Study on the long-term linkages between climate objectives, international trade and investment

Final report

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Abstract in English

This report describes the anticipated effects on trade and on income flows from FDI of a transition of the EU towards a net-zero GHG emissions economy. It is based on the quantitative anticipations of EU demand for climate-relevant goods under 8 scenarios (transition pathways of the EU and of Rest of World, EU competitiveness). These effects are strongly positive on the trade of goods in an Optimistic scenario for EU competitiveness, and moderately positive to neutral in a Pessimistic scenario. These effects on income flows from FDI lead to a modest deterioration in the balance of payments, which is more than compensated by the gains in trade.

The stakeholders in the sectors of climate change-mitigating goods were surveyed. Amongst the surveyed stakeholders who completely filled out the survey, most of them are not in favour of trade liberalisation in their sector.

The study concludes with recommendations on the position of the EU in future trade negotiations for the climate-relevant goods for which offensive interests were identified (wind power), as well as for defensive interests (steel, batteries, solar power, electric personal vehicles, nuts, legumes, vegetable oils).

Résumé en français

Ce rapport décrit les effets anticipés sur le commerce et sur les flux de revenus provenant des investissements directs étrangers (IDE) d'une transition de l'UE vers une économie à zéro émission nette de gaz à effet de serre. Il est basé sur les anticipations quantitatives de la demande de l'UE pour les biens liés au climat selon 8 scénarios (voies de transition de l'UE et du reste du monde, compétitivité de l'UE). Ces effets sont fortement positifs sur le commerce des biens dans un scénario optimiste pour la compétitivité de l'UE, et modérément positifs à neutres dans un scénario pessimiste. Ces effets sur les flux de revenus provenant de l'IDE entraînent une légère détérioration de la balance des paiements, qui est plus que compensée par les gains commerciaux.

Les parties prenantes dans les secteurs des biens atténuant le changement climatique ont été interrogées. Elles rejettent presque unanimement une libéralisation accrue des échanges dans leur secteur.

L'étude se conclut par des recommandations sur la position de l'UE dans les futures négociations commerciales concernant les biens liés au climat pour lesquels des intérêts offensifs ont été identifiés (énergie éolienne), ainsi que pour les intérêts défensifs (acier, batteries, énergie solaire, véhicules personnels électriques, fruits à coque, légumineuses, huiles végétales).

Executive Summary in English

This document presents the results of the study performed by a consortium made of Trinomics B.V., the Institute for European Environmental Policy (IEEP) and BKP Consulting for the European Commission, DG Climate Action (CLIMA) and DG International Trade# (TRADE), on the impacts of a transition of the European Union towards a net-zero greenhouse gas emissions economy on its international trade in goods and on the income flows stemming from Foreign Direct Investment (FDI). It concludes on a range of recommendations to enhance the offensive and defensive interests of the EU, together with its climate policy goals, in international trade negotiations.

The study is structured as follows:

- Chapter 2 identifies the climate-related existing and upcoming EU policies that drive the transition to a net-zero GHG emissions economy, many of which target specific products, with the aim to identifying the products categories where trade is most affected by those climate mitigation policies;
- Chapter 3 describes the products and sectors whose trade is likely to be influenced, positively or negatively, by a transition of the EU towards a net-zero GHG emissions economy, and by the policies leading to it: the "climate-relevant products and sectors". It also identifies among these products and sectors those representing the largest volumes in international trade – or those likely to represent such large volumes in the future. It concludes with a description of the trends in the EU international trade of these products over the latest years on which data is available, namely from 2010 to 2019;
- Chapter 4 describes the method followed by the consultant team to anticipate the volumes of international trade in products in 2050, in a context of a transition of the EU towards a net-zero GHG emissions economy, based on the figures for the internal consumption of goods in the EU until 2050 set in the EU Long-Term Scenarios prepared by the European Commission in 2018 (the EU Long-Term Scenarios)[1]. It also provides the results of these anticipations, and draws conclusions regarding the priority products to be considered in international trade negotiations;
- Chapter 5 applies this method to the anticipation of the income flows stemming from FDI in the few sectors where the available statistics have the level of granularity to enable conclusions to be drawn;
- Chapter 6 spells out the recommendations made by the consultant team regarding positions that the EU could take in international trade negotiations to foster both its climate policy and its offensive and defensive trade interests.

Objectives, rationale, methodology and limitations of the study

Several studies exist that examine the impacts of trade rules on the implementation of EU climate policies.

The **objectives** of this study are to investigate the reverse causal relationship, namely the influence that the transition of the EU towards a net zero GHG emissions economy, rooted in its climate change-mitigating policies, will have on its international trade and income stemming from Foreign Direct Investment (FDI). It aims at understanding the risks and opportunities that this transition creates in international markets, and on the EU Internal Market, for EU producers of tradeable goods and for owners of foreign productive assets, with a particular focus on the producers of goods that contribute to the mitigation of climate change ("climate change-mitigating goods"). Drawing from the dynamics in the Internal Market, the study reflects these changes onto the EU's international trade policy.

[1] *'In-depth analysis in support of the Commission Communication COM(2018)773 A Clean Planet for all - A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy', downloadable at:*
https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf

The ultimate **goal** of this study is to contribute to the reflection of the European Commission regarding the position it could take in international trade negotiations (bilateral, plurilateral or multilateral), in order to best promote the offensive and defensive interests of EU producers, with a focus on the producers of "climate change-mitigating goods".

The study uses the following **methodology** regarding the trade in **goods**:

1. Identify the goods that are relevant both for climate and for trade (the climate-relevant goods), based on the lifecyle GHG emissions that the consumption these goods generate in the EU and on their trade volumes;
2. Assess, based on publicly-available data, the current situation and recent evolution of EU international trade of these climate-relevant goods (Eurostat) and of the income flows generated by the investment in facilities producing these goods (OECD);
3. Using the internal consumption of goods in the EU until 2050 set in the EU Long-Term Scenarios[2], identify the future consumption of these climate-relevant goods – and hence the volume of the facilities manufacturing these goods, when following the Baseline scenario and when following the two ambitious scenarios leading to a net-zero GHG emissions economy, namely 1.5LIFE and 1.5TECH;
4. Determine contrasted scenarios regarding:
    a. the competitive position of EU producers of these goods: Optimistic vs. Pessimistic, with consequences regarding the coverage of EU consumption by imports and the coverage of RoW consumption by EU exports, based on the recent evolution of EU international trade and on the outcomes of a survey of climate change-mitigating goods, and
    b. the alignment between the climate mitigation trajectories of the EU and of the Rest of the World (RoW): Alignment vs. Divergence, with consequences regarding the composition of the market constituted by the RoW. The Divergence scenario considers that the RoW follows the same evolution of consumption as the Baseline scenario of the EU. It should be noted that this already is a rather optimistic climate policy scenario, as this Baseline scenario includes the policy measures already implemented by the EU in 2018, which is beyond what many jurisdictions have achieved to date (2023);
5. For each of the 4 resulting combinations, compute the anticipation of the imports and exports of climate-relevant goods, and of the income flows from FDI in assets producing these goods, and draw conclusions regarding:
    a. The impact of climate change mitigation policies of the EU on the trade situation and that of income flows from FDI of the EU (by comparing the Baseline with the two ambitious scenarios 1.5LIFE and 1.5TECH);
    b. The priority sectors and products on which to concentrate the EU position in international trade negotiations, and the nature (offensive or defensive) of the interests of EU producers of these goods;
6. Select, within a toolbox of available instruments, those appropriate to promote the offensive and defensive interests of EU manufacturers of climate change-mitigating goods.

The **methodology** regarding the **income** from **Foreign Direct Investment (FDI)** follows the same pattern as above, with the following adaptations:

- The sectors being considered are limited to the three for which the granularity of the available data enables reliable anticipation regarding the evolution of EU consumption in the context of a transition towards a net-zero GHG emission economy, namely: (1) the extraction of fossil fuels, (2) oil refining and coke production and (3) supply of electricity;
- No scenarios are developed regarding the competitiveness of EU players (in this case: investors). The assumption is made that FDI money operates in the global market for financing on a very level-playing field.

[2] *'In-depth analysis in support of the Commission Communication COM(2018)773 A Clean Planet for all - A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy', downloadable at:*
https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf

The main **limitations** of the study are the following:

- Despite their importance in the EU economy, and also in the green transition this study does **not** consider **services**, as the available data on their international trade does not have the necessary level of granularity;
- It does not consider the **physical consequences** of climate change on trade patterns, on e.g. supply chain decisions;
- It considers the RoW as a homogeneous region, which it obviously is not;
- The **Divergence** scenario considers that the RoW follows an evolution of its consumption according to the **Baseline Long-Term Scenario** of the EU, i.e. implements the policies that the EU had adopted in 2018. This is an **optimistic** scenario regarding the mitigation of climate change;
- It relies on several **simplifying assumptions** and contrasted scenarios to support reasoning, which are a stylised view of what the future can look like, but cannot be considered as accurate predictions of the future.

Current situation and recent trends in the EU international trade of climate-relevant products

In this report, we consider being a "climate-relevant product" or sector a product (respectively: a sector) that bears one or several of the following features:

- The production, consumption and/or the use of the products consumed in the EU Internal Market generate a large volume of GHG emissions;
- The product is a functional substitute of a product belonging to the previous category, but the GHG emissions per functional unit caused by the production, consumption or use of that product are significantly lower than those of the equivalent functional unit that it substitutes for;
- The product reduces the GHG emissions generated during the production or the use phase of another product.

The categories of such "climate-relevant products" that were considered are:

- **Abiotic** product categories:
  - Generating high GHG emissions upon production: Iron and steel, Organic chemicals, Cement, glass, ceramics and other insulation materials, Plastics and articles thereof;
  - Generating high GHG emissions upon use: Mineral fuels and derivatives, coal, oil, gas, Aircrafts, motor vehicles, motorcycles, ships and boats, Lighting related products;
  - Functional substitutes, with lower GHG emissions, for the above: rail, electric vehicles, Critical raw materials for batteries, for photovoltaic, Solar power, Wind power;
- **Biotic** product categories were also considered, because the consumption area of **food** represents **38.1%** of the climate consumption footprint of the EU, and kept increasing its impact over the last decade[3]:
  - Generating high GHG emissions upon production (including because of induced deforestation): Meat, Dairy produce, Animal fats and oils, Palm oil, Coffee and cocoa, Soya, Fish and crustaceans, molluscs, Live animals, Rubber, Cane sugar;
  - Functional substitutes, with lower GHG emissions, for the above: Vegetable fats and oils other than palm oil, Pulses, Nuts.

Based on the modelling used in the study and on the latest available data on the situation of EU international trade (2019) and its evolution over the previous decade (2010-2019):

- Many of the high-volume products where the EU currently concentrates its international competitiveness and extracts most of its trade surpluses are products whose EU consumption, under the Long-Term Scenarios leading to a net-zero GHG emissions economy, is expected to

[3] European Commission, Joint Research Centre, Consumption Footprint Platform | EPLCA, accessible at: https://eplca.jrc.ec.europa.eu/ConsumptionFootprintPlatform.html

diminish (e.g. beef meat) or even to disappear (e.g. petrol motor vehicles)[4];

- Conversely, the EU competitiveness position for the products whose consumption and production are expected to increase in a context of a transition to a net-zero GHG emissions economy is either: weak, even if improving ("Struggling" quadrant)[5], or strong, but deteriorating ("Declining" quadrant)[6], or even weak, and deteriorating ("Fading" quadrant)[7].

This situation could point to a deterioration, in a context of a transition to a net-zero GHG emissions economy, of the international trade balance of the EU for these products, as the EU is strong where demand will likely fade, and weak (or struggling) where it will likely rise. **However**, as illustrated later in this study, these negative prospects will be more than counterbalanced by the strong decline being expected in the imports of goods connected to high GHG emissions under the EU Long Term Strategies, and that represent high volumes of imports such as fossil fuels and products related to deforestation[8].

Anticipation of the EU international trade in the context of a transition to a net-zero greenhouse gas emissions economy

Based on the methodology outlined above, the evolution foreseen in the EU international trade of climate-relevant goods in 2050 in the context of a transition of the EU towards a net-zero GHG emissions economy, under the scenarios considered for the competitiveness of EU producers (Optimistic vs. Pessimistic) and for the climate policies of the RoW (Alignment vs. Divergence), can be summarised in the Table 0-1 below.

Table 0-1 Total value of imports and exports and trade balance of the selected climate-relevant products in billion EUR in 2050 under the different scenarios considered in this analysis

Scenario / LTS	EU-Optimistic Competitiveness					
	RoW Alignment scenario			RoW Divergence scenario		
	Value of imports	*Value of exports*	*Trade balance*	*Value of imports*	*Value of exports*	*Trade balance*
2019	498	375	**-123**	498	375	**-123**
2050, Baseline	318	287	**-31**	318	287	**-31**
2050, 1.5TECH	253	326	**73**	253	287	**34**
2050, 1.5LIFE	238	305	**67**	238	287	**50**

Scenario / LTS	EU- Pessimistic Competitiveness					
	RoW Alignment scenario			RoW Divergence scenario		
	Value of imports	*Value of exports*	*Trade balance*	*Value of imports*	*Value of exports*	*Trade balance*
2019	498	375	**-123**	498	375	**-123**
2050, Baseline	419	206	**-213**	422	226	**-196**
2050, 1.5TECH	437	235	**-202**	419	226	**-192**
2050, 1.5LIFE	418	199	**-219**	404	226	**-178**

[4] These products are: Petrol Motor vehicles, Diesel motor vehicles, spark ignition vehicles, Civil aircraft (>15 t),Live bovine, Beef & veal carcasses, Frozen pork, Cheese.
[5] These products are: Photosensitive devices (incl. PV cells), Cobalt mattes and products, Lithium cells, Batteries, Legumes (plant-based sources of proteins, alternative to ruminant meat).
[6] These products are: Aluminium structures, Ball bearings, Wind generating sets.
[7] These products are: Electric vehicles (EVs), Rape, colza seeds (plant-based sources of fat, alternative to ruminant and pork meat).
[8] These products are: Crude petroleum oils, Light or medium petroleum or bituminous oils, Natural gas, Bituminous coal, Soya (used in the raising of cattle), Palm oil, Coffee, Cocoa beans (potential sources of deforestation).

