COHERENCE BETWEEN EUROPEAN INVESTMENTS IN THE ENERGY SECTOR AND THE WLEFC-NEXUS

Master Thesis

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ABSTRACT

There is an increasing concern about future developments concerning climate change. In the future, more water, energy, and food will be needed to meet the global demand. Moreover, the supply of natural resources will be affected by climate change. For this reason, the goal is set by the European Union to improve resource efficiency and thereby ensure a sustainable management of scarce resources and limit climate change. To do so, the WLEFC-nexus (water, land, energy, food, climate) concept can be applied to take into account the interlinkages of these sectors rather than to use a sectoral approach. The WLEFC-nexus concept concerns all steps in the policy cycle, including investments. The investment policy of European investment funds is considered as synergistic with the EU policy goals relevant for the WLEFC-nexus in the Horizon 2020 SIM4NEXUS project. However, it was not known whether the actual investments are synergistic with these policy goals as well. Using a 7-point scoring system, the coherence between the investments by the European Investment Bank (Europe's lending arm) in the energy sector and the European Union's policy goals relevant for the WLEFC-nexus appears more synergistic than conflicting. However, there is no nexus-compliance since synergies are not exploited to the utmost and conflicts are not mitigated or compensated to a significant extent. To contribute to a resource efficient and climate resilient Europe, the European Investment Bank should increase its transparency about financed projects to stimulate more research on synergies and conflicts with EU policy goals. Right now, a large amount of the documents needed for such research is lacking. Besides, it should strive for solutions for energy related problems that are most synergistic with these goals. This study is the first academic contribution to the subject of coherence between actual investments in energy projects and EU policy goals relevant for water, land, energy, food and climate (WLEFC). Therefore, more research is needed to exploit the potential to mitigate climate change and at the same time reach WLEFC goals, using a nexus approach.

ABBREVIATIONS AND ACRONYMS

CH_4	Methane
CO_2	Carbon Dioxide
CHP	Combined Heat and Power
CSP	Concentrated Solar Power
EC	European Commission
EFU	Efficiency Upgrade
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ESDS	Environmental and Social Datasheet
ETD	Electricity Transmission and Distribution
EU	European Union
FEP	Fossil Energy Production
FFTD	Fossil Fuel Tranmission and Distribution
INV	Investment
kWh	Kilowatt hour
MSs	Member States
MW	Megawatt
N_2O	Nitrous Oxide
PV	Photovoltaics
REP	Renewable Energy Production
RQ	Research Question
WEF	Water, Energy, Food
WLEFC-nexus	Water, Land, Energy, Food, Climate – nexus

EXECUTIVE SUMMARY

There is an increasing concern about future developments concerning climate change. In the future, more water, energy, and food will be needed to meet the global demand. Moreover, the supply of these natural resources will be affected by climate change. For this reason, the goal is set by the European Union to improve resource efficiency and thereby ensure a sustainable management of scarce resources and limit climate change. To do so, the WLEFC-nexus (water, land, energy, food, climate) concept can be applied to take the interlinkages of these sectors into account rather than to use a sectoral approach. In 2016, the Horizon 2020 SIM4NEXUS research project started to assess low-carbon and resource efficient pathways for Europe, specifically focusing on the WLEFC-nexus. Earlier in the SIM4NEXUS project, EU policy goals are identified and selected that address the five different nexus sectors. Subsequently, they examined the policy coherence between these sectoral policies. The relevant EU policy objectives for the WLEFC-nexus appear to have a higher presence of synergies than conflicts. Moreover, the coherence between investment policies and the EU policy goals relevant for the WLEFC-nexus is examined in the SIM4NEXUS project. In this study too, the presence of synergies was higher than the presence of conflicts. However, it remained unclear whether actual investments of the EU are coherent with the EU policy goals relevant for the nexus. The most prominent fund to allocate the EU budget is the European Investment Bank (EIB). The EIB is the lending arm of the European Union in which it primarily supports European policy goals. Therefore, the aim of this research project is to investigate the coherence between the investments by the European Investment Bank (EIB) in the energy sector and the EU policy goals relevant for the WLEFC-nexus.

All financed projects by the EIB are published on the EIB's website (EIB, 2020). The financed projects have to be compliant with the environmental impact legislation and applicants have to give information on the environmental impact assessment (EIA) of the concerning project. The EIA is a document where the environmental impacts of a certain project are described as well as the mitigation measures for potential negative impacts. Therefore, the EIA documents of the financed projects are used to extract the information necessary to achieve the research goal of this project.

The database of the EIB is subjected to multiple selection procedures. Only projects which require an EIA according the EIA legislation are used in this project. Moreover, only investments with sufficient information about the different sectors of the WLEFC-nexus are considered in this project. To determine whether the EIA of a certain investment provided sufficient information, a keyword count with keywords relevant for the sectors in the WLEFC-nexus was conducted. Last, only projects of which the EIA was published in English, Dutch, or

German are taken into account in this study. This selection procedure ultimately resulted in a remaining 25 out of the possible 333 suitable investments for the coherence assessment with the EU policy goals relevant for the WLEFC-nexus.

The coherence assessment was conducted using a 7-point scale. Each investment received a score based on the described impacts on the concerning sectors of the WLEFC-nexus. In this way, the number of synergies and conflicts are determined between the investments and the selected EU policy goals relevant for the WLEFC-nexus. Besides, a weighted average for each sector is calculated to determine the WLEFC-nexus compliance of the investments by the EIB in the energy sector. To determine the WLEFC-nexus compliance, successful nexus policy criteria are used. These criteria imply that (1) the synergies between the policy domains are exploited and that (2) the trade-offs between the policy domains are assessed, avoided, mitigated, or compensated and transparent choices are made in case of conflicting instruments, objectives or goals, and arrangements are set for 'losers'. All these criteria are included in the assigned coherence scores, which means that a connection with a negative environmental impact could still have received a positive score when the conflict is mitigated or compensated.

The coherence between the investments by the EIB and the EU policy goals relevant for the WLEFC-nexus is more often synergistic (57,5%) than conflicting (42,5%). However, the number of conflicts is high when taking into account that these investments are conducted to support European policy goals. Moreover, it is concluded that the investments by the EIB in the energy sector are not WLEFC-nexus compliant. Two out of the five sectors (land and food) received a negative average score. This means that synergies are not exploited to the utmost or that the conflicts are not mitigated or compensated. It remains unclear whether the compensation for 'losers' is not described or that it is not applied at all, which is a result of a lack of transparency of the EIB database.

The missing transparent information of the EIB database is a significant limitation in this study. Beside the unclarity about compensation, an EIA was published for only half of the EIA-required projects. This means that it is impossible to investigate 50% of the investments carried out by the EIB. In addition, all the EIA's are published in the language of the country where the project is carried out. This is a constriction for researchers to investigate as much as investments as possible. Thus, besides investing in the most synergistic projects or to mitigate or compensate conflicting interests, it is recommended to the EIB to increase its transparency. In this way, the European Union is enabled to conduct its policy in the most synergistic way for a more sustainable, resource efficient, and climate resilient world.

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1 Introduction

There is an increasing concern about future developments concerning climate change and availability of food and natural resources. It is predicted that by 2030 the world will need to produce around 50 per cent more food and energy, and 30 per cent more fresh water will be used compared to 2014, whilst mitigating and adapting to climate change. The problem is that the supply of natural resources will be considerably affected by climate change (Allouche et al., 2014). According to the Intergovernmental Panel on Climate Change (IPCC, 2019), climate change, including increases in frequency and intensity of extremes, has adversely impacted food security and terrestrial ecosystems. John Beddington (Chief Scientific Adviser to the British Government in 2009) describes the relationship between food, energy, water, and climate as '*a perfect storm*' (Allouche et al., 2014). With the 'perfect storm', he means that a bad situation arises as a result of a combination of unfavourable circumstances. In this case, these unfavourable circumstances are the higher need for food, energy, and water in combination with climate change.

Current policies concerning water, energy and food often have a contribution to the decline of natural resources, since policies tend to have a sectoral approach (Leck et al., 2015). There is inadequate attention to the complex interactions that exist between sectors and resource systems. By a sectoral approach, policies often generate unintended consequences, undermining sustainable development and exacerbating livelihood insecurities (Leck et al., 2015). A current example is the production of biomass for electricity production instead of fossil fuels to mitigate climate change. The unintended consequences are the high need for water and land (Gerbens-Leenes et al., 2009; Yang et al., 2009). Thus, the policies for increasing the proportion of renewable energy by using biomass production heightens the competition for water and land.

As a response to these unintended consequences, the academic and political discourse have increasingly turned to the nexus approach as a contemporary guide to policy-making (Allouche et al., 2014). In contrast to current sectoral approaches to policy-making, the nexus approach takes into account the interdependencies between different resources and sectors in order to minimize conflicts and maximize synergies between policies that focus on just one area. The nexus concept is related to the increasing awareness that different sectors are inherently interconnected and must be investigated and governed in an integrated, holistic manner. The ultimate goal is to improve resource efficiency and thereby ensure a sustainable management of scarce resources (Munaretto & Witmer, 2017).

1.1 Background and Problem Definition

As described above, there is an increasing concern about resource scarcity. As a result, the European Union (EU) has made resource efficiency an integral component of its policy agenda (European Commission, 2015). In 2016, the Horizon 2020 SIM4NEXUS research project started to assess low-carbon and resource efficient pathways for Europe, specifically focusing on the water-land-energy-food-climate (WLEFC) nexus. As part of this project, Munaretto & Witmer (2017) identified and selected EU policies that address the five different nexus sectors. Subsequently, they examined the policy coherence between these sectoral policies. The relevant EU policy objectives for the WLEFC-nexus appear to have a higher presence of synergies than conflicts. From this outcome of the coherence analysis, the authors concluded that the policymaker was familiar with the interlinkages between the sectors in the WLEFC-nexus. However, other important policy domains are also linked to the WLEFC-nexus, for example investment policy.

Problems of incoherence arise when EU policies for water, land, energy, food, and climate are implemented (Munaretto & Witmer, 2017). Investments is one of the implementation instruments of policies, which are needed to reach the EU objectives related to resources efficiency. Therefore, it is essential that the WLEFC-nexus policy objectives are integrated in EU investment policies. The coherence between EU investment policies and EU policies relevant for the WLEFC-nexus is investigated by van der Burg, A., (2019) in which trade-offs and synergies between investment policies and EU policy goals relevant for the WLEFC-nexus are identified. The results of this study indicate that overall EU investment policies and EU policy goals relevant for the WLEFC-nexus are more often coherent than conflicting. However, according to Nilsson et al. (2012), it is politically easy to reach agreement on general goals whereas selecting and implementing instruments and measures to achieve those goals is where conflicts and related trade-offs arise (Nilsson et al., 2012). It is therefore unclear whether investment strategies and actual investments by the EU are also consistent with the EU policy goals relevant for the WLEFC-nexus. To examine this, it is important to understand how the investments by the EU are allocated.

1.1.1 The EU budget

The EU budget is a guideline for the European Union to divide investments over different sectors. This budget is meant to support common interests of all Europeans and is used according to the subsidiarity principle; it is only used when it is more effective to spend money at the European level than at local, regional, or national level (EC, 2020). One of the things that matters for all Europeans is climate change. Therefore, almost one fifth of the EU budget is currently dedicated to climate actions, from sustainable agriculture to investments in energy efficiency in buildings and renewable energy. To ensure stability, the EU investment budget is constructed on a long-term basis. Such a long-term spending plan, called the Multiannual Financial Framework (MFF), is adopted for a period of at least five years (generally 7 years). The MMF determines the maximum annual amounts that the EU may spend in different categories. In the period of 2014 – 2020, the EU may spend 39% of the annual budget of €165.8 billion (2019) on sustainable growth and natural resources. In the period thereafter (2021 – 2027), the EU may invest €378.9 billion in natural resources and environment (EC, 2019).

1.1.2 The European Investment Bank (EIB)

The most prominent fund to allocate the EU budget is the European Investment Bank (EIB). The EIB is the lending arm of the European Union in which it primarily supports European policy goals. The EIB is one of the largest providers of climate finance. More than 25% of the annual financing by the EIB is committed to climate change adaptation and mitigation. For investments in developing countries, this figure will rise to 35% by 2020 (EIB, 2019). Since the EIB is the investment bank of the EU, supporting European policy goals, it is relevant to determine whether the bank's investments are coherent with the EU's policies relevant for the WLEFC-nexus.

1.1.3 Environmental Impact Assessment and its role in EIB investment policy

To examine the environmental impact of the proposed projects, the EIB conforms to the Environmental Impact Assessment Directive (EIA Directive (85/337/EEC)). Based on this directive, proposed projects need to conduct an EIA or not. The EIA is elaborated in more detail in section 2.4.

1.2 RESEARCH GOAL AND QUESTIONS

The aim of this research project is to investigate the coherence of the investments by the European Investment Bank (EIB) in the energy sector in the period between the signing of the Paris Agreement and 2020, and the EU policy goals relevant for the WLEFC-nexus. This will lead to suggestions for the EIB to improve this coherence in order to improve the use of natural resources and implementation of climate policy. To achieve this research goal, this thesis will give answers to the following research questions:

1. What is the coherence between EIBs financed projects in the energy sector and the EU policy goals relevant for the WLEFC-nexus?

    1.1. What data and information do the open source descriptions and background information of EIB financed projects provide about coherence of the projects with EU policy goals for water, land, energy, food, and climate?

    1.2. What criteria can be developed to determine whether public investments are nexus-coherent?

    1.3. What are the rules and regulations of the EIB to assess the impact of a submitted project on the elements in the nexus?

    1.4. How can the EIB improve the coherence between its investments and the EU's policy goals relevant for the WLEFC-nexus?

2. How is the environmental impact assessment (EIA) related to the WLEFC-nexus?

    2.1. How are the sectors of the WLEFC-nexus considered in the EIA's quantitatively and qualitatively?

2 THEORETICAL FRAMEWORK

2.1 THE WLEFC-NEXUS

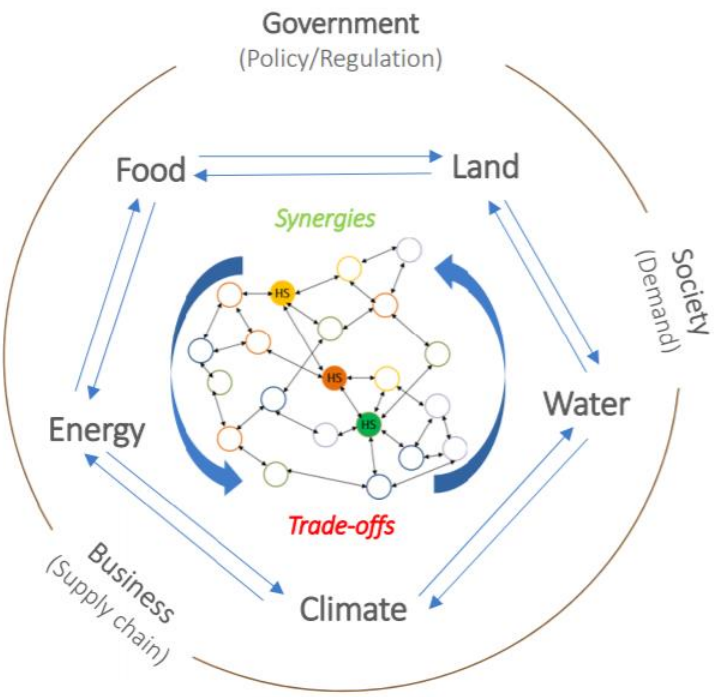

Figure 1. WLEFC-nexus framework (Munaretto & Witmer, 2017).

Over the last ten years, the nexus concept gained momentum in the scientific, policy, and political circles (Munaretto & Witmer, 2017). The various global crises since 2008 in energy, food and global finance, in addition to the uncertainties brought about by climate change, have highlighted the importance of the relationship between the nexus concerning water, energy, food, and climate change (Allouche et al., 2014). During the Bonn conference on water, energy, and food security nexus in 2011, the nexus concept gained further momentum in which the private sector, international organizations, and other major players where stimulated to take note of the nexus concept (Leck et al., 2015). Because of the potential to operationalize the planetary boundaries concept (Steffen et al., 2015), the nexus has reached the scientific agenda (Munaretto & Witmer, 2017). The nexus concept provides a framework for integrated assessments and holistic approaches to multi-agent and multi-scale problems (Munaretto & Witmer, 2017). However, there is a lack of consensus on the exact definition and conceptualization of the nexus. Often, the number of nexus sectors differs. Some papers only focus on the water-energy nexus (WE) (Hussey & Pittock, 2012; Kouangpalath & Meijer, 2015), whereas other papers add the food sector to this nexus (WEF) (Allouche et al., 2014; Weitz et al., 2014). Another sector which is often included in the nexus, is climate (Waughway, 2011; Dovers et al., 2015). Hurni et al., (2015) urge for the inclusion of land and soil to the WEF-nexus, as soil plays a crucial role in diminishing food security risks. In agreement with this, Subramanian & Manjunatha, (2015) focus on the energy-water-soil-food nexus. To ensure the integrity between different sectors, this study will focus on the water-land-energy-food-climate nexus (WLEFC-nexus). The WLEFC-nexus (figure 1) is 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 (Munaretto & Witmer, 2017). Examples of such interlinkages are the lower water demand for cooling fossil fuelled power plants when using renewable energy instead of fossil fuels and switching to drought-tolerant crops which reduces water demand (Rasul & Sharma, 2016).

2.2 Policy Coherence

Policy coherence is a key feature of the WLEFC-nexus approach. Policy coherence as part of the SIM4NEXUS project is comprehensively discussed earlier in the SIM4NEXUS project by Van Der Burg (2019). However, in the current study, the coherence will be applied on another part of the policy cycle, namely the implementation in the form of investments. Policy coherence is an important element of the nexus approach. The unintended consequences that result from misaligned policies are diminished by policy coherence (Weitz et al., 2017; Hoff, 2011). In the literature, the success of policy is explained in different words, which are policy coherence, policy effectiveness, policy consistency, and policy integration. In contrast to policy coherence, which stresses the relationship between two policies, policy effectiveness has a focus on a single policy. Policy integration is primarily concerned with upstream policy making processes (analysing opportunities and initial development) whereas policy coherence analysis is to focus on policy outputs (e.g. implementation) (Nilsson et al., 2012). According to Den Hertog & Stross (2013), the terms policy coherence and policy consistence are often used interchangeably. However, the definition of these two are slightly different. Policy consistency is defined as the 'absence of contradictions within and between individual policies' while policy coherence 'refers to the synergistic and systematic support towards the achievement of common objectives within and across individual policies' (Den Hertog & Stross, 2013). Since policy coherence examines synergies and conflicts among policy goals, policy coherence is used in this study.

According to Munaretto & Witmer (2017), policies can be viewed from a substantive and procedural perspective. A substantive perspective focuses on the content of policies and a procedural perspective is concerned with the processes through which policies are made. Deliverable 2.1 of the SIM4NEXUS project focuses on the analysis of the substantive aspects of the policies in the nexus. The policy coherence in the SIM4NEXUS analysis concerns policy content where policy goals and instruments are substantiated in policy documents and the policy implementation in practice.

Since the current study focuses on the coherence between the WLEFC-nexus policy objectives and the investments by the EIB, a clear policy coherence definition is adopted. Therefore, this study uses the policy coherence definition described by Munaretto & Witmer (2017). They define policy coherence 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 result of each single policy separately and policy conflicts manifest when goals and instruments of one policy are in contrast with goals and instruments of another policy (Munaretto & Witmer, 2017).

Beside the definition of policy coherence as such, policy coherence can be classified in accordance to several levels or categories (Van Der Burg, 2019). Coherence can be classified as vertical and horizontal, where vertical coherence focuses on the relationship between policies at different levels of governance (e.g. between regional, national, and international level). Horizontal coherence focuses on the relationship between policies at the same level of governance. Besides, coherence can be classified as external or internal. External policy coherence refers to policies within different policy domains (e.g. the WLEFC sectors), while internal policy coherence refers to policies within a single policy domain (e.g. water) (Nilsson et al., 2012; Van Der Burg, 2019). In this project, the coherence between WLEFC-nexus policies and investments will be only examined at EU level. Therefore, the policy coherence in this study will be horizontal and external.

2.3 Investments

2.3.1 Investment Definition

Since this study examines the coherence between WLEFC-nexus policy goals and investments by the EIB, it is important to have an understanding of what such an investment is. The term investment will be used for the loans that the EIB gives for projects applications. This means that the investment is not a grant, but that the applicants have to pay back the money they borrowed. To make a claim on a loan, the applied projects need to fit in the EIB's lending policy.

2.3.2 EIB's Lending Policy

The EIB uses strict selection criteria in financing a project (table 1). Criteria for a typical EIB appraisal are tailored to each specific project. The financing decision is made by the Board of Directors of the EIB. They assess the proposed project on the consistency with the EU's priority objectives and the overall quality and soundness of the project. Once financed, the project's progress is regularly monitored. The monitoring takes place from the signature of the loan contract through the project implementation and operation phase until the loan is paid back (EIB, 2020).

