, food and forestry sectors	+1
F6 Reduce and prevent food waste	+1
F7 Alternative proteins replacing animal proteins in human diets (Horizon 2020)	+1

Agriculture has major impacts on water quantity and quality. Water quality conditions to agriculture are part of the CAP. Policies for the use of pesticides have a strong focus on surface water and groundwater quality. Potential synergies between objectives for agriculture and sufficient supply of good quality water may be part of the rural development plans in the second pillar of the CAP. The synergy between resource efficiency in the agriculture, food and forestry sector on the one hand and water supply and use on the other hand, is not explicitly mentioned in the general agriculture policy, but resource efficiency is one of the criteria for regional funding. The synergy between reduction of food waste and water quality and availability is not explicitly mentioned either.

Table 22. Coherence scores Climate > W2

Climate	Coherence score E1 > C1, 2 ...
C1 Reduce GHGs emissions	+2
C3 Support development and uptake of low-carbon technology	-2
C5 Incentivize more climate-friendly land use	+2
C6 Promote climate change adaptation in key vulnerable EU sectors and in MSs	+2

The EU policy documents that are analysed mainly describe the effects of climate change on water supply and water quality and the risks of the latter for economic activities and ecosystems. Synergies with nature based solutions are mentioned in the context of climate change adaptation. Changes to the water system that are positive for water supply may be part of these nature based solutions. The synergy with more climate-friendly land-use –also favourable for water supply - is missed, as is the potential negative effects of CCS technology on water quantity and quality.

6.2.3 Coherence between policy means for the objectives 'Increase biofuel production' and 'Water supply'

A policy objective is usually supported by several policy means and instruments (Appendix I). We tested the applicability of the coherence scoring based on Nilsson et al. (2012; 2016a; 2016b) to policy instruments for the objectives 'Increase of biofuel production (E1)' as an 'influencing objective' and 'Ensure sufficient supply of good quality water for people's needs, the economy and environment (W2)' as the 'influenced objective'. At the level of policy means the questions about coherence were comparable to those for the coherence analysis of objectives, namely: *'what happens with objective W2 if we apply the means of objective E1?'* and *'What happens with means W2a, W2b, W2c, ….. if we apply the policy means E1a, E1b, E1c, …..?'*

Policy instruments to achieve objective E1 and W2 are illustrated in Table 23 and Table 24 respectively.

Table 23. Policy instruments implemented to achieve objective E1 'Increase of biofuel production'

Policy instrument implemented to achieve objective E1	
E1a	Binding national targets for raising the share of renewables in MSs energy consumption by 2020 and national plans for renewables till 2030.
E1b	National support schemes, mostly financial instruments, schemes or mechanisms applied by MSs that promote the production and use of energy from renewable sources and give long-term security for investors.
E1c	EU funds for the development and uptake of renewables.
E1d	Encouraging development of advanced alternative fuels for transport and innovative bioenergy, e.g. by investing and supporting international technology and innovation platforms, as well as large demonstration projects.
E1e	Sustainability criteria for biofuels and bio-liquids, e.g. preventing ILUC and negative environmental effects, protecting ecosystems, biodiversity, high nature value areas and biodiversity.
E1f	Transparent information to users about origin of energy source.
E1g	Stimulate local production e.g. by fair deals for self-consumers and local producers.

Table 24. Policy instruments implemented to achieve objective W2 'Water supply'

Policy instrument implemented to achieve objective W2	
W2a	MS shall conduct economic analysis of water services based on long-term forecasts of supply and demand for water in the river basin district.
W2b	MS shall protect, enhance and restore all bodies of groundwater, ensure a balance between abstraction and recharge of groundwater.
W2c	Put the right price tag on water.
W2d	Improved land use planning.
W2e	Financing water efficiency, fostering water efficient technologies and practices, and the emergence of a water-saving culture in Europe.
W2f	Develop drought risk management plans.
W2g	Consider additional water supply infrastructures.
W2h	Research and technological development.

Unlike the objective-objective coherence analysis, if we look at policy means we need to make assumptions about the changes in behaviour, society and economy that the policy means will bring about and how this may influence other objectives and the effectivity of other policy means. Therefore, even more than in the case of objective-objective coherence scoring, the scoring of

coherence between policy means depends on context and interpretation and should be done per case. In this example, we try to give a general impression.

Table 25. Example of coherence scoring at the level of policy means: how 'E1 Increase biofuel production' influences 'W2 sufficient supply of good quality water'.

	W2	W2a	W2b	W2c	W2d	W2e	W2f	W2g	W2h
E1	-1	**0**	-1	**0**	**0**	-1	**0**	+1	+1
E1a	-1	**0**	-1	**0**	**0**	-1	**0**	+1	+1
E1b	-1	**0**	-1	**0**	**0**	-1	**0**	+1	+1
E1c	-1	**0**	-1	**0**	**0**	-1	**0**	+1	+1
E1d	0	0	0	0	0	0/+1	0	0	0/+1
E1e	+1	**0**	+1	+1	+1	+1	+1	-1	+1
E1f	0	0	0	0	0	0	0	0	0/+1
E1g	0	**0**	0/-1	**0**	**0**	-1/+1	0/+1	0/+1	+1

0: no link.
0: neutral link, i.e. no positive or negative effect, but the W2 mean needs to reckon with the mean for E1 or is influenced by it.

The results show that there may be coherence or conflicts between policy means for the chosen objectives E1 in the energy and W2 in the water policy field. Therefore, it is worthwhile to take the linkages into account when developing or implementing policies for the WLEFC-nexus. Policy means that are designed to support the E1 objective in this case got a similar score as the 'objective E1'-'objective W2' coherence score, as it is assumed that these policy means are adequate for their goal. Mean E1e –sustainability criteria for biofuels- is assumed to support the protection of water resources. Innovation in advanced fuels is assumed to support research and technological development in the field of water too. Awareness among users about the energy source (E1f) may influence their choice for renewable energy, but unless the users are also well-informed about the impact of this specific energy source on water, no effect on water policies is assumed.

6.2.4 Coherence of the EU objectives 'Increase biofuel production' and 'Water supply' with international WLEFC-nexus policies

To investigate if EU policies for biofuels and water supply are coherent with international policies, we compared the key objectives of the EU policies with key objectives in related UN policies.

6.2.4.1 Coherence of EU objective 'Increase biofuel production' with international policies

The two overarching objectives of EU biofuel policies are increasing production and consumption to replace fossil fuels on the one hand, and controlling, preventing and reducing negative impacts of biofuel production on environment and society on the other hand, the latter mainly focused on food security. These objectives are coherent with goals and objectives in international policies reported in Table 26, where you also find the duality of the need to increase the use of renewables but in the meanwhile preventing negative effects of biofuel and biomass production on land use, water, forests and food security. The objective in UNEP (2012) 'Fully consider water and ecosystem footprints of alternative climate change mitigation measures' is not referred to in EU energy and climate policies, nor in international climate policies.

Table 26. International policy goals and objectives coherent with E1 'Increase biofuel production'

Goal or objective	Source
'…low greenhouse gas emissions development, in a manner that does not threaten food production.	Paris Agreement (UN, 2015)
Objective of REDD+ 'Reduce emissions from deforestation and forest degradation in developing countries' and LULUCF 'Ensure that greenhouse gas emissions from land use are compensated by an equivalent absorption of CO_2 made possible by additional action in the land use sector, in developed countries.'	UN Framework Convention on Climate Change (UNFCCC), 1992
Maintain and restore land and soil productivity.	Desertification Convention (UN, 1994)
-Fully consider water and ecosystem footprints of alternative climate change mitigation measures -Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes[1)]	Healthy waters for sustainable development. UNEP Operational Strategy for fresh water (2012-2016) (UNEP, 2012)
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix. 12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle. 15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world .	Transforming our world: The 2030 Agenda for Sustainable Development (UN, 2012)

[1)]Mountains, rivers, aquifers, lakes and water-related ecosystems as a whole are not explicitly mentioned in the EU renewable energy sustainability criteria.

Food security and food prices connected to poverty are a central issue in global food policies and SDGs. The references in the EU policy documents for renewable energy to the effects on food prices and food security that the production of biofuels will have are non-binding. The Commission will observe, but it is not mentioned what they can and will do against undesired effects, when effects are so negative that action is needed, and how this will be investigated. According to the renewable energy policy, the use of biofuels made from food and feed crops in transport will be phased out, but in the years to come, they will still play an important role. Food security is an overarching goal of the CAP, but food prices are addressed in the CAP only from the viewpoint of EU farm income, there is a safety net regulation for farmers in the case of very low prices. Food security and food prices are not addressed specifically from the global consumer's viewpoint.

Also, not addressed in the EU policies for renewable energy are the social aspects of the potential competition for land, water and other natural resources, caused by the increasing production of biofuels, bioliquids and biomass. This is incoherent with targets 1.4 and 2.3 of the SDGs, namely:

- "By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources,……"
- "By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including

  through secure and equal access to land, other productive resources and inputs, ……".

6.2.4.2 Coherence of EU objective 'Water supply' with international policies

The key issues for EU water supply policies are: good water quality, safeguard surface water and groundwater resources, mitigate water scarcity, increase water efficiency and re-use. All these key issues are also part of international water policies, although the latter are strongly linked with the development agenda, with a focus on safe drinking water and sanitation for all.

Table 27. International policy goals and objectives coherent with W2 'Water supply'

Goal or objective	Source
SDG 6 Ensure availability and sustainable management of water and sanitation for all; By 2030: 6.1 achieve universal and equitable access to safe and affordable drinking water for all 6.3 improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally 6.4 substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity 6.5 implement integrated water resources management at all levels, including through transboundary cooperation as appropriate 6.6 protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes 12.2 achieve the sustainable management and efficient use of natural resources SDG 12: Ensure sustainable consumption and production patterns. 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment 12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	Transforming our world: The 2030 Agenda for Sustainable Development (UN, 2012)
Well-managed, healthy freshwater systems supporting sustainable development and human well-being Mainstream resource efficiency.	UNEP, 2012.Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016)
Forge a global partnership to reverse and prevent desertification/land degradation and mitigate effects of drought in affected areas in order to support poverty reduction and environmental sustainability	UN, 1994.Desertification Convention

7 Conclusions

7.1 Identification and review of the most important policy areas for the nexus

The definition of the WLEFC-nexus is context specific and so are the relevant policies.

In the first place, the policies that are relevant for the WLEFC-nexus are those that directly aim at influencing the water, land, energy, food and climate domains, defined in broad terms and considered from an ecological, spatial, production & consumption, and broader socio-economic perspective.

Secondly, policies that do not directly aim at the WLEFC domains are also relevant especially in consideration of the overall objectives of resource efficiency and low-carbon economy in Europe. These other policies may have several impacts on the WLEFC domains, and policy instruments in these domains may interfere with policy instruments in the nexus. These other relevant domains include policies aiming at economy, investment, R&D and innovation, ecosystems and environment, regions, development, risk & vulnerability and trade. Other policies may also be relevant depending on the project cases (e.g. tourism).

7.2 Inventory of policy goals and means in the WLEFC-nexus at international and European scale

Two key international policy documents pave the way for national action in the WLEFC-nexus:

- the UN 2030 Agenda for Sustainable Development;
- the UN Framework Convention on Climate Change (and related Kyoto Protocol and Paris Agreement).

These acts establish two fundamental goals at global level:

- sustainable development and resource management;
- improving resilience of human and natural systems.

The first is articulated in the policy documents as sustainable water management, sustainable land use management, sustainable management of forest and trees, sustainable agriculture, sustainable consumption and production patterns, clean and sustainable energy. The second is phrased as resilient infrastructure, resilient agricultural practices, resilient cities, resilient water supply systems, resilient energy systems, resilient development, resilient socio-ecological systems.

Around these goals numerous objectives have been formulated. The most important ones for the WLEFC-nexus are listed in Table 28.

Table 28. Key policy objectives at international level in the WLEFC-nexus

WATER
SDT061 - by 2030, achieve universal and equitable access to safe and affordable drinking water for all
SDT063 - by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse
SDT064 - by 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity, and substantially reduce the number of people suffering from water scarcity
LAND
DT152 - by 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests, and increase afforestation and reforestation
SDT153 - by 2020, combat desertification, and restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land-degradation neutral world
ENERGY
SDT071 - by 2030 ensure universal access to affordable, reliable, and modern energy services
SDT072 - increase substantially the share of renewable energy in the global energy mix by 2030
SDT073 - double the global rate of improvement in energy efficiency by 2030
FOOD AND AGRICULTURE
SDG2 - End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
SDT024 - by 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality
CLIMATE
SDT131 - strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries
SDT132 - integrate climate change measures into national policies, strategies, and planning
Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels
Reduce GHGs emissions by 18% below 1990 levels between 2013 and 2020
Adapting to the impacts of climate change

Many are the instruments to achieve these objectives. Often they are soft means such as actions aiming at raising awareness, strengthening cooperation among parties, supporting stakeholders' participation, developing knowledge and technology, and building capacity. There are also economic instruments that parties can use to achieve these objectives. For example, in the context of the UNFCCC emission trading, Joint Implementation and Clean Development Mechanisms can be used. In the context of water management, regulatory and planning instruments are supported along with integrated water management, polluter-pays-principle, precautionary approaches, protected areas and technology development. In the forest area, instruments supported include voluntary certification schemes, and forest management and monitoring programmes. In the food and climate sector, investment in developing countries is an important instrument.

The **European policies** concerning the WLEFC-nexus are established by directives, regulations, road maps, plans and programmes. Coherently with the international policy arena, the EU policy integrates the two key goals of sustainable development and resilient human and natural systems. Important objectives are listed in Table 29.

Table 29. Key policy objectives at European level in the WLEFC-nexus

WATER
Achieve at least good water status for each river basin and good groundwater status by 2027
Ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy and the environment
Safe and cost-effective water reuse
Address and mitigate water scarcity and drought in EU
Address flood risks and consequences of floods in EU
LAND
Restore degraded soils and prevent further soil degradation
Maintain and enhance forest cover
Prevent indirect land use change
ENERGY
Reach a 20% share of energy from renewable sources in the EU by 2020 and at least a 27% share of renewable energy consumption by 2030
Have 10% of the transport fuel of every EU country come from renewable sources by 2020
Increase energy efficiency by 20% by 2020 and by at least 30% by 2030
Reduce energy consumption
Ensure a stable and abundant supply of energy for European citizens and the economy
Support the development and deployment of clean energy technologies
FOOD AND AGRICULTURE
Viable EU food production and EU food security (through support to farm income)
Efficiency of food supply chain and competitiveness of agri-food sector
Sustainable management of natural resources and mitigation and adaptation to climate change in agriculture
Support rural areas economy
CLIMATE
20% GHGs emissions reduction (from 1990 levels) by 2020; 40% GHGs emissions reduction (from 1990 levels) by 2030; and 80-95% GHGs emissions reduction (from 1990 levels) by 2050 in EU
Increase efficiency of the transport system
Support the development and uptake of low-carbon technology
Promote adaptation in key vulnerable EU sectors and in MSs

Many are the instruments to achieve these objectives: regulatory instruments especially in the water, land, food and energy sectors (e.g. water quality standards, energy performance standards, water management plans, forest management programmes); financial instruments especially in the agricultural sector (e.g. direct payment to farmers, energy taxes); market instruments especially in the climate sector (e.g. EU ETS); and informational (e.g. eco-labelling on energy products) and voluntary instruments (e.g. environmental conservation measures in rural development) in all nexus sectors.

7.3 Coherence of WLEFC-nexus policies, and their degree of 'nexus compliance' and support of a resource efficient Europe

As a disclaimer to the following conclusions about policy coherence we mention that in this analysis we only investigated policies as described in policy documents at the level of goals, objectives and policy means. We did not analyse how these policies are implemented and may cause synergies or conflicts in practice. This is the task of Deliverable 2.2.

7.3.1 General observations on policy coherence in the WLEFC-nexus at EU level

The results of the assessment showed that synergies are more prominent than conflicts both for the objectives influencing the WLEFC-nexus and for the objectives being influenced by the WLEFC-nexus. Although at first, this may sound surprising, it is in line with the argument of Nilsson and colleagues (2012) who suggest that it is politically easy to reach agreement on general goals. The reality of selecting and implementing instruments and measures to achieve those goals is where conflicts and related trade-offs arise.

The presence of limited conflicts and numerous synergies also suggests a certain level of awareness of the legislator about bio-physical and socio-economic interactions in the WLEFC-nexus. The cross-sectoral sustainability objective and the resilience objective are typical examples of the grown awareness of the interconnection between resource systems and the need to develop integrated policies. Sustainable management of resources is a horizontal policy objective that has entered policy documents in all nexus domains over the past 25 years and it is prompted to remain for the coming decades too. It entails pursuing resource efficiency and integrated resource management. As for the resilience objective, its more recent uptake in international and European policy documents shows capacity, at least at the policy formulation level, to integrate new scientific evidence in policy making processes. Furthermore, similarly to sustainable resource management, resilience is yet another objective that entails resource efficiency and integrated resource management. Therefore, in principle, the inclusion of these goals in policy documents across the WLEFC-nexus implies, at least on paper, nexus compliance of policies. However, as already noted, problems start to manifest when more specific objectives and measures to achieve these cross-sectoral goals need to be articulated and implemented. For this reason, the next step of the SIM4NEXUS policy analysis will focus on the implementation of WLEFC-nexus policies in 10 case studies at regional, transboundary and national scales with the aim to shed light on where policy trade-offs and synergies manifest and how they are addressed.