When considering each scenario individually, i.e. the comparison between the 1.5TECH or 1.5LIFE scenarios with the baseline, it can be seen that the EU transition of the EU towards a net-zero GHG emissions economy, i.e. the comparison between the 1.5TECH or 1.5LIFE scenarios with the baseline, results in:

- A considerable improvement of the EU trade balance in the Optimistic scenarios:
  - EUR +98 to +104 bn. in the Optimistic x Alignment scenario;
  - EUR +65 to +81 bn. in the Optimistic x Divergence scenario;
- A neutral to positive effect on the EU trade balance in the Pessimistic scenarios:
  - EUR +4 to +18 bn. in the Pessimistic x Divergence scenario;
  - EUR -6 to +11 bn. in the Pessimistic x Alignment scenario.

Based on these results and the outcomes of the survey conducted with representatives of the EU manufacturers in the sectors of climate change-mitigating goods, the following conclusions can be drawn regarding the **products** for which the following nature of interests of the EU in international trade negotiations lie:

- **Offensive interests** in wind power;
- **Defensive interests** in:
  - Abiotic products: steel, batteries, solar power, electric personal vehicles;
  - Biotic products: nuts, legumes, vegetable oils.

Current state and anticipation of the income from EU climate-relevant foreign direct investment (FDI), under scenarios of a transition to a net-zero GHG emissions economy

For most sectors, the granularity of available data on Foreign Direct Investment (FDI) is too coarse to enable an anticipation of the overall volume of consumption for that sector under a scenario of a transition to a net-zero GHG emissions economy: some products of that sector are anticipated to experience an increase in demand, whereas the others are anticipated to experience the opposite (e.g. in the automotive sector with the contrasting situations of Internal Combustion Engines and of electric powertrains).

The only three sectors where the granularity of available data is sufficiently fine to make reliable assumptions on the evolution of the demand for their products under scenarios of a transition to a net-zero GHG emissions economy, are listed in the Table 0-2 below.

Table 0-2 Sectors considered for the anticipation of income flows from FDI, with anticipation of demand

Sector	Anticipated evolution of the demand for the products of the sector, under scenarios of a transition to a net-zero GHG emissions economy
Crude petroleum and natural gas extraction and associated mining support service activities;	Sharp decline, as part of the move away from fossil fuels
Manufacture of coke and refined petroleum products;	Sharp decline, as part of the move away from fossil fuels
Electricity, gas, steam and air conditioning supply.	Strong increase in electricity (which dominates that sector), because of the shift to electric power for transport and manufacturing of basic metals

We used the data from the OECD.[9], making sure that we exclude the flows from Special Purpose Entities (SPEs) which have no other purpose than tax optimisation.

Table 0-3 Total value of income flows from FDI of the countries members of the OECD and EU for the three selected sectors in billion USD in 2050 under the scenarios considered in this analysis

[9] OECD Statistics *(last updated in December 2022)*

Scenario / LTS	RoW Alignment scenario			RoW Divergence scenario		
	Income flow from inward FDI	*Income flow from outward FDI*	*Impact on balance of payments*	*Income flow from inward FDI*	*Income flow from outward FDI*	*Impact on balance of payments*
Latest available year (2019 or earlier)	-5.0	+16.8	**+11.8**	-5.0	+16.8	**+11.8**
2050, Baseline	-4.1	+12.6	**+8.5**	-4.1	+12.6	**+8.5**
2050, 1.5TECH	-5.9	+9.8	**+3.9**	-5.9	+12.6	**+6.7**
2050, 1.5LIFE	-4.9	+8.1	**+3.2**	-4.9	+12.6	**+7.7**

When considering each scenario individually, i.e. the comparison between the 1.5TECH or 1.5LIFE scenarios with the baseline, it can be seen that the EU transition of the EU towards a net-zero GHG emissions economy, i.e. the comparison between the 1.5TECH or 1.5LIFE scenarios with the baseline, results in a modest deterioration of the EU balance of payments because of the FDI income flows related to these sectors (USD -0.8 to -5.3 bn.), which is more than compensated by the gains in the trade balance described above.

Opinions of surveyed stakeholders on liberalisation of climate change-mitigating goods

A **survey** of stakeholders in the sector of **climate-change mitigating goods** was performed. The conclusion is that these stakeholders would be reluctant to trade liberalisation in their respective sectors. However, the results of the survey are more nuanced and are further elaborated in the respective section.

Options for a long-term EU trade policy supporting its industrial interests and climate objectives

For **wind power**, the only climate-change mitigating good where **offensive** trade interests have been identified, we suggest that the EU pursue the following goals in international trade negotiations:

- Ensure zero or low import tariffs for EU products in third-country markets;
- Ensure that technical regulations and standards for wind power, as well as associated conformity assessment procedures, do not constitute barriers to exports;
- Open up foreign public procurement markets;

For **steel, batteries, solar power, electric personal vehicles, nuts, legumes, and vegetable oils**, i.e. the climate-change mitigating goods where **defensive** trade interests of the EU were identified, we suggest that the EU pursue the following goals in international trade negotiations:

- Remove EU import tariffs on inputs for production of climate change-mitigating products;
- Ensure availability of critical raw materials needed for climate change-mitigating products;
- Protect EU production against harmful effects of subsidies provided by third countries.

In addition to these defensive trade measures, we suggest that the EU provide **subsidies for R&D** and **production** of climate change-mitigating goods.

1. Introduction

1.1. Objectives of the study

The key objectives of this study were to:

- Assess how the EU's objective to achieve climate neutrality by 2050 current drive of the EU towards a net-zero GHG emissions economy will influence the composition, volume and geography of the EU's trade and non-financial investment relations with the rest of the world (RoW), and hence change the nature and the intensity of dependencies of the EU towards the RoW[10];
- Based on this assessment, identify the resulting opportunities and risks regarding the competitive position of EU businesses in terms of access to key technological and natural assets;
- Identify the trade policy instruments and rules, and the negotiation fora to promote (1) the EU's obligations and objectives on climate change mitigation, and (2) the international competitive position of EU businesses;
- Collect the opinions of representatives of relevant EU economic sectors regarding the liberalisation of the trade of goods & services that have a significant contribution to the mitigation of climate change ("climate change-mitigating goods & services").

1.2. Scope of the study

The study has a **broad** approach, and includes in its scope:

Sectors: all sectors susceptible to be strongly impacted by the drive transition towards a net-zero GHG emissions economy, i.e.:

- renewable and low carbon energy including in particular renewable and low carbon fuels such as hydrogen and its derivatives;
- renewable energy technologies (and related value chains);
- energy efficiency across sectors;
- infrastructure investments;
- raw materials including fossil fuels;
- emerging and new low-emissions and emissions-abating technologies;
- and more generally those with a high GHG emissions intensity (fossil fuels; basic metals, materials & chemicals; ruminant products), and those representing large shares of EU exports (machinery, automotive, aeronautics, chemicals);
- With a focus on "climate change-mitigating goods & services";

International trade negotiation fora: those relevant both for the short- and long-term, with a focus on **plurilateral** or **multilateral** approaches:

- In the WTO:
    - the multilateral discussions on the Environmental Goods Agreement; different WTO Committees and
    - plurilateral discussion in:
        - The Fossil Fuels Subsidy Reform;

[10] The geographic pattern is only lightly touched upon, as the anticipations of trade flows per partner country create an additional level of uncertainty to anticipations that include a significant number of assumptions and approximations.

  - The Trade and Environmental Sustainability Structured Discussions (TESSD);
- In emerging intergovernmental discussion groups such as the Coalition of Trade Ministers on Climate.

Despite their importance in the EU economy, this study **does** not consider **services**.

One reason for this absence is that the available data on their international trade does not have the necessary level of granularity to differentiate between the services that generate GHG emissions and those that save them, or within services such as maintenance or engineering, those related to goods with high GHG emissions intensity and those related to goods that reduce GHG emissions

Another difficulty is that many investment goods, among which the climate-change mitigating goods such as renewable energy production goods, are generally delivered accompanied by a range of services (engineering, installation, commissioning, maintenance, financing). According to whether these services are provided by the manufacturing company or by external service suppliers, they are statistically counted as "manufacturing" or "services", whereas they correspond to the same reality.

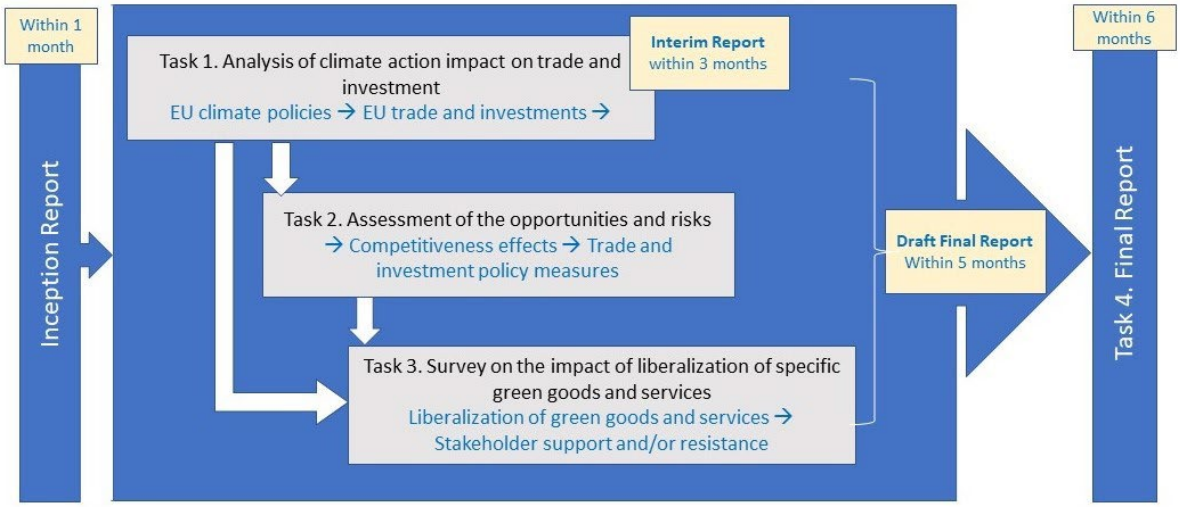
1.3. Overview of tasks performed

As specified in the Service Request, in order to achieve the objectives of this study we have carried out a series of four distinct tasks. In addition, we have carried out an inception phase, Task 0, to confirm the methodology with DG Climate Action at the project inception meeting.

Throughout the three main tasks (Tasks 1-3), we have developed an analysis of the long-term interlinkages between EU climate objectives, and international trade and investment. The time horizon being considered is 2050.

- In Task 1, a first aspect of causal relationships in this interlinkage has been considered, namely: the effects of (1) the attainment of the objectives of key EU climate policies on (2) the composition and geographic distribution of international trade and investment. We have investigated how the attainment of EU climate objectives is likely to impact directly and indirectly international trade and investment for the 6 economic areas identified in the Terms of Reference, categorised under (a) energy related areas, (b) mineral resource related areas, and (c) biotic resource related areas. We have identified the evolutions that are likely to be generated by the pursuit of European climate objectives, over the period of time until the time horizon given above, of (1) the composition and (2) volume of internationally traded goods and investment in these economic areas;
- In Task 2, we have considered a step to further the causal relationship, namely the expected effect of (2) the evolution of composition and geographic distribution of international trade and investment on (3) the competitive position of EU stakeholders in these flows. We have investigated how the evolutions in the composition of international trade and in the geographic location of economic activities, identified in Task 1, will create risks and opportunities for EU economic stakeholders. We have deduced from this an analysis of how the available trade instruments and policies could enhance the long-term competitive position of EU stakeholders subject to these evolutions, by mitigating these risks and supporting these opportunities.
- In parallel to this analytical work, Task 3 consisted of the design and implementation of a survey that was addressed to industrial European stakeholders. This survey enquired about their anticipation of the impacts of the implementation of the liberalisation of the trade in 'goods mitigating climate change' on their competitive position. This has allowed us to validate the nature and intensity of the offensive and defensive interests of EU industrial stakeholders to be addressed and supported by the EU in international trade negotiations.
- Finally, in Task 4, we have summarised in a final report the conclusions of the previous tasks and produced recommendations for further consideration on how the EU climate and trade policy objectives can be jointly supported in future trade negotiations.

Figure 1-1 Overview of the Approach



Given the relatively broad scope of the study, particularly in Tasks 1 and 2, we followed the following prioritisation strategy to sharpen the focus of our analytical approach:

- We focused on the EU's trade and investment relations with the rest of the world (RoW) and major third countries (eg. China, US, Russia, etc), and did not consider intra-EU trade and investment patterns.
- Furthermore, we prioritised trade in goods and foreign direct investments (FDI), i.e. investment in productive assets that can be related to the goods that these assets produce. We did not consider financial investment, whose relation to physical goods and to GHG emissions is too indirect to be reliably included in our work;
- Our analysis emphasized energy-related areas, that constitutes a particularly important source of GHG emissions and are the focus of a significant part of the EU's climate mitigating policies, while those pertaining to mineral and biotic materials were considered at a more aggregate level.
- Finally, EU climate mitigating policies were reviewed primarily to understand their objective and the measures implemented under them.

1.4. Structure of the report

The study is structured as follows:

- Chapter 2 identifies the climate-related existing and upcoming EU policies that drive the transition to a net-zero GHG emissions economy, many of which target specific products, with the aim to identifying the products categories where trade is most affected by those climate mitigation policies;
- Chapter 3 describes the products and sectors whose trade is likely to be influenced, positively or negatively, by a transition of the EU towards a net-zero GHG emissions economy, and by the policies leading to it: the "climate-relevant products and sectors". It also identifies among these products and sectors those representing the largest volumes in international trade – or those likely to represent such large volumes in the future. It concludes with a description of the trends in the EU international trade of these products over the latest years on which data is available, namely 2010 to 2019;
- Chapter 4 describes the method followed by the consultant team to anticipate the volumes of international trade in products in 2050, in a context of a transition of the EU towards a net-zero GHG emissions economy, based on the figures for the internal consumption of goods in the EU until 2050 set in the EU Long-Term Scenarios prepared by the European Commission

in 2018 (the EU Long-Term Scenarios)[11]. It also provides the results of these anticipations, and draws conclusions regarding the priority products to be considered in international trade negotiations;

- Chapter 5 applies this method to the anticipation of the income flows stemming from FDI in the few sectors where the available statistics have the level of granularity to enable conclusions to be drawn;
- Chapter 6 spells out the recommendations made by the consultant team regarding positions that the EU could take in international trade negotiations to foster both its climate policy and its offensive and defensive trade interests.