Table 1. Selection Criteria of the EIB for loan requests (EIB, 2020).

Technical Scope	Definition of the project's 'technical description'
	Technical soundness, innovative technology, risks and mitigation measures.
	Information on capacity for products/services
Implementation	Promoter capability to implement the planned project
	Information on timing and employment during implementation
Operation	Promoter's capability to operate and maintain the project
	Information on production/service, operating and maintenance costs, employment during operational life.
Procurement	Compliance with applicable legislation and EIB guidelines
Environmental Impact	Compliance with applicable legislation
	Information on environmental impact assessment
Market and Demand	Analysis of the products/services demand over the project's life, with reference to sectoral studies of the Projects Directorate
Investment Cost	Information on project costs and its detailed components
	Comparison with cost of similar projects
Profitability	Information on financial profitability and related indicators (e.g. rate of return).
	Information on economic profitability.

According to the EIB (2020), its lending policy in the energy sector is fully aligned with the Paris Agreement. The Energy Lending Policy (2019) of the EIB sets out how the bank, as a public bank, can help support the EU in meeting the challenges in the Paris Agreement. The aim is to focus on those areas in which it can provide a high degree of additional value by overcoming persistent investment gaps. One of the most important intentions by the EIB is phasing out lending to fossil-fuel energy projects. This means that the bank will not support oil or natural gas production, coal mining, infrastructure dedicated to coal, oil and natural gas (networks, liquefied natural gas terminals, storage). Regarding power generation, the EIB will support power projects resulting in emissions below the threshold of 250 gCO_2 per kWh of electricity generated (Emission Performance Standard; EPS) from 2020, which will result in excluding the most polluting power generating alternatives.

In the scope of this study, the environmental impact is the most important parameter. As shown in table 1, a project has the be compliant with the applicable legislation and the applicant has to provide information on the environmental impact assessment (EIA) (EIB, 2020). Based on the compliance with EU legislation, the project will be financed or not.

Thus, the lending policy of the EIB is designed to be in line with the Paris Agreement. However, a review by Roggenbuck (2018) about the EIB's investments in the energy sector between 2013 and 2017 shows that the EIB is still financing environmentally damaging projects in the energy sector. Within electricity and heat generation, almost 90 per cent of the investments went for renewables, but comparing the share of renewable investments with the total for fossil fuels shows that, contrary to its stated policy objectives, the EIB is stimulating the use of fossil fuels, particularly in several EU countries (Italy, Spain, and United Kingdom) (Roggenbuck, 2018). The high percentage of renewables in electricity and heat generation is a result of establishing the Emission Performance Standard (EPS) of 550 g CO_2/kWh in 2013. This EPS has impacted the investments in electricity and heat generation by fossil fuels significantly. However, while the level of investments in fossil fuels has decreased over time, The EIB's involvement in the fossil gas sector has been stable in the period between 2007 and 2017 (Roggenbuck, 2018). This involvement might decrease after 2020 since the EIB has adjusted its EPS to 250 gCO_2/kWh.

Despite the progressive lending policy by the EIB, it becomes apparent that a part of the investments counteract multiple environmental goals of the EU (Roggenbuck, 2018). It is therefore important to investigate whether there are misalignments between the EU's policies and the investments by the EIB. Specifically, considering the importance of the nexus approach for a resource efficient and low-carbon economy in the EU, it is even more important to investigate the coherence between the investments by the EIB and the EU policies relevant for the WLEFC-nexus. However, financial institutions often don't possess an analytical framework to take nexus matters into account (Van Der Burg, 2019). There are multiple studies conducted about the investments of the EIB in the energy sector (Roggenbuck, 2018). However, no study has investigated the coherence between EIB's investments and the EU policy goals relevant for the WLEFC-nexus. Therefore, this study aims to make an academic contribution by examining this topic. To do so, it is essential to understand how the EIA Directive works as the EIB judges its environmental impact and eligibility for financing the proposed project on the basis of this directive.

2.4 Environmental Impact Assessment

To examine the coherence between the EIB's investments and the EU's policy goals relevant for the WLEFC-nexus, it is essential to know how the impact on the WLEFC sectors is reported and considered by the EIB.

2.4.1 Environmental Impact Publication

All financed projects by the EIB are published on the EIB's website (EIB, 2020). As described in section 2.3.2, the financed projects have to be compliant with the environmental impact legislation (section 2.4.2) and applicants have to give information on the environmental impact assessment. In the database of the EIB, a list of financed projects is published for each sector (e.g. energy). Each project has a project description and an environmental and social data sheet (ESDS). In the project description, the project is explained in more detail. In the ESDS, amongst the social factors, the requirements whether to conduct an environmental impact assessment (EIA) or not are discussed, based on the environmental impact legislation and the project description. This leads to three different EIA requirement outcomes: yes, no, or not clear (e.g. 'may require an EIA' or 'dependent on underlying project'). The applicants of the projects which require an EIA have to provide the EIA, which subsequently will be published by the EIB. As mentioned before, the requirements to conduct an EIA are described in the environmental impact legislation (EIA Directive), which is discussed below.

2.4.2 Environmental Impact Legislation

As stated before, the environmental impact legislation is recorded in the EIA Directive (85/337/EEC). The EIA directive is a procedural instrument as confirmed by the Court of Justice (Anker, 2014). It does not guarantee a substantive outcome in the form of reduction or avoidance of adverse environmental effects, but it gives the applicant the obligation to look for alternatives with less environmental impact (Anker, 2014). In general, the EIA Directive is considered as a useful and cost-effective tool (Runhaar et al., 2013), but in the case of some, mainly unexperienced applicants, the EIA directive is perceived as an instrument that creates unnecessary administrative burdens. This results, despite the general acceptance of the EIA, in attempts to avoid – intentionally or unintentionally – full implementation at Member State level (Anker, 2014).

According to Article 2(1), Member States shall ensure that *'projects likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location are made subject to a requirement for a development consent and an assessment with regard to their effects on the environment'* (EIA Directive, 2011). An EIA is required based on the described criteria in annex I and II of the EIA Directive, which are described below (Council of the EU, 2011).

Annex I Projects listed in annex I of the EIA directive are considered as having significant effects on the environment and require an EIA. As described by Article 3 of the EIA directive, the EIA will identify, describe, and assess in each individual case the direct and indirect effects of a project on the following factors:

1. Human beings, fauna and flora.
2. **Soil, water, air, climate, and the landscape.**
3. The inter-action between the factors mentioned in the first and second indents.
4. Material assets and the cultural heritage.

Annex II The projects listed in annex II are in general those not included in annex I and are not expected to have a significant impact on the environment. For projects listed in annex II, the national authorities have to decide whether an EIA is needed. This is done by the 'screening procedure', which determines the environmental effects of projects. The national authorities must take into account the criteria laid down in annex III.

Annex III Here, the criteria are defined for projects listed in annex II, which includes:

1. A description of the project.
2. An outline of alternatives.
3. Aspects of environment likely to be significantly affected by the project.
4. A description of the likely significant effects of the project on the environment resulting from the existence of the project, the use of natural resources, and the emission of pollutants, nuisance, and waste.
5. A description of the measures to prevent adverse effects on the environment.
6. A non-technical summary of the information provided under the above headings.
7. An indication of any difficulties in compiling the required information.

A Member State has to provide the results on the criteria in annex III to the EIB. When these results indicate that an EIA is not required, the EIB puts the label 'no EIA required' to the concerning project. The requirement of an EIA is published by the EIB after the selection for annex I (yes or no), and if 'no', followed by the selection in annex II and III. Thus, the label 'no EIA required' means that the concerning project has in theory no significant effect on the use of natural resources (soil, water, air, climate, and landscape) (EIB, 2020; Anker, 2014; EIA Directive, 2011). The procedure in financing a project based on the environmental impact is shown in figure 2 (Wood, 2002).

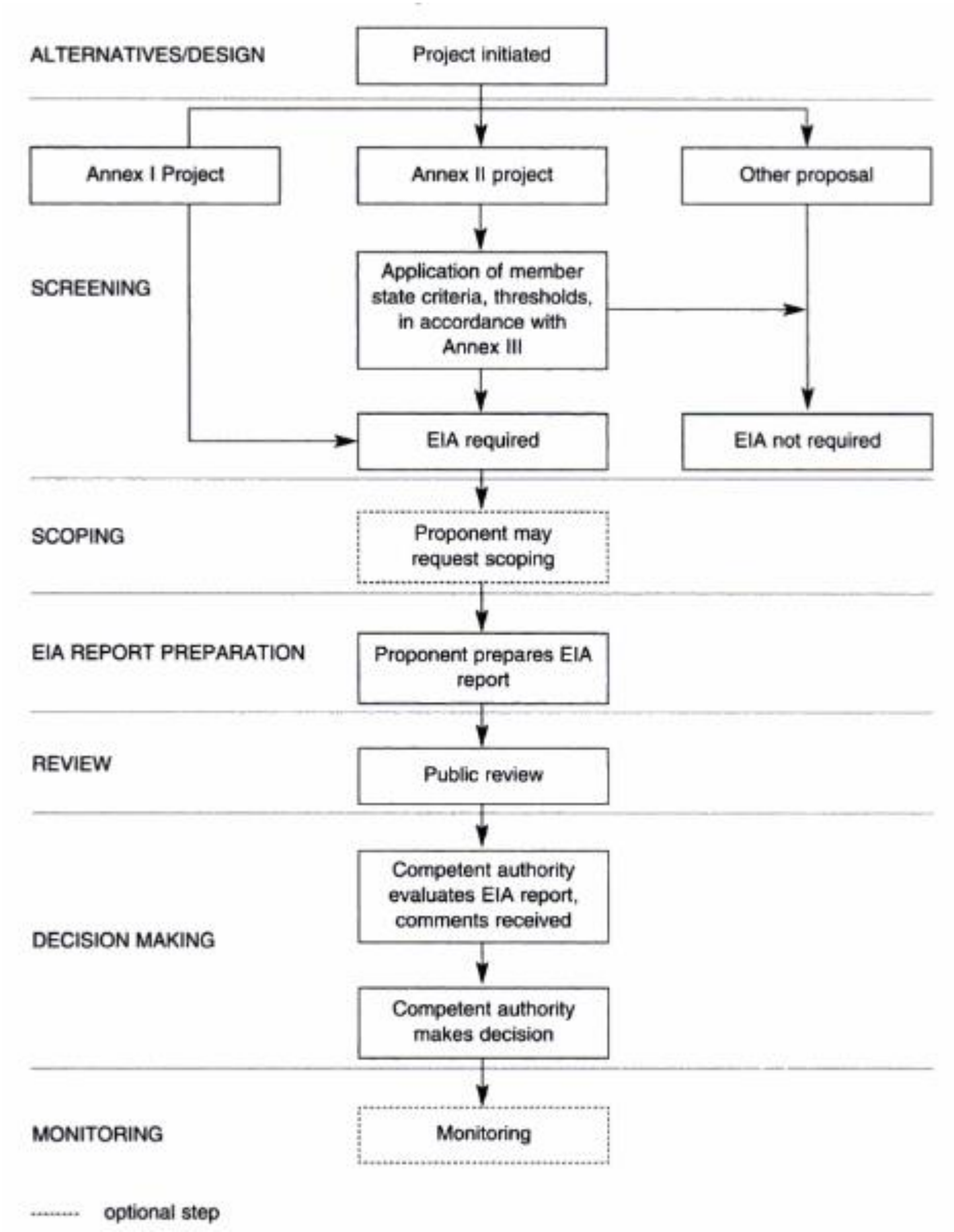

Figure 2. Main steps in the European EIA Directive process (Wood, 2002).

As the WLEFC-nexus approach has the aim to improve resource efficiency and thereby ensure a sustainable management of scarce resources, the presence of an EIA is an essential part to determine the coherence between the investments by the EIB and the EU policies relevant for the WLEFC-nexus.

3 Methodology

Here, the methodology for investigating the coherence between investments by the EIB and the WLEFC-nexus is outlined. To give answers to the research questions described in section 1.2, various methods are used. First, different selection criteria will be discussed to frame this research due to time constraints.

3.1 Selection Criteria

3.1.1 Sector

As stated before, the ultimate goal of the WLEFC-nexus is to improve resource efficiency and thereby ensure a sustainable management of scarce resources (Munaretto & Witmer, 2017), which is even harder because of climate change as a result of the emission of greenhouse gases (Allouche et al., 2014). Given the time constraints of this research, the sector with the highest emission of greenhouse gases is assessed in comparing EU's policy goals with the EU's actual investments. According to the statistics of the International Energy Agency (IEA, 2017), the biggest share of CO_2 emissions can be assigned to the energy sector (46%). Moreover, the major part of other prominent CO_2 emitting sectors (industry and residential) can also be assigned to the use of energy and the production of heat (EPA, 2017). The transport sector is often included in the energy consumption since oil is an energy source (IEA, 2019). However, the EIB makes a distinction between the energy sector and the transport sector. Therefore, investments in the energy sector with the exclusion of the transport sector are examined in this study.

3.1.2 Timeframe

In 1989, climate change was introduced on the political and scientific agenda for the first time. 26 years later, a milestone treaty was signed by 195 countries: the Paris Climate Agreement (2015). All those countries pledged to set targets for their own greenhouse gas cuts and to report their progress. These pledges would result in adjustments of climate policy throughout the world. For this reason, the Paris Agreement is taken as a starting point of this research. This means that investments in the energy sector by the European Union after the signing of the Paris Agreement (12 December 2015) are examined in relation with the EU policies relevant for the WLEFC-nexus.

3.1.3 EU Policy Goals

The EU policies relevant for the WLEFC-nexus are adopted from Deliverable 2.1 of the SIM4NEXUS project. In this part of the project, choices had to be made to keep to coherence assessment manageable. Only a sub-set of all identified objectives was selected for the coherence assessment in 2017, which is updated in 2020. The selection of policy goals relevant for the WLEFC-nexus was guided by the following criteria:

Criterion 1 Relevance of the objectives to the SIM4NEXUS project. This means that the goals are at EU scale since SIM4NEXUS is an EU funded project.

Criterion 2 Potential of the objectives to have a high number of interactions, either positive or negative, in the WLEFC-nexus.

Criterion 3 Unambiguous and clear definition of the objectives.

Using this selection process in 2017 with an update in 2020, 24 policy goals relevant for the WLEFC-nexus are presented in table 2. These policy goals, designed by the EU, support global achievements, unless specifically mentioned in the policy goal (L3, E1, C3, C4). This means that investments outside the EU are subject to the same EU policy goals as EU countries. To make this statement clear; it does not mean that the concerning countries in which a project is financed apply the same policy goals as the EU. It means that the EU has the goal to contribute to for example a global good water quality status (W1).

Table 2. Selected EU policy goals relevant for the WLEFC-nexus (adopted from Munaretto & Witmer, 2017, revised and updated in 2020).

EU WATER POLICY		Reference
W1	Achieve good water quality status	EU, 2020
W2	Ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy and the environment	EC, 2012a; EC, 2000; EC, 2012b
W3	Increase water efficiency	EC, 2012b; EC, 2011
W4	Reduce water consumption	EC, 2012
W5	Assess and manage flood risk and mitigate flood effects	EC, 2016; EU, 2007
W6	Address and mitigate water scarcity and drought	EC, 2007
EU LAND USE POLICY		
L1	Restore degraded soils to a level of functionality consistent at least with current and intended use	EC, 2006
L2	Prevent soil degradation	EC, 2006
L3	The EU's forested area needs to improve, both in quality and quantity	EC, 2019b
L4	Prevent indirect land use change from nature to productive use	EC, 2019a
EU ENERGY POLICY		
E1	Reach at least a 32% share of renewable energy in the EU by 2030	EC, 2018
E1.1	Increase provision of solar energy	EC, 2018
E1.2	Increase provision of wind energy	EC, 2018
E1.3	Increase provision of hydro energy	EC, 2018
E1.4	Increase provision of bioenergy	EC, 2018
E1.5	Increase provision of geothermal energy	EC, 2018
E2	Increase energy efficiency at least 32,5% in 2030, compared to reference scenario	EU, 2018
E3	Reduce energy consumption	EC, 2011
E4	Push forward important energy infrastructure projects (grid, network, interconnectors, etc.)	EC, 2010
E5	Achieve energy supply security	EU, 2006
EU FOOD AND AGRICULTURE POLICY		
F1	Contribute to farmer's income and reduce variability, on conditions of cross-compliance and greening	EU, 2013a; EC, 2019b
F2	Improve competitiveness of agricultural sector (including sector-specific support and international trade issues)	EC, 2020
F3	Ensure provision of environmental public goods in the agricultural sector	EC, 2020
F4	Support rural areas economy (employment, social fabric, local markets, diverse farming systems)	EC, 2015
F5	Promoting resource efficiency and supporting the shift toward a low-carbon and climate resilient economy in the agriculture, food and forestry sectors	EU, 2013b
EU CLIMATE POLICY		
C1	Increase efficiency of the transport system	EC, 2016
C2	Support the development and uptake of low-carbon technology	EU, 2010
C3	Promote adaptation in key vulnerable EU sectors and in MSs	EC, 2013a; EC, 2013b
C4	No net emissions of greenhouse gases in 2050 by Europe.	EC, 2019b

3.2 EIB INVESTMENTS AND THE WLEFC-NEXUS

To determine whether the EIAs of the projects are relevant to score the coherence between the EIB investments and the set policy goals, a keyword search is conducted for every element in the WLEFC-nexus in the published EIAs. Table 3 shows the keywords that are implemented in the counting system.

The counting of keywords determined whether a document was suitable to investigate concerning the WELFC-nexus or not. However, this number of keywords gives no information about the synergistic or conflicting characteristics of a financed project. To determine the synergistic or conflicting character between the set policy goals and the actual investments, a more in-depth scoring system is used (see chapter 3.3).

Table 3. Keywords used to determine the consideration of the WLEFC-nexus elements in the investment documents.

Water	Land/Soil	Energy	Food/Agriculture	Climate
water	land (scape)	energy	food	climat (e, ic, ological, ology)
aquatic	ground	(bio) fuel	farm (er, ing)	greenhouse (gas)
wetland	soil	renewable	irrigation	emission
river	sediment	solar	nutrient	air
transboundary	sand	wind	pesticide	pollutant
aquifer	clay	nuclear	nitr (ate, ogen)	CO2
drought	gravel	gas	fertiliz (e, er, ing)	CH4
eutrophication	desertification	coal	organic	N2O
upstream	erosion	petroleum	animal	methane
downstream	peat	fossil	livestock	nitrous oxide
sanitation	fen	hydropower	fiber	carbon
lake	spatial	biomass	timber	ozone
drink (ing)	zoning	geothermal	crop	anthropogenic
	remediation	electric (ity)	cultivat (e,ed)	temperature
		(co) generation	manure	warming
		grid	harvest (ing)	atmosphere
		combustion		
		network		
		oil		

3.3 EIB INVESTMENTS AND EU POLICY GOALS RELEVANT FOR WLEFC-NEXUS

3.3.1 Selecting Suitable Assessments for in-depth Analysis

The selected policies in section 3.1.3 are compared to selected financed projects. The selection of suitable projects for this comparison is shown in figure 3. This means that a selected project has an ESDS and EIA and the published EIA contains enough keywords to work with. Moreover, only projects of which the EIA is published in English, Dutch, or German, are taken into account.

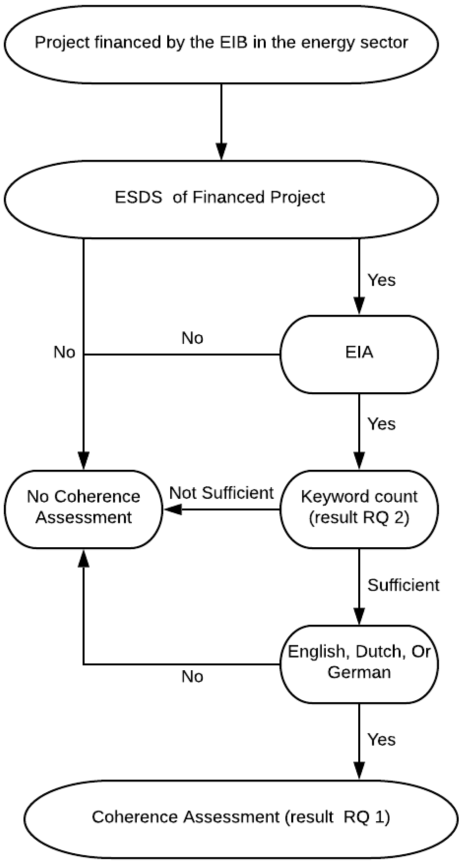

Figure 3. Flowchart of the selection process of financed projects for in-depth analysis.