The overall assessment also revealed a number of objectives that, if pursued with cross-sectoral, integrated policies, could have a cascade of positive, synergist effects in the whole WLEFC-nexus. These are the nexus critical objectives showing a high density of interactions in the WLEFC-nexus and have a positive effect on other objectives. They include:

- W6 - Address and mitigate water scarcity and drought
- L1 - Restoring degraded soils to a level of functionality consistent with at least current and intended use
- L2 - Prevent soil degradation
- F1 – Contribute to farm incomes, under condition that rules on environment and cross-compliance are respected.
- F3 - Ensure provision of environmental public goods in the agriculture sector

- F4 - Support rural areas economy (employment, social fabric, local markets, diverse farming systems) *conditioned to the functioning of the cross-compliance and greening mechanisms*
- F5 - Promote resource efficiency in the agriculture, food and forestry sectors
- F6 - Reduce and prevent food waste
- C1 - Reduce GHGs emissions to keep global temperature increase within 2 degrees
- C5 – Incentivize more climate-friendly land use.
- C6 - Promote adaptation in key vulnerable EU sectors and in member states

Attention should also be paid to those nexus critical objectives that are likely to negatively affect other WLEFC-nexus objectives. Policy-makers should be aware that progress in the achievement of these objectives come at the expenses of other objectives in the nexus. In these situations, a nexus approach involving all affected parties in policy negotiation can help manage the unavoidable trade-offs. These objectives include:

- E1 – Increase of biofuel production (see next section for discussion about it)
- E5 - Increase hydro-energy production
- F2 - Improve competitiveness of agricultural sector (including sector-specific support and international trade issues)
- C4 - Support the development and uptake of safe CCS technology

Finally, attention should be devoted to those nexus critical objectives whose progress may be positively affected by numerous other objectives in the WLEFC-nexus. These are:

- W1 - Achieve good water quality status
- W2 - Ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy and the environment
- W6 - Address and mitigate water scarcity and drought.
- L1 - Restoring degraded soils to a level of functionality consistent with at least current and intended use
- L2 - Prevent soil degradation
- L3 – Maintain and enhance forest cover
- F1 – Contribute to farm incomes, under condition that rules on environment and cross-compliance are respected.
- F2 – Improve competitiveness of agricultural sector
- F3 - Ensure provision of environmental public goods in the agriculture sector
- F4 - Support rural areas economy (employment, social fabric, local markets, diverse farming systems) *conditioned to the functioning of the cross-compliance and greening mechanisms*
- F5 - Promote resource efficiency in the agriculture, food and forestry sectors
- C1 - Reduce GHGs emissions to keep global temperature increase within 2 degrees
- C5 – Incentivize more climate-friendly land use.
- C6 - Promote adaptation in key vulnerable EU sectors and in member states

It should be noted that for all these objectives, the potential synergies are far more than the conflicts when looking at them as objectives influencing the WLEFC-nexus. A nexus approach, by revealing such interactions, could help find a balance between energy production and use, water use and conservation.

7.3.2 Policy coherence for the objectives biofuel production and water supply

Horizontal policy coherence of EU policies

- The EU policy objectives 'Increase biofuel production (E1)' and 'Ensure sufficient supply of good quality water for people's needs, the economy and environment (W2)' have many interlinkages with other EU WLEFC policy objectives, directly and indirectly. E1 causes conflicts with most other objectives in the WLEFC domains, except for the reduction of GHGs if criteria for overall emission reduction during are met, and for farm income and economic development of regions. For this analysis, we narrowed the definition of biofuels to 'biofuels made of food and feed crops', whereas the EU policies use a broader definition. W2 has synergies with most other WLEFC policy objectives, except that it is potentially negatively influenced by increase of CCS, hydropower and production of biofuel crops. Policy means that support the increase of biofuels counteract policy means that protect water resources as well as those aiming at water saving in Europe. However, they have synergies with improving water supply structures and technology development. Assumptions about effects on society of the policy means are crucial for the outcome of this theoretical coherence analysis. The results should be tested by investigation of practical implementation.
- Potential conflicts caused by increase of biofuel production on water quality in the EU are tackled in the CAP. Conflicts with water quantity and water quality outside the EU are addressed in the EU policies for renewable energy through voluntary reporting schemes. As a result, compliance of biofuel production to water related standards depends on strong water management at the production location and willingness of actors in the supply chain to protect water resources. Potential conflicts caused by the increase of biofuel production on land use objectives are well addressed in EU policies.
- The EU policy established strict criteria for the reduction of GHGs emissions to which the production and use of biofuels has to comply.
- The effects of alternative sources of energy on water use and pollution are not generally addressed in EU policies. Neither are the negative effects of hydropower on aquatic ecology, water quality and quantity.

Vertical policy coherence

- EU policies for biofuels are generally coherent with international policies, except for the food security and affordable food prices goals in the context of poverty reduction, central issues in international food policy and in the Sustainable Development Goals - SDGs. The effects of biofuel production on these goals are weakly addressed in EU policies. Prices of agricultural products are addressed in the CAP from the viewpoint of farm income, not from the viewpoint of the food consumer. According to the EU policies for renewable energy, the EC will monitor effects of biofuel production on food prices and security, but no concrete actions are mentioned if unwanted effects would be observed.
- The objective in UNEP (2012) 'Fully consider water and ecosystem footprints of alternative climate change mitigation measures' is not referred to in EU energy and climate policies, nor in international climate policies.

7.4 Windows of opportunity to improve nexus compliance of policies

Policy reviews offer windows of opportunity for the SIM4NEXUS results to be up-taken and integrated in the policy-making process. Table 30 shows the policy reviews expected for a number of policies in the WLEFC-nexus at international and EU level in the coming years. Interesting opportunities to share the SIM4NEXUS results at EU level are represented by the review of the EU energy package, the Water Framework Directive, the Common Agricultural Policy, the EU strategy on adaptation, the EU structural and development funds and the EU LIFE Programme.

Policy reviews are long processes that start much earlier than the expected review date, and opportunities to bring new ideas into the policy revision discussion are many throughout the review process. Indeed, discussion about the review of some of the above-mentioned policies have already started. Typical windows of opportunity in these discussions include consultations with the involved parties, presentations of policy discussion documents, round tables with interested parties, etc. More proactive initiatives include organization of small group meetings with target groups such as policy-makers or affected parties, and bilateral conversations where new ideas are either formally or informally presented. Therefore, identifying and seizing key windows of opportunity over the coming years to share the SIM4NEXUS results in the discussion of these policies is an important follow-up activity of the policy analysis. One window of opportunity that we already aim to exploit is the upcoming interviews with EU stakeholders (public officials, NGO, private sector) for the validation and sharing of our results and conclusions.

Table 30. Windows of opportunity to share SIM4NEXUS results offered by upcoming policy reforms at international and EU level; in red the upcoming windows of opportunity in EU policy reforms

WLEFC-nexus policies	
Water	2019: Water Framework Directive (ongoing discussion)
Land	None
Energy	2016: proposal of a new EU energy package including a number of directives: energy efficiency, renewables, regulation on internal market for electricity, governance of energy union, energy performance of buildings (ongoing discussion of the proposed package)
Food and agriculture	2020: CAP (ongoing discussion) 2020: Action Plan for Organic Production 2020: EU food and nutrition action plan 2015: World Summit Declaration on Food Security and Action Plan (ongoing discussion?)
Climate change	2022: IPCC Sixth Assessment Report 2020: Kyoto Protocol (Paris Agreement enters into force) 2017: EU strategy on adaptation including the annex adapting infrastructure to climate change 2024: Proposal for Regulation on inclusion of GHG emissions and removals from land use
Nexus related policies	
Nature and biodiversity	Convention on the conservation of migratory species: this Convention may be amended at any ordinary or extraordinary meeting of the Conference of the Parties.

	Convention on International Trade in Endangered Species of Wild Fauna and Flora: the Parties shall review the implementation of the Convention at meetings, whether regular or extraordinary. EU biodiversity strategy: targets and measures will be reconsidered as new information becomes available and progress is made on the objectives set in the strategy.
Multiple sectors	2017: EU Green Infrastructure Strategy: the Commission will review progress on developing GI and publish a report on the lessons learnt together with recommendations for future action. 2020: 7th EU Action Programme for Environment to 2020 2017: LIFE Fund 2014 2017 work programme 2019: Eco-design Working Plan 2016-2019 2021: UNEP medium term strategy 2018-2021 2050: A roadmap for moving to a competitive low carbon economy in 2050
EU regional policy and funds	2020: EU structural and development funds
Development	2017: UNDP Strategic Plan 2014 2017 2020: Regulation on the implementation of the 11th European Development Fund 2030: 2030 Agenda for Sustainable Development 2030: Addis Ababa Action Agenda on Financing Development
Vulnerability and risk	2019: Council regulation on emergency support within EU 2020: EU Civil Protection Mechanism 2030: Sendai Framework for disaster risk reduction 2030: Action plan on Sendai framework for disaster risk reduction 2015-2030 2036: UN Habitat III New Urban Agenda

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Appendix I: Inventory of policy goals and means in the WLEFC-nexus at international and European scale

Inventory of policy goals and means in the WLEFC nexus – INTERNATIONAL POLICIES

INTERNATIONAL WATER POLICY **Goals:** • SDG 6 Ensure availability and sustainable management of water and sanitation for all • SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems (incl. inland freshwater ecosystems), sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss • Well-managed, healthy freshwater systems supporting sustainable development and human well-being • Protection of human health and well-being, both individual and collective, within a framework of sustainable development, through improving water management and through preventing, controlling and reducing water-related diseases. • Resilience to climate change	**Reference** https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016) UN_1992_Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes.
WATER SUPPLY AND QUALITY **Overarching objectives:** • SDG 6 Ensure availability and sustainable management of water for all • Well-managed, healthy freshwater systems supporting sustainable development and human well-being	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016)

SAFE DRINKING WATER AND WATER RELATED HEALTH		
Objectives	**Means**	**Reference**
By 2030, achieve universal and equitable access to safe and affordable drinking water for all	**By 2030** Implement integrated water resources management at all levels, including through transboundary cooperation as appropriate Expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies Support and strengthen the participation of local communities in improving water and sanitation management The Parties shall take all appropriate measures to prevent, control and reduce water-related disease within a framework of integrated water-management systems Protection of water resources which are used as sources of drinking water, treatment of water and the establishment, improvement and maintenance of collective systems. Protection from pollution from other causes, including agriculture, industry and other discharges and emissions of hazardous substances Establishment, improvement and maintenance of collective sanitation systems Sufficient safeguards for human health against water-related disease arising from the use of water for recreational purposes, from the use of water for aquaculture, from the water	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals UN_1992_Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes

	in which shellfish are produced or from which they are harvested, from the use of waste water for irrigation or from the use of sewage sludge in agriculture or aquaculture Effective systems for monitoring situations likely to result in outbreaks or incidents of water-related disease and for responding to such outbreaks and incidents and to the risk of them Create legal, administrative and economic frameworks within which the public, private and voluntary sectors can each make its contribution to improving water management for the purpose of preventing, controlling and reducing water-related disease Adoption of the precautionary principle and polluter-pays principle Preventative action is taken to prevent accidents Develop water-management plans	
WATER SCARCITY		
Objectives	**Means**	**References**
Substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.	Support the targeting of interventions through a better spatial and time-bound understanding of where action is needed, involving more comprehensive assessments and accounting of water availability and the demands upon it (including environmental needs), as well as the management options to respond. **Environmental flows** Support international and regional partners in further refining and applying approaches for implementing environmental flows, including considerations of water quantity and water quality.	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016) UN_2007_UNEP water policy and strategy
WATER QUALITY		
Objectives	**Means**	**Reference**
Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials Meet the global water quality challenge Improved assessment and awareness of water issues Improved environmental management of basins, coastal and marine waters, including the identification of linkages with ongoing international processes	See 'Safe drinking water and health' **Water quality** Promote and refine ecologically based technologies for wastewater treatment and reuse and for the restoration of healthy freshwater systems, and showcase results; Promote cleaner production technologies, standards and act as a champion for voluntary standards of corporate responsibility; Encourage pilot-level initiatives on prevention and treatment, including ecosystem-based solutions, to improve water quality in hotspots and across a range of problem areas representative of different pollution drivers, institutional systems and geographic areas, including transboundary cases; Establish strategic partnerships at regional and national levels for the replication of effective water quality improvement solutions and related capacity development and support national Governments to give prominence to water quality improvement in their	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016) UN_2007_UNEP water policy and strategy

Improved cooperation in the water sector Contribute to sound economic and social development, including poverty reduction	national policy and regulatory frameworks using IWRM approach; **Institutions** Build institutions and place water quality protection and improvement on the political agenda. Promote multi-stakeholder participation; Support and take forward the implementation of relevant multilateral environmental agreements, and also key environmental law principles embedded in other instruments, such as the 1997 United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses and the 2008 draft articles on the Law of Transboundary Aquifers, adopted by the International Law Commission (ILC) in 2008. Support regional institutions to demonstrate the application of transboundary ecosystem assessments in a regional context, including connectivity between freshwater and coastal systems, to review the effectiveness of existing legal and policy frameworks for such cases, and support the reform process. **Assessments** Integrated assessment and management of water resources and associated ecosystems; Assessments which build the knowledge base with regard to water resources and related ecosystems constitute the primary mechanism for developing, implementing and evaluating appropriate management measures that take into account the needs of the environment and society. Such assessments must focus on water resources themselves – in terms both of quantity and quality – but must also include the assessment of related ecosystems. **Monitoring and data** Support water quality data collection and intensify assessments of water quality, improve accessibility to reliable data through the global water quality database (under the UNEP Global Environment Monitoring System (GEMS) Water Programme), assess key sources of pollutants and prepare associated policy recommendations; Further develop international standards and guidance on appropriate levels of water quality for healthy freshwater ecosystems; **Integrated water management plans** Review the status of adoption of national IWRM and IWCAM plans and processes, the extent to which ecosystem services are incorporated in water resources planning and management and the scope for further support in institutional and governance reforms both at the national level and globally; **Valuation of water services** Quantify and report on the cost of poor water quality under a range of future scenarios and promote the multiple benefits of improved water quality. Global and regional assessments of the economic value and services provided by freshwater ecosystems, and determine the consequences of degradation and costs of replacing lost services. Review the status of valuation methodologies for freshwater ecosystems and prepare practical guidance on standardized approaches for application and integration into planning systems, including strategic environmental assessment, and develop a standard set of	

	indicators to describe ecosystem health and resilience for application in state-of-the-basin assessments, environmental impact assessments and other relevant tools; Address risks. **Protected areas** Promote the protection of a number of high value freshwater systems, for example through listing as United Nations Educational, Scientific and Cultural Organization(UNESCO) World Heritage sites, wetland sites under the Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (known as "Ramsar sites"), biosphere reserves, national protected areas or through regional and transboundary agreements; **Pilots** Support the preparation, implementation and monitoring of management plans and pilot interventions for identified sites and systems, with emphasis on resolving competing uses and identifying the incentives for stakeholders (Governments, private sector, communities) to participate in the process;	
TRANSBOUNDARY WATERS		
Objectives	**Means**	**References**
Prevent, control and reduce any transboundary impact, e.g. pollution of waters causing or likely to cause transboundary impact Protection of the environment of transboundary waters or the environment influenced by such waters, including the marine environment	Measures for the prevention, control and reduction of water pollution shall be taken, where possible, at source. These measures shall not directly or indirectly result in a transfer of pollution to other parts of the environment; The Riparian Parties shall cooperate on the basis of equality and reciprocity, in particular through bilateral and multilateral agreements, in order to develop harmonized policies, programmes and strategies covering the relevant catchment areas, or parts thereof; Parties shall be guided by the following principles: (a) The precautionary principle; (b) The polluter-pays principle; (c) Water resources shall be managed so that the needs of the present generation are met without compromising the ability of future generations to meet their own needs. Parties shall develop, adopt, implement and, as far as possible, render compatible relevant legal, administrative, economic, financial and technical measures, in order to ensure, inter alia, that: (a) The emission of pollutants is prevented, controlled and reduced at source through the application of, inter alia, low- and non-waste technology; (b) Transboundary waters are protected against pollution from point sources through the prior licensing of waste-water discharges by the competent national authorities, and that the authorized discharges are monitored and controlled; (c) Limits for waste-water discharges stated in permits are based on the best available technology for discharges of hazardous substances; (d) Stricter requirements, even leading to prohibition in individual cases, are imposed when the quality of the receiving water or the ecosystem so requires; (e) At least biological treatment or equivalent processes are applied to municipal waste water; (f) Appropriate measures are taken, such as the application of the best available	UN_1992_Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

	technology, in order to reduce nutrient inputs from industrial and municipal sources; (g) Appropriate measures and best environmental practices are developed and implemented for the reduction of inputs of nutrients and hazardous substances from diffuse sources, especially where the main sources are from agriculture; (h) Environmental impact assessment and other means of assessment are applied; (i) Sustainable water-resources management, including the application of the ecosystems approach; (j) Contingency planning; (k) Additional specific measures are taken to prevent the pollution of groundwaters; (l) The risk of accidental pollution is minimized. Emission limits for discharges from point sources into surface waters based on the best available technology, which are specifically applicable to individual industrial sectors or industries from which hazardous substances derive; Water-quality objectives and water-quality criteria. Provide for the widest exchange of information. Joint monitoring and assessment, common research, development and communication between riparian states. Programmes for monitoring the conditions of transboundary waters; Cooperation in the conduct of research into and development of effective techniques.	
WATER USE		
Objectives	**Means**	**References**
Mainstreaming resource efficiency	**Efficiency of water use** Stimulate knowledge exchange and the sharing of best practices on the efficiency of water use and demand-side management measures from a life-cycle perspective between regions and through different sector networks, investors and the public; Raise awareness on the business opportunities of greater resource efficiency in water-related investments and processes in the value chains worldwide and to strengthen the business case for action that avoids the unsustainable and financial consequences of a business-as-usual approach; Promote measures to increase the efficiency of resource use from both consumption and production perspectives, including a life-cycle approach; Support the further development and dissemination of simple and easy-to-use tools and harmonized international methodologies that quantify and account for water use in the economy and related impacts, for example, by refining water accounting and footprinting techniques in a way that is internally robust and consistent with the hydrological cycle; Demonstrate the value of such tools and methods in identifying, assessing and managing water-related risks and opportunities to reach well founded allocation decisions that are widely accepted, including the disclosure of water sustainability policies and practices as encouraged by the CEO Water Mandate, and working with the private sector to promote water stewardship and the adoption of standards for water efficient technologies and productive systems; Encourage public sector bodies at the basin, regional, national and municipal levels across	UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016) UN_2007_UNEP water policy and strategy

	a range of water-stressed locations to prepare green and blue water accounting, efficiency assessments and management plans analyzing the possibility of decoupling resource use and negative environmental impact from economic growth; Promote the application of water accounting, efficiency measures and management tools in key industry sectors, taking into consideration global supply chain links, and to support the incorporation of water efficiency as a criterion of green procurement processes and rules; Develop a structured, online knowledge-management and capacity-building platform and guidance on harmonized methodologies and management tools to promote improved water management through the operations, value chains and community relations of public and private organizations and to organize regional capacity-building workshops and training of trainers on the methods and tools for improved water accounting, efficiency and management; to facilitate information exchange and coordination between development partners, investors and developing countries.	
SANITATION **Overarching objectives:** • SDG 6 Ensure availability and sustainable management of sanitation for all		https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals
ACCESS TO SANITATION		
Objectives	**Means**	**Reference**
By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation	See 'Safe drinking water and health' Establishment, improvement and maintenance of collective sanitation systems	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals UN_1992_Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes.
WASTEWATER TREATMENT AND RE-USE		
Objectives	**Means**	**Reference**
Halve the proportion of untreated wastewater and substantially increase recycling and safe reuse globally	See 'Safe drinking water and health' Promote and refine ecologically based technologies for wastewater treatment and reuse	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016) UN_2007_UNEP water policy and strategy
FRESHWATER ECOSYSTEMS **Overarching objectives:** • SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems (incl. inland freshwater ecosystems), sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss		**Reference** https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals

PROTECTION OF ECOSYSTEMS AND SPECIES		
Objectives	**Means**	**Reference**
By 2020 Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes Reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species Benefitting from aquatic ecosystems	By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts Take urgent and significant action and mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems Promote ecosystem based approaches	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016)
INVASIVE ALIEN SPECIES		
Objectives	**Means**	**Reference**
Prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species.	By 2020 introduce measures	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals
POACHING AND ILLEGAL TRADE		
Objectives	**Means**	**Reference**
End poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products.	Take urgent action and enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	See above
BENEFIT SHARING		
Objectives	**Means**	**Reference**

Fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed.	Promote as internationally agreed Promote the adoption of benefit-sharing mechanisms	See above UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016)
CLIMATE CHANGE **Overarching objectives:** • Building resilience to climate change through water management • Fully consider water and ecosystem footprints of alternative climate change mitigation measures		**Reference** UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016)
CLIMATE CHANGE ADAPTATION		
Objectives	**Means**	**Reference**
Building resilience to climate change through water management	**Climate change adaptation** Collate and disseminate information on climate change and water-related disaster impacts on the freshwater environment at regional and river-basin levels and the benefits of managing existing aquatic ecosystems for climate change adaptation, for example wetlands and coastal mangroves; Initiate new regional assessments and monitor continuing initiatives on the scale of climate change impacts in critical areas and basins and report on the implications of climate change impacts for water dependent ecosystems within the context of other development pressures, for example using a scenario-based approach; Review existing and proposed approaches, tools and guidelines for incorporating climate change considerations and disaster risk reduction measures in freshwater system management, including a basin perspective and a focus on adaptive management, for example, including the linkages between land and water management, the role of flood and drought forecasting, and the efficiency and resilience of resource use; Review disaster response plans and capability in the context of more frequent and intense events and more extreme consequences, particularly in deltas and island States. Build up a knowledge portfolio of pilot adaptation activities related to water and ecosystems that is representative of geographical conditions, climate conditions and the level of development and to report on lessons learned, also reflecting on relevant experiences from disaster response initiatives; Support integration of best practices and policy recommendations for emergency and recovery programming into the management of freshwater systems and development planning processes	UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016) UN_2007_UNEP water policy and strategy
CLIMATE CHANGE MITIGATION		
Objectives	**Means**	**Reference**
Fully consider water and ecosystem footprints of alternative climate change mitigation measures	Assess and raise awareness of the water and ecosystem footprints of alternative climate change mitigation measures, (e.g., for electricity generation options, carbon sequestration initiatives, etc.), so that they can be fully considered in policy discussions on mitigation options.	UNEP_2012_Healthy waters for sustainable development. UNEP operational strategy for fresh water (2012-2016)

INTERNATIONAL LAND USE POLICY **Goals:** • Sustainable land use		
DESERTIFICATION **Overarching objectives:** • Combat desertification • Mitigate the effects of drought in countries experiencing serious drought and/or desertification		**Reference** UN_1994_Desertification Convention
DROUGHT		
Objectives	**Means**	**Reference**
Forge a global partnership to reverse and prevent desertification/land degradation and mitigate effects of drought in affected areas in order to support poverty reduction and environmental sustainability Improve living conditions for people in drylands	Adopt an integrated approach addressing the physical, biological and socio-economic aspects of the processes of desertification and drought Give due attention, within the relevant international and regional bodies, to the situation of affected developing country Parties with regard to international trade, marketing arrangements and debt with a view to establishing an enabling international economic environment conducive to the promotion of sustainable development Integrate strategies for poverty eradication into efforts to combat desertification and mitigate the effects of drought Promote cooperation among affected country Parties in the fields of environmental protection and the conservation of land and water resources, as they relate to desertification and drought Strengthen sub-regional, regional and international cooperation Cooperate within relevant intergovernmental organizations Determine institutional mechanisms, if appropriate, keeping in mind the need to avoid duplication Promote the use of existing bilateral and multilateral financial mechanisms and arrangements that mobilize and channel substantial financial resources to affected developing country Parties in combating desertification and mitigating the effects of drought	UN_1994_Desertification Convention
LAND AND SOIL PRODUCTIVITY		
Objectives	**Means**	**Reference**
Maintain and restore land and soil productivity	No specific instruments for soil productivity mentioned (see general instruments above)	UN_1994_Desertification Convention
FORESTRY **Overarching objectives:** • Sustainable management of forests and trees		**Reference** FAO_2010_FAO strategy for forest and forestry UN_2006_International tropical timber agreement

		UN_2007_Non legally Binding Instrument on all types of forests
TROPICAL TIMBER		
Objectives	**Means**	**Reference**
To promote the expansion and diversification of international trade in tropical timber from sustainably managed and legally harvested forests To promote the sustainable management of tropical timber producing forests	Providing an effective framework for consultation, international cooperation and policy development Providing a forum for consultation to promote non-discriminatory timber trade practices Promoting and supporting research and development with a view to improving forest management and efficiency of wood utilization and the competitiveness of wood products relative to other materials, as well as increasing the capacity to conserve and enhance other forest values in timber producing tropical forests Developing and contributing towards mechanisms for the provision of new and additional financial resources with a view to promoting the adequacy and predictability of funding and expertise needed to enhance the capacity of producer members to attain the objectives of this Agreement Improving market intelligence and encouraging information sharing on the international timber market with a view to ensuring greater transparency and better information on markets and market trends, including the gathering, compilation and dissemination of trade related data, including data related to species being traded Improving marketing and distribution of tropical timber and timber product exports from sustainably managed and legally harvested sources and which are legally traded, including promoting consumer awareness Encouraging members to develop national policies aimed at sustainable utilization and conservation of timber producing forests, and maintaining ecological balance, in the context of the tropical timber trade Promoting access to, and transfer of, technologies and technical cooperation to implement the objectives of this Agreement, including on concessional and preferential terms and conditions, as mutually agreed	UN_2006_International tropical timber agreement
GENERAL USE OF FOREST		
Objectives	**Means**	**Reference**
Benefits from trees, forests and forestry are increasing, widely recognized and appreciated Decision-making across sectors is	The FAO priorities are: - prepare and disseminate the results of periodic Global Forest Resources Assessments and reports on the State of the World's Forests - support to national and regional forest monitoring and assessment, including interactions with other sectors through integrated land use assessments	FAO_2010_FAO strategy for forest and forestry

informed, better coordinated, transparent and participatory Forest resources are increasing in a majority of countries and ecosystem services are increasingly recognized and valued	- effectively share knowledge and information - provide a dynamic forum for governments and other stakeholders to address policy and emerging issues, including Ministerial Meetings, the Committee on Forestry, the World Forestry Congress, Regional Forestry Commissions, technical panels and commissions, expert consultations, and global and regional networks - strengthen linkages between national, regional and global processes, including through an expansion of the role of Regional Forestry Commissions - provide leadership for the Collaborative Partnership on Forests (CPF), including developing joint programmes or actions, and through other partnerships including hosting the Mountain Partnership and active partnerships with the private sector and non-governmental organizations - support for integrated (cross-sectoral) policy analysis and planning to better understand the implications of policies of other sectors on forests and vice versa - support to effective national forest programmes, including capacity building and knowledge exchange - host and support the National Forest Programme (NFP) Facility. - development and use of guidelines for good forest practices through effective stakeholder consultative processes - support development and implementation of strategies for conservation and sustainable use of forest genetic resources at global, regional and local levels; - support the development and implementation of national and international financial mechanisms to support sustainable forest management; - increased use of financial mechanisms to facilitate information sharing and database development, and to build capacity to strengthen forest management and to reduce deforestation and forest degradation (e.g., REDD). - provide technical, policy, and legal assistance in support of landscape and ecosystem approaches and the development of payment for environmental services schemes, with an emphasis on mountain ecosystems, arid zones and rangelands, coastal forests and other fragile ecosystems - development and use of guidelines for adapting forest policies, institutions, practices and governance arrangements to improve climate change adaptation and mitigation - support national and regional initiatives to conserve forests and their biological diversity, including wildlife resources in protected areas an production forests - provide policy and technical assistance to improve the management of watersheds, to rehabilitate degraded forest lands and combat desertification	
To strengthen political commitment and action at all levels to implement effectively sustainable management of	Non-legally binding instrument on all types of forests; resolution / adopted by the General Assembly: - Develop, implement, publish and, as necessary, update national forest programmes or	UN_2007_Non legally Binding Instrument on all types of forests

all types of forests and to achieve the shared global objectives on forests; To enhance the contribution of forests to the achievement of the internationally agreed development goals, including the Millennium Development Goals, in particular with respect to poverty eradication and environmental sustainability; To provide a framework for national action and international cooperation.	other strategies for sustainable forest management - Promote the use of management tools to assess the impact on the environment of projects that may significantly affect forests, and promote good environmental practices for such projects - Develop and implement policies that encourage the sustainable management of forests to provide a wide range of goods and services, and that also contribute to poverty reduction and the development of rural communities - Promote efficient production and processing of forest products, with a view, inter alia, to reducing waste and enhancing recycling - Support the protection and use of traditional forest-related knowledge and practices in sustainable forest management with the approval and involvement of the holders of such knowledge, and promote fair and equitable sharing of benefits from their utilization, according to national legislation and relevant international agreements; - Further develop and implement criteria and indicators for sustainable forest management that are consistent with national priorities and conditions - Create enabling environments to encourage private sector investment, as well as investment by and involvement of local and indigenous communities, other forest users and forest owners and other relevant stakeholders, in sustainable forest management, through a framework of policies, incentives and regulations - Develop financing strategies that outline the short-, medium- and long term financial planning for achieving sustainable forest management, taking into account domestic, private sector and foreign funding sources - Identify and implement measures to enhance cooperation and cross-sectoral policy and programme coordination among sectors affecting and affected by forest policies and management - Integrate national forest programmes, or other strategies for sustainable forest management into national strategies for sustainable development, relevant national action plans and poverty reduction strategies - Establish or strengthen partnerships, including public-private partnerships, and joint programmes with stakeholders to advance implementation of sustainable forest management - Create, develop or expand, and maintain networks of protected forest areas, taking into account the importance of conserving representative forests, by means of a range of conservation mechanisms, applied within and outside protected forest areas - Promote the development and application of scientific and technological Innovations including those that can be used by forest owners and local and indigenous communities to advance sustainable forest management - Support education, training and extension programmes involving local and indigenous communities, forest workers and forest owners, in order to develop resource	

	management approaches that will reduce the pressure on forests, particularly fragile ecosystems	
ILLEGAL FOREST ACTIVITIES		
Objectives	**Means**	**Reference**
Tackle illegal forest activities in the Partner Countries (East Europe and North Asia)	Develop and implement anti-corruption tools in the forest sector of the Region, including codes of ethics and professional responsibility Promote the collection and dissemination of transparent information on forest resources and their allocation, in a form readily accessible to the public. Monitor and disclose data on domestic and international trade flows of timber products in order to combat their illegal trade within the countries in the Region Strengthen regional cooperation for forest law enforcement and timely exchange of information and experience among all countries in the Region as well as with importing countries Develop effective partnership with the private sector in the Region and in consumer countries, including timber processors, exporters and importers Encourage regional cooperation and build capacity in monitoring trade in timber and wildlife Integrate within existing mechanisms the systematic monitoring, assessment and reporting of progress on FLEG Strengthen international cooperation to build national institutional and human capacity as well as to facilitate technology transfer and information sharing to combat illegal logging Disseminate information on the legality of the products including certification systems to promote marketing of legal timber in consumer countries Cooperate with civil society to inform domestic and foreign consumers of the problems caused by illegal logging, associated corruption and trade	World Bank_2005_Forest Law and Governance St Petersburg declaration

INTERNATIONAL AGRICULTURE AND FOOD POLICY **Goals:** • SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture • SDG 12: Ensure sustainable consumption and production patterns		**Reference** https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals.
FOOD SECURITY **Overarching objectives:** • SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture		**Reference** https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals.
HUNGER AND MALNUTRITION		
Objectives	**Means**	**Reference**
By 2030: end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons Better coordination at global, regional and national levels and ensure that national and regional interests are duly voiced and considered	During the World Food Summit in Rome in 1996 the Rome Declaration on world food security and the world food summit plan of action were adopted by 185 countries. The world food summit plan of action includes the measures to be implemented by countries and the international community to achieve the aim of the Rome Declaration on world food security Seven commitments, further elaborated by detailed steps: 1. Ensure an enabling political, social, and economic environment to create the best conditions for eradication of poverty and durable peace, based on full and equal participation of women and men 2. Implement policies aimed at eradicating poverty and inequality and improving physical and economic access by all, at all times, to sufficient, nutritionally adequate and safe food and its effective utilization 7. Implement, monitor, and follow-up this Plan of Action at all levels in cooperation with the international community Global Partnership for Agriculture, Food Security and Nutrition Reform of the Committee on World Food Security (CFS) Five commitments, further elaborated by detailed steps: 1. Invest in country-owned plans, aimed at channelling resources to well- designed and results-based programmes and partnerships 2. Foster strategic coordination at national, regional and global level to improve governance, promote better allocation of resources, avoid duplication of efforts and identify response-gaps 3. Strive for a comprehensive twin-track approach to food security that consists of: 1) direct action to immediately tackle hunger for the most vulnerable and 2) medium- and long-term	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals. FAO_1996_World Food Summit Plan of Action. FAO_2009_ Declaration of the World Summit on Food Security

	sustainable agricultural, food security, nutrition and rural development programmes to eliminate the root causes of hunger and poverty, including through the progressive realization of the right to adequate food 4. Ensure a strong role for the multilateral system by sustained improvements in efficiency, responsiveness, coordination and effectiveness of multilateral institutions 5. Ensure sustained and substantial commitment by all partners to investment in agriculture and food security and nutrition, with provision of necessary resources in a timely and reliable fashion, aimed at multi-year plans and programmes	
FOOD PRODUCTION		
Objectives	**Means**	**Reference**
By 2030: double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries (Continuation Rome declaration): 3. Pursue participatory and sustainable food, agriculture, fisheries, forestry and rural development policies and practices in high and low potential areas, which are essential to adequate and reliable food supplies at the household, national, regional and global levels, and combat pests, drought and desertification, considering the multifunctional character of agriculture 6. Promote optimal allocation and use of public and private investments to foster human resources, sustainable food, agriculture, fisheries and forestry systems, and rural development, in high and low potential areas Reverse the decline in domestic and international funding for agriculture, food security and rural development in developing countries, and promote new investment to increase sustainable agricultural production and productivity, reduce poverty and work towards achieving food security and access to food for all	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals. FAO_1996_World Food Summit Plan of Action. FAO_2009_ Declaration of the World Summit on Food Security
GENETIC DIVERSITY		
Objectives	**Means**	**Reference**
By 2020, for sustainable agriculture and food security: maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including	1 Each Contracting Party shall, subject to national legislation, and in cooperation with other Contracting Parties where appropriate, promote an integrated approach to the exploration, conservation and sustainable use of plant genetic resources for food and agriculture 2 The Contracting Parties shall develop and maintain appropriate policy and legal measures that promote the sustainable use of plant genetic resources for food and agriculture	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals. FAO_2009_International Treaty on Plant Genetic Resources for Food and Agriculture

through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed by the CBD	3 Each Contracting Party shall, as appropriate, integrate into its agriculture and rural development policies and programmes, activities referred to in (1) and (2), and cooperate with other Contracting Parties, directly or through FAO and other relevant international organizations, in the conservation and sustainable use of plant genetic resources for food and agriculture 4 The Contracting Parties agree to promote the provision of technical assistance to Contracting Parties, especially those that are developing countries or countries with economies in transition, either bilaterally or through the appropriate international organizations, with the objective of facilitating the implementation of this Treaty 5 The Contracting Parties recognize the enormous contribution that the local and indigenous communities and farmers of all regions of the world, particularly those in the centres of origin and crop diversity, have made and will continue to make for the conservation and development of plant genetic resources which constitute the basis of food and agriculture production throughout the world. Each Contracting Party should, as appropriate, and subject to its national legislation, take measures to protect and promote Farmers' Rights 6 The Contracting Parties agree to establish a multilateral system, which is efficient, effective, and transparent, both to facilitate access to plant genetic resources for food and agriculture, and to share, in a fair and equitable way, the benefits arising from the utilization of these resources, on a complementary and mutually reinforcing basis	
SUSTAINABLE CONSUMPTION AND PRODUCTION **Overarching objectives:** • SDG 12: Ensure sustainable consumption and production patterns		https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals.
SUSTAINABLE PRODUCTION		
Objectives	**Means**	**Reference**
By 2030, achieve the sustainable management and efficient use of natural resources By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production. Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals. http://www.scpclearinghouse.org/.
FOOD WASTE		

Objectives	Means	Reference
By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses		https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals.
CONSUMPTION		
Objectives	**Means**	**Reference**
By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	Promote public procurement practices that are sustainable, in accordance with national policies and priorities Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals.
FOOD MARKET AND TRADE		
Objectives	**Means**	**Reference**
Proper functioning of food commodity markets and their derivatives Limit extreme food price volatility Responsible business conduct (RBC) along agricultural supply chains	Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility (Continuation Rome Declaration): 4. Ensure that food, agricultural trade and overall trade policies are conducive to fostering food security for all through a fair and market-oriented world trade system Guidance to help enterprises observe existing internationally agreed standards of responsible business conduct (RBC) along agricultural supply chains: five-step framework, further elaborated by detailed activities: 1. Establish strong enterprise management systems for responsible agricultural supply chains 2. Identify, assess and prioritize risks in the supply chain 3. Design and implement a strategy to respond to identified risks	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals FAO_1996_World Food Summit Plan of Action. FAO_2009_ Declaration of the World Summit on Food Security OECD FAO_2016_Guidance for responsible agricultural supply (RBC) along agricultural supply chains.