[11] *'In-depth analysis in support of the Commission Communication COM(2018)773 A Clean Planet for all - A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy', downloadable at:*
https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf

2. Overview of EU climate-relevant policies and of their anticipated impacts on EU consumption

This chapter presents the initial steps of this study. It assesses the linkage between EU policies that mitigate climate change ("EU climate policies") and international trade. Based on this, it describes the process and criteria based on which policies were sampled for this study. Furthermore, this selection represents the first step in identifying the product categories where trade is most affected by climate policies and, therefore, includes an initial assessment of how product groups and products are influenced by the EU climate-policies. The full list of selected policies and associated products can be found in *Annex 1: List of EU climate-relevant policies and of impacted products*.

2.1. Criteria for selecting policies as 'climate-relevant'

As this chapter represents one of the initial steps of the study, a diverse range of policies, and hence products, is included. This is to ensure that no important product category which is affected by EU climate policies falls outside of the scope of this study. However, measures by Member States were not included, as the purpose of this study was, as defined in its Terms of Reference, to analyse EU policies only. Furthermore, policies adopted by Member States are often transpositions of policies adopted through the European legislative process.

The first step to selecting policies was to identify economic sectors of relevance to this study, defined as those sectors in which climate policy is likely to have the strongest impacts on EU international trade and competitiveness. Two different categories were included, sectors contributing to the Green Transition and sectors associated with a large share of EU emissions. In the current situation, the latter sectors are important to the EU and world trade in terms of volumes and related to significant emission sources, and therefore, they can be expected to change significantly through the influence of climate policies. On the other hand, the former sectors are characterised by a small but growing volume of trade and are likely to strongly benefit from climate policies. Over the medium to long-term, they can be expected to contain the future pillars of the European economy.

The economic sectors selected for this study are:

- Economic sectors contributing to the Green Transition:
    - Renewable and low carbon energy (including renewable and low carbon fuels e.g., hydrogen and its derivatives);
    - Renewable energy technologies (and related value chains);
    - Energy efficiency across sectors;
    - Infrastructure investments;
    - Raw materials (including fossil fuels);
    - Emerging and new low-emissions and emissions abating technologies;
- Economic sectors responsible for the majority of European emissions:
    - Energy generation relying on fossil fuels;
    - Mobility;
    - Manufacturing sectors with high GHG emissions intensity, specifically the basic metals, non-metallic materials and chemicals at the origin of most industrial value chains;
    - Manufacturing based on the above abiotic materials;

- Biotic materials (including food);
- Investments in other assets than infrastructure;
- Land use and land use change.

Policies were then selected based on whether they aim to reduce emissions in these sectors by influencing EU consumption and production patterns within these sectors.

2.2. List of climate-relevant EU policies

Table 2-1 List of EU policies mitigating climate change, per economic area being impacted

Economic areas	EU policies contributing to the mitigation of climate change affecting these economic areas
Overarching	• European Climate Law • Effort-Sharing Regulation & Amendment proposal
Renewable and low-carbon energy	• Renewable Energy Directive • REPowerEU Plan
Renewable and low-carbon fuels	• EU Hydrogen Strategy • REPowerEU Plan • Green Deal Industrial Plan
Renewable and low-carbon energy technologies (including the emerging technologies)	• Green Deal Industrial Plan • Proposal for a Battery Regulation • EU Strategic Energy Technology (SET) Plan
Energy efficiency across sectors	• Energy Efficiency First Principle • Energy Efficiency Directive & Recast Directive • Energy Labelling Regulation, including Registry for Energy Labelling
High GHG emissions sectors: Electricity Manufacturing Transport Housing	• EU Emissions Trading System Directive • Carbon Border Adjustment Measures (CBAM) • Energy Performance of Buildings Directive & recast proposal • Sustainable and Smart Mobility Strategy • Emission Standards for Cars and Vans Regulation • Fuel Quality Directive
Manufacturing based on mineral materials	• Raw Materials Initiative • Action Plan on Critical Raw Materials • Proposal for a new Ecodesign for Sustainable Products Regulation • Proposal for a review of the Construction Products Regulation
Biotic materials	• Common Agricultural Policy • Farm to Fork (F2F) Strategy • Renewable Energy Directive • Fertilising Products Regulation • Forest Strategy for 2030 • Deforestation Regulation
Investment in all economic areas	• Taxonomy Regulation
Investment in infrastructure	• LIFE Clean Energy Transition Sub-Programme • Sustainable and Smart Mobility Strategy • Global Gateway • Modernisation Fund
Investment in innovation	• Innovation Fund • Horizon Europe
Areas affecting land use	• LULUCF Regulation

2.3. List of products whose consumption is anticipated to be impacted by EU climate-relevant policies

For each of the sectors and policies listed in Table 2-1 above, the specific product categories, which are potentially impacted by the policies were investigated in greater detail. Then, for each product category the anticipated effect of the policies (i.e. increase or a decrease in the EU internal consumption) was specified. Below is an overview table summarising the in-/decreasing product groups and giving examples for specific products. The detailed result is provided in Annex 1: List of EU climate-relevant policies and of impacted products.

Table 2-2 List of products whose EU consumption is anticipated to be affected by EU climate policies

Anticipated influence of EU climate policies on EU internal consumption	Product groups	Exemplary products
Increase	Renewable energy products	Hydrogen and other sustainably produced liquid or gaseous fuels
	Infrastructure-related products (generation, storage, transport and consumption) of renewable energy	Generators; electrolysers; batteries; power lines; and pipelines
	Products required throughout the value chains of "green products"	Rare earth elements; lithium; cobalt; and raw & advanced materials for energy conversion and storage
	Products related to zero-emission transport	Electric motors & vehicles; other zero-emission road transport options; high-speed trains; zero-emission marine vessels & aircrafts; and the required transport infrastructure
	Products enhancing energy efficiency in buildings and industry	Energy efficient machinery; processes, heating and cooling systems; insulation materials and equipment; heat pumps; smart readiness buildings; and home appliances
	Basic products using renewable fuels for their manufacturing process	Basic chemicals; fertilisers; and steel
	Investment in activities rated as sustainable in the EU Taxonomy Regulation	Foreign Direct Investment (FDI)
	Products related to CCS, CCU and nuclear safety	Required machinery and chemicals
	Products linked to sustainable agriculture,	EU-grown plant proteins; alternative feed materials; organic/sustainable agricultural products; and organic fertilisers & soil improvers
	Products related to sustainable forest bio-economy	Sustainably produced and harvested timber
Decrease	Fossil fuels and derived fuel products	Coal; oil; gas; coke; and petrol (in response to the invasion of Ukraine, trade with Russia is particularly restricted)
	Agricultural products linked to environmental degradation	Soya gown on deforested land; illegal fish products; products with long supply chains; and animal products related to certain antibiotics
	Products related to unsustainable forest bio-economy and forest degradation	Unsustainably produced and harvested timber
	Products related to emission-intensive transport	Road, air and marine transport options operating with fossil fuels
Increase for the more sustainable variants, decrease for the less sustainable variants	Products covered by the proposed Battery Regulation	Portable batteries; automotive batteries; electric vehicle batteries; industrial batteries; and batteries incorporated/added to other products
	Products covered by the Energy Labelling Directive and the Product Registry for Energy Labelling	Lighting; local space heaters; space & water heaters; fridges; air conditioners;

Anticipated influence of EU climate policies on EU internal consumption	Product groups	Exemplary products
	Products and services with high emission intensity and covered or to be covered by the ETS	Heat; electric energy; refined petroleum products; coke; pig iron & steel; non-ferrous metals; cement; glass; ceramics; pulp, cardboard and paper; intra-EU air, sea and (upcoming: land) transport; (upcoming) domestic heating
	GHG-emissions-intensive products at risk of carbon leakage and to be covered by CBAM	Cement, iron, steel, aluminium, fertilisers, electricity and hydrogen
	Manufactured products targeted by a specific Implementation Regulation of the Ecodesign Directive	lamps (including ultraviolet radiation); fluorescent lamps (without integrated ballast); high-intensity discharge lamps; ballasts and luminaires able to operate such lamps; computers and servers; game consoles
	Construction products and 3D-printer equipment covered or to be covered by the Construction Products Regulation	3D-Printers and required material for their operation

3. Climate-relevant EU international trade: Recent developments and current status

3.1. Structure of this chapter

This chapter is structured in the following way:

- Details on the methodology used for selecting, among climate-relevant products and sectors, those that are relevant for the analysis of international trade;
- Examination of recent evolutions and the current situation of climate-relevant EU international trade through the development of competitiveness assessment charts for selected product categories.

3.2. Climate-relevant products and sectors

3.2.1. Definition of climate-relevant products and sectors

In this report, we consider being a "climate-relevant product" or sector a product (respectively: a sector) that bears one or several of the following features:

- The production, consumption and/or use of the products consumed in the EU Internal Market generate a large volume of GHG emissions;
- The product is a functional substitute of a product belonging to the previous category, but the GHG emissions per functional unit caused by the production, consumption or use of that product are significantly lower than those of the equivalent functional unit that it substitutes for;
- The product reduces the GHG emissions generated during the production or the use phase of another product.

3.2.2. Method

Identification of the most relevant product categories

The first step of our analysis was to identify the most relevant product categories by referring to the ToR and through consultations with the Commission. The most relevant product categories contain:

- **Products with a high GHG emissions intensity upon production** (fossil fuels; primary basic metals, organic chemicals, non-metallic materials) or use (coal power plants; gas turbines; cars with internal combustion engines; aircraft);
- **Critical raw materials**, as listed in the EU 2020 list of critical raw materials
- Products that might be associated with a **high environmental impact**. Some examples of such products include those that can be associated with deforestation or the generation of non-CO2 GHG such as meat related -products, dairy products, oil seeds (e.g., soybeans), vegetable fats (e.g., palm oil and palm oil), cocoa and coffee products and rubber products. Fish-related products were also considered as fishing itself (due to the fishing boat's movements in the search for catches) and the deep-freezing of fish are both GHG-intensive processes.
- Products and services specifically targeted by (implemented or planned) **EU policies** related to the mitigation of **climate change**, as identified in § 2 above;
- **Climate change-mitigating goods & services**, based on the list of Climate Goods and Services published by the World Economic Forum (WEF) in 2022, which includes goods and services categorised into renewable energy and energy efficiency (e.g., solar PVs, wind turbines, installation services); transport (incl., electric vehicles, and trains); buildings (incl. insulation materials, thermostats); and others.

- **Alternatives** of products with high GHG emissions or associated with a high environmental impact not included in the WEF list such as legumes (plant-based sources of proteins, alternative to meat) or trains (alternative to individual cars for personal mobility).

For information on the process of short-listing top products within the most relevant product categories based on trade and production values please see Annex 3.

Data sources used

Eurostat's COMEXT and PRODCOM databases on products were used as a source of data on the EU countries' extra-EU trade by partner, and production in EU countries. We selected data from EU Member States and relevant foreign trade partners, which varied depending on the type of trade product that was analysed. The specific indicators that we selected for our analysis are those described in Table 3-1 below:

Table 3-1 - Indicators used for the trade flows in products in the COMEXT and PRODCOM databases

Indicator	Selection
Time period	2010 - 2019
Currency	Euro
Flow	Import and export
Frequency	Annual
Trading partner country/territory	Rest of the world and relevant countries (depending on the type of product) excl. European Union

3.2.3. List of climate-relevant product categories

Product categories relevant to the analysis of international trade

Table 3-2 and Table 3-3 below provide the lists of products that we considered, respectively biotic (i.e. stemming from plants or animals) and abiotic. A detailed list of products that fall under the corresponding abiotic and biotic product categories can be found in Annex 2.

Table 3-2 List of biotic product categories relevant to the analysis of international trade

Biotic product categories
Animal or vegetable fats and oils (incl. residues from oil)
Coffee and cocoa
Dairy produce; birds' eggs; natural honey; edible products of animal origin
Edible vegetables
Fish and crustaceans, molluscs and other aquatic invertebrates
Live animals
Meat and edible offal
Rubber
Sugars

With €229.8 billion of food exports (9,9% of total EU exports) and €171.8 billion of food imports in 2022, the EU is one of the largest importers and exporters of agri-food products, including aquaculture[12]. EU imports are dominated by low-value raw plant products, such as cocoa, fruits and soybeans, while the EU remains a net exporter of meat (especially pigmeat) and dairy products as well as high-value commodities such as wines and spirits. The environmental impacts of animal production are briefly described in section 3.2.2. However, the relevance of food products increases when considering the EU Consumption Footprint platform developed by the JRC. Food consumption emerges as one of the main drivers of climate impact: in 2021, it represented 38.1% of the overall climate footprint, with animal-

[12] *The consolidated agri-food trade data at EU level covering market developments in 2022 are available at https://agriculture.ec.europa.eu/system/files/2023-04/monitoring-agri-food-trade_dec2022_en.pdf*

based products being responsible for the largest share within this category[13]. Agricultural non-CO_2 emissions (mainly CH_4 and N_2O) account for 12% of the EU's total emissions (of which 45% come from methane emissions from livestock)[14]. Finally, mainly because of its structural dependence on vegetable protein imports for animal feedstuff, the EU has become a net importer of calories[15]. This illustrates the relevance of considering biotic products and diets in the study.