3.3.2 Scoring Interactions and WLEFC-nexus compliance

To score the coherence between the EIB investments and the WLEFC-nexus policy goals, a seven-point scale developed by Nilsson et al. (2016) is used (figure 4). This scale shows the extent to which the relationship between EIB investments and WLEFC-nexus are conflicting (negative score) or synergistic (positive score) and it shows the nature of interaction between the two. The scoring of zero means that there was no interaction between the objectives. An example of a scoring interaction could be that an investment in a solar PV field contributes to reaching at least a 32% share of renewable energy in the EU by 2030 (E1; table 2), but it could conflict with the policy goal to prevent indirect land use change from nature to productive use (L4; table 2). Moreover, the scoring system is bidirectional. This means that aiming to reach a certain policy goal with a certain investment (A→B) is different from the effect of these policy goals on the investments (B→A). However, since the investments are already conducted, the policy goals cannot have an effect on these investments anymore. Therefore, the scoring of the effect of the policy goals on the investments (B→A) is conducted based on the subsector each investment belongs to (see section 4.4.1 for this division). Examples of subsectors are renewable energy production, electricity transmission and distribution, and energy efficiency. This method of scoring is used to clarify which kind of investments (subsectors) are probably screened out in pursuing the EU policy goals relevant for the WLEFC-nexus and ultimately give recommendations to the EIB to shift its investments to the most nexus-compliant subsectors. An example of such a bidirectional scoring system could be as follows; projects in solar PV fields have a synergistic connection with the policy goal to prevent indirect land use change from nature to productive use (L4, table 2) since for the application of solar PV field, less land is needed than for the current global energy mix (Stevens et al., 2017). However, in pursuing this policy goal, it is more interesting to invest in rooftop solar PV rather than in solar PV field since no additional land is needed for this application. For both interactions (A→B and B→A), the scoring system developed by Nilsson et al. (2016) is used. The definition of each score is shown in table 4, as defined by Nilsson et al. (2016).

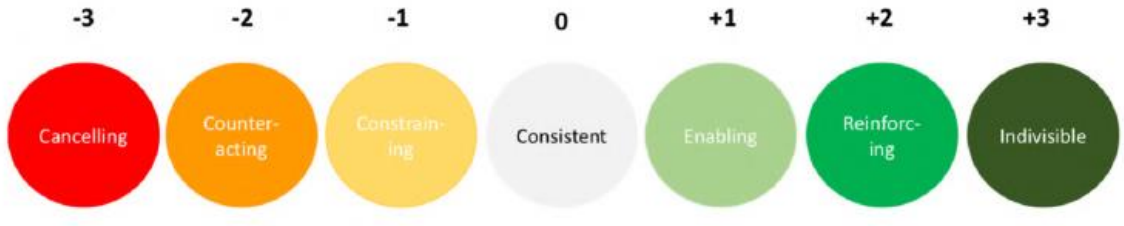

Figure 4. Scoring system for assessing the interaction of EIB investments with the WLEFC-nexus (Nilsson et al., 2016).

Table 4. Definitions of the type of interactions in the scoring system in figure 4 (Nilsson et al., 2016).

Score	Type of Interaction	Definition
-3	Cancelling	'Progress in one goal makes it impossible to reach another goal and possibly leads to a deteriorating state of the second'
-2	Counter-acting	'The pursuit of one objective counteracts another objective'
-1	Constraining	'The pursuit of one objective sets a condition or a constraint on the achievement of another'
0	Consistent	'One objective does not significantly interact with another or where interactions are deemed to be neither positive or negative'
1	Enabling	'The pursuit of one objective enables the achievement of another objective'
2	Reinforcing	'One objective directly creates conditions that lead to the achievement of another objective'
3	Indivisible	'One objective is inextricably linked to the achievement of another'

The scoring in figure 4 is conducted for each suitable financed project in relation with each policy goal relevant for the WLEFC-nexus in table 2. Since policy coherence is bidirectional, both the relations investment X → policy goals and policy goals → investment X will be examined. After scoring, each sector of the WLEFC-nexus received a calculated score (table 5). This is a mean score for every sector rather than the sum of scores since each sectors contains a different amount of policy goals. By using a weighted average, each sector is equal in importance. These mean scores for each sector are used to determine the WLEFC-nexus compliance of a single investment and ultimately the WLEFC-nexus compliance of the investments by the EIB in the energy sector in general. In this study, nexus compliance is addressed as successful nexus policy. In Deliverable 2.3 of the SIM4NEXUS project, Witmer (2018) defined the requirements to give a certain policy the label of successful nexus policy for both cross-sectoral horizontal policy coherence and vertical policy coherence. As described in section 2.2, the policy coherence in the current study is cross-sectoral horizontal. According to Witmer (2018), the criteria for successful nexus policy for cross-sectoral horizontal policy coherence are:

Table 5. Example for calculating the mean score for each sector in the WLEFC-nexus.

Policy Goal	Score
L1	+3
L2	0
L3	-2
L4	+1
Mean	+0,5

Criterion 1 The synergies between the policy domains are exploited.

Criterion 2 Trade-offs between the policy domains are assessed, avoided, mitigated, or compensated. Moreover, transparent choices are made in case of conflicting instruments, objectives or goals, and arrangements are set for 'losers'.

To translate the qualitative description above to semi-quantitative scores, a financed project received the label 'nexus compliant' when synergies are exploited to the utmost and trade-offs are managed or mitigated. The complete scoring process and nexus compliance determination is shown in figure 5.

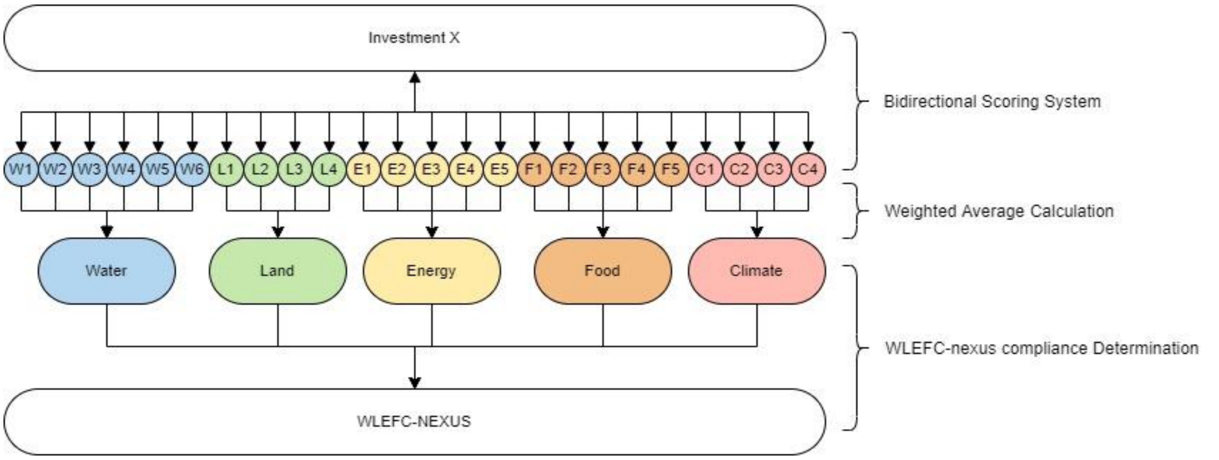

Figure 5. Schematic overview of the scoring process and nexus compliance determination for the connections between the financed projects by the EIB (investment X) and the policy goals relevant for the WLEFC-nexus (W1 – C4). W1 – C4 correspond to the selected policy goals relevant for the WLEFC-nexus in table 2.

4 RESULTS

In this study, 333 financed projects between the signing of the Paris Agreement and 2020 were examined concerning the coherence between investments by the EIB in the energy and the WLEFC-nexus policy goals. An amount of €35.9 billion is invested by the EIB in the period between the signing of the Paris Agreement and the end of 2019. The region, renewability, purpose, resource, year, and amount of the signed projects were determined. First, results will be shown about the regions and subsectors of the financed projects by the EIB. This will be followed by results about the report of the environmental impact, the consideration of the WLEFC-nexus, and the relation of the financed projects with the WLEFC-nexus policy goals.

4.1 EIB ENERGY LENDING

4.1.1 Regions

The EIB has the goal to help the economy, create jobs, promote equality, and improve lives for EU citizens and for people in developing countries. This goal is reflected in the division of regions of the EIB's investments. This division is shown in figure 6.

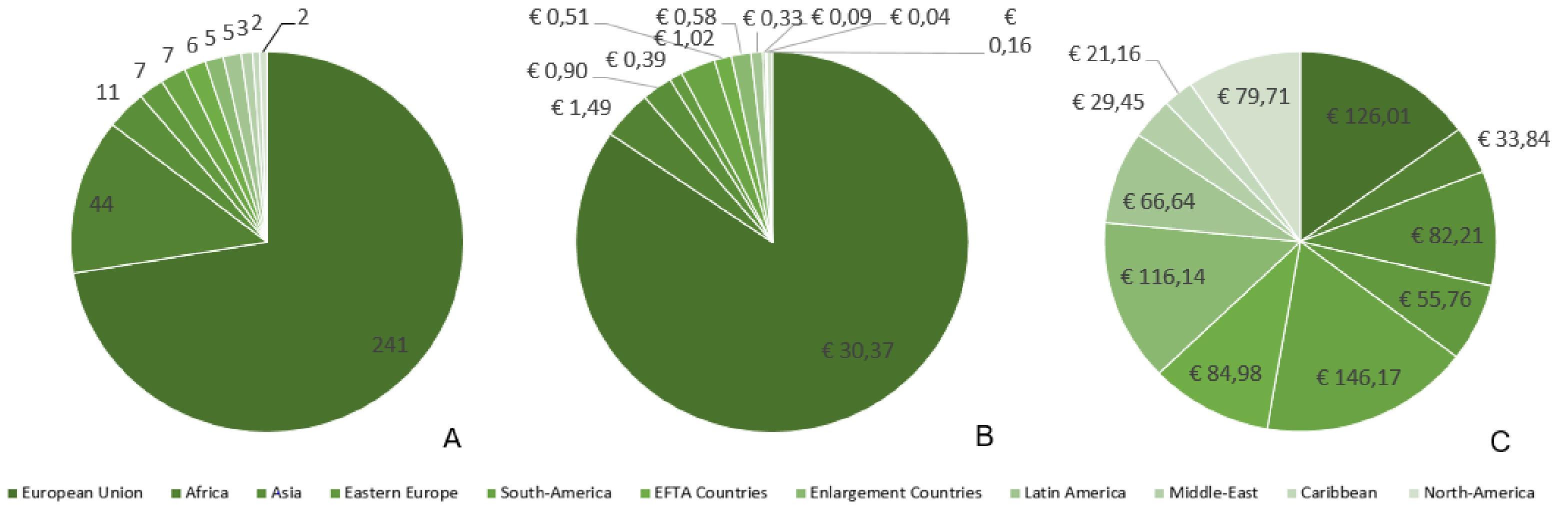

Figure 6. The number of projects per region (A), the amount of money invested per region (B; in billions), and the mean amount of money invested per region (C; in millions). C = B/A

As shown in figure 6, the major part of the investments are conducted in the European Union (241), followed by Africa (44) and Asia (11). The same holds for the amount of money invested. Thus, the amount of projects and the amount of money invested is largest in the European Union and Africa. However, the mean amount of money invested per region shows the difference in purchase power between the European Union and Africa. The mean amount of money invested per project in the European Union is significantly higher than in Africa ($p < .05$).

4.1.2 Sub sectors

The EIB's mission is to play a leading role in mobilizing the finance needed to achieve the worldwide commitment to keep global warming well below 2°C, aiming for 1.5°C, which is in line with the Paris Agreement. According to the EIB's Energy Lending Criteria, for its energy sector operations within the EU, the EIB should develop affordable, sustainable, and secure energy sources through investments primarily in energy efficiency, renewable energy, and energy networks. Similar types of investments should address problems of affordable, modern energy sources outside the EU. The priorities set in the Energy Lending Criteria are generally in line with the conducted lending, with renewable energy production and electricity transmission and distribution as the most financed categories of investment. However, investments in fossil fuels also have a relatively large share of investments (figure 7).

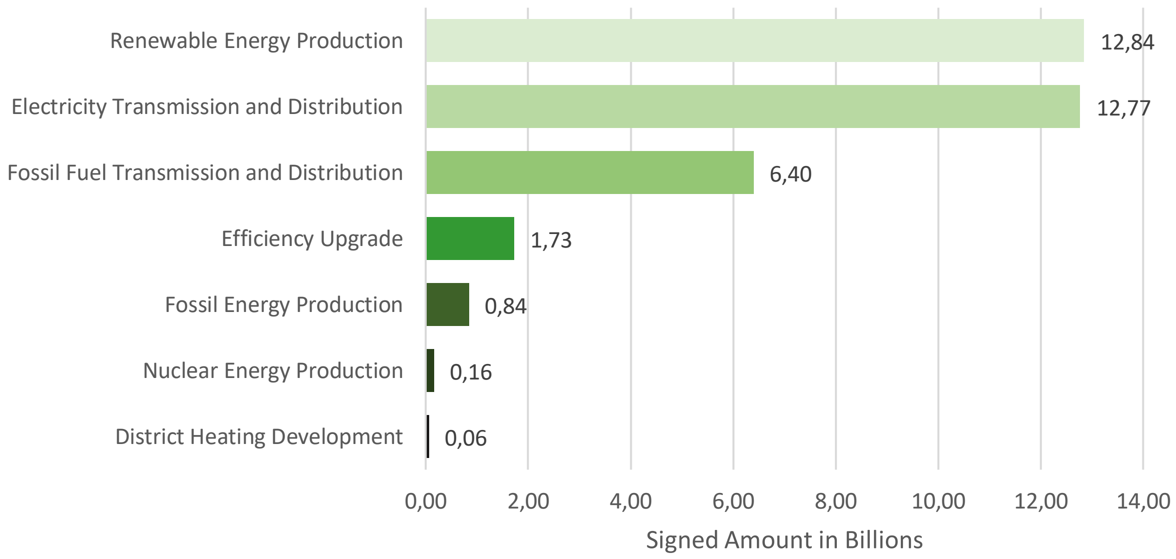

Figure 7. EIB energy lending by subsector between the signing of the Paris Agreement and 2020 in billions. The remaining €1.1 billion to add up to the amount of €35.9 billion invested was not specified by the EIB and is therefore not included in this figure (data retrieved from EIB database)

The relatively large share of fossil fuels in the investment portfolio of the EIB might have an adverse impact on achieving a WLEFC-nexus coherent portfolio, since a relatively high number of EU policy goals relevant for the WLEFC-nexus have the aim to mitigate the effects of climate change. As elaborated in section 2.4, the EIA legislation is used to mitigate the environmentally negative effects by addressing the impacts on soil, water, air, climate, and the landscape. For this reason, the EIA is used to ultimately determine the coherence between the investment by the EIB and the EU policy goals relevant for the WLEFC-nexus. To do so, it is important to know to what extent the EIA is used and how the EIA relates to the WLEFC-nexus. This will be discussed in the section below.

4.2 Environmental Impact Assessments

As stated before, the EIB financed 333 projects between the signing of the Paris Agreement and 2020. However, not every project required an EIA. In figure 8, the flowchart discussed in section 3.3.1 is filled in with the corresponding number of projects after each selection criterion. This shows that 69 projects are used to give an answer to research question 2 (section 1.2). The decrease from 139 projects which require an EIA to 69 projects suitable projects to answer research question 2 is not because of the insufficient number of keywords, but because of the lack of assessment publications in the database of the EIB. Thus, for half of the projects which require an EIA, no assessment is published. It is not clear whether this is a result of organizational problems to publish the assessments by the EIB or that applicants for a loan fall short to put forward their EIAs or a combination of these two. Instead of 139 projects which required an EIA, an EIA was published for 69 of these projects, which means that every project with a published EIA was suitable for the keyword count. The results of this keyword count are elaborated in section 4.3.1. To draw conclusion from this keyword count, it is important to understand the relation of the EIA with the WLEFC-nexus, which will be discussed in the next section.

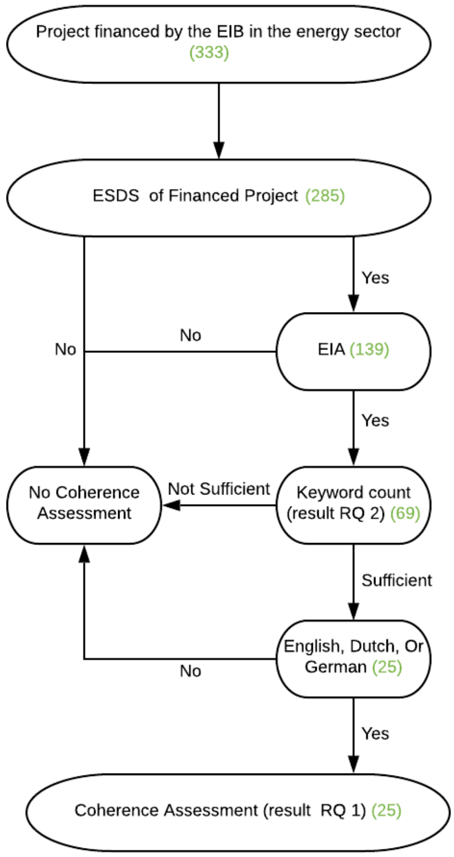

Figure 8. Flowchart of the selection process of financed projects for in-depth analysis with the corresponding number of projects after each selection criterion (green numbers in terminators).

4.3 Environmental Impact Assessments and the WLEFC-nexus

As described in section 2.4, the EIA is used to determine the impact on environmental components as soil, water, air, climate, and landscape. The sector food and agriculture is housed under the chapter ‘interaction with human activities’, but it has no self-contained chapter in the EIA. Nevertheless, all sectors of the WLEFC-nexus are discussed in the EIA’s published by the EIB. To get an idea to which extent the sectors are taken into account in the

EIA's, the quantitative keyword count is discussed in section 4.3.1. The relation of the project with the sectors and the relation between the sectors is discussed in section 4.3.2.

4.3.1 Keyword Count

The counting of keywords in the EIA's helps to understand to what extent the different sectors of the WLEFC-nexus are considered. The EIA's of the financed projects used in this study are published in 14 different languages. As shown in figure 8, only projects published in English, Dutch, and German will be used for the coherence assessment due to language restrictions in other language families. However, the keyword count is conducted for all the languages published in the projects relevant for this study. The keywords in table 3 are translated using Google translate. It is therefore important to assess whether a bias originates as a result of language constraints. Figure 9 shows the mean number of keywords for English, Dutch, and German (25) and other languages (44). The difference in mean number of keywords for projects published in English, Dutch, and German (2527) and other languages (1812) is not significant (p = .17). This means that the assumption can be made that the translations were sufficient to conduct a keyword count for every project with a published EIA. The results of this keyword count are shown in figure 10. This figure shows that every sector in the WLEFC-nexus is taken into account with mean keyword counts of 321, 526, 745, 135, and 354 for water, land, energy, food, and climate respectively. However, the number of keywords in the food sector is significantly lower than the keyword count in the other sectors (p < .05)[1]. This implies that the food sector is considered less in the EIA's than the other sectors. This can be explained by the fact that the food sector is not discussed as a separate sector as such. The food sector is housed in the section about social impacts. Besides, the number of keywords in the energy sector is significantly higher than the number of keywords in the water sector and the climate sector, which is probably a follow up of the fact that all investments are conducted in the energy sector.

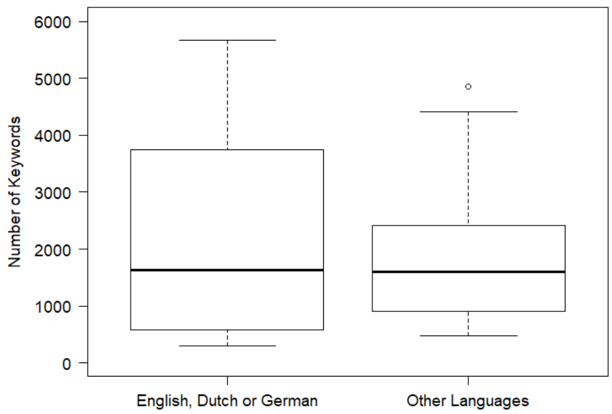

Figure 9. Difference in mean number of keywords for projects published in English, Dutch, and German and other languages.

[1] The results of these statistical test are shown in appendix 1.

Thus, the number of keywords in the EIA's shows that the sectors of the WLEFC-nexus are taken into account, which means that the published EIA's are suitable to examine the coherence between the investments by the EIB and the EU policy goals relevant for the WLEFC-nexus. The results of the coherence examination are shown in section 4.4.