	4. Verify supply chain due diligence 5. Report on supply chain due diligence	
CLIMATE CHANGE MITIGATION AND ADAPTATION **Overarching objectives:** • Resilient agricultural practices that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters • Mitigation in agriculture		**Reference** https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals. FAO_2009_ Declaration of the World Summit on Food Security
Objectives	**Means**	**Reference**
Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality Proactively face the challenges of climate change to food security and the need for adaptation of, and mitigation in, agriculture, and increase the resilience of agricultural producers to climate change, with particular attention to small agricultural producers and vulnerable populations	(Continuation of Rome Declaration): 5. Prevent and be prepared for natural disasters and man-made emergencies and to meet transitory and emergency food requirements in ways that encourage recovery, rehabilitation, development and a capacity to satisfy future needs	https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals FAO_1996_World Food Summit Plan of Action. FAO_2009_ Declaration of the World Summit on Food Security

INTERNATIONAL CLIMATE POLICY	**Reference**
Goals: UNFCCC • To achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner Kyoto Protocol • Setting internationally binding emission reduction targets Paris Agreement • Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels • Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production • Enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change • Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development • Fully realizing technology development and transfer • Accelerating, encouraging and enabling innovation	United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 Paris Agreement on climate change, United Nations, 2015
GHGs EMISSIONS **Overarching objectives:** • Reduce GHGs emissions by 18% below 1990 levels between 2013 and 2020	**Reference** Kyoto Protocol, United Nations, 1997 Doha Amendment to the Kyoto Protocol, United Nations, 2012 http://unfccc.int/focus/overview/items/7879.php

EMISSIONS REDUCTION		
Objectives	**Means**	**Reference**
Achieve GHGs emission reduction according to national targets agreed in the Kyoto Protocol - II commitment period 2013-2020	*Quantified emission limitation and reduction commitment* for each developed country Party. *Rules* for emission accounting, reporting and verification. *International Emission Trading.* IET provides for the transfer of units under the Kyoto Protocol between Annex I Parties with mitigation commitments under the Kyoto Protocol. *Joint Implementation*. JI provides for the identification of projects that reduce or remove emissions in Annex I Parties with commitments under the Kyoto Protocol and the issuance of credits (known as emission reduction units (ERUs)) corresponding to the reductions or removals achieved by such projects.	United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 Doha Amendment to the Kyoto Protocol, United Nations, 2012 Paris Agreement on climate change, United Nations, 2015

	Clean Development Mechanism. The CDM provides for the registration of projects that reduce or remove emissions in non-Annex I Parties and the issuance of credits (known as certified emission reductions (CERs)) corresponding to the reductions or removals achieved by such projects. *International Transaction Log*. The instrument verifies the validity of transactions, including issuance, transfer and acquisition between registries, cancellation, retirement, and (where applicable) carry-over, of the various unit types under the Kyoto Protocol. *Compliance mechanism* to facilitate, promote and enforce compliance with the commitments under the Kyoto Protocol. The Compliance Committee implements the procedures and mechanisms relating to compliance under the Kyoto Protocol. *Nationally appropriate mitigation commitments or actions of developed countries* consisting of economy-wide emission reduction targets with a timeframe of 2020. *Nationally appropriate mitigation actions of developing countries (NAMAs)* including quantified emission reductions below 'business as usual', intensity targets, sectoral policies and programmes, investment projects, and others with a timeframe of 2020. *Registry of NAMAs*. *Forum on the impact of the implementation of response measures* aiming to minimize adverse economic, social and environmental impacts of response measures on other Parties, especially developing country Parties.	http://unfccc.int/focus/overview/items/7879.php
FOREST AND AGRICULTURE IN DEVELOPING COUNTRIES (REDD+)		
Objectives	**Means**	**Reference**
Reduce emissions from deforestation and forest degradation in developing countries Improve conservation, sustainable management of forests in developing countries Enhance forest carbon stocks in developing countries	REDD+ mechanism which includes: - work programme on results-based finance and enhanced support - methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries - REDD Web Platform to make available information relating to support efforts, capacity building, demonstration activities and mobilization of resources.	United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php
FOREST AND AGRICULTURE IN DEVELOPED COUNTRIES (LULUCF)		
Objectives	**Means**	**Reference**
Ensure that greenhouse gas emissions from land use are compensated by an equivalent absorption of CO_2 made possible by additional action in the	*Reporting of the LULUCF sector by Parties included in Annex I to the Convention.* Reporting refers to providing information, including estimates of the changes in carbon stocks and anthropogenic GHGs by sources and removals by sinks from land use, land-use change and forestry activities. *Accounting of LULUCF activities under the Kyoto Protocol.* The Kyoto Protocol restricts the accounting of the LULUCF sector to emissions and removals from specific activities including direct, human-induced,	United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php

land use sector	afforestation, reforestation and deforestation activities, forest land management, cropland management, grazing land management and/or revegetation, wetland drainage and rewetting. Cooperation with other organizations: *The United Nations Forum on Forests (UNFF).* The UNFF is an intergovernmental process with the objective of promoting the management, conservation and sustainable development of all types of forests. It allows forest policy dialogue facilitated by the Intergovernmental Panel on Forests (IPF) and the Intergovernmental Forum on Forests (IFF). *The Collaborative Partnership on Forests (CPF).* The CPF is s an innovative interagency partnership on forests comprising 14 international organizations, institutions and secretariats that have substantial programmes on forests. The mission of the Collaborative Partnership on Forests is to promote sustainable management of all types of forests and to strengthen long-term political commitment to this end.	
FINANCE **Overarching objectives:** • Promote cooperation and ensure that the implementation of the UNFCCC and the actions on climate change by developing countries are supported and enabled through the provision of resources that shall be provided by developed country Parties.		**Reference** United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php
Objectives	**Means**	**Reference**
Provide financial resources to developing country Parties to support the implementation of the UNFCCC	Financial mechanism of the UNFCCC: *Green Climate Fund.* It supports projects, programmes, policies and other activities in developing country Parties using thematic funding windows. *Global Environment Facility.* It is an independently operating financial organization and is one of the operating entities entrusted by the COP with the operation of the financial mechanism in order to finance climate change activities. Other funds under the UNFCCC: *Special Climate Change Fund*. It provides finance to projects on adaptation, technology transfer and capacity building, energy, transport, industry, agriculture, forestry and waste management, and economic diversification *Least Developed Countries Fund.* It support a work programme to assist the LDCs to carry out, inter alia, the preparation and implementation of their NAPAs (national adaptation programmes of action) *Adaptation Fund under the Kyoto Protocol*. It finances adaptation projects and programmes in developing country Parties to the Kyoto Protocol that are particularly vulnerable to the adverse effects of climate change. *Standing Committee on Finance*. It aims at improving coherence and coordination in the delivery of climate change financing, the rationalization of the financial mechanism, mobilization of financial resources, and the measurement, reporting and verification of the support provided to developing	United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php

	country Parties.	
TECHNOLOGY **Overarching objectives:** • Promoting the effective development and transfer of environmentally sound technologies		**Reference** United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php
Objectives	**Means**	**Reference**
Promote, facilitate and finance the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly to developing countries.	Technology mechanism (TM), which includes: *Technology Executive Committee (TEC).* It is the policy component of the TM, providing recommendations on technology development and transfer issues. The TEC also serves to inform Parties and stakeholders by disseminating information via policy briefs, technical papers, a dedicated website and a variety of events. It also engages with relevant stakeholders outside of the Convention to promote coherence and coordination across technology activities. *Climate Technology Centre and Network (CTCN).* It is the implementation component of the TM, facilitating the preparation and implementation of technology projects and strategies in developing countries. *Poznan strategic programme on technology transfer.* Program to scale up the level of investment for technology transfer by providing support for: technology needs assessments; technology transfer pilot projects; and disseminating experience of the Global Environment Facility (GEF) and successfully demonstrated environmentally sound technologies. It is run by the GEF which: provide support for climate technology centres and a climate technology network; pilot priority technology projects to foster innovation and investments; support public-private partnerships for technology transfer; and act as a catalytic supporting institution for technology transfer.	United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php
CAPACITY BUILDING **Overarching objectives:** • Enhancing the ability of individuals, organizations and institutions in developing countries and in countries with economies in transition to identify, plan and implement ways to mitigate and adapt to climate change		**Reference** United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php
Objectives	**Means**	**Reference**
Increase education, training and public awareness about climate change	*Framework for capacity building in developing countries.* It provides a set of principles for and approaches to capacity-building, defines a list of priority areas for action and provides guidance to the Global Environment Facility, bilateral and multilateral agencies and other intergovernmental organizations and institutions on supporting the implementation of this framework. *Framework for capacity building in countries with economies in transition.* It identifies guiding principles, approaches and priority areas for capacity-building and includes guidance on financial and technical support to be provided by Annex II Parties, the Global Environment Facility, bilateral and multilateral agencies, and other intergovernmental organizations and institutions in implementing this framework. *Durban Forum on capacity building.* It is an annual platform that brings together Parties, bodies	United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php

	established under the Convention and its Kyoto Protocol and stakeholders involved in building the capacity of developing countries to mitigate and adapt to climate change with the aim of further enhancing the monitoring and review of the effectiveness of capacity-building; exchanging experiences, good practices and lessons learned; providing an overview of capacity-building elements in the work of bodies established under the Convention and its Kyoto Protocol; and providing inputs to the review of the framework for capacity-building in developing countries. *Doha work programme on article 6 of the UNFCCC.* It is an 8 year program (2012-2020) that recommends concrete actions in relation to climate change education, training, public awareness, public participation, public access to information and international cooperation. *Dialogue on article 6 of the UNFCCC.* It aims to regularly share experiences and exchange ideas, best practices and lessons learned regarding the implementation of climate change education, training, public awareness, public participation, public access to information and international cooperation. The Dialogue has two focal areas: education and training, and public awareness, participation and access to information.	
ADAPTATION **Overarching objectives:** • Adapting to the impacts of climate change		**Reference** United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php
Objectives	**Means**	**Reference**
Improve understanding, modelling and prediction of the climate system and climate change impacts Assess climate change impacts on natural systems and human systems Identify and prioritize urgent and immediate needs with regard to adaptation to the adverse effects of climate change Implement adaptation actions Ensure continuous and flexible adaptation	*Subsidiary Body for Scientific and Technical Advice* (SBSTA) of the UNFCCC *Global observation systems*: - Global Ocean Observing System - Global Terrestrial Observing System - Global Climate Observing System *Cancun Adaptation Framework* including: - National Adaptation Plans process. It enables Parties to formulate and implement National Adaptation Plans (NAPs) as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs. It is a continuous, progressive and iterative process which follows a country-driven, gender-sensitive, participatory and fully transparent approach. - Warsaw international mechanisms for loss and damage. It aims to address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change - The adaptation committee. Its objective is to promote the implementation of enhanced action on adaptation in a coherent manner under the Convention. *Nairobi Work Programme (NWP)* assisting all Parties to: improve their understanding and assessment of impacts, vulnerability and adaptation to climate change; and make informed decisions on practical	United Nations Framework Convention on Climate Change (UNFCCC), 1992 Kyoto Protocol, United Nations, 1997 http://unfccc.int/focus/overview/items/7879.php

process, including feedback through monitoring and evaluation Ensure effective engagement of stakeholders Ensure effective management of knowledge for adaptation	adaptation actions and measures. Its work has been defined around nine work areas. The NWP plays a key role in engaging a wide spectrum of stakeholders and catalysing targeted actions ranging from raising awareness on the need for adaptation, developing global public good such as climate and weather indices, to organization of thematic training sessions and learning events. *The Least Developed Countries (LDC) Work Programme*. It aims to build and strengthen the capacity of LDCs to address adverse effects of climate change given their specific needs and special circumstances. The activities under the work programme are structured around six elements: preparation of guiding materials; training workshops; monitoring of progress; outreach through various channels; side events; and the mobilization of the GEF and its agencies and other organizations to support the LDCs. *Least Developed Countries Working Group (LEG).* It provides technical support and advice to the LDCs. Its work is structured around seven objectives: providing technical guidance and advice on the NAP process; supporting implementation of NAPAs; supporting and guiding the integration of gender and other considerations regarding vulnerable communities within the LDCs; supporting the implementation of the LDC work programme; providing support to LDC Parties for the preparation, revision and updating of their NAPAs; conducting outreach in relation to the NAPA process and the work of the LEG; supporting the coherence and synergy of adaptation work under the Convention. *National Adaptation Programmes of Action (NAPAs).* NAPAs provide means for LDCs to identify and implement urgent and immediate needs with respect to the adverse effects of climate change.	

Inventory of policy goals and means in the WLEFC nexus – EUROPEAN POLICIES

EUROPEAN WATER POLICY **Goals:** • Maintaining and improving the aquatic environment (essentially water quality) which includes inland surface waters, transitional waters, coastal waters and groundwater • A sufficient quantity of good quality water is available for people's needs, the economy and the environment throughout the EU • Sustainable, balanced and equitable water use based on long-term protection of available water resources • Address water scarcity and droughts in EU • Disaster and imminent disaster prevention, preparedness and response, inside and outside EU	**Reference** Directive 2000/60/EC of 23 October 2000 establishing a framework for community action in the field of water policy Directive 2006/118 EC of 12 December 2006 on the protection of groundwater against pollution and deterioration Council Directive of 21 May 1991 concerning urban waste water treatment (91/271/EEC) EC_2012_Blueprint to safeguard EU water resources EC_2015_Closing the loop an EU action plan for the circular economy Addressing the challenge of water scarcity and droughts in the European Union (SEC(2007)/993; SEC(2007)/996) Action Plan on the Sendai Framework for Disaster Risk Reduction 2015-2030: A disaster risk-informed approach for all EU policies Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism
WATER QUALITY **Overarching objectives:** • Maintain and improve the aquatic environment which includes inland surface waters, transitional waters, coastal waters and groundwater	**Reference** Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy

WATER STATUS		
Objectives	**Means**	**Reference**
At least good water status for each river basin and good groundwater status by 2015 (final deadline 2027) Prevent further deterioration, protect and enhance the status of aquatic ecosystems and water needs of terrestrial ecosystems and wetlands Achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic	<u>Water framework directive</u> MS should: - Establish common definitions of the status of water in terms of quality and, where relevant for the purpose of the environmental protection, quantity - Define and implement the necessary measures within integrated programmes to achieve the objective of at least good water status for each river basin - Set overall principles for control on abstraction and impoundment in order to ensure environmental sustainability MS shall: - Protect, enhance and restore all bodies of surface water to achieve good surface water status in 2015 - Protect and enhance all artificial and heavily modified bodies of water to achieve good ecological potential and good surface water chemical status by 2015 - Implement the necessary measures with the aim of progressively reducing pollution from	Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy EC_2012_Blueprint to safeguard EU water resources

substances	priority substances - Identify and establish river basin districts, and competent authority for the district - Ensure coordination of measures within the river basin either using existing structures or new one - Implement a programme of measures to prevent deterioration of the status of all bodies of surface water - Conduct economic analysis of water services based on long-term forecasts of supply and demand for water in the river basin district - Establish monitoring of water status on a systematic and comparable basis throughout the Community; - Conduct analyses of the characteristics of a river basin and the impacts of human activity - Conduct economic analysis of water uses - Achieve compliance with any standards and objectives for marine protected areas by 2015 MS may use economic instruments in the program of measures <u>Blueprint to safeguard EU water resources</u> - Evaluate existing policy and gather existing measures that could be leveraged	
EMISSIONS INTO SURFACE WATER AND GROUNDWATER		
Objectives	**Means**	**Reference**
Progressive reduction of discharges, emissions and losses of priority substances and the cessation of discharges, emissions and losses of the priority hazardous substances Progressive reduction of pollution of groundwater and prevent further pollution Protect the environment from the adverse effects of discharge of urban waste water and waste water from certain industrial sectors	<u>Water framework directive</u> - MS shall implement the necessary measures: with the aim of progressively reducing pollution from priority substances - Necessary to prevent or limit the input of pollutants into groundwater and to prevent the deterioration of the status of all bodies of groundwater and necessary to reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity to reduce pollution of groundwater - Establish common environmental quality standards and emission limit values for certain groups or families of pollutants - The EC shall provide a list of priority substances and priority hazardous substances <u>Groundwater directive:</u> - Criteria for the assessment of good groundwater chemical status and for upward trends and trend reversal, standards and threshold values <u>Urban waste water directive:</u> MSs shall ensure that: - All agglomerations are provided with collecting systems for urban waste water - Urban waste water entering collecting systems shall before discharge be subject to secondary treatment or an equivalent treatment	Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy. Directive 2006/118 EC of 12 December 2006 on the protection of groundwater against pollution and deterioration. Council Directive of 21 May 1991 concerning urban waste water treatment (91/271/EEC). EC_2015_Closing the loop an EU action plan for the circular economy