Table 3-3 List of abiotic product categories relevant for the analysis of international trade

Abiotic product categories
Aircrafts, motor vehicles, motorcycles, rail, electric vehicles, ships and boat
Cement, glass, ceramics and other insulation materials
Critical raw materials, batteries, photovoltaic, others
Iron and steel
Lighting related products
Mineral fuels and derivatives – Various aromatic hydrocarbons, coal, oil, gas,
Other ores and concentrates
Organic chemicals
Other energy and storage-related products
Plastics and articles thereof
Solar power, Wind power

3.3. Recent evolutions and current state of climate-relevant EU international trade

3.3.1. Construction of extra-EU27 Competitiveness Assessment Charts for the selected product categories

The current situation and recent trends of the extra-EU27 international trade were described in a single chart, which aims:

- To describe the **current state** of EU international trade in a given product, using the variable "**normalised trade balance**", equal to the ratio between the trade balance of the EU for the product and the total traded volume of that product (sum of imports and exports). This indicator varies between –1, where the trade is only made of imports, with no exports, and +1, where conversely the trade is only made of exports with no imports. This variable enables the comparison of the trade situation of products with very different trading volumes;
- To describe the **recent trend** of the EU international trade position of that product, the **difference** between the "normalised trade balances" of that product over the last decade of available data, (i.e. difference between 2019 and 2010), divided by 2 so that the values remain again within the [-1; +1] range.

To assess the extra-EU27 trade evolution of the selected product categories, trade data extracted from COMEXT was analysed, and figures were constructed to show the relationship between the current trade situation (using 2019 data) and how it has changed since 2010. The data extracted included the values, in euro, of imports from outside of the EU, and of exports outside of the EU. The purpose of this

[13] *All data related to food consumption are available on the Consumption Footprint Platform at https://eplca.jrc.ec.europa.eu/ConsumptionFootprintPlatform.html. Sala and Sanyé (2022) present a summary of the methodology and main findings.*

[14] *More data on Greenhouse gas emissions from agriculture in Europe are available on the EEA website https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-agriculture#:~:text=Based%20on%20national%20projections%2C%20only,emissions%20in%20the%20agriculture%20sector.*

[15] *Schiavo, M, Le Mouël, C, Poux, X and Aubert, P M (2021) An agroecological Europe by 2050: What impact on land use, trade and global food security?*

analysis was to provide an indication of the competitiveness of the EU-27 in the extra EU market for the selected products and to compare the current trade position with the one from the past decade.

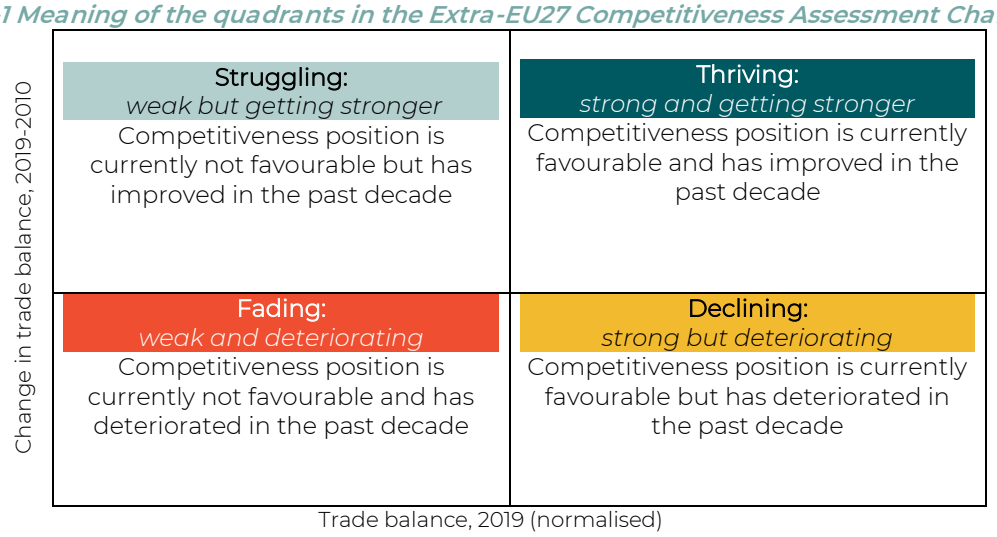
The normalised trade balance was selected as the main indicator for this assessment because of its relevance and simplicity of calculation with the available information.[16] By using a normalised approach, it was possible to ensure that the figures accurately reflected the trade balance trends, while also allowing for a comparison between products with different levels of trade balance. This resulted in the categorisation of the products into four quadrants depending on the competitiveness position of the extra EU-27 market: a quadrant *thriving* includes products for which the EU-27 shows a strong and improving competitiveness position; *struggling*, products with currently weak but improving competitiveness position; *fading,* products with weak and deteriorating competitiveness position; and *declining*, products with strong but deteriorating competitiveness position. To complete this analysis, treemaps with nested rectangles proportional to the trade value of the products were included.

Following the methodology mentioned above, competitiveness assessment charts and treemaps based on trade values were constructed for four product categories:

- biotic products, Figure 3-2 and Figure 3-3;
- abiotic products (excluding critical raw materials, and mineral fuels derivatives), Figure 3-4 and Figure 3-5;
- critical raw materials, Figure 3-6 and Figure 3-7;
- mineral fuels derivatives, Figure 3-8 and Figure 3-9.

Figure 3-1 explains the meaning of the content of the quadrants in the Extra-EU27 competitiveness assessment charts. The x-axis represents the extra-EU trade balance in 2019, which (as explained above) was normalised to allow for a comparison between products with different trade volumes. The y-axis represents the change in the extra EU trade balance between 2010 and 2019.

Figure 3-1 Meaning of the quadrants in the Extra-EU27 Competitiveness Assessment Charts



3.3.2. Summary of main findings

The main findings of our analysis of the competitiveness assessment charts and corresponding treemaps are presented in Table 3-4

16 Although competitiveness can be affected by various factors such as productivity, innovation, price, and market access, among others, the trade balance can provide valuable insights about competitiveness (i.e., a positive trade balance means that extra-EU27 exports exceed imports and can suggest that EU27 countries are producing and selling products more efficiently and effectively than its trading partners).

Table 3-4 Key findings from the analysis of the competitiveness assessment charts and corresponding treemaps by product group

Product group	Main findings
Biotic products	Results for this product group are displayed in Figure 3-2 and Figure 3-3 • While the competitiveness positions of some of the biotic products considered in the analysis have shifted, the overall trade balance has remained relatively stable. Low-fat milk displayed the largest increase in its trade balance between 2010 and 2019, while pork carcasses experienced the largest decrease. • The edible vegetables category, including products such as dried lentils, chickpeas, peas, and beans, all fall within the *Struggling* quadrant of the competitiveness chart. This means that while the EU eventually may face challenges in meeting increased demand driven by climate policies (e.g., concerning dietary changes), the position of the EU today is better than it was in the past decade. • Except beef and veal cuts and pig meat carcasses, meat products generally show a positive trade balance in 2019, but their evolution between 2010 and 2019 varies, although to a limited extent. • Regarding the products representing the top five highest extra-EU 27 trade values: • Frozen pork exhibits a robust and enhancing competitiveness position, placing it in the *Thriving* quadrant. This suggests that the product is performing well in the extra EU-trade and that its trade balance has improved, although marginally, over the past decade. • In contrast, cheese (incl. grated, powdered, and blue-veined) has a strong but diminishing competitiveness position, placing it in the *Declining* quadrant. This indicates that, despite still having a relatively strong position in extra-EU trade, the competitiveness of the product has been gradually declining over the past decade, although to a limited extent. • Soya beans and coffee are currently positioned in the *Struggling* quadrant of the competitiveness graph, indicating a weak but improving competitiveness position. • Lastly, oil cake soya bean residues have a deteriorating and weak competitiveness position, positioning them in the *Fading* quadrant, signifying that their performance in regard to extra EU-trade has been faltering over the past decade. If demand for this product increases as a result of climate policies, EU producers will have difficulties in maintaining their position in the extra-EU market. • In general, none of the top-traded products exhibit a significant change between their respective trade balances in 2010 and 2019.
Abiotic products (excl. critical raw materials and mineral fuels)	Results for this product group are displayed in Figure 3-4 and Figure 3-5 • The competitiveness position of products related to renewable energy generation varies significantly. Photosensitive devices, which are crucial for solar power, are currently positioned in the *Struggling* quadrant of the competitiveness graph. On the other hand, aluminium structures, ball bearings, and wind-generating sets, which are essential components for wind power, are positioned in the *Declining* quadrant, indicating a strong but deteriorating competitiveness position. For the first group, this means that while the EU eventually may face challenges in meeting increased demand driven by climate policies (e.g., due to the increase in solar power generation), the position of the EU today to satisfy this demand is better than it was in the past decade. In contrast, for the second group (i.e., in the *Declining* quadrant) this means that despite still having a relatively strong position in extra-EU trade, the EU's competitiveness in the extra-EU market for these products has been gradually declining over the past decade, which may translate into difficulties in reaching increased demand in the coming years. • The majority of motor vehicles show a positive trade balance (placed on the right-hand side of the graph), but their trade balance trends between 2010 and 2019 differ. • Conversely, electric vehicles (EVs) are positioned in the *Fading* quadrant suggesting a weakening competitiveness position, which may indicate an increase in competition from other countries outside the EU. With an increase in demand for EVs in the EU as a result of climate policies, measures will be needed to reverse the current trend of declining competitiveness and increase the ability of the EU to scale up production and trade. • Regarding the products representing the top five highest extra-EU 27 trade values: • Petrol Motor vehicles are currently positioned in the *Thriving* quadrant of the competitiveness graph, indicating a strong and (slightly) improving competitiveness position in extra-EU trade between 2010 and 2019. This suggests that EU27 countries are producing and exporting petrol motor vehicles outside the EU more than they are importing them which also implies that EU exporters of this product to outside the EU may be particularly impacted by more stringent climate policies. • Civil turbo/jet propeller parts have a weak but improving competitiveness position, placing them in the *Struggling* quadrant. This indicates that the competitiveness of this product has been gradually improving, but the trade balance is still negative (with imports larger than exports). In particular, for civil turbo/jet propeller parts, the current trade balance is very close to zero, suggesting that the difference between exports and imports is marginal.

Product group	Main findings
	• Diesel motor vehicles, spark ignition engines, and civil aircraft (>15 t) are currently positioned in the *Declining* quadrant, indicating a strong but deteriorating competitiveness position over the past decade. It is noted, however, that none of these products show a significant change in their respective trade balances between 2010 and 2019.
Critical raw materials	Results or this product group are displayed in Figure 3-6 and Figure 3-7 Most of the critical raw materials analysed exhibited a negative trade balance in 2019, indicating that their imports exceeded their exports. This is expected as the EU is not a major producer of most of the critical raw materials analysed. Despite this, there is a positive trend showing an improvement in the competitiveness position of most of these materials over the past decade, for example for cobalt ores and concentrates. • The products 'natural graphite' and 'niobium, tantalum, or vanadium ores and concentrate' show the best competitive position among the critical raw materials analysed (with a positive trade balance in 2019 and a significant increase in the past years compared to other products in this category). Being highly carbon-intensive, the production of natural graphite is likely to be impacted by climate policies, which can potentially affect the positive trend of improved competitiveness observed in recent years. Additionally, as natural graphite is a crucial component in the production of batteries, any increase their demand may have implications for the competitiveness position of EU producers. On the other hand, niobium, tantalum, or vanadium have a range of industrial applications (tantalum is used in capacitors for electronic devices and super alloys, while vanadium finds use in high-strength-low-alloys for industries such as aeronautics, niobium is used in the production of high-strength steel and super alloys for infrastructure, capacitors and superconducting magnets). Based on the EU's competitive position, the EU will be able to meet the potentially increasing demand for these products. • Regarding the products representing the top five highest extra-EU 27 trade values: • Pure silicon (>99,99%) exhibits a favourable and strengthening competitiveness position, placing it in the *Thriving* quadrant. This suggests that the product is performing well in the extra EU-trade and that its trade balance has improved over the past decade. This is a promising sign for the EU, particularly if there is an increase in demand for the product in both the EU and global markets. As a top-performing product with a strengthening trade balance, pure silicon may be able to meet this increased demand and potentially even expand its market share in the extra EU-trade market. • Cobalt mattes and products, lithium cells, and batteries have a less favourable but gradually improving competitiveness position, placing them in the *Struggling* quadrant. This suggests that while the current trade balance of these products is negative, the EU may still be able to compete in the extra EU-trade market if the demand for these products increases (due to an increase in the production of batteries and photovoltaic cells) as its competitiveness has been slowly improving over time. • Phosphorus showed a negative trade balance in 2019 and a weakening competitiveness position over the past decade, placing it in the *Fading* quadrant. This may imply that the product is facing challenges in extra EU-trade, and its competitiveness has been gradually diminishing over the past decade.
Mineral fuels and derivatives	Results or this product group are displayed in Figure 3-8 and Figure 3-9 • Most of the mineral fuels and derivatives analysed exhibited a negative trade balance in 2019, indicating that their imports exceeded their exports. This is expected as the EU is not a major producer of the products analysed in this group. • 'High-temp coal tar oils'[19] show a strong competitiveness position that has substantially improved between 2010 and 2019. This implies that EU27 countries are producing and exporting this product outside the EU more than they are importing it, resulting in extra-EU27 exports exceeding imports. However, this also means that EU exporters of this product (fossil fuel derivative) can be, in particular, adversely impacted by more stringent climate policies. • Regarding the products representing the top five highest extra-EU 27 trade values: • Light petroleum or bituminous oils show a strong and improving competitiveness position, placing them in the *Thriving* quadrant of the competitiveness graph. • Conversely, bituminous coal, crude petroleum oils, and medium petroleum or bituminous oils exhibit a weak and declining competitiveness position, placing them in the *Struggling* quadrant. This suggests that these products face challenges in extra-EU trade, but their competitiveness has been gradually increasing over the past decade

This results and can be summarised as follows.

Many of the high-volume products where the EU currently concentrates its international competitiveness and extracts most of its trade surpluses are products whose EU consumption is

expected to diminish, according to models used in the study, (e.g. beef or pork meat, petrol motor vehicles) in the context of a transition to a net-zero GHG emissions economy. These products are:

- Petrol Motor vehicles, Diesel motor vehicles, spark ignition vehicles;
- Civil aircraft (>15 t);
- Live bovine, Beef & veal carcasses;
- Frozen pork;
- Cheese.