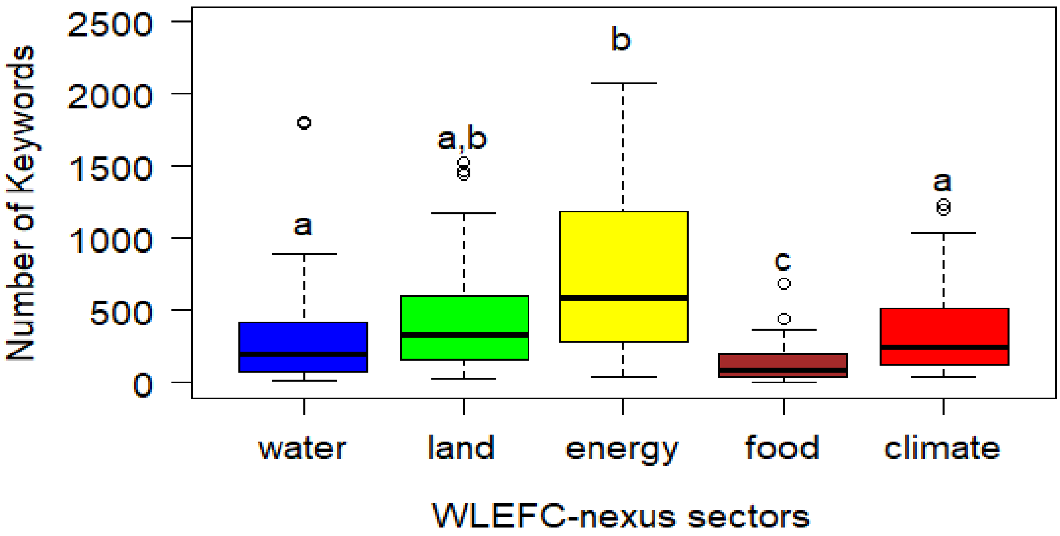

Figure 10. The mean number of keywords in the different sectors of the WLEFC-nexus. The characters on top of the boxes (a,b,c) represent the significance of the difference between the mean number of keywords. When 2 sectors have the same characters, there is no significant difference in the mean number of keywords between these sectors.

4.3.2 Qualitative consideration of the WLEFC-nexus sectors

The keyword count shows that the sectors of the WLEFC-nexus are taken into account in the EIA's published by the EIB. As a qualitative result, it is important to mention that only the impact of the project itself on these sectors is taken into account. This means that relationships within the WLEFC-nexus sectors are hardly, if at all, described in the EIA's, which means that indirect impacts via nexus connections are neglected. Moreover, as described in section 3.3.2, policy coherence is a bidirectional process, which means that the A→B interaction is different from the B→A interaction. In practice, this means that an investment can have a certain effect on achieving a certain policy goal, but that the effect of achieving a policy goal has a different effect on similar, future investments. Beside the relation between the WLEFC-nexus sectors in the EIA's, this is not taken into account. Thus, based on the keyword count and the qualitative consideration of a nexus approach, the main result is that the EIA's published by the EIB are suitable to give answers to the research questions, but no conclusions can be drawn concerning the coherence between the investments by the EIB and the policy goals relevant for the WLEFC-nexus. Therefore, a coherence assessment is conducted to asses the connections described in section 3.3.2. The results of this coherence assessment are elaborated in section 4.4.

4.4 Coherence Assessment

4.4.1 Selected Financed Projects

As shown in figure 8, 25 financed projects qualified for a coherence assessment. These projects are shown in table 6 with their corresponding description.

Table 6. The financed projects qualified for a coherence assessment. FFTD = fossil fuel transmission and distribution, FEP = fossil energy production, ETD = electricity transmission and distribution, REP = renewable energy production, EFU = efficiency upgrade.

No.	Country	Subsector	Signed Amount	Description
INV1	Bulgaria	FFTD	€ 90.920.270	The project consists of the financing of the Greece-Bulgaria gas interconnector (IGB Interconnector) to provide another direct link between the national natural gas systems of Greece and Bulgaria.
INV2	Greece	FFTD	€ 18.979.730	See INV1.
INV3	Croatia	FEP	€ 43.000.000	Construction of a combined cycle gas turbine, heat and electricity cogeneration plant to replace obsolete, mostly oil-fired, environmentally non-compliant heat-generation assets in Zagreb.
INV4	Belgium	ETD	€ 100.000.000	Upgrade and reinforcement of the high-voltage electricity transmission grid in Belgium.
INV5	Austria	REP	€ 40.000.000	Construction and operation of two wind parks and a single wind turbine in the Austrian Federal States of Lower Austria and Burgenland, respectively. The project has a total capacity of 39 MW.
INV6	Austria	REP	€ 8.000.000	Construction and operation of 7 onshore wind parks for a total capacity of 165 MW in the Austrian Federal State of Lower Austria (municipalities of Bad Deutsch Altenburg-Carnutum, Höflein Ost, Rohrau, Haadfeld, Hof, Seibersdorf and Au).
INV7	Lithuania	EFU	€ 30.000.000	Co-financing of priority investments in the Republic of Lithuania with EU Structural and Investment Funds in the 2014-2020 programming period. The Structural Programme Loan will mainly support schemes under the operational programme for the 2014-2020 period.
INV8	Cyprus	FEP	€ 35.000.000	Construction of a 210 000 t petroleum tank farm for Cyprus's strategic oil reserves.
INV9	Lithuania	REP	€ 104.500.000	Construction of two biomass-fired and waste-to-energy-fired combined heat and power (CHP) plants with a total capacity of 88 MWe and 227 MWh supplying electricity to the national grid and heat to the district heating system in Vilnius.
INV10	Maldives	REP	€ 45.000.000	The project will finance individual minigrid systems consisting of solar photovoltaic panels, together with efficient modern diesel generators, and integrated lithium accumulators in the Maldives' outer islands.
INV11	Belgium	REP	€ 437.901.634	Construction and operation of an offshore wind park 22 km from the Belgian Coast with an estimated capacity of up to 370MW.
INV12	Belgium	REP	€ 210.000.000	The project consists of the construction, financing and operation of a 218.5 MW offshore wind farm located 46 km from the Belgium coast.
INV13	Kenya	REP	€ 72.000.000	The project consists of the extension of the existing 140 MW Olkaria I Unit 4 & 5 geothermal power plant with an additional 70 MW turbine (Unit 6), the necessary wells, steam-gathering system and interconnection facilities.
INV14	Morocco	REP	€ 32.100.000	Construction and operation of a 150 MW concentrating solar power (CSP) Tower plant under the third phase of the Ouarzazate solar power complex.
INV15	Zambia	REP	€ 10.148.558	The construction and operation of an independent 34MW solar photovoltaic (PV) plant under the World Bank Group's Scaling Solar programme, located in the Lusaka industrial zone, Zambia.
INV16	Belgium	REP	€ 262.467.397	The project comprises the construction of two offshore wind farms about 38 and 50 km off the Belgian coast, with a total installed power of up to 488 MW depending on the final design, and associated ancillary facilities, including inter-array cables, an offshore substation and export cable to connect to an offshore connection point to the national Belgian grid.

INV17	Austria	REP	€ 48.000.000	Construction and operation of three wind parks in the Austrian Federal State of Lower Austria. The project has a total capacity of 39MW.
INV18	UK[2]	ETD	€ 610.816.154	The project covers the promoter's investments to create additional power transmission capacity in Scotland. It comprises about 180 km of underground and subsea cable, 2 AC/DC converter stations, and the construction or reinforcement of 8 substations and 2 power transmission lines, in north-eastern Scotland.
INV19	Iceland	REP	€ 125.000.000	Development of an existing geothermal field and construction of a new geothermal power plant with a capacity of 90 MWe. The project is located 30 km south-east of Husavik. It is intended to provide additional supplies of electricity to meet the projected growth in electricity demand in the region.
INV20	Albania	FFTD	€ 105.000.000	The project concerns the financing and construction of the Trans Adriatic Pipeline (TAP), which is the western part of the Southern Gas Corridor that goes from the Greek/Turkish border to Italy through Albania.
INV21	Romania	FFTD	€ 100.000.000	Financing the first phase of the BRUA gas interconnection project to be implemented by Transgaz.
INV22	Moldova	FFTD	€ 41.000.000	Construction of a natural gas pipeline with a length of 120km connecting the existing Moldova-Romania gas interconnection from Ungheni at the Modova-Romania border to Chisinau, the capital city of the Republic of Moldova.
INV23	Egypt	REP	€ 115.000.000	Construction of a 200 MWe windfarm on the Red Sea coast - at the Gulf of Suez - to supply the national grid.
INV24	Austria	REP	€ 19.300.000	Construction and operation of 5 wind turbines in Lower Austria and Burgenland, respectively, totaling 17MW.
INV25	India	REP	€ 167.688.737	A framework loan of up to USD 200 m to part-finance renewable energy projects in India. This operation concerns a framework loan to support the construction and operation of solar photovoltaic (PV) power plants in India.

These investments by the EIB are used to ultimately assess the coherence between the EU policy goals relevant for the WLEFC-nexus and the investments in the energy sector by the EIB. To do so, it is important to understand how these 25 selected projects represent the total dataset of the EIB for investments in the energy sector between the signing of the Paris Agreement and 2020. Every subsector shown in figure 7, with the exception of nuclear energy production and district heating development, is represented by the selected financed projects for the coherence assessment. Table 7 shows the representation of the selected financed projects (25 projects) for the total dataset (333 projects).

[2] For the project in the United Kingdom, the EU policy goals relevant for the WLEFC-nexus that only concern the EU are also applied for this project since the project was conducted before Brexit.

Table 7. Difference in percentage of subsectors in the selected projects for coherence assessments and projects in the original dataset.

Subsector	**Percentage original dataset**	**Percentage selected projects for coherence assessment (table 6)**
Renewable Energy Production	41.2%	60.0%
Electricity transmission and distribution	23.0%	8.0%
Efficiency upgrade	19.5%	4.0%
Fossil fuel transmission and distribution	11.9%	20.0%
Fossil energy production	3.5%	8.0%
Nuclear energy production	0.6%	0.0%
District heating development	0.3%	0.0%

There are some remarkable differences in the percentages of subsectors between the selected projects for coherence assessment and the projects in the original dataset. However, the selected projects for coherence assessment are only those projects that require an EIA. This means that an environmental impact is expected. Thus, for renewable energy production, fossil fuel transmission and distribution, and fossil energy production, more environmental impacts are expected than for electricity transmission and distribution, and efficiency upgrade. It is assumed that the assigned scores in the next section are an average representation of the subsectors (see table 6). In this way, an idea of the coherence score between the EU policy goals relevant for the WLEFC-nexus and the investments by the EIB in the energy sector for the total database can be delineated. First, the scores for the 25 selected investments are shown and elucidated in the next section.

4.4.2 Interaction Scores: INV → EU policy goals

In this section, the interaction scores between the investments by the EIB and the EU policy goals relevant for the WLEFC-nexus are shown. The seven-point scale developed by Nilsson et al. (2016) is used to score the interactions of which the scores are shown in sector dependent matrices. Each matrix is followed by an explanation of the assigned scores.

4.4.2.1 EU Water Policy Goals

Table 8.Screening matrix of coherence between investments by the EIB and EU water policy objectives relevant for the WLEFC-nexus: what happens to W when progress is made on INV?

	W1	W2	W3	W4	W5	W6	Mean
INV1 FFTD	-1	-2	-1	-1	1	-1	-0.83
INV2 FFTD	-1	-2	-1	-1	1	-1	-0.83
INV3 FEP	0	1	2	0	0	0	0.50
INV4 ETD	-2	-3	0	0	-1	-3	-1.50
INV5 REP	1	0	2	2	0	1	1.00
INV6 REP	1	0	2	2	0	1	1.00
INV7 EFU	0	0	1	1	0	0	0.33
INV8 FEP	-1	-2	-2	-2	0	-2	-1.50
INV9 REP	0	-1	1	0	0	0	0.00
INV10 REP	1	0	2	2	0	1	1.00
INV11 REP	1	0	2	2	0	1	1.00
INV12 REP	1	0	2	2	0	1	1.00
INV13 REP	-1	-2	0	-2	0	-1	-1.00
INV14 REP	0	-1	-2	-2	0	-1	-1.00
INV15 REP	1	-1	2	2	-1	1	0.67
INV16 REP	-1	0	2	2	0	0	0.50
INV17 REP	1	0	2	2	0	1	1.00
INV18 ETD	-1	-1	0	0	-1	0	-0.50
INV19 REP	-1	0	0	0	0	0	-0.17
INV20 FFTD	0	-1	0	-1	0	0	-0.33
INV21 FFTD	-1	-3	0	-1	-2	0	-1.17
INV22 FFTD	0	-1	-1	-1	0	0	-0.50
INV23 REP	1	0	2	2	0	1	1.00
INV24 REP	1	0	2	2	0	1	1.00
INV25 REP	1	-1	2	2	-1	1	0.67
Mean	**0.00**	**-0.76**	**0.72**	**0.48**	**-0.16**	**0.00**	**0.05**

The interactions between the investments by the EIB and the EU water policy goals relevant for the WLEFC-nexus consist of both trade-offs and synergies. The overall coherence score is slightly positive (0.05). Most of the synergies arise for investments in renewable energy production in the form of wind energy and water energy (INV5, 6, 10 – 12, 15 – 17, 23 – 25). Therefore, investments in these projects have a positive effect on water efficiency (W3) and water consumption (W4). An important note here is that it is assumed that the electricity demand at the moment of the implementation remains the same. This means that such energy producing projects replace the same capacity of the global energy mix. Wind energy production, solar PV energy production, and geothermal energy production have a significantly lower water footprint than fossil energy producing plants (Mekonnen et al., 2015). This includes water use for the supply of fuel, construction of the plants (including materials), and the operation of the power plants. Multiple studies showed that there is very little water needed for the production of wind energy and solar PV energy (Mekonnen et al., 2015; Spang et al., 2014). The order of an increasing water use for the other energy producing techniques are nuclear, natural gas, coal, solar CSP, and oil energy respectively. The more water needed, the less efficient the energy production is concerning the use of water. For this reason, renewable energy projects in biomass-fired energy production plants, together with projects investing in fossil fuels, received a lower score than renewable energy projects in solar power and wind power. The mean positive effect of the investments by the EIB on policy goals W3 (water efficiency) and W4 (water consumption) are mainly due to this effect on water consumption since the proportion of solar power and wind power projects in the selected projects is relatively high.

The investments of the EIB have a negative impact on the other water policy goals relevant for the WLEFC-nexus. The negative impact on the water quality status (W1) is mainly a result of the spillage of contaminated water used for the construction of projects. This effect is mostly temporary resulting in the possibility to mitigate this effect. Therefore, the negative impacts of the concerned investments are no more than constraining on the achievement of the policy goal to achieve a good water quality status. A more severe impact occurs for policy goal W2 to ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy and the environment. This policy goal is an extension of policy goal W1 (water quality status), but policy goal W2 is more comprehensive which results in a higher amounts in connections than for policy goal W1. There were less connections between the investments of the EIB and policy goals W5 to assess and manage flood risk and mitigate flood effects and W6 to address and mitigate water scarcity and drought. The project-specific connections with the EU water policy goals relevant for the WLEFC-nexus are shown in appendix 2.

4.4.2.2 EU Land Policy Goals

Table 9. Screening matrix of coherence between investments by the EIB and EU land policy objectives relevant for the WLEFC-nexus: what happens to L when progress is made on INV?

	L1	L2	L3	L4	Mean
INV1 FFTD	-1	-3	-2	-1	-1.75
INV2 FFTD	-1	-3	-2	-1	-1.75
INV3 FEP	0	0	1	1	0.50
INV4 ETD	-1	-2	0	0	-0.75
INV5 REP	-1	-1	-1	0	-0.75
INV6 REP	-1	-1	-1	0	-0.75
INV7 EFU	0	0	1	1	0.50
INV8 FEP	0	-1	0	0	-0.25
INV9 REP	-1	-3	0	0	-1.00
INV10 REP	0	0	0	1	0.25
INV11 REP	0	0	3	3	1.50
INV12 REP	0	0	3	3	1.50
INV13 REP	1	0	0	0	0.25
INV14 REP	0	0	0	0	0.00
INV15 REP	-1	-2	0	3	0.00
INV16 REP	0	0	3	3	1.50
INV17 REP	-1	-2	-1	0	-1.00
INV18 ETD	-3	-3	2	-1	-1.25
INV19 REP	-1	-3	-3	-3	-2.50
INV20 FFTD	-1	-3	-1	-3	-2.00
INV21 FFTD	-1	-2	0	0	-0.75
INV22 FFTD	-1	-3	-3	0	-1.75
INV23 REP	0	0	0	0	0.00
INV24 REP	-1	-1	-1	0	-0.75
INV25 REP	-1	-2	0	3	0.00
Mean	**-0.64**	**-1.40**	**-0.08**	**0.36**	**-0.44**

The interactions between the investments by the EIB and the EU land policy goals relevant for the WLEFC-nexus consist of both trade-offs and synergies. The overall coherence score is negative (-0.44). The most negative score is for policy goal L2 to prevent soil degradation (-1.40) and only conflicts were found between the investments by the EIB and this policy goal. This is due to the fact that for almost every project, excavation of the soil was needed. In general, this excavation leads to an increase in soil erosion and thus degradation. There was no connection between investments and policy goal L2 when no additional land was needed for the project (INV3,7), the soil was not economically valuable (INV10, 14, 23), or a sufficient amount of mitigation measures where taken (INV13).

The negative scores for the connection between the investments by the EIB and policy goal L1 to restore degraded soils to a level of functionality consistent at least with current and intended use is a result of the soil degradation. When a soil is highly degraded, restoring becomes harder. However, it is not impossible to restore a degraded soil to the intended use. Therefore, the impact on L1 (restoring) is less severe than on L2 (preventing degradation). INV18 is the only project with a cancelling effect on policy goal L1 since this project resulted in the permanent loss of high amounts of soil. There was one positive effect on L1, since the mitigation measures by the applicant for the project in Kenya (INV13) were to such an extent that it enabled the achievement of policy goal L1.

The connection between the investments by the EIB and policy goals L3 to improve the EU's forested area both in quality and quantity and L4 to prevent indirect land use change from nature to productive use was both conflicting and synergistic. This is highly dependent on the amount of land needed for the production of energy. Including the land footprint of each type of energy, the global energy mix uses approximately 55 ha of land for every MW energy capacity in 2017 (Stevens et al., 2017; IEA, 2017). This includes the use of land for the energy plant, the resource production, transmission and transportation, and storage. Energy production from coal, gas, nuclear, and solar use less land than the average global energy mix whereas onshore wind and hydro energy use more land than the global energy mix. Therefore, investments in the energy production with gas, solar, and offshore wind energy score positive for policy goal L4 (INV3, 10 – 12, 15, 16, 25). Due to the large share of these investments, this is the only EU land policy goal scoring positive (+0.36). Investments in such projects where no economically or naturally valuable land is used, are scored as consistent (INV8, 9, 13, 14, 23). Besides, onshore wind farms are scored as consistent with this policy goal since the amount of land needed for onshore wind power production does not affect the productive land in such a way that natural lands have to be sacrificed to compensate for the lost agricultural land (INV 5, 6, 24). INV19 and INV20 are assigned a cancelling score since high amounts of forest and agricultural land respectively is sacrificed for these projects. The scores for policy goal L3 (improving EU's forested area) are very similar to the scores for policy goal L4 (preventing indirect land use change). However, L3 is only applied to projects conducted in the European Union. If a project is not conducted in the European Union, there is no connection between the investment and policy goal L3 (INV 10, 13 – 15, 20, 22, 23, 25). The explanation of all the assigned scores are discussed in more detail in appendix 3.

4.4.2.3 EU Energy Policy Goals

Table 10. Screening matrix of coherence between investments by the EIB and EU energy policy objectives relevant for the WLEFC-nexus: what happens to E when progress is made on INV?

	E1	E2	E3	E4	E5	Mean
INV1 FFTD	0	0	0	3	3	1.20
INV2 FFTD	0	0	0	3	3	1.20
INV3 FEP	-2	0	0	1	3	0.40
INV4 ETD	0	0	0	3	3	1.20
INV5 REP	3	0	0	1	1	1.00
INV6 REP	3	0	0	1	1	1.00
INV7 EFU	0	3	3	0	0	1.20
INV8 FEP	0	0	0	0	0	0.00
INV9 REP	3	0	0	1	1	1.00
INV10 REP	3	0	0	1	1	1.00
INV11 REP	3	0	0	1	1	1.00
INV12 REP	3	0	0	1	1	1.00
INV13 REP	3	0	0	1	1	1.00
INV14 REP	3	0	0	1	1	1.00
INV15 REP	3	0	0	1	1	1.00
INV16 REP	3	0	0	1	1	1.00
INV17 REP	3	0	0	1	1	1.00
INV18 ETD	0	0	0	3	3	1.20
INV19 REP	3	0	0	1	1	1.00
INV20 FFTD	0	0	0	3	3	1.20
INV21 FFTD	0	0	0	3	3	1.20
INV22 FFTD	0	0	0	3	3	1.20
INV23 REP	3	0	0	1	1	1.00
INV24 REP	3	0	0	1	1	1.00
INV25 REP	3	0	0	1	1	1.00
Mean	**1.72**	**0.12**	**0.12**	**1.48**	**1.56**	**1.00**

The interactions between the investments by the EIB and the EU energy policy goals relevant for the WLEFC-nexus consists of mainly synergies. The overall coherence score is very positive (+1.00). The most positive score is for policy goal E1 to reach at least a 32% share of renewable energy in the EU by 2030 (+1.72). This is due to the high share of renewable energy projects in this selection. The investment in renewable energy is intrinsically connected with this policy goal. The only negative score for this policy goal is by INV3. This is a gas-fired power plant, which has a counter-active effect on the achievement of at least a 32% share of renewable energy in the EU by 2030.