	- The identification of sensitive areas is reviewed at intervals of no more than four years Where waters within the area of jurisdiction of a Member State are adversely affected by discharges of urban waste water from another Member State, the Member State whose waters are affected may notify the other Member State and the Commission of the relevant facts Treated waste water shall be reused whenever appropriate. Disposal routes shall minimize the adverse effects on the environment Sludge arising from waste water treatment shall be re-used whenever appropriate Quantified limits for nutrients and chemicals	
INTERNATIONAL AGREEMENTS AND PROTECTED AREAS		
Objectives	**Means**	**Reference**
Achieve objectives of international agreements, including those which aim to prevent and eliminate pollution of the marine environment Protection of territorial and marine waters MS shall achieve compliance with any standards and objectives for protected areas by 2015	See above	Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy
WATER QUANTITY **Overarching objectives:** • A sufficient quantity of good quality water is available for people's needs, the economy and the environment throughout the EU		EC_2012_Blueprint to safeguard EU water resources
SAFEGUARD WATER RESOURCES		
Objectives	**Means**	**Reference**
Control quantity to secure good water quality Tackle the obstacles which hamper action to safeguard Europe's water resources	MS shall conduct economic analysis of water services based on long-term forecasts of supply and demand for water in the river basin district Evaluate existing policy and gather existing measures that could be leveraged	Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy. EC_2012_Blueprint to safeguard EU water resources.
GROUNDWATER QUANTITY		
Objectives	**Means**	**Reference**

Good groundwater status by 2015 (final deadline 2027)	MS shall protect, enhance and restore all bodies of groundwater, ensure a balance between abstraction and recharge of groundwater.	Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy.
WATER SCARCITY		
Objectives	**Means**	**Reference**
Address and mitigate water scarcity and drought with policy options at European, national and regional levels	Putting the right price tag on water Improving land use planning Financing water efficiency Developing drought risk management plans Developing an observatory and an early warning system on droughts Further optimising the use of the EU Solidarity Fund and European Mechanism for Civil Protection Considering additional water supply infrastructures Fostering water efficient technologies and practices Fostering the emergence of a water-saving culture in Europe A water scarcity and drought information system in Europe Research and technological development	EC_2007_COM: Addressing the challenge of water scarcity and droughts in the European Union (SEC(2007)/993; SEC(2007)/996)
WATER USE **Overarching objectives:** • Sustainable, balanced and equitable water use based on long-term protection of available water resources.		**Reference** EC_2015_Closing the loop an EU action plan for the circular economy
WATER EFFICIENCY AND RE-USE		
Objectives	**Means**	**Reference**
Safe and cost-effective water reuse, e.g. treated wastewater Water efficiency	Water efficiency measures and reuse of treated wastewater Promotion of safe and cost-effective water reuse, including guidance on the integration of water reuse in water planning and management Inclusion of best practices in relevant BREFs Support to innovation (through the European Innovation Partnership and Horizon 2020) and investments (2016-2017) Legislative proposal on minimum quality standards for reuse in agricultural irrigation and aquifer recharge	EC_2015_Closing the loop an EU action plan for the circular economy EC_2012_Blueprint to safeguard EU water resources
FLOOD RISK **Overarching objectives:** • Flood disaster and imminent disaster prevention, preparedness and response, inside and outside EU		**Reference** EC_2016_Action Plan on the Sendai Framework for Disaster Risk Reduction 2015-2030: A disaster risk-informed approach for all EU policies EU_2013_Decision No 1313/2013/EU of the

		European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism
FLOOD RISKS MANAGEMENT		
Objectives	**Means**	**Reference**
Address flood risks and consequences of floods in EU: prevention, preparedness and reduction of adverse consequences for human health, the environment, cultural heritage and economic activity associated. *Policy context is overall disaster risk reduction framework:* Prevent new and reduce existing disaster risks, through an all-of-society and all-hazards risk approach across economic, social, and environmental policy areas, with a view to reduce vulnerability and increase resilience Further enhance and promote disaster risk management and its integration in EU policies Cover primarily people, but also the environment and property, including cultural heritage, against all kinds of natural and man-made disasters, including environmental disasters, marine pollution and acute health emergencies, occurring inside or outside the Union. Improve effectiveness of systems for preventing, preparing for and responding to natural and man-made disaster.	<u>Action Plan on the Sendai Framework for disaster risk reduction</u> - Understanding disaster risk - Strengthening disaster risk governance to manage disaster risk - Investing in disaster risk reduction for resilience - Enhancing disaster preparedness for effective response and Build Back Better <u>EU council decision on a Union Civic Protection Mechanism</u> - Promote solidarity and support, complement, and facilitate the coordination of MS' actions in the field of civil protection <u>Flood directive</u> - Maps showing at risk areas and history of flooding in each region - Assessment of adverse consequences for human health - Exchange information between States - Each state should produce flood risk and flood hazard maps, for flood of low, medium and high probability of occurrence, and to include extent and depth, and the number of people affected - Flood risk management plans are to be defined and drawn up - Where appropriate, coastal and groundwater flood risks should be accounted for.	EC_2016_Action Plan on the Sendai Framework for Disaster Risk Reduction 2015-2030: A disaster risk-informed approach for all EU policies EU_2013_Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism Directive 2007/60/EC of 23 October 2007 on the assessment and management of flood risks

EUROPEAN LAND USE POLICY **Goals:** • Sustainable land use		**Reference**
FOREST **Overarching objectives:** • Promote sustainable forest management		**Reference** EC_2013_EU Forestry Strategy EC_2003_Forest law enforcement governance and trade action plan
ILLEGAL TIMBER LOGGING		
Objectives	**Means**	**Reference**
Reduce consumption of illegally harvested timber in the EU (and ultimately major consumer markets elsewhere in the world)	EU Action Plan for Forest Law Enforcement, Governance and Trade: - Efforts to develop multilateral collaboration to combat the trade in illegally harvested timber - Voluntary measures to support governments wanting to ensure that illegally harvested timber from their territory is not admitted to the EU market - Public procurement policy - Private sector initiatives - Measures to avoid investment in activities which encourage illegal logging, and conflict timber	EC_2003_Forest law enforcement governance and trade action plan
USE OF FOREST		
Objectives	**Means**	**Reference**
Sustainable forest management and the multifunctional role of forests, delivering multiple goods and services in a balanced way and ensuring forest protection Resource efficiency, optimizing contribution of forests and the forest sector to rural development, growth and job creation Global forest responsibility, promoting sustainable production and consumption of forest products Balanced forest	Member States should make use of rural development funds to improve competitiveness, promote the diversification of economic activity and quality-of-life, and deliver specific environmental public goods The Commission and the Member States should assess and improve the effect of forestry measures under rural development policy With the help of rural development funding, MSs are encouraged to support Forest Advisory Systems for awareness-raising; training; and communication between local forest holders and authorities The Commission will, together with MSs and stakeholders: - Explore and promote the use of wood as a sustainable, renewable, climate and environment friendly raw material more fully without damaging the forests and their ecosystem services - Assess the climate benefits of material and energy substitution by forest biomass and harvested wood products and the effect of incentives for using forest biomass in creating market distortions - Assess potential wood supply and facilitating increased sustainable wood mobilisation - Develop good-practice guidance for this and for the “cascade” principle, as well as on resource- and energy-efficient manufacturing processes, especially for Forest-based Industries, SMEs and micro-firms - Stimulate market growth and internationalisation of EU Forest-based Industry products and improve sectorial knowledge, including on sustainable construction and consumer information on furniture; - Facilitate access to third markets for EU Forest-based Industry products and raw materials via bilateral trade agreements, and by improving information on import conditions and raw material exports;	EC_2013_EU Forestry Strategy

functions, meeting demands and delivering vital ecosystem services Forestry and whole forest-based value chain to be competitive and viable contributors to bio-based economy	- Support the Forest-based Sector Technology Platform and encourage new initiatives, such as private-public partnerships, e.g. in the bio-based sector, which foster research and innovation for various resource- and energy-efficient products and processes Member States will develop a conceptual framework for valuing ecosystem services by 2020. They will build on the Mapping and Assessment of the state of Ecosystems and of their Services The Commission and the MSs will: - set up of the Forest Information System of Europe - promote the further development of the EU database of forest reproductive material, including hyperlinks to national registers and maps The Commission will develop several modules, e.g. on forests and natural disturbances like fires and pests, forest and the bio–economy, forests and climate change and forest and ecosystem services that could contribute to the EU's forestry statistics and Integrated Environmental and Economic Accounting for Forests The Commission will assist Member States and stakeholders in transferring technological and scientific knowledge to forest practice and the market	
SOIL **Overarching objectives:** • Protection and sustainable use of soil		**Reference** EU_2005_Protocol on the implementation of the Alpine Convention of 1991 in the field of soil conservation
SOIL DAMAGE		
Objectives	**Means**	**Reference**
Reduce quantitative and qualitative soil damage	Applying agricultural and forestry methods which do not harm the soil Minimum interference with soil and land Control of erosion Restriction of soil sealing Designation of protected areas Economical and prudent use of soils Economical use and prudent extraction of mineral resources Conservation of soils in wetlands and moors Designation and management of endangered areas Designation and management of Alpine areas threatened by erosion Practices in agriculture, pasture farming and forestry Silvicultural and other measures Measures for effects of tourism infrastructures	EU_2005_Protocol on the implementation of the Alpine Convention of 1991 in the field of soil conservation

	Limiting inputs of harmful substances - Minimising the use of gritting salt - Avoiding soil contamination and ensuring the environmentally compatible pretreatment, treatment and disposal of waste and residual materials, waste management concepts shall be drawn up and implemented.	
SOIL PROTECTION		
Objectives	**Means**	**Reference**
Preventing further soil degradation and preserving its functions Restoring degraded soils to a level of functionality consistent at least with current and intended use, thus also considering the cost implications of the restoration of soil Achieving more rational use of soil	For erosion, organic matter decline, salinization, compaction and landslides, MS shall identify risk areas, set risk reduction targets and establish programmes of measures For management of contamination, MS shall identify contaminated sites on their territory and establish a national remediation strategy; take appropriate measures to limit sealing by rehabilitating brownfield sites and to mitigate its effects by using construction techniques that allow as many soil functions as possible; fostering initiatives for public awareness raising	EC_2006_Thematic Strategy for Soil Protection
LAND-USE CHANGE See EU energy policy – biofuels		

EUROPEAN ENERGY POLICY **Goals:** • Developing a secure, competitive and decarbonised energy system by 2050 • Achieving an energy efficient Europe • Building a truly pan-European integrated energy market • Empowering consumers and achieving the highest level of safety and security • Extending Europe's leadership in energy technology and innovation • Strengthening the external dimension of the EU energy market	**Reference** Energy 2020 A strategy for competitive, sustainable and secure energy [COM(2010) 639] A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15] Energy Roadmap 2050 [COM(2011) 885] A roadmap for moving to a competitive low carbon economy in 2050 [COM(2011)112]
SUSTAINABLE AND RENEWABLE SOURCES OF ENERGY **Overarching objectives:** • Increase the share of renewable energy in the EU energy mix • Produce, promote and use energy from biofuel • Increase the development of biomass energy from wood, wastes and agricultural crops • Promote biomass use in heating, electricity and transport	**Reference** Energy 2020 A strategy for competitive, sustainable and secure energy [COM(2010) 639] A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15] Energy Roadmap 2050 [COM(2011) 885] A roadmap for moving to a competitive low carbon economy in 2050 [COM(2011)112]

GENERAL PROVISIONS

Objectives	**Means**	**Reference**
Reach a 20% share of energy from renewable sources in the EU by 2020 Achieve national renewable energy targets in MSs by 2020	A common EU policy framework for the production, promotion and use of energy from renewable sources (renewable energy directive) Binding national renewable energy targets in MSs to be achieved by 2020 National renewable energy action plans set out by MSs to meet national renewable energy targets and the general course of their renewable energy policy. National support schemes: any instrument, scheme or mechanism applied by a Member State or a group of Member States, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased. This includes, but is not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and premium payments When it is not possible for energy producers fully to ensure transmission and distribution of electricity produced from renewable energy sources without affecting the reliability or safety of the grid system, financial compensation may be given to those energy producers.	Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

	Promotion of cooperation among MSs, which takes the form of: - statistical transfers of renewable energy among MSs - joint renewable energy projects among MSs - joint renewable energy support schemes among MSs Incentives for the use of energy from renewable sources in transport Investment in new renewable technologies such as ocean energy, concentrated solar power	
Reach at least a 27% share of renewable energy consumption in the EU by 2030 Address investment uncertainty Ensure cost-effective deployment and market integration of renewable electricity Develop renewable energy potential in the heating and cooling sector Achieving global leadership in renewable energies	Investment in new renewable technologies such as ocean energy, concentrated solar power Proposal for a revision of the renewable energy directive which includes: - MSs' respective contributions to the 2030 target shall be set and notified to the Commission as part of their Integrated National Energy and Climate Plans - The Commission shall support the high ambition of MSs through an enabling framework comprising the enhanced use of Union funds, in particular financial instruments, especially in view of reducing the cost of capital for renewable energy projects - Financial support for electricity from renewable sources through national support schemes - Opening of support schemes for renewable electricity to generators located in other Member States - MSs shall ensure that investors have sufficient predictability of the planned support for energy from renewable sources. - MSs shall ensure that their competent authorities at national, regional and local level include provisions for the integration and deployment of renewable energy and the use of unavoidable waste heat or cold when planning, designing, building and renovating urban infrastructure, industrial or residential areas and energy infrastructure, including electricity, district heating and cooling, natural gas and alternative fuel networks. - MSs shall introduce in their building regulations and codes appropriate measures in order to increase the share of all kinds of energy from renewable sources in the building sector. - With respect to their building regulations and codes, Member States shall promote the use of renewable energy heating and cooling systems and equipment that achieve a significant reduction of energy consumption. Member States shall use energy or eco-labels or other appropriate certificates or standards developed at national or Union level, where these exist, as the basis for encouraging such systems and equipment. - MSs shall carry out an assessment of their potential of renewable energy sources and of the use of waste heat and cold for heating and cooling. - Member States shall remove administrative barriers to corporate long-term power purchase agreements to finance renewables and facilitate their uptake. - MSs shall ensure that renewable energy communities are entitled to generate, consume, store and sell renewable energy, including through power purchase agreements, without being subject to	A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15] Proposal for a directive on the promotion of the use of energy from renewable sources (recast) [COM(2016)767] Clean energy for all Europeans [COM(2016)860]

	disproportionate procedures and charges that are not cost-reflective. - In order to facilitate the penetration of renewable energy in the heating and cooling sector, each Member State shall endeavour to increase the share of renewable energy supplied for heating and cooling by at least 1 percentage point (pp) every year Achieving global leadership in renewable energies by: - Allowing a level playing field for all technologies without jeopardizing climate and energy targets - Adapting the market rules to manage variability and ensure security of electricity supply - Rewarding flexibility in the market both for generation, demand or storage - Keeping priority dispatch for existing installations, small-scale renewable installations, demonstration projects - Investing in a well-interconnected European network - Using the potential of heating and cooling to contribute to the overall renewables target - Encouraging development of advanced alternative fuels for transport - Ensuring climate benefits in the long term by limiting additional pressure on forests - Promote synergies between the circular economy and various biomass uses - Continue to support sustainable forest management	
BIOFUELS		
Objectives	**Means**	**Reference**
To have 10% of the transport fuel of every EU country come from renewable sources by 2020 Reduce indirect land use change for biofuels and bioliquids Ensure sustainable supply of biofuels Standardize biofuels and biofuel blends quality for vehicle engines Construct and make operational a first set of biofuels production	Sustainability criteria for biofuels and bioliquids. The main criteria: - To be considered sustainable, biofuels must achieve greenhouse gas savings of at least 35% in comparison to fossil fuels. This savings requirement rises to 50% in 2017. In 2018, it rises again to 60% but only for new production plants. All life cycle emissions are taken into account when calculating greenhouse gas savings. This includes emissions from cultivation, processing, and transport. - Biofuels cannot be grown in areas converted from land with previously high carbon stock such as wetlands or forests. - Biofuels cannot be produced from raw materials obtained from land with high biodiversity such as primary forests or highly biodiverse grasslands. Voluntary schemes for proving compliance of biofuels with sustainability criteria (compliance to sustainability criteria is needed to receive public support or count towards mandatory national renewable energy targets). They check that biofuel production did not take place on land with high biodiversity, that land with high carbon stock was not converted for biofuel production, and that the production of biofuels leads to a sufficient level of greenhouse gas emissions savings. Several schemes also take into account additional sustainability aspects such as soil, water, air protection and social criteria. For the purpose of certification, the whole production chain from the farmer growing the feedstock up to the biofuel producer or trader is checked by independent auditors.	Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC Commission Communication of 8 February 2006 'An EU Strategy for Biofuels' (COM(2006) 34 final) Directive 2009/30/EC of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC Communication from the Commission on voluntary schemes and default values in the EU biofuels and bioliquids sustainability scheme (2010/C 160/01)

plants by 2015 or 2016 and a second set by 2020 Get the aviation industry to use 2 million tonnes of biofuels by 2020	Limit indirect land-use change by means of: - Limits to the share of biofuels from crops grown on agricultural land that can be counted towards the 2020 renewable energy targets to 7% - an indicative 0.5% target for advanced biofuels as a reference for national targets which will be set by EU countries in 2017 - harmonization of the list of feedstocks for biofuels across the EU whose contribution would count double towards the 2020 target of 10% for renewable energy in transport - requirement that biofuels produced in new installations emit at least 60% fewer greenhouse gases than fossil fuels - introduction of stronger incentives for the use of renewable electricity in transport (by counting it more towards the 2020 target of 10% for renewable energy use in transport) - inclusion of a number of additional reporting obligations for the fuel providers, EU countries and the European Commission European Advanced Biofuel Flightpath Initiative to finance the construction of advanced biofuel production plants. Investment in second and third generation biofuels	https://ec.europa.eu/energy/node/76 Directive to reduce indirect land use change for biofuels and bioliquids ((EU)2015/1513)
The contribution from biofuels and bioliquids, as well as from biomass fuels consumed in transport, if produced from food or feed crops, shall be no more than 7% of final consumption of energy in road and rail transport in that MSs. This limit shall be reduced to 3,8% in 2030 Develop the decarbonisation potential of advanced biofuels and clarify role of food-based biofuels post 2020	With effect from 1 January 2021, MSs shall require fuel suppliers to include a minimum share of energy from advanced biofuels and other biofuels and biogas produced from feedstock, from renewable liquid and gaseous transport fuels of non-biological origin, from waste-based fossil fuels and from renewable electricity in the total amount of transport fuels they supply for consumption or use on the market in the course of a calendar year. The minimum share shall be at least equal to 1.5% in 2021, increasing up to at least 6.8% in 2030. Within this total share, the contribution of advanced biofuels and biogas produced from feedstock listed in part A of Annex IX shall be at least 0.5% of the transport fuels supplied for consumption or use on the market as of 1 January 2021, increasing up to at least 3.6% by 2030. The greenhouse gas emission savings from the use of advanced biofuels and other biofuels and biogas produced from feedstock shall be at least 70% as of 1 January 2021.	Proposal for a directive on the promotion of the use of energy from renewable sources (recast) [COM(2016)767]
BIOMASS		
Objectives	**Means**	**Reference**