Conversely, the EU competitiveness position for the products whose consumption and production are expected to increase in a context of a transition to a net-zero GHG emissions economy is either:

Weak, even if improving ("Struggling" quadrant):

- Photosensitive devices (incl. PV cells);
- Cobalt mattes and products;
- Lithium cells;
- Batteries;
- Legumes (plant-based sources of proteins, alternative to ruminant meat);

Or Strong, but deteriorating ("Declining" quadrant):

- Aluminium structures;
- ball bearings,;
- wind-generating sets;

Or even weak, and deteriorating ("Fading" quadrant):

- Electric vehicles (EVs);
- Rape, colza seeds (plant-based sources of fat, alternative to ruminant and pork meat).

This situation may point at a deterioration, in a context of a transition to a net-zero GHG emissions economy, of the international trade balance of the EU for these products, as the EU is strong where demand will likely fade, and weak (or struggling) where it will likely rise. However,

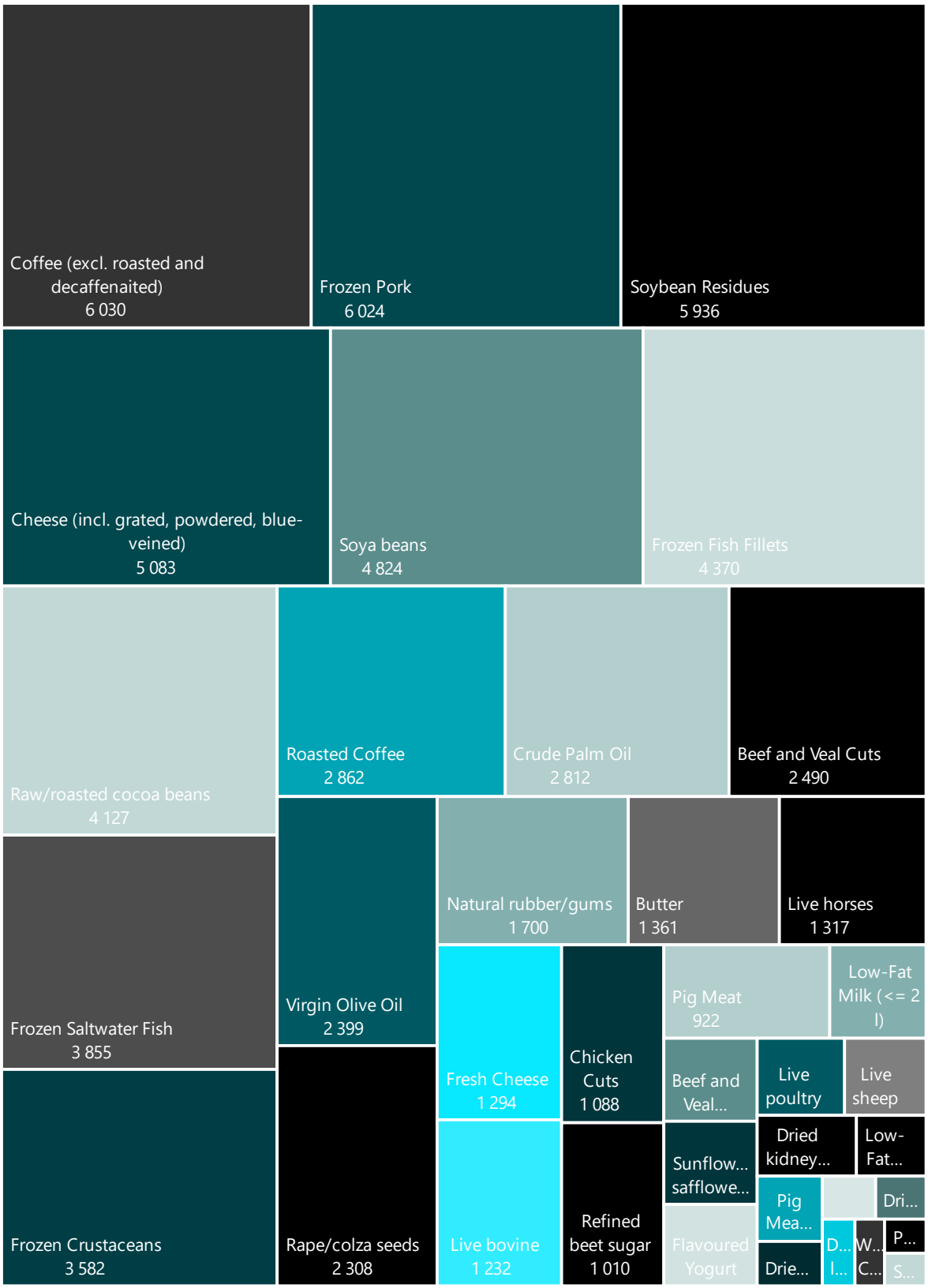
these negative prospects will be more than counterbalanced by the strong decline being expected in the imports of goods connected to the emission of GHG under the EU Long Term Strategies (see chapter 4.2), and in particular of products which represent high volumes of imports such as:

- Crude petroleum oils, Light petroleum or bituminous oils, Medium petroleum or bituminous oils;
- Natural gas;
- Bituminous coal;
- Soya beans, Oilcake, soya beans residues (used in the raising of cattle);
- Palm oil, coffee, cocoa beans (potential sources of deforestation).

The detailed description of the trade situation for each product group, including of the main trade partners of the EU relevant for that product group, can be found in the Annex 4.

Figure 3-2 ***EU competitiveness in extra EU-trade based on relationship between extra-EU trade balance in 2019 and change from 2010-2020 for selected biotic products.*** The products highlighted in light blue represent the top five highest extra-EU 27 trade values within the products considered (imports + exports), as illustrated in Figure 3-3

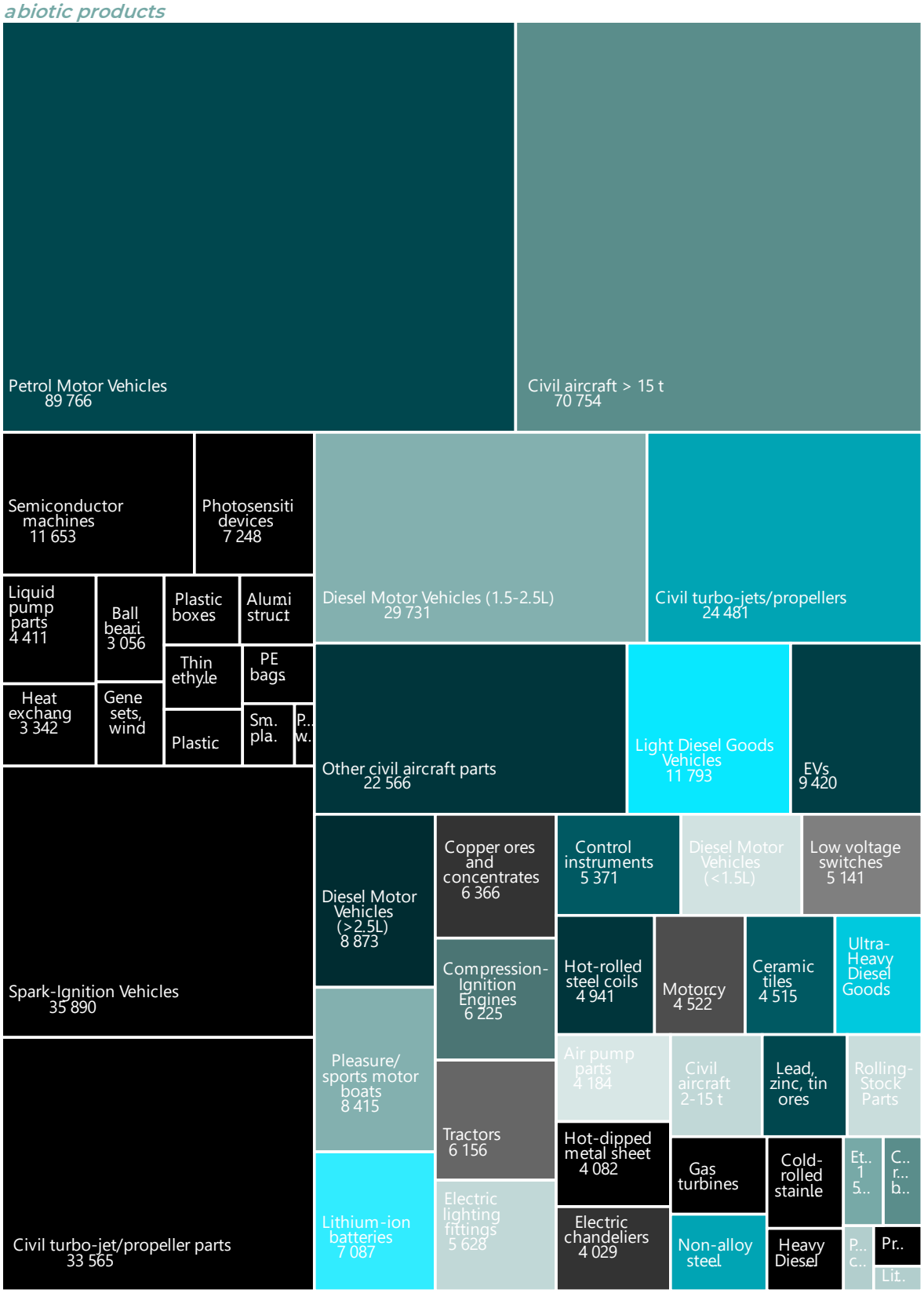
Figure 3-3 *Extra-EU 27 trade value 2019 (M EUR) (Exports value + imports value) for selected biotic products*



Manufactured products

Figure 3-4 ***EU competitiveness in extra EU-trade based on relationship between extra-EU trade balance in 2019 and change from 2010-2020 for selected abiotic products.*** The products highlighted in light blue represent the top five highest extra-EU 27 trade values within the products considered (imports + exports), as illustrated in Figure 3-5.

Figure 3-5 *Extra-EU 27 trade value 2019 (M EUR) (Exports value + imports value) for selected abiotic products*



Critical Raw Materials

Figure 3-6 ***EU competitiveness in extra EU-trade based on relationship between extra-EU trade balance in 2019 and change from 2010-2020 for selected critical raw materials.*** The products highlighted in light blue represent the top five highest extra-EU 27 trade values within the products considered (imports + exports), as illustrated in Figure 3-7

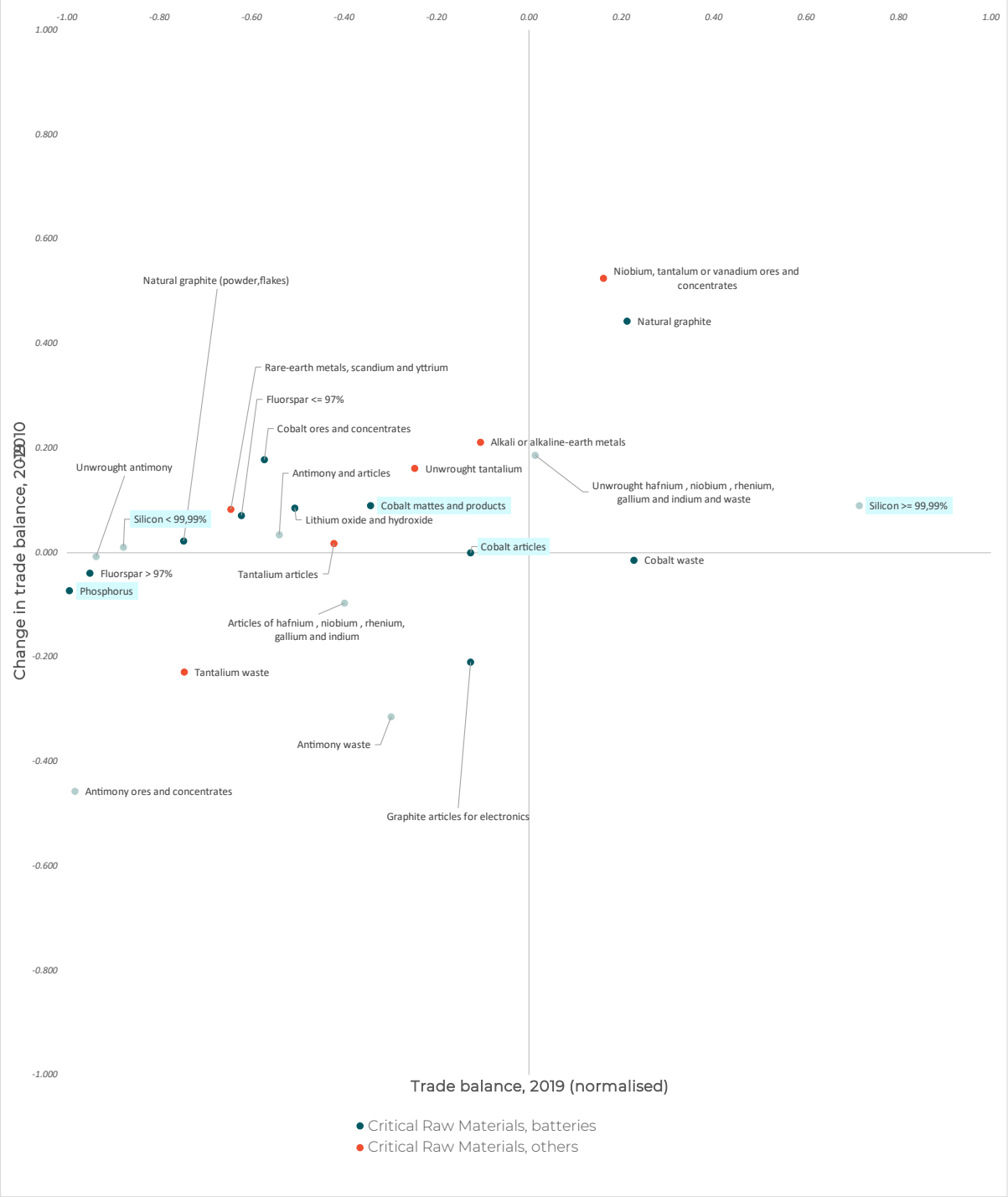
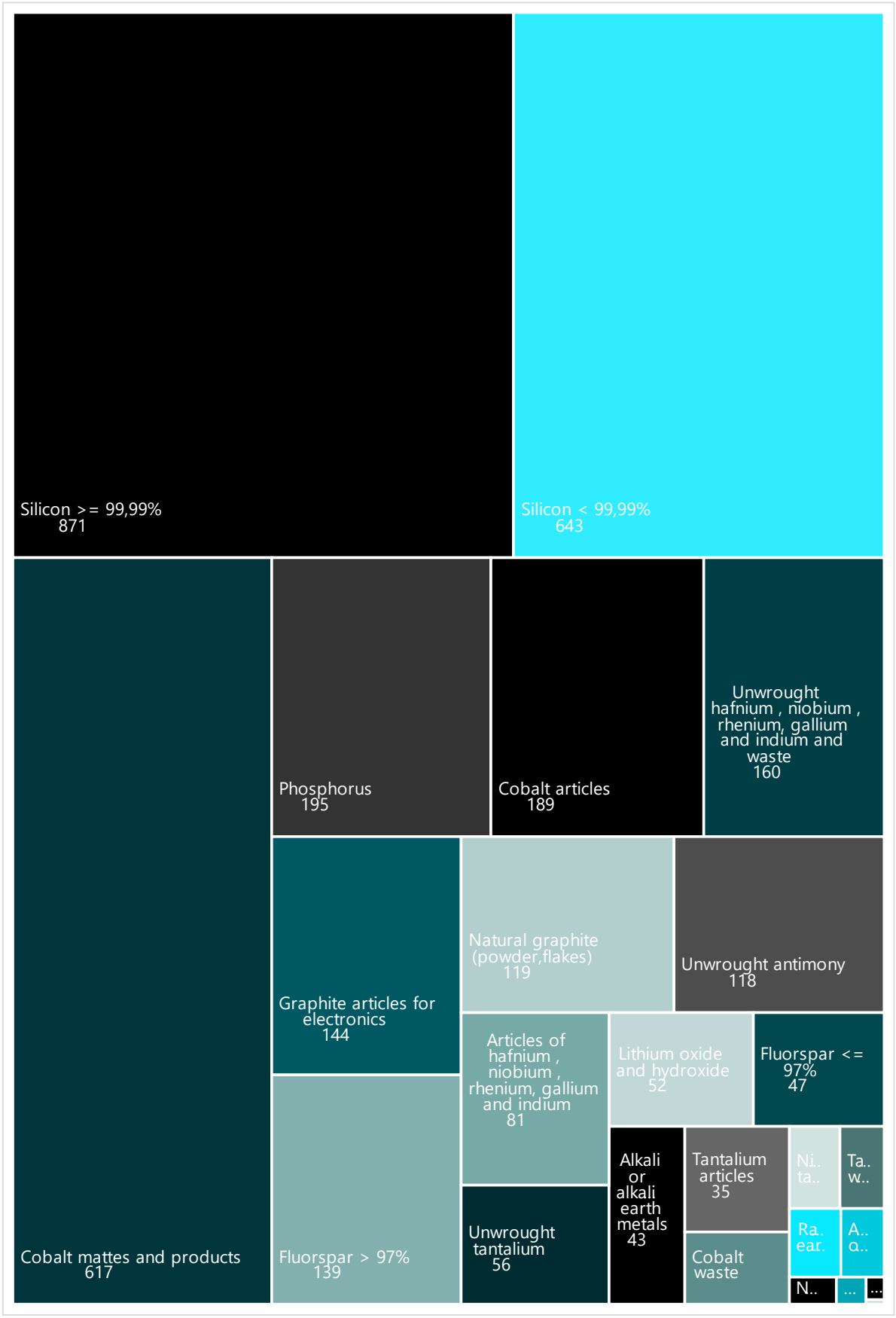