For policy goals E2 to increase the energy efficiency at least 32.5% in 2030 relative to a reference scenario and E3 to reduce the energy consumption, there was only one connection. This connection was the investment in energy efficiency in Lithuania (INV7), which has an intrinsic connection with these policy goals. The other projects (energy production and transmission and distribution) have no effect on the energy efficiency or energy consumption.

Policy goals E4 to push forward energy infrastructure projects (grid, network, interconnectors) and E5 to achieve energy supply security are an extension of each other. Therefore, each project scores similar for these two policy goals, with the exception of INV3 which is a gas-fired power plant. This results in an intrinsic connection with policy goal E5 and an enabling connection with policy goal E4. Transmission and distribution projects (INV1, 2, 4, 18, 20 – 22) all have an intrinsic connection with both policy goals. The other projects are assigned an enabling connection with these policy goals except for INV7 and INV8 which are an efficiency upgrade project and oil storage project respectively. These projects have a consistent connection with policy goals E4 (energy infrastructure projects) and E5 (energy supply security).

The assigned scores for the coherence between the investments by the EIB and the EU energy policy goals relevant for the WLEFC-nexus are explained in more detail in appendix 4.

4.4.2.4 EU Food Policy Goals

Table 11. Screening matrix of coherence between investments by the EIB and EU food policy objectives relevant for the WLEFC-nexus: what happens to F when progress is made on INV?

	F1	F2	F3	F4	F5	Mean
INV1 FFTD	-2	-1	-2	0	-1	-1.20
INV2 FFTD	-2	-1	-2	0	-1	-1.20
INV3 FEP	0	0	1	0	-2	-0.20
INV4 ETD	-3	-1	-3	0	-1	-1.60
INV5 REP	-2	-1	-1	0	0	-0.80
INV6 REP	-2	-1	-1	0	0	-0.80
INV7 EFU	0	0	1	0	1	0.40
INV8 FEP	0	0	0	0	0	0.00
INV9 REP	0	0	0	0	-2	-0.40
INV10 REP	0	0	1	0	1	0.40
INV11 REP	0	0	1	0	1	0.40
INV12 REP	0	0	1	0	1	0.40
INV13 REP	0	1	0	-1	0	0.00
INV14 REP	0	0	0	0	0	0.00
INV15 REP	0	0	1	0	1	0.40
INV16 REP	0	0	1	0	1	0.40
INV17 REP	-2	-1	-1	0	0	-0.80
INV18 ETD	-3	-1	-2	-1	-1	-1.60
INV19 REP	0	0	0	0	-1	-0.20
INV20 FFTD	-3	-1	-2	-1	-1	-1.60
INV21 FFTD	-3	-1	-2	-2	0	-1.60
INV22 FFTD	-2	0	0	0	-1	-0.60
INV23 REP	0	0	0	0	0	0.00
INV24 REP	-2	-1	-1	0	0	-0.80
INV25 REP	0	0	0	0	1	0.20
Mean	**-1.04**	**-0.36**	**-0.40**	**-0.20**	**-0.16**	**-0.43**

The interactions between the investments by the EIB and the EU food policy goals relevant for the WLEFC-nexus consist of both trade-offs and synergies. The overall coherence score is negative (-0.43). The most negative score is for policy goal F1 to contribute to farmer's income and reduce variability, on conditions of cross-compliance and greening (-1.04). This is mostly due to the decrease of fertility of agricultural lands. This is a result of the excavation, erosion, and degradation of the soils. In this way, farmers have a lower yield and thus a lower income. Moreover, there is an increase in the variability of cross-compliance. Cross-compliance is a mechanism that links direct payments to compliance by farmers with basic standards concerning the environment, food safety, animal and plant health and animal welfare, as well as the requirement of maintaining land in good agricultural and environmental condition (EC, 2012). Due to less fertile land due to some projects of the EIB, farmers can contribute less to food safety and maintaining their land in good agricultural and environmental condition. The negative effect on policy goal F1 (farmer's income) also leads to an overall constraining effect to achieve policy goal F2 to improve competitiveness of the agricultural sector (-0.36). Van Arendonk (2015) found that the factor with the highest impact on the economic development of agriculture is the increase in agricultural productivity. The lower the agricultural productivity, the less competitive the agricultural sector is. A good mitigation measure for the loss of competitiveness of the agricultural sector was found by the applicant of INV13. Here, the owners of the surrounding land are invited to the discussion table for this project. In this way, the competitiveness of these farmers is enabled, since they can participate in the decision making process to prevent productivity loss to the utmost.

The investments by the EIB also have a negative effect on policy goal F3 to ensure the provision of environmental public goods in the agricultural sector (-0.40). The most relevant environmental public goods in the agricultural sector in this context are soil functionality, climate stability (reducing greenhouse gas emissions), agricultural landscapes, food security, rural vitality, and water quality and availability (Baldock et al., 2010). For this policy goal, there are conflicts as well as synergies, depending on mainly whether the investment concerns renewable energy or not. As described before, many projects result in the degradation of the soil which has a negative impact on soil functionality as an environmental public good. Besides, some projects have a positive effect on the amount of land needed for energy production (see 4.4.2.2) and thus a positive effect on agricultural landscapes on a global scale. Thus, for policy goal F3 (environmental public goods) (and policy goal F4 to support rural areas economy), multiple factors play a role in the assigning of a negative or positive coherence score (see appendix 5).

The effect of the investments by the EIB on policy goal F5 to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the agriculture, food and forestry sectors is highly dependent on the use of agricultural land and removal of forests. When less land is needed for the energy production in a certain project than for the global energy mix, it enables this policy goal. This mainly results in a low carbon and climate resilient economy in the forestry sector. The detailed explanation of all the scores assigned are shown in appendix 5.

4.4.2.5 EU Climate Policy Goals

Table 12. Screening matrix of coherence between investments by the EIB and EU climate policy objectives relevant for the WLEFC-nexus: what happens to C when progress is made on INV?

	C1	C2	C3	C4	Mean
INV1 FFTD	0	-2	0	-3	-1.25
INV2 FFTD	0	-2	0	-3	-1.25
INV3 FEP	0	-2	0	-3	-1.25
INV4 ETD	0	0	0	0	0.00
INV5 REP	0	3	0	3	1.50
INV6 REP	0	3	0	3	1.50
INV7 EFU	0	1	0	1	0.50
INV8 FEP	0	-3	0	-3	-1.50
INV9 REP	0	3	0	3	1.50
INV10 REP	0	3	0	0	0.75
INV11 REP	0	3	0	3	1.50
INV12 REP	0	3	0	3	1.50
INV13 REP	0	3	0	0	0.75
INV14 REP	0	3	0	0	0.75
INV15 REP	0	3	0	0	0.75
INV16 REP	0	3	0	3	1.50
INV17 REP	0	3	0	3	1.50
INV18 ETD	0	0	0	0	0.00
INV19 REP	0	3	0	3	1.50
INV20 FFTD	0	-2	0	0	-0.50
INV21 FFTD	0	-2	0	-3	-1.25
INV22 FFTD	0	-2	0	0	-0.50
INV23 REP	0	3	0	0	0.75
INV24 REP	0	3	0	3	1.50
INV25 REP	0	3	0	0	0.75
Mean	**0.00**	**1.24**	**0.00**	**0.52**	**0.44**

The interactions between the investments by the EIB and the EU climate policy goals relevant for the WLEFC-nexus consist of both trade-offs and synergies. The overall coherence score is positive (+0.44). The most positive score was for policy goal C2 to support the development and uptake of low-carbon technology (+1.24). This is due to the intrinsic connection between renewable energy projects and this policy goal. The projects investing in fossil energy were assigned a counteractive or cancelling connection since these technologies emit high amounts of carbon and prohibit the transition to renewable energy generation for the lifetime of the investment (INV1 – 3, 8, 20 – 22).

There were no connections between the investments by the EIB and policy goal C1 to increase the efficiency of the transport system (0.00). There was simply no relation with the transport system in the assessed projects.

Policy goal C4 to have net zero greenhouse gases emissions by 2050 by Europe was supported by the investments made by the EIB (+0.52). The projects scored mainly cancelling (-3) or indivisible (+3). This is due to the mix of renewable energy projects (indivisible) and fossil fuel projects (cancelling) in the selected investments. This policy goal is only applied to projects conducted in European countries. Projects not conducted in Europe have no connection with this policy goal.

To explain the assigned scores for policy goal C3 to promote adaptation in key vulnerable EU sectors and Member States (MSs), it is important to address the difference between mitigation and adaptation concerning climate change. According to Jagers & Duus-Otterström (2008), mitigation consists in addressing the causes of climate change. For example, reducing the emission of greenhouse gases. Adaptation, on the other hand, means coping with the ill-effects of climate change. For example, developing more heat resilient crops or building banks that protect societies from flooding. In the case of the investments by the EIB, there were no direct investments in the adaptation to climate change, but only in the mitigation to climate change. Therefore, no connections were found between the investments by the EIB and policy goal C3 to promote adaptation in key vulnerable EU sectors and MSs.

The assigned scores for the coherence between the investments by the EIB and the EU climate policy goals relevant for the WLEFC-nexus are explained in more detail in appendix 6.

4.4.3 Interaction Scores: EU policy goals → INV

In this section, the results of the scores for the effect of the policy goals on the investments by the EIB is discussed. A detailed description of the scoring system is shown in section 3.3.2. An important note here is that the assigned score concerns the effect on the type of investment (subsector; see table 6) rather than the project specifically. In other words, a negative score results in a constriction to conduct the concerning investment and a positive score results in a stimulating effect to conduct the concerning investment. To be able to reflect on the EU's investment portfolio, the European Union is more assisted with the effect of its policies on certain investments in general than with the effect of policies on a site specific, one-off project. The detailed explanation of the assigned scores is shown in appendix 7.

Table 13. Screening matrix of coherence between investments by the EIB and EU climate policy objectives relevant for the WLEFC-nexus: what happens to INV when progress is made on W, L, E, F, and C.

	Investment Number (INV)																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
W1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W2	-1	-1	-1	0	1	1	1	-1	1	1	1	1	1	1	1	1	1	0	1	-1	-1	-1	1	1	1
W3	-1	-1	-2	0	2	2	2	-2	2	2	2	2	2	2	2	2	2	0	2	-1	-1	-1	2	2	2
W4	-1	-1	-2	0	2	2	2	-2	2	2	2	2	2	2	2	2	2	0	2	-1	-1	-1	2	2	2
W5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W6	0	0	-1	0	1	1	1	-1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	1	1
L1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	0	0	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
L2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	0	0	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2
L3	1	1	2	-1	-2	-2	1	2	0	0	3	3	0	0	0	3	-2	-1	0	0	1	0	0	-2	0
L4	1	1	2	-1	-2	-2	1	2	-1	1	3	3	1	1	1	3	-2	-1	-1	1	1	1	-2	-2	1
E1	-2	-2	-3	0	3	3	0	-3	3	0	3	3	0	0	0	3	3	0	3	0	-2	0	0	3	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
E3	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
E4	3	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	3	3	0	0	0
E5	3	3	2	3	2	2	0	2	2	2	2	2	2	2	2	2	2	3	2	3	3	3	2	2	2
F1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F5	0	0	1	0	-1	-1	1	1	0	0	1	1	0	0	0	1	-1	0	0	0	0	0	-1	-1	0
C1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C2	-1	-1	-3	0	3	3	2	-3	3	3	3	3	3	3	3	3	3	0	3	-1	-1	-1	3	3	3
C3	-2	-2	-3	0	3	3	3	-3	3	0	3	3	0	0	0	3	3	0	3	0	-2	0	0	3	0
C4	-2	-2	-3	0	3	3	3	-3	3	0	3	3	0	0	0	3	3	0	3	-2	-2	-2	0	3	0
Weighted Average[3]	-0.24	-0.24	-0.60	-0.01	0.46	0.46	1.03	-0.60	0.65	0.33	1.19	1.19	0.33	0.33	0.33	1.19	0.46	-0.01	0.65	-0.11	-0,24	-0.11	0.14	0.46	0.33

[3] The weighted score means that every sector in the WLEFC-nexus contributes equally to this score. This is calculated with the following formula: The sum of average score per sector / number of sectors. The same calculation holds for the weighted averages in section 4.4.2. All the weighted averages are additionally shown in table 14 (section 4.4.4).

The higher the score in this section for a certain investment, the higher the probability that the European Union will invest in such a project when they pursue its policy goals relevant for the WLEFC-nexus. The projects with the highest score are offshore wind parks (+1.19). A very striking result in the table above is that all the fossil fuel investments are assigned a negative score and all the other investments a positive score. This will ultimately lead to a screen out of investments in fossil fuels when pursuing the EU policy goals relevant for the WLEFC-nexus.

4.4.4 Interactions, synergies, and Conflicts

The assigned scores in the previous sections showed that there are numerous synergies and conflicts between the investments by the EIB and the EU policy goals relevant for the WLEFC-nexus. The amount of these interactions is shown in table 14. This table shows that there is a total of 585 interactions out of the possible 1200 (48.8%). These 585 interactions consist of 323 synergies and 262 conflicts. The interpretation of this table is elaborately explained in the discussion section.

Table 14. The number of interactions, synergies and conflicts, mean score and number of keywords for each project. INV → policy goals = what happens to W, L, E, F, and C when progress is made on INV. Policy Goals → INV = what happens to INV when progress is made on W, L, E, F, and C. Int. = interaction. Syn. = Synergies. Con. = Conflicts.

Nr.	INV → policy goals				Policy Goals → INV				Total interactions out of 48	Total nr. of keywords
	Int.	Syn.	Con.	Score	Int.	Syn.	Con.	Score		
INV1	18	3	15	-0.77	13	4	9	-0.24	31	5663.00
INV2	18	3	15	-0.77	13	4	9	-0.24	31	5663.00
INV3	11	7	4	-0.01	14	4	10	-0.60	25	1599.00
INV4	12	2	10	-0.53	6	2	4	-0.01	18	10431.00
INV5	15	9	6	0.39	14	9	5	0.46	29	505.00
INV6	15	9	6	0.39	14	9	5	0.46	29	553.25
INV7	10	10	0	0.59	14	14	0	1.03	24	343.50
INV8	8	0	8	-0.65	14	4	10	-0.60	22	4582.00
INV9	8	5	3	0.22	12	9	3	0.65	20	4975.00
INV10	11	11	0	0.68	9	7	2	0.33	20	1634.00
INV11	13	13	0	1.08	12	12	0	1.19	25	1189.00
INV12	13	13	0	1.08	12	12	0	1.19	25	2628.00
INV13	11	6	5	0.20	9	7	2	0.33	20	1343.50
INV14	8	4	4	0.15	9	7	2	0.33	17	306.00
INV15	15	11	4	0.56	9	7	2	0.33	24	2486.00
INV16	12	11	1	0.98	12	12	0	1.19	24	4761.67
INV17	15	9	6	0.34	14	10	4	0.46	29	485.00
INV18	14	3	11	-0.43	6	2	4	-0.01	20	2330.00
INV19	11	5	6	-0.07	12	9	3	0.65	23	947.00
INV20	14	2	12	-0.65	10	3	7	-0.11	24	410.00
INV21	14	2	12	-0.71	13	4	9	-0.24	27	669.00
INV22	11	2	9	-0.43	10	3	7	-0.11	21	3399.00
INV23	8	8	0	0.55	10	6	4	0.14	18	1951.00
INV24	15	9	6	0.39	14	10	4	0.46	29	583.00
INV25	14	10	4	0.52	9	7	2	0.33	23	3750.00
TOTAL	**314**	**167**	**147**	**0.12**	**284**	**177**	**107**	**0.29**	**598**	**5663.00**

The projects with the highest contribution to the amount of synergies and to the mean score are offshore wind projects (INV11, 12, 16) and energy efficiency projects (INV7). The share of synergies compared to the total amount of interactions in these projects were 95.8 – 100.0% and 100.0% respectively. The projects with the lowest contribution to the amount of synergies and to the mean score are projects where fossil fuels are involved (INV1 – 3, 8, 20 – 22) and electricity transmission and distribution projects (INV4, 18). The share of synergies compared to the total amount of interactions in these projects varied between 18.2% and 44.0% with an average contribution of 24.9% for fossil fuel projects and between 22.2% and 25.0% with an average contribution of 23.7% for electricity transmission and distribution projects. All the other projects (all renewable energy projects) were assigned with 60.9 – 95.8% of synergies compared with the total amount of interactions with an average of 68.9%. The lowest score in these remaining projects was for a geothermal power plant in Iceland (60.9%) and the highest score for a solar PV field (90.0%).

5 Discussion and Conclusions

5.1 Interpretation of the Results

The coherence between the investments by the EIB in the energy sector and the EU policy goals relevant for the WLEFC-nexus is more often synergistic than conflicting (Research Question 1). Specifically, 344 synergies and 254 trade-offs were identified. This is in line with the findings of Munaretto & Witmer (2017) where more synergies than conflicts were found between the EU policy goals relevant for the nexus (Munaretto & Witmer, 2017) as well as the findings of Van der Burg (2019) where more synergies than conflicts were found between European investment policy and the EU policy goals relevant for the WLEFC-nexus (Van der Burg, 2019). Despite the higher amount of synergies than conflicts, the number of conflicts is high since the investments are designed to support the EU policy goals. This is also in line with the statement of Nilsson et al. (2012) that it is politically easy to reach agreement on general goals whereas selecting and implementing instruments and measures to achieve those goals (investments) is where conflicts and related trade-offs arise. Thus, in the case of the actual investments in the energy sector by the EIB, this statement is confirmed.

The conclusions described above are based on the information provided by the EIA's published by the EIB. The EIA is considered as the most suitable document to determine the coherence between the investments of the EIB in the energy sector and the EU policy goals relevant for the WLEFC-nexus. The relation of the EIA with the WLEFC-nexus is described in more detail in section 4.2 both in the form of legislation (Research Question 1.3) and in the form of described content (Research Question 2). The conclusion that the EIA is suitable to determine the coherence between the investments by the EIB in the energy sector and the policy goals relevant for the WLEFC-nexus is based on both a quantitative tool and a qualitative assessment (Research Question 2.1). The quantitative tool (keyword count; see section 5.2) has been a helpful tool to assess whether certain subjects (sectors in this case) are discussed in the EIA's. However, a qualitative assessment of the individual projects showed that the WLEFC-sectors are only discussed individually without appointing the interlinkages between the sectors. This means that no conclusions can be drawn about the coherence between investments by the EIB in the energy sector and the EU policy goals relevant for the WLEFC-nexus as well as the WLEFC-nexus compliance of the investments. Therefore, a more advanced method to determine this coherence and compliance was needed for which the scoring system by Nilsson et al. (2016) is used.

Since policy coherence is bidirectional (investments → policy goals; policy goals → investments), there is a difference in effect depending on the direction of scoring. In both cases, the coherence is more often synergistic than conflicting (see table 14 in section 4.4.4). This bidirectional coherence resulted in a binary meaning of these results. First, the in particular conflicting effect of the investments by the EIB in the energy sector on the EU policy goals relevant for the WLEFC-nexus (INV → policy goals) means that there is no WLEFC-nexus compliance based on the following criteria. As described in section 3.3.2, the criteria for successful nexus policy for cross-sectoral, horizontal policy are that the synergies between the policy domains are exploited (1) and that trade-offs between the policy domains are managed or mitigated, transparent choices are made in case of conflicting instruments, objectives or goals, and arrangements are set for 'losers' (2) (Witmer et al., 2018; Research Question 1.2). A negative interaction score means that these successful nexus criteria are not complied by the applicant for the concerning project. This means that all the criteria for successful nexus policy are included in the scoring system. Thus, a project with a negative environmental impact could still have received a positive score when this negative environmental impact is mitigated or compensated. 2 out of the possible 5 sectors (land, and food) were assigned a negative score, which means that the investments by the EIB in the energy sector are not considered as WLEFC-nexus compliant. The main reason for the assigning of negative scores was the total lack of compensation measures (with the exception of very few cases) by the applicants for the financed projects. It is unclear whether such compensation measures are simply not mentioned in the EIA documents or not applied at all. In the first case, it would be a lack of transparency by the EIB. In the latter case, it would lead to the hard conclusion that the investments by the EIB in the energy sector are not WLEFC-nexus compliant.

The second meaning of the bidirectional coherence is that the effect of pursuing the EU policy goals relevant for the WLEFC-nexus could have consequences for the future investment portfolio of the EIB. If the EIB would improve its compliance to the successful nexus criteria, this could mean that certain projects will be screened out in the future. On the other hand, conflicting interests after complying to the successful nexus criteria can result in an unchanging investments portfolio. Since the EIB does not live up to the successful nexus criteria yet, it is unclear what the investment portfolio will look like in the future. However, based on the findings in this study, it is expected that the nexus-compliance will increase when the EIB starts investing with a nexus-approach. Thus, combining the non-compliance and the expected screening out of certain projects in the future, it is important to understand which projects contribute to the arising synergies and conflicts.