Create market-based incentives to biomass use Remove barriers to the development of the biomass market Ensure sustainable supply of biomass	EU biomass action plan EU and national biomass action plans Sustainability criteria for biomass (non-binding). These are meant to apply to energy installations of at least 1MW thermal heat or electrical power. They: - forbid the use of biomass from land converted from forest, and other high carbon stock areas, as well as highly biodiverse areas - ensure that biofuels emit at least 35% less greenhouse gases over their lifecycle (cultivation, processing, transport, etc.) when compared to fossil fuels. For new installations this amount rises to 50% in 2017 and 60% in 2018 - favour national biofuels support schemes for highly efficient installations - encourage the monitoring of the origin of all biomass consumed in the EU to ensure their sustainability Member States shall, where relevant, take steps with a view to developing a district heating infrastructure to accommodate the development of heating and cooling production from large biomass, solar and geothermal facilities.	Commission Communication of 7 December 2005 on A biomass action plan (COM(2005) 628) Report on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling (COM/2010/11) Proposal for a directive on the promotion of the use of energy from renewable sources (recast) [COM(2016)767]
ENERGY EFFICIENCY **Overarching objectives:** • Achieving an energy efficient Europe • Achieve a decarbonized energy building stock by 2050 • Improve energy performance of buildings • Promote co-generation of heat and power • Improve environmental performance of energy related products • Improve energy end–users awareness on energy consumption		**Reference** Energy 2020 A strategy for competitive, sustainable and secure energy [COM(2010) 639] A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15] Energy Roadmap 2050 [COM(2011) 885] A roadmap for moving to a competitive low carbon economy in 2050 [COM(2011)112]
GENERAL PROVISIONS		
Objectives	**Means**	**Reference**
Increase energy efficiency by 20% by 2020 in EU Energy distributors, retail energy sales companies and MSs have to achieve 1.5% energy savings per year	Indicative national energy efficiency targets in MSs Energy efficiency directive establishing a framework and obligations for MSs including: - An annual reduction of 1.5% in national energy sales - National energy efficiency action plans every three years and annual reports - Energy Efficiency Obligation Scheme - The public sector in EU countries should purchase energy efficient buildings, products and services - Energy consumers should be empowered to better manage consumption. This includes easy and free access to data on consumption through individual metering. Install close to 200 million smart meters	Energy 2020 A strategy for competitive, sustainable and secure energy [COM(2010) 639] Directive 2012/27/EU of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Energy Efficiency Plan 2011 Energy Efficiency and its contribution to energy

	for electricity and 45 million for gas by 2020 - National incentives for SMEs to undergo energy audits - Large companies will make audits of their energy consumption to help them identify ways to reduce it - Monitoring efficiency levels in new energy generation capacities - EU guidelines on good practice in energy efficiency Financial instruments to leverage private sector investment in energy efficient equipment and technology, the delivery of affordable, innovative energy efficient products as well a new business models for such delivery: - Horizon 2020 - Project Development Assistance (PDA) - European Energy Efficiency Fund (EEE F) - Private Financing for Energy Efficiency instrument (PF4EE) - European Structural & Investment Funds (ESIF) - Energy Efficiency Financial Institutions Group (EEFIG) - Investor Confidence Project - Europe Incentives for the use of energy efficiency technologies Incentives for improving the efficiency of heating systems, installing double glazed windows or insulating roofs	security and the 2030 Framework for climate and energy policy
Increase energy efficiency of at least 27% by 2030 in EU, to be reviewed by 2020 with the potential to raise the target to 30% by 2030	Proposal for a revision of the energy efficiency directive extending the energy savings requirement to 2030 and establishing that: - MSs shall set an indicative national energy efficiency target for 2020, and an indicative national energy efficiency contributions towards the Union's 2030 target - MSs shall put in place measurement, control and verification system under which documented audits are carried out on a statistically significant proportion and representative sample of the energy efficiency improvement measures put in place by the obligated parties - MSs shall ensure that, in so far as it is technically possible, financially reasonable and proportionate in relation to the potential energy savings, final customers for natural gas are provided with competitively priced individual meters that accurately reflect the final customer's actual energy consumption and that provide information on actual time of use. - MSs shall ensure that final customers for district heating, district cooling and domestic hot water are provided with competitively priced meters that accurately reflect the final customer’s actual energy consumption. As of 1 January 2020 meters and cost allocators installed shall be remotely readable devices.	A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15] Proposal for a directive amending Directive 2012/27/EU on energy efficiency [COM(2016) 761] Clean energy for all Europeans [COM(2016)860]
BUILDINGS		

Objectives	Means	Reference
By 2020, all new buildings are nearly zero-energy buildings By 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings Improve efficiency of heating and cooling systems in buildings and industry	Energy efficiency standards. These include standards on the calculation of delivered energy, energy needs, energy costs, and inspections MSs should apply a common general framework for a methodology for calculating the integrated energy performance of buildings and building units; MSs should provide: national plans for increasing the number of nearly zero-energy buildings; energy certification of buildings or building units; regular inspection of heating and air-conditioning systems in buildings; and independent control systems for energy performance certificates and inspection reports. MSs shall take the necessary measures to ensure that new buildings meet the minimum energy performance requirements set in accordance with the directive MSs shall take the necessary measures to ensure that when buildings undergo major renovation, the energy performance of the building or the renovated part thereof is upgraded in order to meet minimum energy performance requirements EU countries have to make energy efficient renovations to at least 3% of buildings owned and occupied by central governments per year Rules on energy performance of buildings, including: - Member States shall lay down the necessary measures to establish a system of certification of the energy performance of buildings. - Energy performance certificates are to be included in all advertisements for the sale or rental of buildings - EU countries must establish inspection schemes for heating and air conditioning systems or put in place measures with equivalent effect - EU countries must set minimum energy performance requirements for new buildings, for the major renovation of buildings, and for the replacement or retrofit of building elements (heating and cooling systems, roofs, walls and so on) - EU countries must draw up lists of national financial measures to improve the energy efficiency of buildings - EU governments should only purchase buildings which are highly energy efficient - EU countries must draw-up long-term national building renovation strategies which can be included in their National Energy Efficiency Action Plans EU strategy on heating and cooling including (proposal): - Automation and control in buildings - Eco-design and energy labelling requirements for space and water heaters - Incentives on non-fossil fuel based heating and cooling technologies The Commission invites MSs:	Directive 2010/31/EU on the Energy Performance of Buildings Directive 2012/27/EU of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC An EU Strategy on Heating and Cooling [COM(2016)51] Energy Efficiency Plan 2011 [COM(2011)109] Directive 2010/30/EU on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products

	- To review their property laws to address how to share gains from energy improvements in private rented properties between landlords and tenants, and how to share benefits and costs among residents of multi-apartment buildings - To work with stakeholders to raise consumer awareness of household energy efficiency aspects - To support local and regional actors who can improve the bankability of investments through 'bundling' individual projects into bigger investment packages The Commission will examine: - Developing a toolbox of measures to facilitate renovation in multi-apartment buildings - Promoting proven energy efficiency models for publicly owned educational buildings and hospitals - Using inspections of boilers to provide information on the efficiency of existing heating and cooling systems - Facilitating the market uptake of voluntary certification schemes for non-residential buildings Commission will look into: - Strengthened feedback to consumers through advanced metering and billing - Making advanced tools for metering, control and automation based on real time information standard requirements for service sector buildings - Empowering consumers to participate in demand response, thus saving them money	
Reduce the energy needed to meet the energy demand associated with the typical use of buildings Accelerate cost-effective renovation of existing buildings	Proposal for a revision of the building efficiency directive. The proposed directive: - encourages the use of ICT and smart technologies to ensure buildings operate efficiently over time - sets clear requirements for feasibility studies before buildings are commissioned - streamlines provisions on inspections of heating systems and air-conditioning systems, while enhancing the use of building automation and control to ensure continuous buildings' performance - introduces building automation and control systems as an alternative to physical inspections, encourages the roll-out of the required infrastructure for e-mobility (with a focus on large commercial buildings and excluding public buildings and SMEs), and introduces a smartness indicator to assess the technological readiness of the building to interact with their occupants and the grid and to manage themselves efficiently. *Smart Finance for Smart Buildings investment initiative*. It will contribute to mobilise and unlock private investments in a larger scale. Relying on the Investment Plan for Europe, including the European Fund for Strategic Investments and the European Structural Investment Funds, this initiative will support the effective use of public funds, support promoters and investors to bring good ideas to maturity with more project development assistance and project aggregation mechanisms. In their long-term renovation strategy Member States shall set out a roadmap with clear milestones and measures to deliver on the long-term 2050 goal to decarbonise their national building stock, with specific	Proposal for a directive amending Directive 2012/27/EU on energy efficiency [COM(2016)761]

	milestones for 2030. In addition, the long term renovation strategy shall contribute to the alleviation of energy poverty. Member States shall ensure that in all new non-residential buildings and in all existing non-residential buildings undergoing major renovation with more than ten parking spaces, at least one of every ten is equipped with a recharging point within the meaning of Directive 2014/94/EU on the deployment of alternative fuels infrastructure Member States shall ensure that, when a technical building system is installed, replaced or upgraded, the overall energy performance of the complete altered system is assessed, documented it and passed on to the building owner	
CO-GENERATION		
Objectives	**Means**	**Reference**
Facilitate the installation and operation of electrical co-generation plants	EU countries must ensure that a cost-benefit analysis is conducted of the potential for using cogeneration when they plan to build or substantially refurbish: - a heat or electrical installation with a total thermal input exceeding 20MW - an industrial installation generating waste heat with a total thermal input exceeding 20MW - a district heating and cooling network exceeding a total thermal input of 20MW. In this case, the intention is to see if it is cost-effective to utilise waste heat from nearby industry MSs carried out a comprehensive assessment of the national potential of cogeneration and district heating and cooling EU countries are required to publish national reports on cogeneration every four years	Directive 2004/8/EC on the promotion of cogeneration based on a useful head demand in the internal energy market Directive 2012/27/EU of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
PRODUCTS AND SERVICES		
Objectives	**Means**	**Reference**
Achieve minimum energy saving in MSs Increase efficiency in public procurement Increase efficiency in energy services Increase energy savings in products and services Promotes a transition towards a more circular economy in the EU	Framework for energy end-use efficiency and energy services including: obligations on national public authorities on energy savings and efficient procurement; measures to promote energy efficiency and energy services (public procurement) Minimum energy efficiency standards and labelling for a variety of energy using products (EUPs) and other energy related products (ERPs) such as boilers, household appliances, lighting and televisions (Ecodesign directive) Ecodesign Working Plan 2016-2019: - Harmonised standards supporting Ecodesign Regulations is available at the Europa website; - Ecodesign measure for air heating and cooling products; - Ecodesign and an energy labelling measure on verification tolerances to improve product testing and reduce the scope for cheating; - Recommendation for self-regulation providing guidance to support industry in the pursuit of voluntary	Public Procurement for a better Environment [COM(2008)400] Ecodesign Working Plan 2016-2019 [COM(2016)773] Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-ralated products Directive 2010/30/EU on the indication by labelling and standard product information of the consumption of energy and other resources by energy-ralted products

through a series of measures covering the whole lifecycle of products and materials	agreements as an alternative to regulation; - List of energy-related product groups considered priorities for the undertaking of preparatory studies and eventual adoption of implementing measures; Rules for energy labelling: framework for the harmonisation of national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during use, and supplementary information concerning energy-related products	
INTERNAL MARKET AND COMPETITIVENESS **Overarching objectives:** • Building a truly pan-European integrated energy market • Ensuring competition in integrated markets • Improve and expand electricity grid • Develop energy infrastructure • Create a legal framework for the functioning and competitiveness of the EU integrated energy market		**Reference** Energy 2020 A strategy for competitive, sustainable and secure energy [COM(2010) 639] A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15] Energy Roadmap 2050 [COM(2011) 885] A roadmap for moving to a competitive low carbon economy in 2050 [COM(2011)112]
INFRASTRUCTURE AND GRID		
Objectives	**Means**	**Reference**
Completion of the internal energy market by reaching an electricity interconnection target of 15% between EU countries by 2030 Pushing forward important energy infrastructure projects	Guidance for trans-European energy network (TEN-E). The guidelines list and rank projects eligible for community assistance. New indicators for the competitiveness and security of the energy system, such as price differences with major trading partners, diversification of supply, and interconnection capacity between EU countries Unbundling energy suppliers from network operators: - ownership Unbundling where all integrated energy companies sell off their gas and electricity networks. In this case, no supply or production company is allowed to hold a majority share or interfere in the work of a transmission system operator - Independent System Operator where energy supply companies may still formally own gas or electricity transmission networks but must leave the entire operation, maintenance, and investment in the grid to an independent company - Independent Transmission System Operator where energy supply companies may still own and operate gas or electricity networks but must do so through a subsidiary. All important decisions must be taken independent of the parent company Strengthening the independence of regulators: - regulators must be independent from both industry interests and government. They must be their own legal entity and have authority over their own budget. National governments must also supply them with sufficient resources to carry out their operations	A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15] Decision 1364/2006/EC laying down guidelines for trans-European energy networks