Figure 3-7 *Extra-EU 27 trade value 2019 (M EUR) (Exports value + imports value) for selected critical raw materials*



Mineral fuels and derivatives

Figure 3-8 ***EU competitiveness in extra EU-trade based on relationship between extra-EU trade balance in 2019 and change from 2010-2020 for selected mineral fuels and derivatives.*** The products highlighted in light blue represent the top five highest extra-EU 27 trade values within the products considered (imports + exports), as illustrated in Figure 3-9

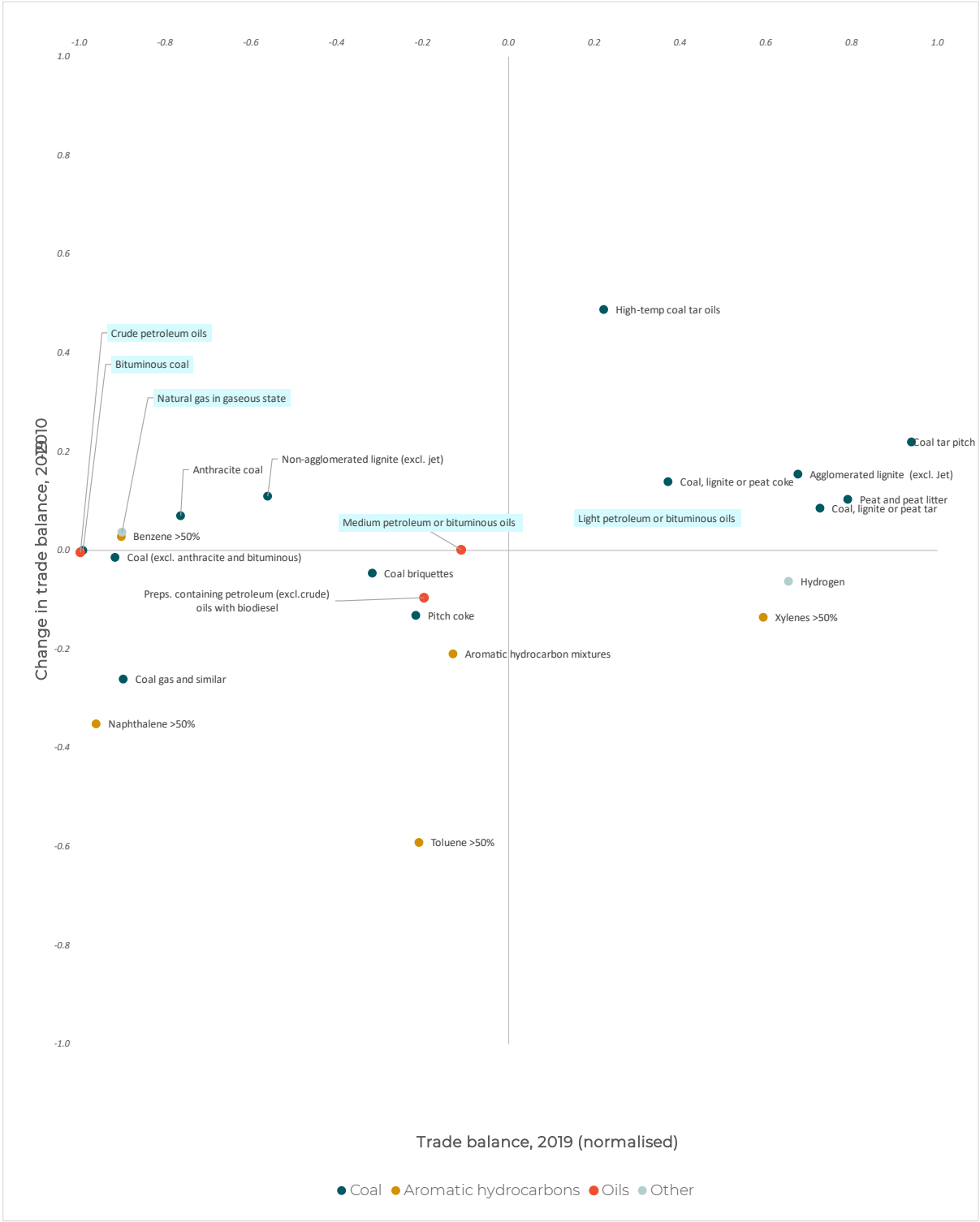
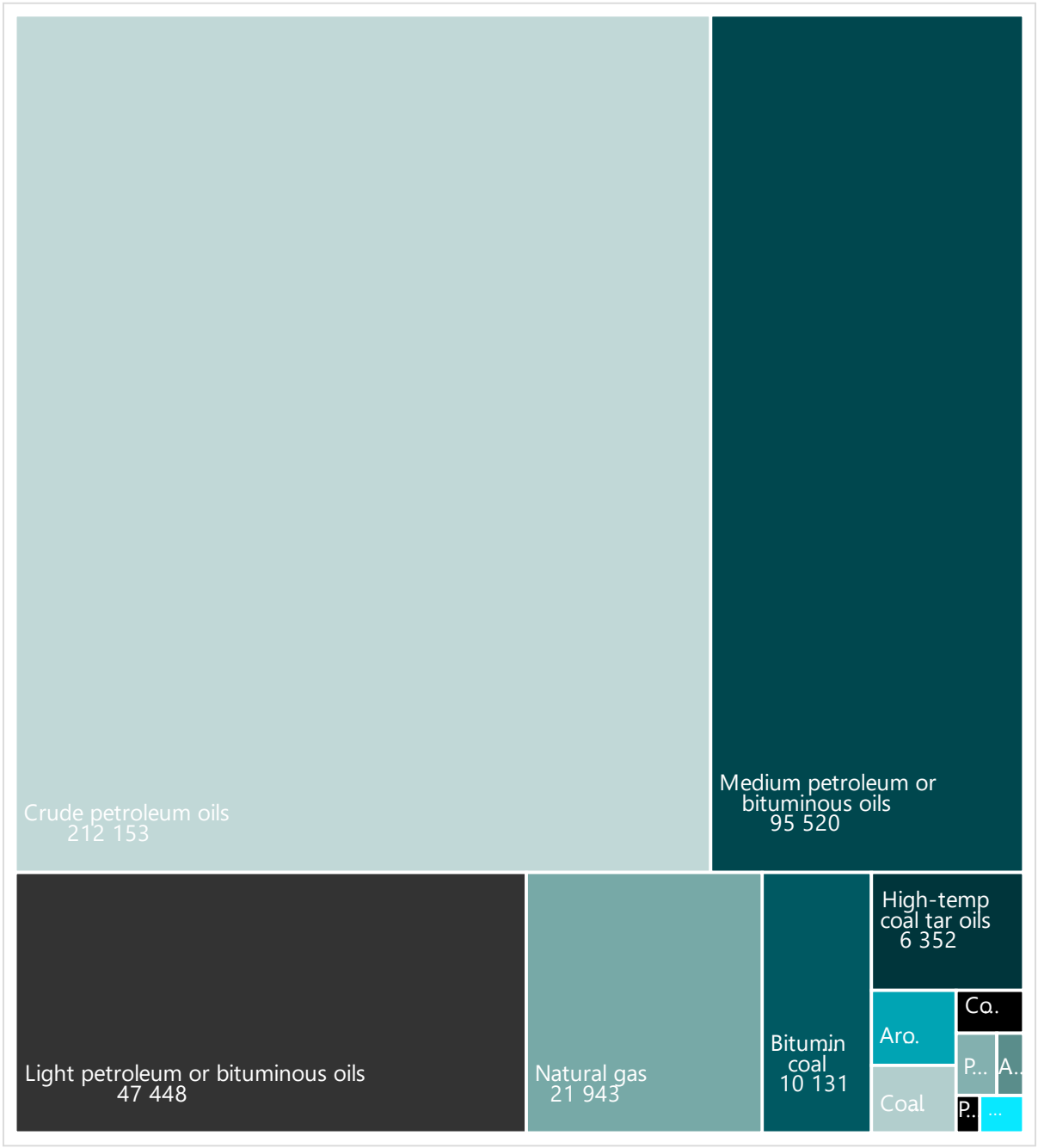


Figure 3-9 *Extra-EU 27 trade value 2019 (M EUR) (Exports value + imports value) for selected Mineral fuels and derivatives*



4. Anticipation of EU international trade of climate-relevant goods by 2050

4.1. Structure of this chapter

The aim of this chapter is to present the results of the anticipation of the EU trade of climate-relevant products by 2050, under different pathways of a transition to a net-zero GHG emissions economy, considering different hypothetical scenarios of the competitiveness of EU producers as well as in the climate policies of the Rest of the World (RoW).

This chapter is structured as follows:

- Section 4.2 presents the methodological foundations for the 2050 trade projections, including the hypothetical scenarios used for the analysis;
- Section 4.3 presents the results of our analysis;
- Section 4.4 presents the next steps of the study.

4.2. Methodological foundations for 2050 EU trade projections

In this section, the methodological foundations employed in this study for the anticipation of EU trade in climate-relevant goods by 2050 are presented. It commences with a summary of the EU Long-Term Strategies (LTS) used, a description of the hypothetical scenarios developed and a step-by-step overview of the methodology. This is then followed by an explanation of how the competitive position of EU producers was projected to evolve, including details of the survey conducted for this analysis. The section concludes with a concise summary of key assumptions. These methodological insights are very important for comprehending the subsequent findings in the study.

4.2.1. Long-Term scenarios for the European Union (EU)

Our projections of trade volumes by 2050 is based on a selection of Long-Term strategies (LTS) supporting the Commission Communication "A clean planet for all"[17] net-zero scenarios for the evolution of the EU consumption of climate-relevant goods. Specifically, the analysis is based on the decarbonisation pathways **1.5LIFE** and **1.5TECH.** The consideration of these decarbonisation pathways is justified for several reasons:

- Both scenarios (1.5LIFE and 1.5TECH) are compatible with the EU net-zero GHG emissions objective by 2050.[18] In these scenarios, the goal is to balance out any remaining emissions that cannot be reduced by 2050 by incorporating negative emissions, including those generated by the Land Use, Land-Use Change, and Forestry (LULUCF) sink[19]. Specifically:
  a. The 1.5TECH scenario aims to increase the contribution of various technological options and relies heavily on the deployment of biomass coupled with significant carbon capture and storage (BECCS) to achieve net-zero emissions by 2050.
  b. The 1.5LIFE scenario places less emphasis on technological options but assumes a shift in EU business practices and consumption patterns towards a more circular economy. It accounts for changes in EU citizens' climate awareness, resulting in lifestyle modifications and consumer choices that are more favourable for the climate such as less carbon-intensive diets, the sharing economy in transport, limiting growth in air transport demand and more rational use of energy for heating and cooling

17 'In-depth analysis in support of the Commission Communication COM(2018)773 A Clean Planet for all - A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy', downloadable at: https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf
18 See: In-depth analysis supporting the Communication "A clean planet for all"
19 Both scenarios include incentives to enhance the LULUCF sink, but the 1.5LIFE scenario places a significantly stronger emphasis on this aspect.