The projects with the highest contribution to the amount of synergies are offshore wind projects and energy efficiency projects whereas projects with the highest contribution to the amount of conflicts are projects with fossil fuels involved and transmission and distribution projects. However, this does not mean that nexus compliance can only be achieved by investing in offshore wind projects and energy efficiency projects. There are often conflicting interests. For example, electricity transmission and distribution is essential to provide electricity for everyone. Therefore, it is important to note that exploring synergies, mitigating conflicts, and compensate the trade-offs all contribute to the nexus-compliance of the EIB.

This study showed that the coherence between the investments by the EIB and the EU policy goals relevant for the WLEFC-nexus is more often synergistic than conflicting, but that the investments by the EIB are not considered as WLEFC-nexus-compliant. However, since this is the first academic contribution to this topic, there are limitations concerning this research.

5.2 Limitations of Research

In the methodology section (section 3), it is described how the selection of suitable projects for the coherence assessments is conducted. It was expected that this selection process would bring unintended biases in the results. These biases, in their turn, will cause limitations for this study. Therefore, these limitations are discussed here. The limitations in this study can (1) concern limitation by the EIB in providing information in its database and (2) concern research limitation in the way this research is conducted. First, limitations in the project selection process are discussed (database limitations and research related limitations) followed by limitations in the scoring system process (research related limitations).

5.2.1 Limitations in Project Selection Process

In this study, only projects that required an EIA are examined for the coherence assessment. This is the first expected research related limitation since this expectation was that this selection step results in an overestimation of the interaction scores. This is due to the fact that EIA-required projects are expected to have a negative impact on the environment and thus on the sectors in the WLEFC-nexus. Therefore, it was expected that the interaction scores are more negative than the effects of the investments by the EIB in reality are. However, as shown in section 4.4.1, table 7, it is assumed that the assigned scores in section 4.4.2 and 4.4.3 are an average representation of the subsectors in table 6. Projecting the assigned coherence scores on the complete dataset of 333 projects, a difference in mean assigned score of 0.057 arises in favour of the original dataset. After conducting a Levene's test (p = .664) the two sampled T-test showed that this difference in mean assigned scores between the selected dataset and the original dataset was not significant (p = .903). For this reason, it is concluded that the selected list of 25 projects is a sufficient representation of the original dataset of 333 projects and that no overestimation of the coherence interactions is made (no limitation).

There are two limitations in this research which resulted in the impossibility to examine more projects to reinforce the coherence scores. The first limitation is that the EIB only published 69 EIA documents out of the 139 EIA-required projects. The reason for the absence of these documents is not clear (database limitation). The second limitation is that all EIA documents are published in the language of the country where the project is conducted. Due to language constraints of the researcher, only EIA documents in English, Dutch, and German are examined for coherence scores (database limitation and research related limitation). For the latter reason, 25 projects remained to score the coherence between the investments by the EIB in the energy sector and the EU policy goals relevant for the WLEFC-nexus.

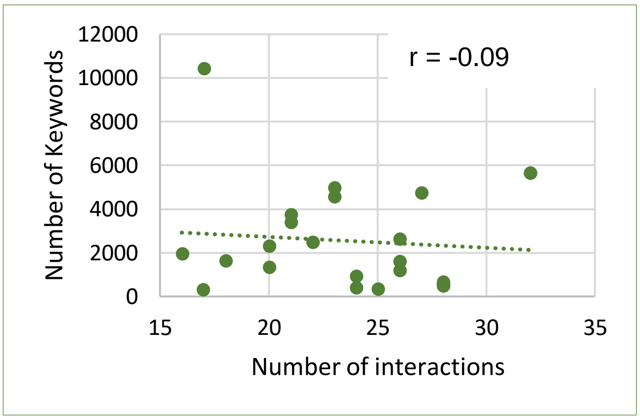

Figure 11. The relation between the number of keywords in an EIA document and the number of assigned interaction based on this EIA document.

In other words, if the EIA documents were all published in for example English (and without time constraints), it would have been possible to assess 69 projects. The keyword count in section 4.3.1 showed that all 69 projects were suitable for a coherence assessment. This keyword count also showed that there was a significant difference in the number of keywords between different sectors in the WLEFC-nexus. It was therefore expected that sectors with a significant lower number of keywords (food, see section 4.3.1) would be assigned less interactions than the other sector. However, a Pearson correlation test (figure 11) showed that there is no correlation between the number of keywords and the number of assigned interactions. This also means that it is not possible to draw conclusion about the coherence between the investments by the EIB and the EU policy goals relevant for the WLEFC-nexus based on the number of keywords in the EIA documents. The keyword count is thus only a helpful tool to ascertain whether and to which extent certain subjects are discussed.

All in all, the database of the EIB is not complete since the background information of projects is not always given (Research Question 1.1). Besides, in 50% of the cases, the required EIA documents are not published. As stated before, there is no information provided by the EIB concerning the coherence between its investments and the EU policy goals for water, land, energy, food, and climate.

5.2.2 Limitations in the Scoring System

During the SIM4NEXUS project, the scoring system of Nilsson et al. (2016) is used to compare EU policy goals relevant for the WLEFC-nexus with each other (Munaretto & Witmer, 2017) and EU investment policies with the EU policy goals relevant for the WLEFC-nexus (Van der Burg, 2019). This scoring system is developed to score the coherence between policies which includes the coherence between the EU policy goals relevant for the WLEFC-nexus and the investments by the EIB in the energy sector in this study. After all, investing is part of the policy cycle (implementation). As stated before, this scoring system is used in a bidirectional way, meaning that the investments have an effect on the policy goals (A→B), but also that the policy goals have an effect on the investments (B→A). However, after interpreting the results of this study, it became clear that there is an important difference in the bidirectional use of the scoring system between policy goals on paper (Munaretto & Witmer, 2017; Van der Burg, 2019) and the actual implementation of policies (investments; this study). Namely, it is not possible to score the effect of policy goals on the investments by the EIB since these investments are already conducted. Therefore, the choice was made to score the effect of the policy goals on the subsector of the conducted projects and not on the individual project. At this point, it became clear that a circular argument arises. This can be explained by the following example. Wind energy projects have a positive connection with the policy goal to reach at least a 32% share of renewable energy in the EU by 2030 (E1). In the other scoring direction (B→A), this policy goal has a positive effect on this wind energy project since it is more likely that such projects will be conducted in the future. The latter reasoning results in again a support of the investment in the achievement of the policy goal (B→A = A→B). This reasoning is also reflected in table 14; section 4.4.4, where in 96% of the cases the connection A→B and B→A is similar (both positive or both negative). All in all, since it is not possible for the policy goals to have a direct effect on the conducted investments, it is unnecessary to conduct the scoring in this direction. This limitation, however, has no effect on the conclusion that the coherence between the investments by the EIB and the policy goals relevant for the WLEFC-nexus is more often synergistic than conflicting and that the investments by the EIB are not considered as WLEFC-nexus-compliant. Moreover, this limitation is a valuable result since this study is the first academic contribution to this topic. Thus, the conclusion here is that it is redundant to score the effect of policy goals on implemented policies in general using this bidirectional scoring system.

The limitations in this section directly resulted in multiple recommendations for the EIB to improve its nexus compliance and for future research (Research Question 1.4). This recommendations are discussed in section 5.3 below.

5.3 Recommendations

5.3.1 Increase Transparency

The first recommendation is to improve the transparency of the EIB. This has no direct effect on the possible improvement in coherence between its investments and the EU policy goals relevant for the WLEFC-nexus. However, by improving the transparency about the investments, the possibility to investigate the WLEFC-nexus potentials is enabled. In this way, it becomes more clear where gains can be made. In the first place, the EIB can increase its transparency by creating a structured publishing routine to make sure its database is complete and up-to-date. This enables researchers to investigate more data which will increase the strength of the drawn conclusion. Second, the EIB could consider to demand the applicants to conduct the EIA's in English. This will increase the number of investigable projects which, again, will strengthen the potential conclusions about the investments by the EIB.

5.3.2 Strive for the most synergistic solution

The second recommendation is to strive for the most synergistic solution. This recommendation seems obvious, but it is essential to understand which kind of investments contribute to a higher share of synergistic interactions between the investments and the EU policy goals relevant for the WLEFC-nexus. This is discussed in section 5.1. It became clear that renewable energy projects (especially offshore wind projects) and energy efficiency projects are more often synergistic than conflicting with the EU policy goals relevant for the WLEFC-nexus. Therefore, the recommendation for the EIB is to focus on such investments. The EIB should strive for the most synergistic solution for projects with a similar outcome. A very simple example here is the application of a solar field with rooftop solar panels. Both have the same outcome (capacity in Watts) when the same amount of panels is applied. However, rooftop solar panels will have a much less conflicting effect since no land is needed, no vegetation is cleared, and no excavation is needed. Thinking in the most synergistic solutions, the EIB will be able to increase its WLEFC-nexus compliance and the coherence between its investments and the EU policy goals relevant for the WLEFC-nexus.

5.3.3 Increase Mitigation and Compensation Measures

This recommendation is to increase mitigation and compensation measures, which is in line with the previous recommendation. However, the difference is here that it is not always possible to choose between projects. For example, to achieve energy supply security (E5), it is essential to invest in electricity transmission and distribution projects. Therefore, the EIB should demand its applicants to apply mitigation measures to reduce the share of conflicts to the utmost. If there are still conflicting interests, the applicant can choose to compensate the 'losers'. A nexus is not necessarily about the goal to have only synergies. It is about exploiting all possible synergies, while mitigating conflicts and compensating conflicting interests (Witmer et al., 2018). In this way, the investment portfolio of the EIB will increase in nexus-compliance.

6 Final Statement

The coherence between the investments by the EIB in the energy sector and the EU policy goals relevant for the WLEFC-nexus between the signing of the Paris agreement and 2020 are more often synergistic than conflicting. However, the investments by the EIB are not WLEFC-nexus compliant. This conclusion is drawn based on a restricted selection of projects from the EIB database. To strengthen the conclusions in this study, the EIB should strive for more transparency. What is clear from the results is that the EIB should make an effort to invest in the most synergistic solutions and mitigate insurmountable conflicts. In doing so, the European Union is enabled to conduct its policy in the most synergistic way for a more sustainable, resource efficient, and climate resilient world.

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8 APPENDICES

8.1 APPENDIX 1 – STATISTICAL TESTS KEYWORD COUNT

A Levene's test showed that there was no homogeneity of variance between the number of keywords for the different sectors in the WLEFC-nexus (F = 7.4696, *p* = 8.974e-06). Therefore, a robust Welch two sample T-test was conducted to examine the difference in the mean number of keywords between the sectors of the WLEFC-nexus. The results of these tests are shown in table 5.

Table 15. Welch two sample T-test with WLEFC-sectors as a factor.

Compared Sectors	t	df	*p*-value
Water – Land	-1.94	97.09	.05585
Water – Energy	-5.05	116.68	1.62e-06
Water – Food	3.80	81.21	.00028
Water – Climate	-0.56	128.25	.5767
Land – Energy	-1.85	122.71	.06732
Land – Food	4.05	70.41	.0001306
Land – Climate	1.68	87.20	.09698
Energy – Food	8.54	73.36	1.341e-12
Energy – Climate	4.93	102.71	3.207e-06
Food – Climate	-5.42	88.51	5.124e-07

8.2 APPENDIX 2 – EXPLANATION SCORING INTERACTIONS WATER POLICY

INV1 & INV2

INV 1 and INV2 are the same project, but conducted in a different country (Greece or Bulgaria). This project scores negative mainly due to the construction phase. The project has a negative impact on the water quality since 0-5% leakage from wastewater occurs (W1, W2). Besides, the excavation of the soil in rivers resulted in a temporary decrease of the water quality. However, the applicant only used wastewater in the areas where the groundwater already had a poor condition. Therefore, the relative impact on the water quality was low, which resulted in a score of -1 (W1). Not only the quality, but also the quantity of good quality water was affected. Drinking water of villages surrounding the pipeline was used for the manufacturing of the pipeline (W2, W3, W4). In this way, the water consumption was increased and the water efficiency decreased since water of less quality could also have been used. The decrease of both quantity and quality of water for people's needs, the economy, and environment resulted in a score of -2 for W2. W3 and W4 both received the score of -1 since the use of drinking water was limited to the construction phase. During operation, there was no effect on the water efficiency (W3) and water consumption (W4). Also, during the construction phase, the rivers and water flows which are crossed by the pipeline were pumped dry, which induces drought (W6). However, this drought was only for a maximum duration of 10-15 days, which will have very little hydrological and ecological effect when it only happens once (Hamlin & Wright, 1978). This resulted in the score of -1 (W6). The only positive score assigned to this project was for the achievement of policy goal W5. Large parts of the pipeline were constructed in a river for which the river was deepened. This resulted in less flood risks. During the construction phase, there was an increase of erosion and washing of soil into rivers. However, this was directly mitigated during construction. Therefore, W6 received a score of +1. Despite the negative note of this project, there were no scores of -3 assigned since all impacts only occurred during the construction phase (with the exception of deepening the river bed). For this reason, this project did not make the achievement of the EU water policies cancelling (table 4).

INV3

This combined heat and power plant in Croatia has an overall neutral effect on the EU water policies. There is no significant effect on the water quality since all the water used in the plant goes back in the sewage system (W1;0). This CHP plant collects rainfall to cool the system and discharges clean rainfall. This results in a higher quality of surface water and groundwater for people's needs, the economy, and environment (W2;+1). After use, the used water is treated to enter the sewage system. Beside rainfall, sanitary waste water is used for this plant. In this way, there is a direct aim in increasing water efficiency (W3;+2). The net consumption in water consumption is not altered since only rainfall and sanitary wastewater is used (W4;0). The amount of rainfall collected is so minimal on a global scale that it is not considered as significant (W6;0). There was no connection to the policy goal to assess and manage flood risk and mitigate flood effects (W5).

INV4

The construction of this electricity network has an overall negative score in relation with the EU water policy goals relevant for the WLEFC-nexus, which is mainly a result of temporary dewatering and permanent increased permeability of the soil resulting in permanent lower groundwater tables. Dewatering for the construction of the network results in contamination plumes in the groundwater, which has a negative effect on the quality status of the groundwater (W1, W2). The temporary effect of dewatering results in a permanent salinization of the groundwater in the region of the electricity network, which contains high amounts of agricultural land. For this reason, this project results in a decrease of the usability of the groundwater in this region, which affects humans and the economy in these regions (W2). Moreover, dolomite beds are used for the electricity cables, which results in a permanent lowering of the groundwater table due to a higher infiltration rate of surface water into the ground. As a result, less groundwater is available for humans to use (W2;-3). The higher permeability of the soil also results in an increased infiltration of polluted water into the groundwater, which has an adverse effect on the water quality (W1;-2). Dewatering of the areas around the electricity network also results in permanent drought (W6;-3). The last negative score is in relation with the policy goal to assess and manage flood risks and mitigate flood effects (W5). For this projects, terrains are paved which results in less water infiltration resulting in flood risks. The construction area of this project already is vulnerable for floods, which is aggravated by this project (W5;-1).

INV5

This wind park project only has one direct connection with the EU water policy goals relevant for the WLEFC-nexus. The wind turbines are constructed outside the flooding area of the river Leitha in Austria. However, in worst-case scenario, the area of the wind park can flood and the pavement around the wind turbines results in less water drainage. In this case, there are less possibilities for mitigating these flood effects because of pavement (W5). Since these effects will only occur in a worst-case scenario, this connection is assigned with a score of 0. The indirect connection of this project with the EU water policy goals relevant for the WLEFC-nexus is that no water is needed to produce wind energy. Compared to other sources of energy production, this is much more water efficient (W3;+2) and the global water consumption will decrease with investments in wind energy (W4;+2) (Spang et al., 2014). Moreover, this also results in more available water for other users (W2;+1) and less drought (W6;+1).

INV6

No direct connections between this project and the EU water policy goals relevant for the WLEFC-nexus were described in the EIA of this project. The indirect connection of this project with the EU water policy goals relevant for the WLEFC-nexus is that no water is needed for the production of wind energy. Compared to other sources of energy production, this is much more water efficient (W3;+2) and the global water consumption will decrease with investments in wind energy (W4;+2) (Spang et al., 2014). Moreover, this also results in more available water for other users (W2;+1) and less drought (W6;+1).

INV7

This project is to increase the energy efficiency in Lithuania using a co-funding programme. There are no direct connections described between this project and the EU water policy goals relevant for the WLEFC-nexus. However, the indirect connection between energy production and water use leads to a positive score for this project. Increasing the energy efficiency with the same energy demand means that less energy is needed to be produced which results in a lower need for water and an increase in water efficiency (W3; +1, W4;+1) (Spang et al., 2014).

INV8

The project to store oil in Cyprus has a negative coherence score with the EU water policies relevant for the WLEFC-nexus. First of all, there is an occurrence of oil spills at the site of the storage system. This affects the water quality (W1, W2). Most of the process water is treated and therefore contains relatively low amounts of oil residues (max. 10 ppm) (W1;-1). For the operation of the storage plant, almost 8,000 m^3 of public freshwater is used annually. This is 0.7% of the annual water use by the inhabitants of Cyprus. This is a significant increase of water consumption (W4;-2). The use of public freshwater results also in a decrease of water efficiency (W3; -2), since the public freshwater is discharged into surrounding surface waters after use. This gives an additional reduction of the quality of the surface water (W2; -2). To prevent the oil from leaking into the surface water and groundwater, the complete area around the plant is drained. The intention to reduce the effect on water quality results in an increase of water scarcity and drought. Drought already is a problem in Cyprus (European Parliament, 2019), which is aggravated by this project (W6;-2).

INV9

The CHP project in Lithuania uses mainly rainwater for the operation of the CHP plant. There is no significant effect on the water quality since all the water used in the plant is treated until water standards are met (W1; 0). There is no public water used for the operation of the CHP plant. Enormous amounts of rainwater are used for this plant (1.8 – 2.7 million $M^3 \cdot year^{-1}$), but the net use is 0 since all the water is discharged in the rainwater networks (W4;0, W6;0).

INV10

There were no direct connections between the solar PV project in the Maldives with the EU water policies relevant for the WLEFC-nexus since almost no water is used for solar PV energy production. The same indirect connection as with INV5 and INV6 holds for this project. There is an increase in water efficiency since less water is needed to produce the same amount of energy (W3; +2) and there is an absolute reduction of water consumption (W4; +2) (Spang et al., 2014). Moreover, this also results in more available water for other users (W2;+1) and less drought (W6;+1).

INV11

No direct connections between this project and the EU water policy goals relevant for the WLEFC-nexus were described in the EIA of this project. The indirect connection of this project with the EU water policy goals relevant for the WLEFC-nexus is that no water is needed for the production of wind energy. Compared to other sources of energy production, this is much more water efficient (W3;+2) and the global water consumption will decrease with investments in wind energy (W4;+2) (Spang et al., 2014). Moreover, this also results in more available water for other users (W2;+1) and less drought (W6;+1).

INV12

No direct connections between this project and the EU water policy goals relevant for the WLEFC-nexus were described in the EIA of this project. The indirect connection of this project with the EU water policy goals relevant for the WLEFC-nexus is that no water is needed for the production of wind energy. Compared to other sources of energy production, this is much more water efficient (W3;+2) and the global water consumption will decrease with investments in wind energy (W4;+2) (Spang et al., 2014). Moreover, this also results in more available water for other users (W2;+1) and less drought (W6;+1).

INV13

The geothermal energy extension in Kenya has an overall negative effect on the EU water policy goals relevant for the WLEFC-nexus. The most significant impact of the project is the use of surface water from a lake (70,000 m^3) which aggravates the severe drought in Kenya (Gebrechorkos et al., 2020) (W6;-1). This also results in less supply of good quality surface water for people's needs, the economy, and the environment (W2;-2) and it results in an increase in water consumption (W4;-2). In addition to the increase of water use, contamination of groundwater with geothermal fluids takes place. Among other substances, heavy metals (arsenic and mercury) are present in the vapour as a result of the pressure. The major part of the produced and contaminated steam is collected and re-injected (W1;-1).

INV14

The concentrated solar power (CSP) plant in Morocco has an overall negative effect on the EU water policy goals relevant for the WLEFC-nexus. This is mainly due to the high amounts of water needed to create steam for heat production. Water from the Mansour Ed Dahbi dam is used for the production of steam. The surface water in this reservoir is also used as drinking water for the inhabitants of Morocco. However, the amount of less available drinking water from this dam is only 0.13% - 0,29% (W2;-1). Evaporating drinking water is counteracting the EU policy goals to increase water efficiency (W3;-2) and reduce water consumption (W4;-2). It creates also constraining conditions to achieve the EU policy goal to assess and mitigate water scarcity (W6;-1).

INV15

The solar PV field in Zambia has a slight positive effect on the EU water policy goals relevant for the WLEFC-nexus. Again, less water is needed for the production of solar energy than for the production of fossil fuel energy. This has a positive effect on the water efficiency and water demand (W3;+2, W4;+2). The negative effect of this solar PV field is that an increase of surface runoff is effectuated. This is a result of removing the vegetation from the construction site which leads to less water infiltrating the ground. This ultimately leads to a decrease in the supply of good quality surface water and groundwater for people's needs, the economy, and environment and to an increase in flood risks (W2; -1, W5;-1).