	- regulators can issue binding decisions to companies and impose penalties on those that do not comply with their legal obligations - electricity generators, gas network operators, and energy suppliers are required to provide accurate data to regulators - regulators from different EU countries must cooperate with each other to promote competition, the opening-up of the market, and an efficient and secure energy network system Establishment of the Agency for the Cooperation of Energy Regulators (ACER). Its work involves: - drafting guidelines for the operation of cross-border gas pipelines and electricity networks - reviewing the implementation of EU-wide network development plans - deciding on cross-border issues if national regulators cannot agree or if they ask it to intervene - monitoring the functioning of the internal market including retail prices, network access for electricity produced from renewables, and consumer rights Cross-border cooperation between national transmission system operators (TSOs) and the creation of European Networks for Transmission System Operators (ENTSOs). TSOs are responsible for ensuring electricity and natural gas is effectively transported through pipelines and grids. Due to the cross-border nature of Europe's energy market, they must work together to ensure the optimal management of EU networks. This is done through the European Network for Transmission System Operators for Electricity (ENTSO-E) and the European Network for Transmission System Operators for Gas (ENTSOG). These organisations: - develop standards and draft network codes to help harmonise the flow of electricity and gas across different transmission systems - coordinate the planning of new network investments and monitor the development of new transmission capabilities. This includes publishing a Europe-wide 10 year investment plan to help identify investment gaps every two years. Rules designed to benefit European energy consumers and protect their rights. They include the right to choose or change suppliers without extra charges, receive information on energy consumption, and quickly and cheaply resolve disputes.	
Accelerating the completion of the internal energy market and thereby set the basis for an efficient achievement of the climate and energy framework for 2030	Proposal of revision of directive on internal market which includes: - Measures for adapting the market design to the rise in renewables and technological development: enhancement of current market rules to create a level-playing field among all generation technologies. Rules addressed are those that discriminate between resources and those that limit or favour the access of certain technologies to the electricity grid. Also, all market participants will bear costs for imbalances caused on the grid and all resources will be remunerated in the market on equal terms. - Measures to tackle under-performance of retail markets: Gradual phasing-out by MS of blanket price regulation by a deadline set in EU legislation, starting with price below costs. The use of contract	Proposal for a regulation of the EU parliament and of the Council on the internal market for electricity [COM(2016)861]

	termination fees for consumers is restricted. High-level principles ensuring that energy bills are clear and easy to understand, through minimum content requirements. Monitor number of households on energy poverty. Clear billing information and certified comparison tools. Provisions that ensure that consumers are able to freely choose and change supplier, are entitle to dynamic price contract and are able to engage in self-generation and self-consumption of electricity. Framework for local energy communities - Improvement of the institutional framework and of the Agency for the Cooperation of Energy Regulators (ACER). Set out a flexible regional regulatory framework to enhance regional coordination through a system of coordinated regional decisions and oversight of certain topics by national regulatory authorities (NRAs) of the region and would give ACER a role for safeguarding the EU interest. *The Electricity Marked Design initiative.* The initiative aims to adapt current market rules by allowing electricity to move freely to where it is most needed when it is most needed via undistorted price signals, whilst empowering consumers, reaping maximum benefits for society from cross-border competition and providing the right signals and incentives to drive the necessary investments to decarbonise our energy system. It will also give priority to energy efficiency solutions, and contribute to the goal of becoming a world leader in energy production from renewable energy sources, thus contributing to the Union's target to create jobs, growth and attract investments. Increase coordination between Transmission System Operators (TSOs) and regulators. Following this successful example, mandatory cooperation should be expanded to other areas in the regulatory framework. To this end, TSOs could decide within 'Regional Operational Centres' (ROCs) on those issues where fragmented and uncoordinated national actions could negatively affect the market and consumers (e.g. in the fields of system operation, capacity calculation for interconnectors, security of supply and risk preparedness). MS shall put in place appropriate legal frameworks to enable the formation and functioning of local energy communities. Strengthening the powers of ACER for those cross-border issues which require a coordinated regional decision would contribute to faster and more effective decision-making on cross-border issues. National regulators, deciding within ACER on those issues through majority voting, would remain fully involved in the process. The Commission committed in its Energy Union Framework Strategy to phase-out regulated prices below cost and to encourage Member States to establish a road map for the phasing-out of all regulated prices. The new market design aims at ensuring that supply prices are free of any public intervention, and only with duly justified exceptions.	
COMMON RULES		
Objectives	**Means**	**Reference**
Establish common rules	*Rules to ensure access of third parties to liquefied natural gas.* A directive to lay down the right of third	Directive 2003/55/EC concerning common rules for

for the achievement of an EU internal market Establish common rules for the increasing competitiveness in the EU internal market	parties to non-discriminatory access to transmission and distribution systems and to liquefied natural gas (LNG) facilities *Rules establishing minimum taxation of energy.* Directive that sets the minimum rates of taxation applicable to energy products, to improve the operation of the internal market by reducing distortions of competition between mineral oils and other energy products *Common rules for electricity supply.* Rules relating to the organization and functioning of the electricity sector, access to the market, the criteria and procedures applicable to calls for tenders and the granting of authorizations and the operation of systems *Rules ensuring cross-border exchange in electricity.* National regulatory authorities shall send the European Commission notification of decisions concerning the certification of a transmission system operator. National TSOs form the European Network of Transmission System Operators (ENTSO) for electricity *Common rules on prospection, exploration and production of hydrocarbons.* Rules to ensure non-discriminatory access to the activities of prospection, exploration and production of hydrocarbons to help to reinforce the integration of the internal energy market, encourage greater competition within it and improve security of supply *Rules for increasing transparency in market operations*. To have transparent and competitive energy markets which contribute to the creation and smooth operation of the internal energy market	the internal market in natural gas and repealing Directive 98/30/EC Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity Directive 2003/54/EC concerning common rules for the internal market in electricity and repealing Directive 96/92/EC Regulation (EC) No 714/2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/ 2003 Directive 94/22/EC on the conditions for granting and using authorizations for the prospection, exploration and production of hydrocarbons Directive 90/377/EEC concerning a Community procedure to improve the transparency of gas and electricity prices charged to industrial end-users Directive 2009/73/EC concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC Directive 2009/72/EC concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC
Governance of the Energy Union	Proposal of a directive. According to the proposed new rules, EU countries will be required: - to develop Integrated National Energy and Climate Plans for the period 2021 to 2030 (and every subsequent ten year period) based on a common template - to report on the progress they make in implementing the Integrated National Energy and Climate Plans, mostly on a biennial basis The Commission will monitor the progress of the EU as a whole, notably as part of the annual State of the Energy Union report	Proposal for a regulation on the Governance of the Energy Union [COM(2016)/0759]
ENERGY SUPPLY SECURITY **Overarching objectives:** • Achieving the highest level of safety and security • Increase security of energy supply		**Reference** Energy 2020 A strategy for competitive, sustainable and secure energy [COM(2010) 639] A policy framework for climate and energy in the

• To secure the supply of gas • To secure the supply of oil • To secure the supply of electricity		period from 2020 to 2030 [COM(2014) 15] Energy Roadmap 2050 [COM(2011) 885] A roadmap for moving to a competitive low carbon economy in 2050 [COM(2011)112]
GENERAL PROVISIONS		
Objectives	**Means**	**Reference**
Ensure a stable and abundant supply of energy for European citizens and the economy	*Energy security strategy.* It sets out areas where decisions need to be taken or concrete actions implemented in the short, medium and longer term to respond to energy security concerns. 8 areas: 1. Immediate actions aimed at increasing the EU's capacity to overcome a major disruption during the winter 2014/2015; 2. Strengthening emergency/solidarity mechanisms including coordination of risk assessments and contingency plans; and protecting strategic infrastructure; 3. Moderating energy demand; 4. Building a well-functioning and fully integrated internal market; 5. Increasing energy production in the European Union; 6. Further developing energy technologies; 7. Diversifying external supplies and related infrastructure; 8. Improving coordination of national energy policies and speaking with one voice in external energy policy. New indicators for the competitiveness and security of the energy system, such as price differences with major trading partners, diversification of supply, and interconnection capacity between EU countries EU and Energy Community countries adopted regional energy security preparedness plans in 2015 Speaking with one voice in external energy policy, including ensuring that EU countries inform the European Commission early on about planned agreements with non-EU countries that may affect the EU's security of supply Strengthening emergency and solidarity mechanisms and protecting critical infrastructure. This includes more coordination between EU countries to use existing storage facilities, develop reverse flows, conduct risk assessments, and put in place security of supply plans at regional and EU level	European energy security strategy [COM(2014)330] A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15]
GAS		
Objectives	**Means**	**Reference**
Achieve security in gas supply	A common framework and rules for security in gas supply including: - a common indicator to measure serious threats to gas security; - a supply standard that EU countries must prepare to meet; - national gas authority monitoring supply; - Preventive Action Plans and Emergency Plans for dealing with a crisis;	Directive 2004/67/EC of 26 April 2004 concerning measures to safeguard security on natural gas supply Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010

	- Gas Coordination Group to coordinate actions and exchange information between national authorities and industry Proposal of new rules to improve gas supply security including: regional cooperation and coordination on gas; solidarity in the event of an emergency; risk assessments of gas supply	concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC Proposal for a regulation concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010 [COM(2016)52]
OIL		
Objectives	**Means**	**Reference**
Maintain minimum stocks of crude oil and petroleum products	Rules including: - Obligation to maintain emergency stocks of crude oil and/or petroleum products equal to at least 90 days of net imports or 61 days of consumption - Obligation to make stocks must be readily available so that in the event of a crisis they can be allocated quickly - Obligation to send the Commission a statistical summary of MSs stocks at the end of each month - During a supply crisis, the Commission is responsible for organising a consultation between EU countries	Directive 2009/119/EC imposing an obligation on MSs to maintain minimum stocks of crude oil and/or petroleum products
ELECTRICITY		
Objectives	**Means**	**Reference**
Expand electricity network Safeguard security of electricity supply Set up an appropriate level of inter-connection between EU countries	A framework in which the EU countries are to define policies on security of electricity supply compatible with the internal market for electricity Obligations to MSs to safeguard security of electricity supply and for investment in electricity networks including: - Set up a stable investment climate - Define the roles and responsibilities of the various authorities - Set minimum operational rules and obligations on network security - Take appropriate measures to maintain a balance between the demand for electricity and the availability of generation capacity - Facilitate new generation capacity and the entry of new generation companies to the market - Remove barriers that prevent the use of interruptible contracts - Remove barriers that prevent the conclusion of contracts of varying lengths for both producers and customers - Support the adoption of real-time demand management technologies such as advanced metering systems and energy conservation measures - Establish a regulatory framework that provides investment signals for both the transmission and distribution system network operators to develop their networks in such a way that they can meet foreseeable demand and that facilitates maintenance as well as the renewal of their networks	Directive 2005/89/EC concerning measures to safeguard security of electricity supply and infrastructure investment

INNOVATION AND TECHNOLOGY **Overarching objectives:** • Accelerate the EU energy system transformation in a cost-effective way • Bring promising new zero-emissions energy technologies to market • Extending Europe's leadership in energy technology and innovation • Transfer clean technology to developing countries		**Reference** Energy 2020 A strategy for competitive, sustainable and secure energy [COM(2010) 639] A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15] Energy Roadmap 2050 [COM(2011) 885] A roadmap for moving to a competitive low carbon economy in 2050 [COM(2011)112]
R&D		
Objectives	**Means**	**Reference**
Support the development, improvement and deployment of clean energy technologies Bring down costs of new technologies Promote cooperation amongst EU countries, companies, research institutions and the EU	Proposal of a new Integrated Strategic Technology Plan: focus on renewables, consumers, efficiency, transport; horizontally integrated approach; increased transparency, accountability and monitoring Strategic Energy Technology Plan (SET): it seeks to improve new technologies and bring down costs by coordinating national research efforts and helping to finance projects across Europe European Technology and Innovation Platforms (ETIPs): created to support the implementation of the SET Plan by bringing together EU countries, industry, and researchers in key areas. They promote the market uptake of key energy technologies by pooling funding, skills, and research facilities European Energy Research Alliance (EERA): aims to accelerate new energy technology development by cooperation on pan-European programmes. It brings together more than 175 research organisations from 27 countries, involved in 17 joint programmes EU's SET-Plan Information System (SETIS) provides information on the state of low-carbon technologies. It also assesses the impact of energy technology policies, reviews the costs and benefits of various technological options, and estimates implementation costs NER 300 funding programme: provides substantial funding for the large-scale demonstration of CCS and renewable energy technology Energy funding under H2020 and FP7 programmes. These programmes cover areas such as energy efficiency, renewables, smart energy networks, and energy storage	Towards an Integrated Strategic Energy Technology (SET) Plan [COM(2015)6317] Investing in the development of low carbon technologies (SET-Plan) [COM(2009)519] A European strategic energy technology plan (SET Plan) - Towards a low carbon future [COM(2007)723] Energy Technologies and Innovation [COM(2013) 253] Regulation No 1291/2013 of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC Commission Decision 2010/670/EU laying down criteria and measures for the financing of commercial demonstration projects that aim at the environmentally safe capture and geological storage of CO2 as well as demonstration projects of innovative renewable energy technologies under the scheme for greenhouse gas emission allowance trading within the Community established by Directive 2003/87/EC of the European Parliament and of the Council Roadmap for the Energy Union [COM(2015)80]

		A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy [COM(2015)80] Horizon 2020 - The Framework Programme for Research and Innovation - Communication from the Commission [COM(2011)0808]
TRANSFER CLEAN TECHNOLOGY		
Objectives	**Means**	**Reference**
Mobilise private investment in small-scale energy efficiency and renewable energy projects in developing countries	Global Energy Efficiency and Renewable Energy Fund (GEEREF): global risk capital fund that uses limited public money to mobilise private investment in small-scale energy efficiency and renewable energy projects in developing countries	Mobilising public and private finance towards global access to climate-friendly, affordable and secure energy services: The Global Energy Efficiency and Renewable Energy Fund [COM(2006) 583]

EUROPEAN FOOD AND AGRICULTURE POLICY **Goals:** • Viable EU food production and EU food security • Sustainable management of natural resources and climate action • Balanced territorial development • Improve efficiency of food supply chain and competitiveness of agri-food sector • Prevent diet-related diseases and premature deaths • Reduce and prevent food waste		**Reference** EC_2010_The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future. WHO_European Food and Nutrition Action Plan 2015–2020 EC_2015_Closing the loop an EU action plan for the circular economy High Level Forum for a Better Functioning Food Supply Chain. Report 2014 EC_2013_Green Paper on Unfair B2B Trading Practices in food and non-food supply chain.
FOOD PRODUCTION AND SECURITY **Overarching objectives:** • Viable EU food production • EU food security		**Reference** The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future.
FARM INCOME		
Objectives	**Means**	**Reference**
Contribute to farm incomes and reduce variability.	**Direct payments** Basic decoupled income support and coupled support in certain regions, specific support small farmers. European Agricultural Guarantee Fund (EAGF). **Market measures**, *see below*	Regulation (EU) No 1307/2013 of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No 637/2008 and Council Regulation (EC) No 73/2009 https://ec.europa.eu/agriculture/cap-funding_en.
COMPETITIVENESS		
Objectives	**Means**	**Reference**
Enhance viability and competitiveness of all types of agriculture, and promote innovative farm technologies and sustainable forest management; Knowledge transfer and innovation in agriculture, forestry and rural areas; Enhance value share of agricultural sector in food chain; Improve efficiency of food supply	**Market measures** Intervention in case of price crisis and potential market disruption Risk toolkit End quotas Measures aimed at improving the functioning of the food supply chain European Agricultural Guarantee Fund (EAGF) Rural Development Fund and Programmes (7 years), Partnership Agreements between EC and MSs: European Agricultural Fund for Rural Development (EAFRD). Additional funding by MSs	Regulation (EU) No 1308/2013 of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007 EC_2015_European Structural Investment Funds 2014-2020: official texts and commentaries. https://ec.europa.eu/agriculture/rural-development-2014-2020_en.

chain and thus the competitiveness of the agri-food sector; Promote food chain organisation, animal welfare and risk management in agriculture; Improve competitiveness of EU organic producers; Increase consumer confidence in organic farming and products; Improve external organic production.	Inform organic producers about EU instruments Financially support and facilitate research, innovation, dissemination of organic production; Communicate about organic production sector, market and trade. Horizon 2020 Societal challenge 'Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy'	https://ec.europa.eu/programmes/horizon2020/en/h2020-section/food-security-sustainable-agriculture-and-forestry-marine-maritime-and-inland-water. EC_2014_High Level Forum for a Better Functioning Food Supply Chain. Communication from the EC: Action Plan for the future of Organic Production in the European Union. 24.3.2014, COM(2014) 179 final.
NATURAL RESOURCES AND CLIMATE ACTION **Overarching objectives:** • Sustainable management of natural resources • Mitigate and adapt to climate change		EC_2010_The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future.
NATURAL RESOURCES		
Objectives	**Means**	**Reference**
Sustainable management of natural resources; Guarantee sustainable production and secure provision of environmental public goods in rural areas; Preservation of European landscapes; Restoring, preserving and enhancing ecosystems related to agriculture and forestry; Promote resource efficiency and support the shift toward a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors.	Mandatory "greening" of direct payments Cross compliance (a.o. Nitrate directive and Natura2000) Rural Development Fund and Programmes (7 years), Partnership agreements between EC and MSs; European Agricultural Fund for Rural Development (EAFRD). Additional funding by MSs	Regulation (EU) No 1307/2013 of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No 637/2008 and Council Regulation (EC) No 73/2009 https://ec.europa.eu/agriculture/direct-support/cross-compliance_en. http://ec.europa.eu/agriculture/rural-development-2014-2020_en. EC_2015_European Structural Investment Funds 2014-2020: official texts and commentaries.
CLIMATE ACTION		
Objectives	**Means**	**Reference**
Climate change mitigation and adaptation; Promote resource efficiency and support shift toward a low-carbon and	Cross compliance Rural Development Fund and Programmes (7 years), Partnership Agreements between EC and MSs; European Agricultural Fund for Rural Development (EAFRD). Additional funding by MSs	See above.

climate-resilient economy in the agriculture, food and forestry sectors.		
PESTICIDES		
Objectives	**Means**	**Reference**
Sustainable use of pesticides Reduce risks and impacts on human health and the environment Promote integrated and alternative pest management	Mandatory national action plans on pesticides: quantitative objectives, targets, measures, timetables, monitoring Authorisation procedures of Plant protection products	EC_2009_Framework for Community action to achieve sustainable use of pesticides
TERRITORIAL DEVELOPMENT **Overarching objectives:** • Balanced territorial development		**Reference** EC_2010_The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future.
REGIONAL FUNDS		
Objectives	**Means**	**Reference**
Support rural areas: economy, employment and social fabric, local markets, diverse farming systems, small farms, attractiveness and identity Balanced territorial development of rural economies and employment; Promote social inclusion, poverty reduction and economic development in rural areas Prevent land abandonment in areas with natural constraints	Rural Development Fund and Programmes (7 years), Partnership agreements between EC and MSs: European Agricultural Fund for Rural Development (EAFRD); Additional funding by MSs Payments for areas facing natural or other specific constraints (EAFRD)	EC_2015_European Structural Investment Funds 2014-2020: official texts and commentaries. https://ec.europa.eu/agriculture/rural-development-2014-2020_en.
FOOD SUPPLY CHAIN **Overarching objectives:** • Improve efficiency of food supply chain • Fair trade practices • Prevent diet-related diseases and deaths • Address growing global demand for proteins • Reduce and prevent food waste		**Reference** High Level Forum for a Better Functioning Food Supply Chain. Report 2014 EC_2013_Green paper on unfair trading practices in the business-to-business food and non-food supply chain in Europe WHO_European Food and Nutrition Action Plan 2015–2020

		http://www.2020-horizon.com/Proteins-of-the-future-i1828.html EC_2015_COM: Closing the loop - An EU action plan for the Circular Economy.
FUNCTIONING OF SUPPLY CHAIN		
Objectives	**Means**	**Reference**
Improve efficiency of food supply chain Address unfair trade practices	Stimulate dialogue among food supply chain stakeholders Public consultation on unfair trade	High Level Forum for a Better Functioning Food Supply Chain. Report 2014 EC_2013_Green paper on unfair trading practices in the business-to-business food and non-food supply chain in Europe
HEALTH		
Objectives	**Means**	**Reference**
Prevent diet-related diseases and premature deaths Healthy diets throughout life for everyone in Europe	Plan of action for MSs, supporting: Promotion of gains of healthy diet Reinforce health systems Support surveillance, monitoring, evaluation, research Strengthen governance, alliances and networks	WHO_2014_European Food and Nutrition Action Plan 2015–2020
PROTEINS		
Objectives	**Means**	**Reference**
Address growing global demand for meat and other protein-rich food sources.	Grant SFS-15-2014 proteins of the future in Horizon2020 programme for Safe food, healthy diets and sustainable consumption	http://www.2020-horizon.com/Proteins-of-the-future-i1828.html
FOOD WASTE		
Objectives	**Means**	**Reference**
Reduce and prevent food waste.	Develop a common EU methodology and indicators to measure food waste Clarify EU legislation relating to waste, food and feed and facilitate food donation and the use of former foodstuff and by-products e.g. for animal feed Examine ways to improve the use of date marking by actors in the food chain for more effective use and understanding Stakeholders platform to examine how to achieve SDGs goals on food waste Share best practice and evaluate progress (2016)	EC_2015_COM: Closing the loop - An EU action plan for the Circular Economy.