- Based on the 1.5LIFE and 1.5TECH scenarios, it is possible to generate quantitative estimates of the effects on trade of climate policy. These scenarios provide a framework for assessing the potential impacts of GHG emissions reduction pathways on various aspects, including the future demand of selected climate-relevant products in comparison to a baseline scenario.
- The inclusion of scenarios 1.5LIFE and 1.5TECH allows for benchmarking against the current situation and the Baseline scenario for 2050 (which is also described in detail, together with the 1.5TECH and 1.5LIFE scenarios). By comparing the outcomes of these scenarios with the existing data and the baseline projection, it is possible to identify the extent to which the transition to a net-zero economy can influence trade patterns and values.

Next to the 1..5 TECH and 1.5 LIFE scenarios, our analysis also refers to the EU LTS baseline scenario, which was developed to represent the current EU decarbonisation trajectory in line with the Paris Agreement. Therefore, it includes existing EU policies and proposed policies by the Commission (some of which are still under discussion). It also incorporates some specific technology assumptions and projects the achievement of energy and climate targets for 2030 as agreed by June 2018 as well as a continuation of policies impacting non-CO2 emissions.[20] This baseline scenario serves as a tool to demonstrate the effects of existing climate and energy policies and objectives in the long-term.

4.2.2. Hypothetical scenarios for the projections of trade volumes in 2050

The projections of trade volumes in 2050 of the climate-relevant products listed in Chapter 3 were made under four different hypothetical scenarios for abiotic products and two hypothetical scenarios for biotic products. These scenarios were specifically developed for this analysis and resulted from the combination of:

- Three different EU Long-Term strategies as described in 4.2.1. (i.e,. baseline, 1.5LIFE and 1.5TECH);
- Opposing situations concering the development of climate policies in the Rest of the Wold (Row); which allows for a comprehensive analysis of different potential trajectories in global consumption patterns and the corresponding impact on extra-EU trade for the selected products, including imports and exports.
    - The EU-RoW Alignment, refers to a situation where the (RoW) follows a similar trajectory as the EU towards achieving a net-zero economy. This scenario assumes that the RoW undergoes a transformation aligned with the assumptions made to guide EU's efforts to reduce GHG emissions under the 1.5 TECH and 1.5 LIFE scenario.
    - The EU-RoW Divergence, assumes that the consumption patterns of the RoW deviate from those projceted by the LTS 1.5 TECH and 1.5 LIFE but align with the EU baseline scenario. As explained above, the EU baseline scenario signifies that 2030 EU climate targets are achieved but does not consider additional measures. Within the EU-RoW Divergence scenario, it is further assumed that exports (i.e.., RoW consumption) remain the same as in the baseline scenario across all transformation pathways (1.5TECH and 1.5 LIFE)
- Opposing situations regarding the future competitiveness of EU producers The trade flows of a given product between the EU and the RoW are determined by the consumption of that product, but also by the competitive position of EU producers compared to those in the RoW. We considered two contrasting scenarios regarding the competitiveness of EU producers:
    - An Optimistic scenario, where the evolution of the competitiveness of EU producers is the most favourable among the options currently envisaged by EU policymakers;
    - A Pessimistic scenario, where the EU efforts supporting the competitiveness of its

[20] *The 2030 targets considering by the Baseline scenario are: at least 40% GHG emissions reduction compared to 1990; with 43% GHG emissions reduction in ETS sector compared to 2005 and 30% GHG emissions reduction in effortsharing sector compared to 2005; at least 32% renewable energy share in final energy consumption and at least 32.5% reduction in both primary and final energy consumption compared to (2030 projections established in) 2007 Baseline – see more details on EU policies in section 2.2 and 3.1 of European Commission (2018) A Clean Planet for all. A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy. In-depth analysis in support of the Commission Communication COM(2018) 773. Brussels: European Commission.*

producers fail, and where current negative trends are pursued or even increased.

These hypothetical scenarios are summarised in Table 4-1 (abiotic products) and Table 4-2 (biotic products)

Table 4-1 Overview of hypothetical scenarios used for this study for abiotic products

Scenario	Description	Climate policies of the Rest of the World	Competitiveness of EU producers
Abiotic products			
EU-Optimistic Competitiveness Scenario			
EU- Optimistic Competitiveness and RoW Alignment scenario	EU producers maintain or improve their positive competitiveness outside the EU. At the same time, RoW countries align their efforts with the EU's assumptions in the EU's LTS net-zero scenarios(1.5 TECH and 1.5 LIFE)	Aligned with the EU's LTS net-zero scenarios (1.5 TECH and 1.5 LIFE)	EU producers maintain or improve their positive competitiveness outside the EU
EU- Optimistic Competitiveness and RoW Divergence scenario	EU producers maintain or improve their positive competitiveness outside the EU. At the same time, RoW countries only align their efforts with the EU's assumptions in the EU's LTS baseline scenario	Aligned with the EU's LTS baseline scenario	EU producers maintain or improve their positive competitiveness outside the EU
EU-Pessimistc Competitiveness Scenario			
EU- Pessimistic Competitiveness and RoW Alignment scenario	EU producers face challenges in maintaining competitiveness outside the EU. At the same time, the RoW follows a similar trajectory as the EU towards achieving a net-zero economy in line with the assumptions in the EU's LTS (1.5 TECH and 1.5 LIFE)	Aligned with the EU's LTS net-zero scenarios (1.5 TECH and 1.5 LIFE)	EU efforts to support the competitiveness of its producers fail, leading to negative trends being pursued or even exacerbated.
EU- Pessimistic Competitiveness and RoW Divergence scenario	EU producers face challenges in maintaining competitiveness outside the EU. At the same time, the RoW follows a similar trajectory as the EU towards achieving a net-zero economy in line with the assumptions in the EU's LTS baseline scenario	Aligned with the EU's LTS baseline scenario	EU efforts to support the competitiveness of its producers fail, leading to negative trends being pursued or even exacerbated.

Table 4-2 Overview of hypothetical scenarios used for this study for biotic products

Scenario	Description	Climate policies of the Rest of the World	Competitiveness of EU producers
Biotic products			
EU- RoW Alignment scenario	RoW countries align their efforts with the EU's assumptions in the EU's LTS 1.5 LIFE	Aligned with the EU's LTS net-zero scenario (1.5 1.5 LIFE)	Not considered
EU- RoW Divergence scenario	RoW follows a similar trajectory as the EU towards achieving a net-zero economy in line with the assumptions in the EU's LTS baseline scenario	Aligned with the EU's LTS baseline scenario	Not considered

4.2.3. Step-by-step methodology for estimating the future value of trade in 2050

To estimate the trade value for each product in 2050, the following methodology was employed. A more detailed explanation of this methodology is presented in Annex 5 and 6.

1. The consumption in the EU of the product, expressed in functional units (e.g. physical energy units, tonnes, units for cars), results from the selected Long-Term Scenarios 1.5TECH and 1.5LIFE;
2. The number of functional units was converted into quantities of products using substitution factors in some specific, but important, cases:
    a. The total number of personal vehicles was split between power train technologies (various types of internal combustion engines, electric), as per the selected Long-Term Scenarios;
    b. The proteins and fats that come from animal-based products like beef, pork, and dairy items have been partially replaced or substituted with proteins and fats from plant-based sources such as legumes (e.g., beans and lentils), oils, and nuts. The specific details of how this substitution occurs are outlined in Annex 6.
3. To forecast the future consumption of each product, we projected a demand growth rate from 2019 to 2050 considering the LTS scenarios. The anticipated demand growth for each product is detailed in Annex 5.
4. The future value of imports and exports was estimated based on the projected future consumption. This future consumption, expressed in physical units, was then converted into economic value by applying the expected prices per functional unit as derived from the following sources
    a. For abiotic products: the prices per functional unit from the techno-economic forecasts used in other assessments by the European Commission[21];
    b. For biotic products: the prices per tonne anticipated by the *EU agricultural outlook 2022-32*[22];
5. A "Competitiveness Multiplier (CM)" was computed for imports (resp. for exports) of manufactured products, dependent upon the scenario (optimistic or pessimistic) regarding the competitiveness of EU producers for the most traded climate-relevant manufactured products. The CM is based on data on:
    a. for imports: the current and anticipated future share of the EU internal demand covered by imports, in each of the competitiveness scenarios (Optimistic or Pessimistic);
    a. for exports: the current and anticipated future share of the global demand covered by EU producers, in each of the competitiveness scenarios (Optimistic or Pessimistic).

    In both cases, the current value is based on the data available from sector associations and external studies. Future value is estimated based on the consultants' expert view on representative figures in each of the contrasted scenarios. More details about the CM and the overall methodology to anticipate the evolution of the competitive position of EU producers is presented in the next section 4.2.4. The CM used for each product are detailed in Annex 5.
6. The future value of **imports** in a given scenario was computed as per the following formula: Future value of imports = Value of imports in 2050 x Competitiveness Multiplier for imports;

The future value of **exports** in a given scenario was computed as per the following formula: Future value of exports = Value of exports in 2050 x Competitiveness Multiplier for exports.

21 Techno-economic assumptions of the PRIMES-TREMOVE model by E3 modelling for the transport-related products; additional Technology assumptions for the domestic, industry, power/ heat when applicable.
22 Documentation available at https://agriculture.ec.europa.eu/data-and-analysis/markets/outlook/medium-term_en

4.2.4. Anticipation of the evolution of the competitive position of EU producers

As stated above in §3.3, the recent trends in the competitive position of EU producers of climate-relevant goods are not encouraging:

- Many of the high-volume products where the EU currently concentrates its international competitiveness and extracts most of its trade surpluses are products whose EU consumption is expected to diminish or even disappear in the context of a transition to a net-zero GHG emissions economy;
- Conversely, the EU competitiveness position for the products whose consumption and production are expected to increase in a context of a transition to a net-zero economy is weak, or deteriorating, or both;
- These negative prospects will be counterbalanced by the strong decline being expected in the imports of goods connected to the emission of GHG (mainly fossil fuels).

These recent trends in the EU trade balance of climate-relevant goods reveal a concerning situation for EU producers. The EU's current international competitiveness is centered around high-volume products that are expected to decline as the transition to a net-zero economy takes place. To gather insights into how EU trade policy aligns with the interests of European industry, a survey was conducted. The results of this survey are summarised below

Results of a survey of stakeholders of climate change-mitigating goods

The main objectives of the survey wer to a) gather information from the EU industry, so as to provide EU trade negotiators with the input necessary to avoid that EU trade policy inadvertently causes damage against the interests of European industry, or loss of control over technology; b) acquire further intelligence on the risks and opportunities of liberalization liberalisation of the international trade of climate-mitigating or green goods, c) collecting the views of industrial stakeholders, not of NGOs or trade unions, since there was a particular focus on those stakeholders that might be negatively affected and could influence liberalization measures.

The survey was open to receiving responses from April 17th to May 23rd, 2023 and was accompanied with a referral letter by the European Commission, DG Climate Action. It is important to note that due to time constraints, it was not possible to extend the deadline. It is also possible that if the duration of the survey was longer, more companies might have responded. The total number of responses received for the survey was 39, out of which 14 respondents completed the survey and 25 respondents partially filled out the survey questionnaire. It is important to note that one major limitation of this survey is the low number of complete responses. As a result of this, , we have chosen to include some of the respondents who partially filled in the survey, since many of them have answered several questions. up the total number of respondents from 14 to 29, with the majority of them answering most of the questions. The remaining 10 respondents who were not included in the analysis were those who answered only one question.

One of the main limitations of the survey is that it focuses on the industry associations and does not look deep enough into other stakeholders' positions, e.g., trade unions. While trade unions were included, there were still a relatively low number of contacts, compared to the number of industry association contacts. Other segments of the EU economy may likely have pronounced interests in opening the EU market to renewable energy technologies, as it will ultimately reduce energy prices and improve their competitiveness on the global market.

Table 4-3 Categorisation of respondents to the survey

Category	Percentage of respondents	Number of respondents
Industry association - general	62.1%	18
Industry association – climate change mitigating goods and services	37.9%	11
Total		29

Most of the respondents belonged to the category, industry association – general (18 respondents), while the remaining, belonged to the category, industry association - climate-change mitigating

goods & services (11 respondents). Most of the industry associations dealing with climate change mitigating goods and services are associations working on products and services linked to wind power (wind turbines, air borne wind energy systems), solar power (photovoltaic modules and a range of solar products along the value chain), electromobility and biogas, biomethane and other gaseous biomass fuels. In comparison, industry associations – general refer to organisations that are not directly dealing with climate change mitigating goods and services, however, their work could be significantly impacted by these goods and services (e.g., Business Europe, SME United). Within the list of climate change mitigating goods and services, those goods and services that were indicated as having a high level of interest to the respondent's associations included: utility-scale PV at 26.1% (6 responses); followed by distributed solar PV and hydrogen at 21.7% (5 responses); concentrated solar power, biomass, geothermal, and electric cars at 17.4% (4 responses); on-shore wind power, high-efficiency heat pumps, solar water heaters, tidal systems at 13% (3 responses).