INV16

During the construction of this offshore wind farm in Belgium, the water quality is temporary decreased as a result of drilling to construct the funding of the windmills (W1;-1). Further, no direct connections between this project and the EU water policy goals relevant for the WLEFC-nexus were described in the EIA of this project. The indirect connection of this project with the EU water policy goals relevant for the WLEFC-nexus is that no water is needed for the production of wind energy. Compared to other sources of energy production, this is much more water efficient (W3;+2) and the global water consumption will decrease with investments in wind energy (W4;+2) (Spang et al., 2014).

INV17

No direct connections between this project and the EU water policy goals relevant for the WLEFC-nexus were described in the EIA of this project. The indirect connection of this project with the EU water policy goals relevant for the WLEFC-nexus is that no water is needed for the production of wind energy. Compared to other sources of energy production, this is much more water efficient (W3;+2) and the global water consumption will decrease with investments in wind energy (W4;+2) (Spang et al., 2014). Moreover, this also results in more available water for other users (W2;+1) and less drought (W6;+1).

INV18

The project in electricity transmission and distribution in the United Kingdom has an overall negative effect on the EU water policies relevant for the WLEFC-nexus. The quality of the water in the nearby conserved nature site (Achanarras Burn) decreases as a result of contamination by drainage and material use (W1;-1). This has also an effect on the supply of good quality surface water and groundwater for people's needs (W2;-1). A permanent, but relatively small effect is the increase of flood risks due to the sedimentation of surrounding watercourses (W5;-1).

INV19

The only connection of this geothermal power plant in Iceland with the EU water policies relevant for the WLEFC-nexus is a negative impact on water quality due to leakage of geothermal fluids (W1;-1).

INV20

The trans Adriatic pipeline in Albania has an overall negative effect on the EU water policy goals relevant for the WLEFC-nexus. This is the result of river crossings and hydrotesting during the construction phase. 372 river crossings have to be constructed, which has a negative effect on the supply of surface water (W2;-1). For hydrotesting the pipeline, large amounts of water are needed. This has a negative effect on the policy goal to reduce water consumption. However, after use, the water is re-injected to restrict the use of water to the utmost (W4;-1).

INV21

The gas interconnection in Romania has a negative impact on the EU water policy goals relevant for the WLEFC-nexus. First of all, the wate quality of both the surface water and groundwater is negatively affected by the mobilisation of contaminants in the soil (W1;-1). An additional decrease in quality of the surface water takes place due to the clearance of vegetation. Groundwater tables decrease due to dewatering of the construction site and a direct discharge of pollutants after hydrotesting discharge occurs (W2;-3). This hydrotesting also results in a temporary increase of the water consumption (W4;-1). Lastly, this project has an adverse effect on the policy goal to assess and manage flood risks. A temporary positive effect occurs due to the construction of cofferdams on the site. This results in a lower water flow downstream leading to less flood risks. However, a permanent increase of flood risks occur after the introduction of the pipeline into the waterbeds. There is no application of deepening the water bed, which results in a permanent higher surface water level which results in a permanent increase of flood risks (W5;-2).

INV22

The biggest effects on the EU water policy goals relevant for the WLEFC-nexus of this gas pipeline in Moldova are a result of river crossings and hydrotesting of the pipeline. The river crossings result in a lower surface water flow. This is aggravated by hydrotesting the pipeline for which river water is used (W2;-1). The high amounts of water needed for hydrotesting results in an increase of water consumption (W4;-1). The open-cut wet ditch method to construct the pipeline results in an increase of sediment runoff into the waters resulting in an increased flood risk (W5;-1).

INV23

No direct connections between this project and the EU water policy goals relevant for the WLEFC-nexus were described in the EIA of this project. The indirect connection of this project with the EU water policy goals relevant for the WLEFC-nexus is that no water is needed for the production of wind energy. Compared to other sources of energy production, this is much more water efficient (W3;+2) and the global water consumption will decrease with investments in wind energy (W4;+2) (Spang et al., 2014). Moreover, this also results in more available water for other users (W2;+1) and less drought (W6;+1).

INV24

No direct connections between this project and the EU water policy goals relevant for the WLEFC-nexus were described in the EIA of this project. The indirect connection of this project with the EU water policy goals relevant for the WLEFC-nexus is that no water is needed for the production of wind energy. Compared to other sources of energy production, this is much more water efficient (W3;+2) and the global water consumption will decrease with investments in wind energy (W4;+2) (Spang et al., 2014). Moreover, this also results in more available water for other users (W2;+1) and less drought (W6;+1).

INV25

The solar PV field in India has a slight positive effect on the EU water policy goals relevant for the WLEFC-nexus. Again, less water is needed for the production of solar energy than for the production of fossil fuel energy. This has a positive effect on the water efficiency and water demand (W3;+2, W4;+2). Moreover, this also results in more available water for other users (W2;+1) and less drought (W6;+1). The negative effect of this solar PV field is that an increase of surface runoff is effectuated. This is a result of removing the vegetation from the construction site which leads to less water infiltrating the ground. This ultimately leads to a decrease in the supply of good quality surface water and groundwater for people’s needs, the economy, and environment and to an increase in flood risks (W2; -1, W5;-1).

8.3 Appendix 3 – Explanation Scoring Interactions Land Policy

INV1 & INV2

The gas interconnector between Bulgaria and Greece has a significant negative effect on the EU land policy goals relevant for the WLEFC-nexus. The most significant impact is a result of the excavation of soil for the construction of the pipeline, which results in soil erosion. Besides, the fertility of the soil decreases due to compaction of the soil by heavy machinery. The erosion, compaction, and fertility loss results in a permanent highly degraded soil (L2;-3). The new created soil conditions sets a constraint on achieving the policy goal to restore degraded soils to a level of functionality at least with current and intended use (L1;-1). The project ultimately results in a permanent loss of 20.29 ha of valuable soils. For the construction of the pipeline, cleaning of woods is necessary. This directly results in a decrease in quantity of the EU's forested area (L3;-2). Beside the clearance of woods, high amounts of valuable agricultural land is lost due to this project. Despite the loss of agricultural land, there is no change in the demand of agricultural products, which will result in practicing agriculture elsewhere, possibly at the expense of nature sites. This is a classical example of indirect land use change (iLUC) (L4;-1).

INV3

The EIA of the CHP plant in Croatia describes no direct impact of the gas-fired plant on the EU land policy goals relevant for the WLEFC-nexus. The plant is built homogeneous to an already existing industrial site and the CHP plant runs on gas wherefore no biomass has to be cultivated. A study of Allred et al. (2015) showed that among other fuels, gas development results in a reduction of forestlands as well as croplands. However, comparing each energy source concerning their footprint on land use, after coal, gas needs the least amount of land (12.41 ha·MW^{-1}) (Stevens et al., 2017). The global energy mix uses approximately 55 ha·MW^{-1} (IEA, 2017). Thus compared to the total energy mix, the development of gas-fired energy production results in an increase of available land for forests (L3;+1). This will also create conditions to prevent indirect land use change from nature to productive use (L4;+1).

INV4

The electricity transmission and distribution in Belgium has an overall negative impact on the EU land policy goals relevant for the WLEFC-nexus. The most significant impact is the compaction and disintegration of the soil where the soil is excavated for the construction of the electricity lines. These are permanent effects. However, the applicant took measures to mitigate these effects by for example dividing the excavated soil and returning it in the original order (L2;-2). The policy goal to restore degraded soils to a level of functionality at least with current and intended use is difficulted (L1;-1). The degradation of soil is not significant enough to induce indirect land use change (L4;0). The degradation of the soil is mainly a negative effect for farmer who cultivate crops on these soils (see food policy).

INV5

The construction of the onshore wind power plant in Austria has a slight negative effect on the EU land policy goals relevant for the WLEFC-nexus. A direct impact is that each wind turbine needs 110 m^2 of agricultural land for which the soil is excavated and removed. This cannot be restored (L1;-1, L2;-1). However, the amount of degraded soil is limited. An indirect effect of the construction of onshore wind power is that the construction of wind energy demands a higher amount of land for the production of energy (70.64 $ha \cdot MW^{-1}$) compared to the global energy mix (see earlier). The higher amounts of land needed for this project puts constrains on the policy goal to increase the quantity of forests in the EU (L3;-1). The absolute amount of land used for a wind park is not considered as significant concerning indirect land use change. However, the loss of agricultural land is mainly a negative impact for the landowners (see food policy).

INV6

The construction of the onshore wind power plant in Austria has a slight negative effect on the EU land policy goals relevant for the WLEFC-nexus. A direct impact is that each wind turbine needs 110 m^2 of agricultural land for which the soil is excavated and removed. This cannot be restored (L1;-1, L2;-1). However, the amount of degraded soil is limited. An indirect effect of the construction of onshore wind power is that the construction of wind energy demands a higher amount of land for the production of energy (70.64 $ha \cdot MW^{-1}$) compared to the global energy mix (see earlier). The higher amounts of land needed for this project puts constrains on the policy goal to increase the quantity of forests in the EU (L3;-1). The absolute amount of land used for a wind park is not considered as significant concerning indirect land use change. However, the loss of agricultural land is mainly a negative impact for the landowners (see food policy).

INV7

The project to increase the energy efficiency in Lithuania results in a positive effect on the EU land policies relevant for the WLEFC-nexus. Every form of energy production needs land (Stevens et al., 2017). More energy efficiency leads to less energy consumption and therefore less energy production for which less land is needed. This provides more room for forests to be planted (L3;+1). Another positive effect is that indirect land use change is prevented since there is less land needed for energy production (L4;-1).

INV8

The storage of oil in Cyprus has little effect on the EU land policies relevant for the WLEFC-nexus. The only minor effect that this project has, is that soil is excavated for the construction of fundings to store the oil. This results in compaction and disintegration of the soils which leads to soil degradation (L2;-2).

INV9

This project consists of the construction of a combined CHP power plant in Lithuania. The construction of this power plant results in asphalting 7.1 ha of soils, which has a direct and permanent adverse effect on the EU policy goal to prevent soil degradation (L2;-3). Moreover, restoring degraded soils to a level of functionality at least with current and intended use is difficulted (L1;-1). On the construction site of this CHP power plant was no forested land or farmland present. Therefore, there was no effect on EU's forested area (L3;0) and there is no indirect land use change (L4;0).

INV10

The solar PV plant in the Maldives has a positive impact on the EU land policy goals relevant for the WLEFC-nexus, since for the production of solar power, less land is needed (43.50 $ha \cdot MW^{-1}$) than for the global energy mix (55 $ha \cdot MW^{-1}$). This, would result in the opportunity to increase the amount of forested area, but this project is not situated in Europe (L3;0). The prevention of indirect land use change from nature to productive use is prevented, because of the less land needed for energy production (L4;+1).

INV11

This offshore wind park in the North Sea in Belgium has a positive effect on the EU land policy goals relevant for the WLEFC-nexus. This is mainly due to the fact that no land is needed to produce energy in this case. Thus, if the energy demand remains the same, less land will be used to produce the same amount of energy. This gives a direct and permanent opportunity to increase the amount of forests in the EU (L3;+3). Besides, indirect land use change is directly prevented by this project (L4;+3). Since policy goals L1 and L2 concern land soils, this projects has no effect on these policy goals (L1;0, L2;0).

INV12

This offshore wind park in the North Sea in Belgium has a positive effect on the EU land policy goals relevant for the WLEFC-nexus. This is mainly due to the fact that no land is needed to produce energy in this case. Thus, if the energy demand remains the same, less land will be used to produce the same amount of energy. This gives a direct and permanent opportunity to increase the amount of forests in the EU (L3;+3). Besides, indirect land use change is directly prevented by this project (L4;+3).). Since policy goals L1 and L2 concern land soils, this projects has no effect on these policy goals (L1;0, L2;0).

INV13

This geothermal heat plant in Kenya has a slight positive effect on the EU land policies relevant for the WLEFC-nexus. New pipelines are constructed for which vegetation is removed resulting in degradation of the soil. However, this effect is only temporary. After the construction of the pipeline, trees and grasses are replanted to create the same vegetation as before. In this way, the soil degradation will only be temporary (L2;0). The planting of trees and grasses results in the possibility to restore the degraded soil to a level of functionality at least with current and intended use (L1;+1). No extra land is needed for the extension of this geothermal heat plant. Therefore, it has no effect on L3 and L4.

INV14

No direct connections with this concentrated solar power plant and the EU land policies relevant for the WLEFC-nexus were found. The plant is constructed on a flat rocky plateau in Morocco, wherefore no effect on the soil is expected. The site of this plant had no commercial use. Thus, there is no indirect land use change.

INV15

This solar PV field in Zambia has a neutral effect on the EU land policy goals relevant for the WLEFC-nexus. For the construction of the solar panels, the vegetation needs to be cleared. This results in less availability of the soil to retain water which leads to more surface run-off and erosion. For this reason, there is soil degradation (L2;-2). This soil degradation has also a constraining effect to restore degraded soils to a level of functionality at least with current and intended use (L1;-1). For the production of energy with solar power, less land is needed than for the global energy mix (Stevens et al., 2017). However, L3 is about the forested area in the EU. For this reason, this solar PV plant in Zambia has no effect on this policy goal (L3;0). A big positive effect of this project is the prevention of indirect land use change as a result of the decrease of land needed for the same amount of energy production. This gives more room for nature (L4;+3).

INV16

This offshore wind park in the North Sea in Belgium has a positive effect on the EU land policy goals relevant for the WLEFC-nexus. This is mainly due to the fact that no land is needed to produce energy in this case. Thus, if the energy demand remains the same, less land will be used to produce the same amount of energy. This gives a direct and permanent opportunity to increase the amount of forests in the EU (L3;+3). Besides, indirect land use change is directly prevented by this project (L4;+3). Since policy goals L1 and L2 concern land soils, this projects has no effect on these policy goals (L1;0, L2;0).

INV17

The construction of the onshore wind power plant in Austria has a slight negative effect on the EU land policy goals relevant for the WLEFC-nexus. A direct impact is that each wind turbine needs 110 m^2 of agricultural land for which the soil is excavated and removed (L2;-2). This cannot be restored (L1;-1). An indirect effect of the construction of onshore wind power is that the construction of wind energy demands a higher amount of land for the production of energy (70.64 $ha \cdot MW^{-1}$) compared to the global energy mix (Stevens et al., 2017). The higher amounts of land needed for this project puts constrains on the policy goal to increase the quantity of forests in the EU (L3;-1). The absolute amount of land used for a windpark is not considered as significant concerning indirect land use change since it is assumed that the production of agricultural products will not shift to other places. However, the loss of agricultural land is mainly a negative impact for the landowners (see food policy).

INV18

The electricity transmission and distribution project in the United Kingdom has a negative impact on the EU land policies relevant for the WLEFC-nexus. There is a permanent loss of soil of approximately 92.000 m^3 (L2;-3). This has also the consequence that these soils cannot be restored (L1;-3). The loss of land is mainly agricultural land. The loss of this agricultural land (17 ha) directly results in a decrease of the possibilities to prevent indirect land use change from nature to productive use (L4;-1). However, as a mitigation measure, the applicant plants 10 ha of trees instead of the original agricultural land. The planting of this 10 ha of trees has a positive effect on the EU policy goal to improve the EU's forested area (L3;+2).

INV19

The construction of this geothermal plant in Iceland has a negative impact on the EU land policy goals relevant for the WLEFC-nexus. This is mainly due the removing of wild forest for productive use of the geothermal plant. 9% of wild forest in a nature reserve is lost due to this project (L3;-3). This has, however, no impact on policy goal L4 since it concern direct land use change in this case. A secondary effect of this forest removal is soil degradation. The loss of vegetation on top of the soil results in less water retention and therefore an increase in erosion (L2;-3). Restoring this degraded soil is made more difficult in this way, but not impossible (L1;-1).

INV20

The trans Adriatic pipeline in Albania has a negative impact on the EU land policy goals relevant for the WLEFC-nexus. For this pipeline, the soil is exposed to compaction and erosion which results in soil degradation (L2;-3). These degraded soils are more difficult to restore, but not impossible (L1;-1). Another negative effect is the loss of 209 ha of agricultural land. In this way, with an equal demand for agricultural products, indirect land use change from nature to productive use is initiated (L4;-3). The effect on EU's forested area is less since a landscape management plan is used for this project to restore the forests (L3;-1).

INV21

This project of gas connection in Romania has a negative impact on the EU land policy goals relevant for the WLEFC-nexus. For the construction of this connection, the working strip is cleared and soil is excavated for the pipeline. This results in a deterioration in soil quality. There is also soil compaction as a result of machinery. Both these impacts lead to soil degradation (L2;-2). A more degraded soil is more difficult to restore, but it is not impossible (L1;-1). No effect on the other EU land policy goals are described.

INV22

The construction of this gas pipeline in Moldova has a very negative impact on the EU land policy goals relevant for the WLEFC-nexus. The soil is permanently degraded as a result of erosion and compaction due to the excavation and machinery (L2;-3). These degraded soil make it constraining to restore the degraded soils to a level of functionality at least with current and intended use (L1;-1). The gas pipeline crosses both protected forests (0.41 – 1.69 ha) and unprotected forests (23 – 39 ha), which results in a loss of EU's forested area (L3;-3). The gas pipeline also crosses several agricultural lands. However, after construction, the agricultural lands are restored to original state. Therefore, there is no significant impact on the indirect land use change from nature to productive use (L4;0).

INV23

This wind park in Egypt has no significant impact on the EU land policy goals relevant for the WELFC-nexus. The wind park is situated in a desert without any agriculture or other economic purposes of land use. The soil in this area has no productivity, thus there is no soil degradation by this project.

INV24

The construction of the onshore wind power plant in Austria has a slight negative effect on the EU land policy goals relevant for the WLEFC-nexus. A direct impact is that each wind turbine needs 110 m^2 of agricultural land for which the soil is excavated and removed. This cannot be restored (L1;-1, L2;-1). However, the amount of degraded soil is limited. An indirect effect of the construction of onshore wind power is that the construction of wind energy demands a higher amount of land for the production of energy (70.64 $ha \cdot MW^{-1}$) compared to the global energy mix (see earlier). The higher amounts of land needed for this project puts constrains on the policy goal to increase the quantity of forests in the EU (L3;-1). The absolute amount of land used for a wind park is not considered as significant concerning indirect land use change. However, the loss of agricultural land is mainly a negative impact for the landowners (see food policy).

INV25

This solar PV field in India has a neutral effect on the EU land policy goals relevant for the WLEFC-nexus. For the construction of the solar panels, the vegetation needs to be cleared. This results in less availability of the soil to retain water which leads to more surface run-off and erosion. For this reason, there is soil degradation (L2;-2). This soil degradation has also a constraining effect to restore degraded soils to a level of functionality at least with current and intended use (L1;-1). For the production of energy with solar power, less land is needed than for the global energy mix. However, L3 is about the forested area in the EU. For this reason, this solar PV plant in India has no effect on this policy goal (L3;0). A big positive effect of this project is the prevention of indirect land use change as a result of the decrease of land needed for the same amount of energy production. This gives more room for nature (L4;+3).

8.4 Appendix 4 – Explanation Scoring Interactions Energy Policy

INV1, 2, 4, 18, 20 – 22

All these investments are about upgrading the energy transmission and distribution in terms of electricity (INV 4&18) or gas (INV 1,2, 20-22). These investments have no impact on reaching a share of renewable energy, energy efficiency or the amount of energy consumption (E1 – E3;0). An upgrade of energy transmission and distribution is inextricably connected to pushing forward important energy infrastructure projects (E4;+3) and achieving energy supply security (E5;+3).

INV3

This project is a gas fired power plant in Croatia. The use of fossil fuels for energy generation has a direct negative impact on the EU policy goal to reach at least a 32% share of renewable energy in the EU by 2030. However, this project does not make the accomplishment of this policy goal impossible (E2;-2). The production of energy, no matter what the source, stimulate the achievement of energy supply security (E5;+3) and it enables pushing forward important energy infrastructure projects (E4+1).

INV5, 6 9 – 17, 19, 23 – 25

The investment in renewable energy is inextricably connected to the policy goal to reach at least a 32% share of renewable energy in the EU by 2030 (E1;+3). The production of renewable energy has no connection with energy efficiency and the amount of energy consumption (E2&E3;0). The construction of renewable energy, however, can have an enabling effect to push forward important energy infrastructure projects (E4;+1) and achieve energy supply security (E5;+1).

INV7

This project to increase the energy efficiency in Lithuania has a positive effect on achieving the policy goal to increase the energy efficiency at least 32.5% in 2030 (E2;+3) and reduce energy consumption (E3;+3). This project does not have an effect on the share of renewable energy, energy infrastructure, and energy security (E1, E4&E5; 0).

INV8

This project to store oil reserves in Cyprus has no connections to the EU energy policy goals relevant for the WLEFC-nexus.