EUROPEAN CLIMATE POLICY **Goals:** • 20% GHGs emissions reduction in EU (from 1990 levels) by 2020 • 40% GHGs emissions reduction in EU (from 1990 levels) by 2030 • 80-95% GHGs emissions reduction in EU (from 1990 levels) by 2050 • The power sector can almost totally eliminate CO2 emissions by 2050 • Emissions from transport could be reduced to more than 60% below 1990 levels by 2050 • Emissions from houses and office buildings can be almost completely cut by around 90% in 2050 • Energy intensive industries could cut emissions by more than 80% by 2050 • After 2035, CCS technology would be applied to emissions from industries unable to make cuts in any other way • Agriculture will need to cut emissions from fertilisers, manure and livestock and can contribute to the storage of CO2 in soils and forests. Changes towards a more healthy diet with more vegetables and less meat can also reduce emissions.		**Reference:** 20 20 by 2020 - Europe's climate change opportunity [COM(2008)30] Council of the EU, 12 December 2008, Energy and climate package - elements of the final compromise agreed by the European Council Presidency of the EU Council, 12 December 2008, Presidency conclusions of the European Council A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15] European Council 20/21 March 2014 – Conclusions European Council 26/27 June 2014 – Conclusions European Council 23/24 October 2014 – Conclusions A roadmap for moving to a competitive low carbon economy in 2050 [COM(2011)112]
INDUSTRY **Overarching objectives:** • Reduce GHGs emissions from large-scale facilities in the power sectors, industry sector and aviation sector in cost-effective manner (ETS sectors) • Cut EU F-gas emissions in a cost-effective manner		**Reference** Consolidated version of Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC Regulation (EU) No 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006
GHGs		
Objectives	**Means**	**Reference**
GHGs emissions from large-scale facilities in the power sector and energy intensive industry 21% lower than in 2005 by 2020 GHGs emissions from large-scale facilities in the power sector and	*EU emission trading system (EU ETS):* 31 countries; 11.000 energy intensive installations accounting for 45% EU emissions. EU ETS phase 3 2013-2020: - A single EU-wide CAP - Aviation cap set at 210 million allowances - Auctioning as default method of allocation of allowances, and a harmonised allocation rules for the allowances still given away for free. - At least 50% of auctioning revenues should be used by MSs for climate and energy related purposes - More sectors and gases included (CO2, N2O, PFCs)	Consolidated version of Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC

energy intense industry 43% lower than in 2005 by 2030	- 300 million allowances set aside in the *New Entrants Reserve* to fund the deployment of innovative renewable energy technologies and CCS through the NER 300 programme - *Rules* for monitoring, reporting and verification of ETS emissions - *Back-loading 2014-2016*: the auctioning of 900 million allowances is postponed until 2019-2020 - *Market stability reserve*. It will start operating in January 2019. The reserve will adjust the supply of allowances to be auctioned thus improving the system's resilience to major shocks. The 900 million allowances that were back-loaded in 2014-2016 will be transferred to the reserve rather than auctioned in 2019-2020. The reserve will work according to pre-defined rules <u>EU ETS phase 4 2021-2030</u>: - *Cap to decline with 2.2%* linear reduction factor - *Free allocation*: focus on 50 sectors at highest risk of relocating their production outside the EU. A considerable number of free allowances set aside for new and growing installations. More flexible rules and update of benchmarks to reflect technological advances since 2008. It is expected that around 6.3 billion allowances will be allocated for free to companies over the period 2021-2030 - *Redistribution of revenues*: 90% among all 28 Member States / 10 % among lower income Member States - *Innovation fund "NER400"*: it extends existing NER300 programme for CCS and renewables to the demonstration of innovative technologies in industry; funded with 400 million allowances (amount depending on carbon price); it is open for projects in all MS - *Modernization fund*: to improve energy efficiency and modernise energy systems in 10 lower income MSs (with a GDP/cap < 60% EU average); funded with 300 million allowances (amount depending on carbon price); fund will be reviewed in 2024	
FLUORINATED GHGs		
Objectives	**Means**	**Reference**
Cut EU's F-gas emissions by two-thirds compared with 2014 levels by 2030 Improve the prevention of leaks from equipment containing F-gases Avoid the use of F-gases where environmentally superior alternatives are cost-effective	Rules including prohibition of the use of F-gases with a global warming potential of more than 150 times greater than carbon dioxide (CO2) in new types of cars and vans introduced from 2011, and in all new cars and vans produced from 2017 Measures for containment of gases and proper recovery of equipment; training and certification of personnel and of companies handling these gases, and labelling of equipment containing F-gases From 2015 the volume of HFCs which can be placed on the EU market is subject to quantitative limits which will be phased down over time. In addition, measures include restrictions on the marketing and use of certain products and equipment containing F-gases.	Regulation (EU) No 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 Commission Regulation (EC) No 842/2006 of the European Parliament and of the Council on certain fluorinated greenhouse gases Proposal for a Council Decision on the conclusion of the agreement to amend the Montreal Protocol on substances that deplete the ozone layer adopted in Kigali [COM(2017)0016]
HOUSING, AGRICULTURE, WASTE, TRANSPORT IN MSs **Overarching objectives:**		**Reference** Decision No 406/2009/EC of the European

• Cut GHGs emissions in housing, agriculture, waste and transport (excluding LULUCF, international shipping and aviation) in MSs in cost-effective manner (non-ETS sectors)		Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020
GENERAL PROVISIONS		
Objectives	**Means**	**Reference**
Reduction of around 10% in total EU emissions compared with 2005 levels from the sectors covered, i.e. housing agriculture, waste, transport (emissions from LULUCF and international shipping are not included)	Binding annual targets until 2020 for cutting emissions in non-ETS sectors (compared to 2005) in MSs Rules for calculating the annual emission allocations (AEAs) in tonnes for each year from 2013 to 2020 Guidance for determining non-ETS targets in MSs beyond 2020: national emission targets should be between 0% and -40%, established with existing methodology, and adjusted with cost-effectiveness	Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15]
TRANSPORT **Overarching objectives:** • Transition towards low- and zero-emission vehicles		**Reference** A European Strategy for Low-Emission Mobility [COM(2016)501]
ROAD TRANSPORT		
Objectives	**Means**	**Reference**
Increasing the efficiency of the transport system Speeding up the deployment of low-emission alternative energy for transport Removing obstacles to the electrification of transport	Binding emission targets for new car and van fleets + penalty payments for excess emissions Labelling for cars about CO2 emission and fuel efficiency European strategy for low emission mobility, including: - digital mobility - fair and efficient pricing in road transport - promoting multi-modality - standardisation and inter-operability for electro-mobility in the context of the European Standardisation Organisations - support use of advanced biofuels, electricity, hydrogen and renewable synthetic fuels in transport Financial instruments: - European Fund for Strategic Investment - European Structural and Investment Fund: EUR 70 billion is available for transport - Horizon2020: EUR 6.4 billion is available for low-carbon mobility projects	A European Strategy for Low-Emission Mobility [COM(2016)501] Regulation (EC) No 443/2009 of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO2 emissions from light-duty vehicles Directive 1999/94/EC relating to the availability of consumer information on fuel economy and CO2 emissions in respect of the marketing of new passenger cars

FUEL		
Objectives	**Means**	**Reference**
Reduce the GHG intensity of the EU fuel mix by 6% by 2020 in comparison to 2010 Improve fuel quality Remove inefficient fossil fuel subsidies	Fuel quality standards applied to all petrol, diesel and biofuels used in road transport, as well as to gasoil used in non-road-mobile machinery Establishment of a methodology for calculating the greenhouse gas intensity of fossil fuels Requirements for calculating the greenhouse gas emissions for biofuels: - Greenhouse gas emissions must be at least 35% lower than from the fossil fuel they replace. From 2017, this will increase to 50% and, from 2018, the saving must be at least 60% for new installations; - The raw materials for biofuels cannot be sourced from land with high biodiversity or high carbon stock	A European Strategy for Low-Emission Mobility [COM(2016)501] Directive (EU) 2015/1513 of the European Parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources (Text with EEA relevance)
SHIPPING		
Objectives	**Means**	**Reference**
Emissions from maritime transport should be cut by at least 40% from 2005 levels by 2050, and if feasible by 50% (not binding) CO2 emission reduction commitments to be agreed by 2018	EU strategy for progressively integrating maritime emissions into EU's policy. The strategy consists of 3 consecutive steps: - Monitoring, reporting and verification of CO2 emissions from large ships. EU ports will be required to report their verified annual emissions from 2018 - Greenhouse gas reduction targets for the maritime transport sector - Further measures, including market-based measures, in the medium to long term Joint EC-IMO energy efficiency project with more than 10 million Euro to invest	A European Strategy for Low-Emission Mobility [COM(2016)501] Integrating maritime transport emissions in the EU's greenhouse gas reduction policies [COM(2013)479] Delegated Regulation (EU) 2016/2072 - Monitoring, reporting and verification of carbon dioxide emissions from maritime transport
AVIATION		
Objectives	**Means**	**Reference**
Stabilise CO_2 emissions from international aviation at 2020 levels	Emissions from aviation are included in the EU ETS since 2012. Under the EU ETS, all airlines operating in Europe, European and non-European alike, are required to monitor, report and verify their emissions, and to surrender allowances against those emissions. They receive tradeable allowances covering a certain level of emissions from their flights per year. The scope of the EU ETS for aviation is limited to flights within the EEA Operational measures such as modernising and improving air traffic management technologies, procedures and systems Global market-based measure to address CO2 emissions from international aviation as of 2021: the Carbon Offsetting and Reduction Scheme for International Aviation, or CORSIA, aims to stabilise CO2 emissions at 2020 levels by requiring airlines to offset the growth of their emissions after 2020.	A European Strategy for Low-Emission Mobility [COM(2016)501] Proposal for a Regulation amending Directive 2003/87/EC to continue current limitations of scope for aviation activities and to prepare to implement a global market-based measure from 2021 [COM(2017)54] 2016 ICAO Assembly Resolution Regulation (EU) No 421/2014 of the European Parliament and of the Council amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in view of the implementation by 2020

		of an international agreement applying a single global market-based measure to international aviation emissions
ENERGY See table on EU energy policy		
LOW CARBON TECHNOLOGY Overarching objectives: • Extending Europe's leadership in developing the technologies required to tackle climate change • Provide for the safe deployment of innovative technologies • Ensure environmentally safe geological storage of carbon dioxide		
CCS		
Objectives	**Means**	**Reference**
Provide support for the uptake of innovative and safe CCS technology	NER 300 funding programme: provides substantial funding for the large-scale demonstration of CCS and renewable energy technology European Economic Recovery Programme: allocates funds to CCS demonstration and other clean technology demonstration	Commission Decision 2010/670/EU laying down criteria and measures for the financing of commercial demonstration projects that aim at the environmentally safe capture and geological storage of CO2 as well as demonstration projects of innovative renewable energy technologies under the scheme for greenhouse gas emission allowance trading within the Community established by Directive 2003/87/EC of the European Parliament and of the Council
CLEAN ENERGY TECHNOLOGY See table on EU energy policy		
FOREST AND AGRICULTURE **Overarching objectives:** • Reduce emissions from agriculture, land use, land use-change and forestry • Reduce emissions from deforestation and forest degradation		**Reference** A policy framework for climate and energy in the period from 2020 to 2030 [COM(2014) 15]
DEVELOPED COUNTRIES – LULUCF		
Objectives	**Means**	**Reference**
Incentivise more climate-friendly land use Ensuring fair and cost-effective achievement of targets	Legislative proposal to integrate greenhouse gas emissions and removals from land use, land use-change and forestry (LULUCF) into the 2030 climate and energy framework Binding commitment for each MS in the period 2021-2030 to ensure that accounted emissions from land use are entirely compensated by an equivalent removal of CO_2 from the atmosphere through action in the sector, what is known as the "no debit rule."	Proposal for a regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring an d reporting greenhouse gas emissions and other

	emissions of biomass used in energy will be recorded and counted towards each Member State's 2030 climate commitments	information relevant to climate change [COM(2016) 479]
DEVELOPING COUNTRIES – REDD+		
Objectives	**Means**	**Reference**
Slowing, halting and sustainably reversing global forest cover and carbon loss (including the enhancement of forest carbon stocks)	The EU's approach to REDD+ builds on its Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan as well as international initiatives such as the REDD+ Partnership, the Forest Carbon Partnership Facility (FCPF) the EU REDD Facility, and the UN-REDD programme. The European Commission commits approximately €25 million a year to initiatives piloting REDD+ in Asia, Africa and Latin America. For more info about REDD+ see also the international climate policy table above	26/03/2014 - EU submission: Methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries 08/03/2012 - EU submission: Enhanced action on mitigation, policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
ADAPTATION Overarching objectives: • Foster adaptation to climate change at EU level • Foster adaptation to climate change at MS level • Foster adaptation knowledge development		**Reference** An EU Strategy on Adaptation to Climate Change [COM (2013) 21]
EU ADAPTATION		
Objectives	**Means**	**Reference**
Promoting adaptation in key vulnerable EU sectors Ensuring more resilient infrastructure	*Provide LIFE funding to support capacity building and step up adaptation action in Europe (2014-2020).* - A climate-action sub-programme under the 2014-2020 LIFE funding programme for the environment. - Priority vulnerable areas have been identified to steer discussions with MSs on the 2014-2020 LIFE work programme *Introduce adaptation in the Covenant of Mayors framework (2013/2014).* An initiative through which local authorities can make a voluntary commitment to adopt local adaptation strategies and awareness-raising activities *Facilitate the climate-proofing of the Common Agricultural Policy (CAP), the Cohesion Policy and the Common Fisheries Policy (CFP).* The Commission has provided guidance on how to further integrate adaptation into the CAP, the Cohesion Policy and the CFP. This guidance aims to help managing authorities and other stakeholders involved in programme design, development and implementation during the 2014-2020 budget period.	An EU Strategy on Adaptation to Climate Change + Annexes [COM (2013) 21] Green Paper on the prevention and insurance of disasters, COM (2013) 213 Guidelines on developing adaptation strategies, Commission Staff Working Document [SWD(2013)1] Technical guidance on integrating climate change adaptation in programmes and investments of Cohesion Policy, Commission Staff Working Document [SWD(2013)135] Principles and recommendations for integrating

	Ensuring more resilient infrastructure - European standardisation organisations have to map industry-relevant standards in the area of energy, transport and buildings and to identify standards that need to be revised to achieve better inclusion of adaptation considerations - Guidelines to help project developers working on infrastructure and physical assets to climate-proof vulnerable investments Guidance for authorities and decision makers, civil society, private business and conservation practitioners to ensure the full mobilisation of ecosystem-based approaches to adaptation *Promote insurance and other financial products for resilient investment and business decisions* - The Green Paper on the insurance of natural and man-made disasters, adopted as part of the Adaptation Strategy package, is a first step towards encouraging insurers to improve the way they help to manage climate change risks - Improve the market penetration of natural disaster insurance and to unleash the full potential of insurance pricing and other financial products for risk-awareness prevention and mitigation and for long-term resilience in investment and business decisions (2014-2015)	climate change adaptation considerations under the 2014-2020 rural development programmes, Commission Staff Working Document [SWD(2013)139]
MSs ADAPTATION		
Objectives	**Means**	**Reference**
Promoting adaptation actions by MSs	All Member States to adopt comprehensive adaptation strategies. As part of the Adaptation Strategy package the Commission has provided guidelines to help Member States formulate adaptation strategies. The Commission will develop an 'adaptation preparedness scoreboard', identifying key indicators for measuring Member States' level of readiness. In 2017, the Commission will assess whether action being taken in the Member States is sufficient. If it deems progress insufficient, the Commission will consider proposing a legally binding instrument.	An EU Strategy on Adaptation to Climate Change [COM (2013) 21]
KNOWLEDGE		
Objectives	**Means**	**Reference**
Address gaps in knowledge about adaptation	Identify adaptation knowledge gaps and the relevant tools and methodologies to address them. The findings are fed into the programming of Horizon 2020 and will address the need for better interfaces between science, policy making and business EU-wide vulnerability assessments. The Commission will in particular support the Joint Research Centre in its work on estimating the implications of climate change and undertake a comprehensive review of what global climate change will mean for the EU Further develop Climate-ADAPT as the 'one-stop shop' for adaptation information in Europe Improve access to information and develop interaction between Climate-ADAPT and other relevant platforms, including national and local adaptation portals	An EU Strategy on Adaptation to Climate Change [COM (2013) 21]

	Cost-benefit assessments of different policy experiences and innovative funding Inclusion of the Copernicus climate services (previously known as GMES – Global Monitoring for Environment and Security) Member States and regions can use funding under the 2014-2020 Cohesion Policy and CAP to address knowledge gaps, to invest in the necessary analyses, risk assessments and tools, and to build up capacities for adaptation	