8.5 Appendix 5 – Explanation Scoring Interaction Food Policy

INV1 & 2

The gas interconnector between Bulgaria and Greece has an overall negative impact on the EU food policy goals relevant for the WLEFC-nexus. This is mainly the result of the degradation of agricultural soils. Due to the erosion and compaction of agricultural lands, farmers have lower crop yields which results in a lower income for farmers (F1;-2). These lower crop yields have a constraining effect on the competitiveness of the agricultural sector (F2;-1). Soil functionality is also an environmental public good in the agricultural sector (Baldock et al., 2010). Thus, therefore, the degradation of the soil has a negative impact on this policy goal (F3;-2). The indirect effect of the loss of soil fertility is that the efficiency of resource use decreases. There is more land needed to produce the same amount of food (F5;-1).

INV3

The only direct effect of this gas fired CHP plant in Croatia is that the use of gas fired power plants does not contribute to a low-carbon and climate resilient economy in the agricultural sector (F5;-2). An indirect effect of this gas fired CHP plant is that the use of gas needs less land than the global energy mix which results in more room for agricultural land. Agricultural landscapes are one of the environmental public goods for agriculture. Therefore, the use of a gas fired power plant has an enabling effect on the provision of environmental public goods in the agricultural sector (F3;+1).

INV4

This electricity transmission and distribution project in Belgium has an overall negative effect on the EU food policy goals relevant for the WLEFC-nexus. First of all, there is soil erosion and compaction due to the excavation of soils and the use of heavy machinery. Beside this, there is salinization of groundwater and soils, which leads to a reduction of productivity of many agricultural crops, including most vegetables (Machado & Serralheiro, 2017). The salinization due to the dewatering of the groundwater is an irreversible effect, which will not restore in 4 – 9 years. The combination of soil erosion, compaction and salinization leads to permanent lower crop yields. This has a cancelling effect on the particular farmers (F1;-3). This also results in constraining effects on the competitiveness of the agricultural sector (F2;-1). Again, soil functionality is an environmental public good for agriculture. The permanent decrease of soil fertility leads to a permanent decrease of soil functionality. Therefore, the provision of environmental public goods in the agricultural sector decreases permanently (F3;-3). To produce the same amount of food, there is more land needed. Therefore, this project has a constraining effect on promoting resource efficiency in the agriculture, food, and forestry sector (F5;-1).

INV5

This onshore wind park in Austria has a negative effect on the EU food policy goals relevant for the WLEFC-nexus. 3.36 ha of agricultural land is used for this project. This results in a lower yield for the concerned farmers leading to a lower income. There is no further effect on cross-compliance since the Good Agriculture and Environmental Conditions (GAECs) of the soil remain the same (F1;-2). The impact described here has also a constraining effect on the competitiveness of the agricultural sector (F2;-1) and the provision of environmental public goods by the agricultural sector (F3;-1).

INV6, 17 & 24

This onshore wind park in Austria has a negative effect on the EU food policy goals relevant for the WLEFC-nexus. Agricultural land is used for this project. This results in a lower yield for the concerned farmers leading to a lower income. There is no further effect on cross-compliance since the Good Agriculture and Environmental Conditions (GAECs) of the soil remain the same (F1;-2). The impact described here has also a constraining effect on the competitiveness of the agricultural sector (F2;-1) and the provision of environmental public goods by the agricultural sector (F3;-1).

INV7

This project for increasing the energy efficiency in Lithuania has no direct effect on the EU food policy goals relevant for the WLEFC-nexus. However, the indirect effect of an increase in energy efficiency is that less land is needed for the same amount of energy production, which results in an enabling effect to ensure the provision of agricultural lands which is an environmental public good (F3;+1). Moreover, because of the prevention of indirect land use change from productive use to nature described in section 4.4.2.3, this project has an enabling effect on the policy goal to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the forestry sector (F5;+1).

INV8

This oil storage project in Cyprus has no impact on the EU food policy goals relevant for the WLEFC-nexus. The project is constructed on an existing industrial site, thus no agricultural land is needed. Therefore, no negative effects on the farmers income, competitiveness, public goods, economy, and resource efficiency are present.

INV9

This CHP plant in Lithuania uses woodchips and pellets of forests to produce heat and electricity. Therefore, this project has a direct negative impact on the policy goal to promote resource efficiency and a low-carbon and climate resilient economy in the agriculture, food and forestry sectors (F5;-2). No other impacts of this project on the EU food policy goals relevant for the WLEFC-nexus are present.

INV10

This solar PV field in the Maldives has no direct effect on the EU food policy goals relevant for the WLEFC-nexus since no agricultural land is used to construct this project. However, the production of energy with solar PV needs less land than the production of energy with the global energy mix. Therefore, this project has an enabling effect on ensuring the provision of environmental public goods in the agricultural sector since agricultural landscapes are such an environmental public good (F3;+1). Moreover, because of the prevention of indirect land use change from productive use to nature described in section 4.4.2.3, this project has an enabling effect on the policy goal to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the forestry sector (F5;+1).

INV11, 12 & 16

These projects are all offshore wind parks resulting in the absence of direct impacts on the EU food policy goals relevant for the WLEFC-nexus. However, since no land is needed for the production of energy at offshore wind parks, there is more room for agricultural landscapes, which is an environmental public good in the agricultural sector (F3;+1). Moreover, because of the prevention of indirect land use change from productive use to nature described in section 4.4.2.3, this project has an enabling effect on the policy goal to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the forestry sector (F5;+1).

INV13

This geothermal extension project in Kenya has a constraining effect on the rural areas economy since the introduction of this geothermal company creates anxiety to lose their land to this company (F4;-1). However, the owners of the surrounding land are invited to the discussion table for this project. In this way, the competitiveness of these farmers is enabled, since they can participate in the decision making process (F2;+1).

INV14

This concentrated solar power (CSP) plant in Morocco has no impact on the EU food policy goals relevant for the WLEFC-nexus. This plant is constructed in the desert where no other economic activities are carried out.

INV15

This solar PV field in Zambia has a positive effect on the EU food policy goals relevant for the WLEFC-nexus. This is a result of the fact that solar energy production needs less land than the global energy mix. This enables the provision of more agricultural land, which is an environmental public good. Moreover, because of the prevention of indirect land use change from productive use to nature described in section 4.4.2.3, this project has an enabling effect on the policy goal to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the forestry sector (F5;+1).

INV18

This electricity transmission and distribution project in the United Kingdom has a very negative impact on the EU food policy goals relevant for the WLEFC-nexus. The most important impact is the loss of agricultural land. This results in a direct loss of income for the concerned farmers (F1;-3), which also lead to a constraining effect on the competitiveness of the agricultural sector (F2;-1). Because of the loss of these amounts of agricultural lands (17 ha), which is an environmental public good, the provision of environmental public goods by the agricultural sector decreases directly due to this project (F3;-2). A loss of this significance in the agricultural sector could lead to a constraining effect on supporting rural areas economy since there is a potential of losing jobs (F4;-1). Lastly, there is indirect land use change as a result of the loss of agricultural lands. Therefore, this project has a constraining effect on the policy goal to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the forestry sector (F5;-1).

INV19

This geothermal power plant in Iceland has no direct effect on the EU food policy goals relevant for the WLEFC-nexus. There is only a constraining effect on the goal to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the forestry sector since large amounts of wild forest is removed to build this project (F5;-1).

INV20

This trans Adriatic pipeline in Albania has a negative impact on the EU food policy goals relevant for the WLEFC-nexus. The most important impact is the loss of 209 ha of agricultural land. This results in a direct loss of income for the concerned farmers (F1;-3), which also leads to a constraining effect on the competitiveness of the agricultural sector (F2;-1). Because of the loss of these amounts of agricultural lands, which is an environmental public good, the provision of environmental public goods by the agricultural sector decreases directly due to this project (F3;-2). A loss of agricultural lands of this significance, it could lead to a constraining effect on supporting rural areas economy since there is a potential of losing jobs (F4;-1). Lastly, there is potential indirect land use change as a result of the loss of agricultural lands. Therefore, this project has a constraining effect on the policy goal to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the forestry sector (F5;-1). This is due to the fact that nature will be sacrificed as a result of indirect land use change.

INV21

This gas interconnection in Romania has a negative impact on the EU food policy goals relevant for the WLEFC-nexus. The most important impact of this project is the decrease of soil quality because of incorrect depositing of the topsoil. There is also land-take by the project.

These two combined result in a permanent decrease of productivity and therefore a loss of income for farmers (F1;-3). As a result of this, there is a constraining effect on the competitiveness of the agricultural sector (F2;-1). The loss of agricultural landscapes leads to a loss of environmental public goods in the agricultural sector (F3;-2). This project has also a social effect on the agricultural sector since the applicant described that there was a temporary loss of employment for seasonal or permanent workers in agricultural activities. Moreover, the compensation for land-take is a potential tension in case of informal agreements between different land-owners (F4;-2). This means that, for example, farmers can agree to lease their land to another farmer. The applicant hinted that such agreements are present in the surrounding area of the project.

INV22

This gas pipeline in Moldova has a slight negative impact on the EU food policy goals relevant for the WLEFC-nexus. There is a permanent loss of soil quality by erosion, compaction and mixing due to crossing of agricultural lands (F1;-2). Another negative impact of this project is that there is a loss in forested area, which has a constraining effect on the policy goal to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the forestry sector (F5;-1).

INV23

This wind park in Egypt has no impact on the EU food policy goals relevant for the WLEFC-nexus. The wind park is situated in a desert without any agriculture or other economic purposes of land use.

INV25

This solar PV field in India has a slight positive effect on the EU food policy goals relevant for the WLEFC-nexus. The only impact that his project has is that there is prevention of indirect land use change since solar energy needs less land than the global energy mix when the global demand remains the same. Therefore, there is more land available for the agriculture, food, and forestry sector. In this way, this project has an enabling effect on the policy goal to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in these sectors (F5;+1).

8.6 Appendix 6 – Explanation Scoring Interactions Climate Policy

INV1 & 2

This gas interconnector in Bulgaria and Greece has a negative impact on the EU climate policy goals relevant for the WLEFC-nexus. The main reason for this is the fact that natural gas is used for this interconnector. The ultimate combustion of natural gas is not considered as a low-carbon technology. However, comparing natural gas with coal or oil, it is more carbon-friendly (C2;-2). The use of natural gas for heat and electricity production gives a constraining effect on the policy goal to promote adaptation in key vulnerable EU sectors and in Member States (C3;-1). The policy goal to have no net emission of greenhouse gases in 2050 is not achievable when natural gas is used for the production of heat and electricity (C4;-3).

INV3

This gas fired combined cycled power plant in Croatia has a negative impact on the EU climate policy goals relevant for the WLEFC-nexus. The main reason for this is the fact that natural gas is used for this plant. The combustion of natural gas is not considered as a low-carbon technology. However, comparing natural gas with coal or oil, it is more carbon-friendly (C2;-2). The use of natural gas for heat and electricity production gives a constraining effect on the policy goal to promote adaptation in key vulnerable EU sectors and in Member States (C3;-1). The policy goal to have no net emission of greenhouse gases in 2050 is not achievable when natural gas is used for the production of heat and electricity (C4;-3).

INV4

The electricity transmission and distribution project in Belgium has no impact on the EU climate policy goals relevant for the WLEFC-nexus. This network has no change on the global energy mix and therefore no effect on the amount of emitted greenhouse gases.

INV5, 6, 9 – 17, 19, 23 – 25

These renewable energy production projects all have a positive impact on the EU climate policy goals relevant for the WELFC-nexus. It supports the development and uptake of low-carbon technologies (C2;+3) since there is no emission of greenhouse gases from the production of wind energy. This effect enables the policy goal to promote adaptation in key vulnerable sectors and in MSs (C3;+1). Moreover, this wind project fully contribute to the goal to have no net emission of greenhouse gases in 2050 by Europe (C4;+3). For INV10, 13 – 15, 23 & 25, the scores for C3 and C4 are not applicable since these policy goals are on European scale. These investments are conducted outside the European Union.

INV7

This energy efficiency project in Lithuania has a positive effect on the EU climate policy goals relevant for the WLEFC-nexus. An increase in energy efficiency enables the support of the development and uptake of low-carbon technologies, the promotion of the adaptation in key vulnerable EU sectors and in MSs, and less emission of greenhouse gases in 2050 by Europe (C2 – C4; +1).

INV8

This oil storage project in Cyprus has a negative impact on the EU climate policy goals relevant for the WLEFC-nexus. The main reason for this is the fact that oil is used for this plant. The combustion of oil is not considered as a low-carbon technology. After coal, oil is the most polluting energy source (IPCC, 2011). Therefore, this project has a cancelling effect on supporting the development and uptake of low-carbon technology (C2;-3). This has also a constraining effect on the policy goal to promote adaptation in key vulnerable EU sectors and in Member States (C3;-1). The policy goal to have no net emission of greenhouse gases in 2050 is not achievable when oil is used as an energy source(C4;-3).

INV18

The electricity transmission and distribution project in the United Kingdom has no impact on the EU climate policy goals relevant for the WLEFC-nexus. This network has no change on the global energy mix and therefore no effect on the amount of emitted greenhouse gases.

INV20 – 22

These investments in Albania, Romania, and Moldova are all conducted to improve the transmission and distribution network of gas. This results in a negative impact on the EU climate policy goals relevant for the WLEFC-nexus. The ultimate combustion of natural gas is not considered as a low-carbon technology. However, comparing natural gas with coal or oil, it is more carbon-friendly (C2;-2). The use of natural gas for heat and electricity production gives a constraining effect on the policy goal to promote adaptation in key vulnerable EU sectors and in Member States (C3;-1). The policy goal to have no net emission of greenhouse gases in 2050 is not achievable when natural gas is used for the production of heat and electricity (C4;-3). For the projects in Albania and Moldova, there is no connection with policy goals C3 and C4 since these policy goals are only applicable for EU countries.

8.7 Appendix 7 – Explanation Scoring Interactions Investments (INV)

W1, W5, F1 – F4

There were no connections between these EU policy goals and the investments by the EIB.

W2

This policy goal is to ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy, and the environment. The pursue of this policy goal has a negative impact on fossil fuel projects, both transmission and distribution projects as well as (??) fossil energy production projects. This is a result of the high use of water during the production of energy with fossil fuels (INV1 – 3, 8, 20 – 22; -1). This policy goal has a positive effect on the production of renewable energy since the production of renewable energy requires less water than the global energy mix (Stevens et al., 2017). Therefore, with pursuing this policy goal, there is still the availability to invest in the production of renewable energy (INV5 – 7, 9 – 17, 19, 23 – 25; +1). This policy goal has no effect on investments in electricity transmission and distribution (INV4, 18; 0).

W3, W4

The policy goal of W3 is to increase water efficiency and the policy goal of W4 is to reduce water consumption. These two policy goals have the same effect on the investments by the EIB since these goals are an extension of each other. The effects of these policy goals are very similar to the effects of W2 on the investments. The only difference is that increasing the water efficiency and reducing the water consumption have a direct negative impact on fossil energy production (INV 3, 8; -2). The other effects are similar as the effect of W2 on the investments by the EIB.

W6

This policy goal is to address and mitigate water scarcity and drought. This policy goal only has a constraining effect on the investments in the production of fossil energy since high amounts of water are needed (INV3, 8; -1). This policy goal has an enabling effect on the production of renewable energy since renewable energy saves water compared to the global energy mix (INV5 – 7, 9 – 17, 19, 23 – 25) (Stevens et al., 2017). There is no connection between this policy goal and electricity transmission and distribution and fossil fuel transmission and distribution (INV1, 2, 4, 18, 20 – 22).

L1, L2

These policy goals are an extension of each other. Policy goal L1 is to restore degraded soils to a level of functionality consistent at least with current and intended use. Policy goal L2 is to prevent soil degradation. In preventing soil degradation, it is important to prevent soil excavation, erosion, compaction, etc. This cannot be prevented for all projects (INV1 – 6, 8 – 10, 13 – 15, 17 – 25; -2), except for projects to increase energy efficiency (INV7) and produce offshore wind energy (INV11, 12, 16). The pursue of policy goal L2 has a constraining effect on conducting the same projects, since restoring soils is more difficult when the soils are degraded (-1).

L3, L4

Again, these policy goals are an extension of each other. Policy goal L3 is to improve EU's forested area, both in quality and quantity. Policy goal L4 is to prevent indirect land use change from nature to productive use. The scores for these two policy goals are the same, except for the projects not conducted in the EU (INV10, 13 – 15, 20, 22, 23, 25) since L3 is only applied to the EU. There is no connection between policy goal L3 and these investments. The scores of the impact of these policy goals on the investments is based on the amount of land needed to conduct the project. Onshore wind parks are the only projects that need a higher amount of land than the global energy mix. Therefore, the pursue of L3 and L4 have a counter-acting effect on these investments (INV5, 6, 17, 23, 24; -2). There is a constraining effect on electricity transmission and distribution networks, since these projects often require the sacrifice of agricultural land (INV4, 18; -1). A positive effect of these policy goals is found for the other projects with the most positive effect for offshore wind energy (INV11, 12, 16; +3), followed by fossil energy production (INV3, 8; +2), and fossil fuel transmission and distribution, solar energy production, energy efficiency, and geothermal energy production respectively (INV1, 2, 7, 10, 13 – 15, 20 – 22, 25; +1). The scores of +3, +2, and +2 correspond with no land needed, very little land needed, less land needed than the global energy mix.

E1

This policy goal is to reach at least a 32% share of renewable energy in the EU by 2030. For this reason, this policy goal only has a positive effect on renewable energy projects conducted in the EU. This is an indivisible effect since the achievement of policy goal E1 is inextricably linked to these renewable energy projects (INV5, 6, 9, 11, 12, 16, 17, 19, 24; +3). This goal has a cancelling effect on the fossil energy production projects (INV3, 8; -3) and a counter-acting effect on the fossil fuel transmission and distribution projects (INV1, 2, 21).

E2, E3

Policy goal E2 is to increase the energy efficiency at least 32.5% in 2030, relative to a reference scenario and policy goal E3 is to reduce energy consumption. These two policy goals are an extension of each other since a higher energy efficiency results in a lower energy consumption. The only connection between these policy goals and the investments by the EIB is that there is an increase in energy efficiency and a reduction in energy consumption with the project to increase the energy efficiency in Lithuania (INV7; +3).

E4

This policy goal is to push forward important energy infrastructure projects (grid, network, interconnectors, etc.). This policy goal only has an indivisible effect on the transmission and distribution upgrade projects both for fossil fuels as for electricity (INV1, 2, 4, 18, 20 – 22; +3).

E5

This policy goal is to achieve energy supply security. The security of energy supply can be achieved in two ways. One is the direct transmission and distribution of energy both in fossil fuels and in electricity (INV1, 2, 4, 18, 20 – 22); +3, and the other is the production of energy both in fossil fuels and in renewables (INV3, 5, 6, 8 – 17, 19, 23 – 25; +2).

F5

This policy goal is promoting resource efficiency and supporting the shift toward a low-carbon and climate resilient economy in the agriculture, food and forestry sectors. This policy goal is linked to policy goals L3 and L4, mainly due to the inclusion of the forestry sector. The prevention of indirect land use change and the improvement of the EU's forested area leads to an enabling effect to promote resource efficiency and support the shift toward a low-carbon and climate resilient economy in the forestry sector. It also goes the other way, a negative impact on land use change and forested areas has a constraining effect on this policy goal. Therefore, this policy goal has an enabling effect on projects which have a minimum of a reinforcing effect (+2) on policy goal L3 or L4 (INV3, 7, 8, 11, 12, 16; +1) and a constraining effect on projects which have a maximum of a counter-acting effect (-2) on policy goal L3 or L4 (INV5, 6, 17, 23, 24; -1).

C1

This policy goal is to increase the efficiency of the transport sector. The only connection between this policy goal and the investments by the EIB is that the pursue of this policy goal has an enabling effect on energy efficiency projects (e.g. for electric cars) (INV7;+1).

C2

This policy goal is to support the development and uptake of low-carbon technology. Therefore, this policy goal has a positive effect on projects which invest in the production of renewable energy (INV5, 6, 9 – 17, 19, 23 – 25; +3) and energy efficiency (INV7; +2). This policy goal has a cancelling effect on projects which invest in fossil energy production (INV3, 8; -3) and a constraining effect on projects which invest in the distribution and transmission of fossil fuels (INV1, 2, 20 – 22; -1).

C3

This policy goal is to promote adaptation in key vulnerable EU sectors and in MSs. This policy goal has similar effects on the financed projects as policy goal C2. Thus, it is has an indivisible effect on renewable energy projects and energy efficiency projects in the EU (INV5 – 7, 9, 11, 12, 16, 17, 19, 24; +3). The most negative effect of this policy goal is on fossil energy production projects (INV3, 8; -3), followed by more in-direct projects of fossil fuel transmission and distribution projects (INV1, 2, 21; -2).

C4

This policy goal is to have no net emissions of greenhouse gases in 2050 by Europe. The only difference between this policy goal and policy goal C3 is that investments 20 (Moldova) and 22 (Albania) are included since these two countries belong to the continent Europe, but not to the European Union. Similar to other investments in the transmission and distribution of fossil fuels, this policy goal has a counter-acting effect on these investments by the EIB (INV20, 22; -2).