Additional climate change mitigating goods and services: There were 19 respondents that believed there were additional goods and services that contributed significantly to the mitigation of climate change other than those listed in the survey, and hence could be qualified as a 'climate change mitigating good or service'. While 4 respondents believed that there were no additional goods and services that contributed significantly,. Examples of those not listed include battery grade lithium, tidal stream energy, wave energy converters, batteries/alternative storage options, concentrated solar thermal (CST) , biogas upgrading systems, charging points which can help integrate renewables in the grid, battery-grade lithium, airborne wind energy systems, photovoltaic cells (also ingots and wafers), efficient and renewable ready heating appliances (other than electric heat pumps), biogas upgrading system, solar thermal systems (since the list only included solar water heaters, which respondents consider to be only a part of the solar thermal solutions available in the market), solar glass, polysilicon, amongst a few others. The remaining respondents had no opinion or did not respond to this question. In terms of the competitiveness of EU players, respondents to the survey indicated the following:

- Wind power: The current competitive position is strong, however, in the longer term the sector is likely to be threatened largely by the presence of competition from China. Respondents commented that they witness Chinese competitors moving at a very fast pace, increasingly closing the gap, which has been attributed to the availability of cheaper goods from China due to subsidies.
- Solar power: The current, near future and long-term competitive position of solar power is very weak. One of the many reasons cited for this is that in terms of product manufacturing, the entire supply chain is dominated strongly by Chinese manufacturers who have been able to scale up very fast, partly due to long lasting, local and stable incentives. In addition to this, it is increasingly more expensive to manufacture solar PV modules in Europe due to it being a non-level playing field, compared to partners in other countries who have lower electricity prices and labour costs, higher production scale, stable sustainability criteria, amongst other factors.
- Niche or emerging technologies (airborne wind power, geothermal energy): The current and near future competitive position appears to be strong for some of the niche or emerging technologies. However, it is to be noted that across sectors, respondents seem to be unsure about the competitive position in the long term, except for high-efficiency heat pumps that are considered to be strong throughout.
- Negotiation agenda in trade discussions: There is a consensus among respondents in disagreeing with the measures proposed regarding trade liberalisation. These measures include (1) enforcement of Intellectual Property Rights owned by EU-based companies in the sector, (2) fair treatment of EU-based companies in the sector regarding the verification of compliance of their products with national regulations, (3) access by EU companies in the sector to public procurement by national and sub-national entities, (4) freedom of establishment by EU companies in the sector (including licenses to operate), (5) abolition of public subsidies to R&D, (6) abolition of public subsidies to investment (CAPEX), (7) abolition of public subsidies to production (OPEX) . The only exception lies with the sector of utility scale PV and distributed solar PV, where half of the respondents support the proposed measures such as (1) lower tariffs or (2) higher quotas compared to conventional goods of the same category, or (3) the elimination of non-tariff barriers. Similarly, an equal number of respondents in these sectors were neutral or agreed to actions improving the enforcement in third countries of intellectual property rights owned by EU-based companies.
- Limitations of the survey: It is important to note that there are strong limitations to the survey

due to the very low number of complete responses received. For most sectors and products, except for those linked to solar energy, there are no more than two respondents who have filled out the survey. Despite this, the survey still gives insight into the overarching concerns about competition from non-European manufacturers, such as China, and into a consensus among respondents that they disagree with trade liberalisation measures for this sector.

In order to see the survey questionnaire, please refer to Annex 7 and to see a complete review of the survey results please refer to Annex 8.

Estimation of Competitiveness Multipliers (CM)

One of the critical components of our methodology involves estimating the evolution of EU producers' competitive position in the forthcoming years. The survey findings contributed to gaining valuable insights into this aspect, gathering stakeholders' perspectives on how climate and energy policy measures may influence the competitiveness of EU producers in the extra-EU market for the most traded climate-relevant manufactured products. Nevertheless, to ensure a robust analysis, additional inputs needed to be considered, such as market and forecasts and EU producers' role in the global market.

In section 4.2.3, we introduced a competitiveness multiplier (CM). This CM was used as part of the methodology to adjust the import and export volumes of selected abiotic products based on changes in the competitiveness of EU producers outside the EU, under two opposing scenarios designed to capture uncertainty effectively (i.e., optimistic and pessimistic scenarios, as presented in Table 4-1). The CM is intended to reflect how the competitiveness of EU producers is anticipated to vary in the future, corresponding to each of the scenarios described in 4.2.

The trade of biotic products under opposite scenarios of EU competitiveness was not considered and thus CM were not derived for these products. This approach was followed for two main reasons. First, the competitive positions of agricultural products, including biotic products, are primarily influenced by climatic and soil aspects., which tend to be more stable over time compared to the dynamic nature of manufacturing industries. As a result, it is reasonable to expect the current competitive position of the EU for biotic products to remain relatively stable until 2050. Secondly, the lack of sufficient data for biotic products (compared to the selected abiotic products) renders it more challenging to quantitatively assess the precise impact of climate and energy policy on biotic products' competitiveness.

For abiotic products, in addition to insights from the survey and expert inputs, relevant sectorial reports were consulted that provide information on market and demand forecasts, as well as data regarding the current and anticipated future share of EU demand covered by imports and share of global demand covered by EU exports. This data served as a basis for estimating the CM for each product category of abiotic products.

It is important to note that the CM used have a significant impact on the projections in the scenarios, making it a key driver of the conclusions drawn from the analysis. The CM values that were used for each product category are documented in Annex 5 and 6 along with the reasoning that informed the analysis, and the evidence supporting the selection of specific values or scenarios for each factor when applicable.

4.2.5. Summary of assumptions

As outlined in our methodology, a set of assumptions was necessary to estimate the trade values of the different scenarios considered. These assumptions can be grouped into two main categories.

The first group of assumptions refers to the anticipation of future consumption (or demand growth) following the LTS. These assumptions make it possible to project future consumption patterns and their potential impact on trade volumes for the selected products. The second group of assumptions is related to the CM which, as explained above, plays a significant role in determining the trade values and, consequently, influences the overall conclusions of the analysis.

All these assumptions, including those regarding future consumption and the CM, are summarised in Annex 5. These assumptions should not be taken as a strict prediction of the future. Assumptions are necessary to provide quantitative estimates in this analysis, as it deals with uncertain scenarios such as the future competitiveness of EU producers. These assumptions are educated estimations based on

the available data, expert insights, and a thorough understanding of the context of each product category. References to the sources of data are included for each product category. In cases when data was not sufficient to assess the impact of climate and energy policy on some of these products' future competitiveness, a multiplier of 1 (assuming no change) was used in specific categories.

In addition to the above, we took into account the potential impact of various policies on the EU's trade balance in climate-relevant goods. For instance, the EU Batteries Alliance's[23] substantial investment programme aimed at establishing battery production for electric vehicles within the EU was considered. Other policies such as the US Inflation Reduction Act (IRA) were also qualitatively considered. The IRA, for instance, subsidises production and investment in renewable technology in the US, potentially bolstering the competitiveness of American renewable energy manufacturers.[24] Similar to the US, there is a global race to provide subsidies and support for industries driving climate-friendly technologies and products, such policy measures can introduce additional complexities and uncertainties.

4.3. Projections of EU international trade of climate-relevant products by 2050 under hypothetical scenarios

In this sub-chapter, we present results of the imports and exports of the most strongly traded climate-relevant products, under the combined scenarios presented in Chapter 4.2.

Following our analysis, Table 4-4 presents the projected total extra-EU27 trade values for selected climate-relevant abiotic and biotic products in 2050. The trade surpluses and deficits detailed in Table 4-4 across various scenarios are the outcome of a multifaceted interplay of factors influencing the competitiveness of EU producers and the alignment of RoW nations with the EU's net-zero objectives.

Table 4-4 Total value of extra-EU imports and exports and trade balance of the selected climate-relevant products in billion EUR in 2050 under the different scenarios considered in this analysis

Scenario / LTS	RoW Alignment scenario			RoW Divergence scenario		
	Value of imports	*Value of exports*	*Trade balance*	*Value of imports*	*Value of exports*	*Trade balance*
EU-Optimistic Competitiveness Scenario						
2019	498	375	**-123**	498	375	**-123**
2050, Baseline	318	287	**-31**	318	287	**-31**
2050, 1.5TECH	253	326	**73**	253	287	**34**
2050, 1.5LIFE	238	305	**67**	238	287	**50**
EU- Pessimistic Competitiveness Scenario						
2019	498	375	**-123**	498	375	**-123**
2050, Baseline	419	206	**-213**	422	226	**-196**
2050, 1.5TECH	437	235	**-202**	419	226	**-192**
2050, 1.5LIFE	418	199	**-219**	404	226	**-178**

The assumptions behind the trade surpluses and deficits observed in Table 4-4 can be summarised as follows. Subsequent sections provide a comprehensive explanation of the results.

- In the EU- Optimistic Competitiveness and RoW Alignment scenario, EU producers maintain or improve their positive competitiveness outside the EU, and RoW countries align their efforts with the EU's LTS net-zero assumptions in the 1.5 TECH and 1.5LIFE LTS. This alignment fosters the demand for climate and energy-relevant products globally. The optimistic outlook for EU producers (who are well-positioned to cater to the increasing global demand for climate-relevant products), combined with the RoW's alignment results in a trade surplus of 73 billion

[23] See EU Batteries Alliance
[24] A summary of of Inflation Reduction Act provisions related to renewable energy is available

EUR in the 1.5 TECH LTS and 67 billion in the 1.5LIFE LTS.

- In the EU- Optimistic Competitiveness and RoW Divergence scenario, EU producers maintain or improve their positive competitiveness outside the EU, but RoW countries only align their efforts with the EU's baseline scenario. While EU producers remain competitive, the divergence in policies and regulations between the EU and RoW decreases the global demand for climate and energy-relevant products. Despite the competitive edge of EU producers, the limited alignment with the RoW leads to more moderate export growth, resulting in a smaller trade surplus compared to the previous scenario, reaching 34 billion EUR in the 1.5 TECH LTS and 50 billion EUR in the 1.5LIFE LTS. The primary reason for the greater trade surplus in the 1.5 LIFE LTS is that the demand for renewable energy-related products within the EU is lower compared to the 1.5TECH LTS, resulting in reduced imports.
- In the EU- Pessimistic Competitiveness and RoW Alignment scenario, EU producers face challenges in maintaining competitiveness outside the EU, while RoW countries still align their efforts with the EU's net-zero assumptions in the 1.5 TECH and 1.5LIFE LTS. The difficulties faced by EU producers translate into a decline in exports and an upswing in imports of climate-relevant products. In this scenario, the trade deficit is relatively high, reaching - 202 billion in the 1.5TECH LTS and -219 in 1.5LIFE.
- The EU- Pessimistic Competitiveness and RoW Divergence scenario also presents challenges for EU producers in maintaining competitiveness outside the EU, and RoW countries only align their efforts with the EU's baseline assumptions. The combination of lower competitiveness and minimal alignment with RoW countries creates obstacles for EU producers in the global market and lower demand for climate-related products. Consequently, imports of climate-relevant products increase, leading to a considerable trade deficit: -196 billion EUR in the baseline, -192 billion EUR in the 1.5TECH LTS, and -178 billion EUR in 1.5LIFE

4.3.1. EU-Optimistic Competitiveness scenario

RoW Alignment scenario and EU-Optimistic Competitiveness scenario

This section presents the anticipated imports and exports of the highly traded climate-relevant products under the combination of the optimistic scenario for the competitiveness of EU producers and the 'alignment between the EU and RoW policies' scenario. We present estimations for both import and export values in Figure 4-1 and Figure 4-2.

As introduced in section 4.3, this scenario assumes that EU producers will either maintain or enhance their positive competitiveness outside the EU, while the RoW countries align their efforts with the EU's assumptions in the EU's LTS for achieving net-zero emissions (1.5 TECH and 1.5 LIFE). Consequently, trade volumes, particularly exports of products contributing to the achievement of a net-zero economy, increase compared to current and baseline values.

Notably, under this scenario, there is a substantial growth in electric vehicle exports, soaring from 22 to 132 billion EUR, while imports increase from 12 to 55 billion EUR for the climate neutrality LTS. This significant increase in exports results in a considerable trade surplus (exports-imports) in favour of the EU (trade surplus increases in ca. 65 billion EUR).

Regarding renewable energy technologies, wind turbines' exports markedly surge from 2 to 16-18 billion, while imports also experience an increase from 0.2 billion to around 1.8 billion EUR (in this scenario, it is assumed that EU manufacturers of wind turbines maintain their current leading position in the world market, as explained in). In the case of solar PV, exports also increase substantially (from 1 billion EUR to 4.3 billion EUR in the 1.5TECH LTS). As the analysis assumes EU producers prioritise the internal market over exports, imports also show a considerable increase due to the predicted demand growth in the EU. This upswing is also observed in the product category CRM photovoltaics in (import value escalates from 0.4 billion EUR to 13.3 billion EUR in the 1.5TECH LTS). This remarkable surge is the result of the combined effect of the expected increase in demand for solar energy and the (ca-fourfold) gains in production capacity anticipated by the current investment plans, as explained in . Consequently, there is a growing need for CRM such as silicon and antimony to meet the escalating demands of the solar energy sector.

Furthermore, the product category of *other energy and storage* comprising lithium batteries, heat pumps and gas turbines, experience significant export growth (increasing in ca. 10 billion EUR)

compared to 2019 values. This growth is solely attributed to the surge in demand for these products (mainly batteries) outside the EU. Within this context, the participation of EU producers in markets outside the EU is anticipated to remain unchanged, as this optimistic scenario assumes that EU battery manufacturers successfully secure a significant portion of the domestic market and sustain their current market share in the export markets (rather than expanding it). In addition, this optimistic scenario predicts that imports of lithium batteries decrease as EU producers cover most of the internal market. This is reflected in the relatively modest increase in import value (in ca. 2.5 million) compared to the export value for this product category. In contrast, the case of the product category CRM batteries in Figure 4-2, imports value grow considerably (ca. 16x times) in response to the significant expansion of the production of batteries in the EU which require CRM sourced from outside the EU. Exports of CRM, conversely, grow only in proportion to the demand increase outside of the EU.

On the other hand, products that are rendered unnecessary or phased out due to net-zero targets, such as fossil-based energy carriers and internal combustion engine (ICE) vehicles, witness a substantial decline in their trade values, encompassing both imports and exports.

In the case of iron & steel, ores & concentrates, and cement & ceramics, the assumption in this analysis is that growth is expected to be aligned with the forecasted changes in the EU GDP. This assumption assumes a proportional relationship between sectorial growth and the overall EU economic performance. As a result, there is no difference between the different scenarios; in all cases, the imports and exports grow as a result of the increased demand. Moreover, due to the lack of differentiation between renewable hydrogen and fossil-fuel-based hydrogen in existing trade databases, the trade values for hydrogen remain relatively low, despite the substantial predicted increase in demand.

Figure 4-1 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products assuming an optimistic competitive position of EU producers compared to 2019 data and different EU-Long Term Strategies (LTS) (baseline, 1.5TECH and 1.5 LIFE) assuming alignment of RoW policies with EU policies.

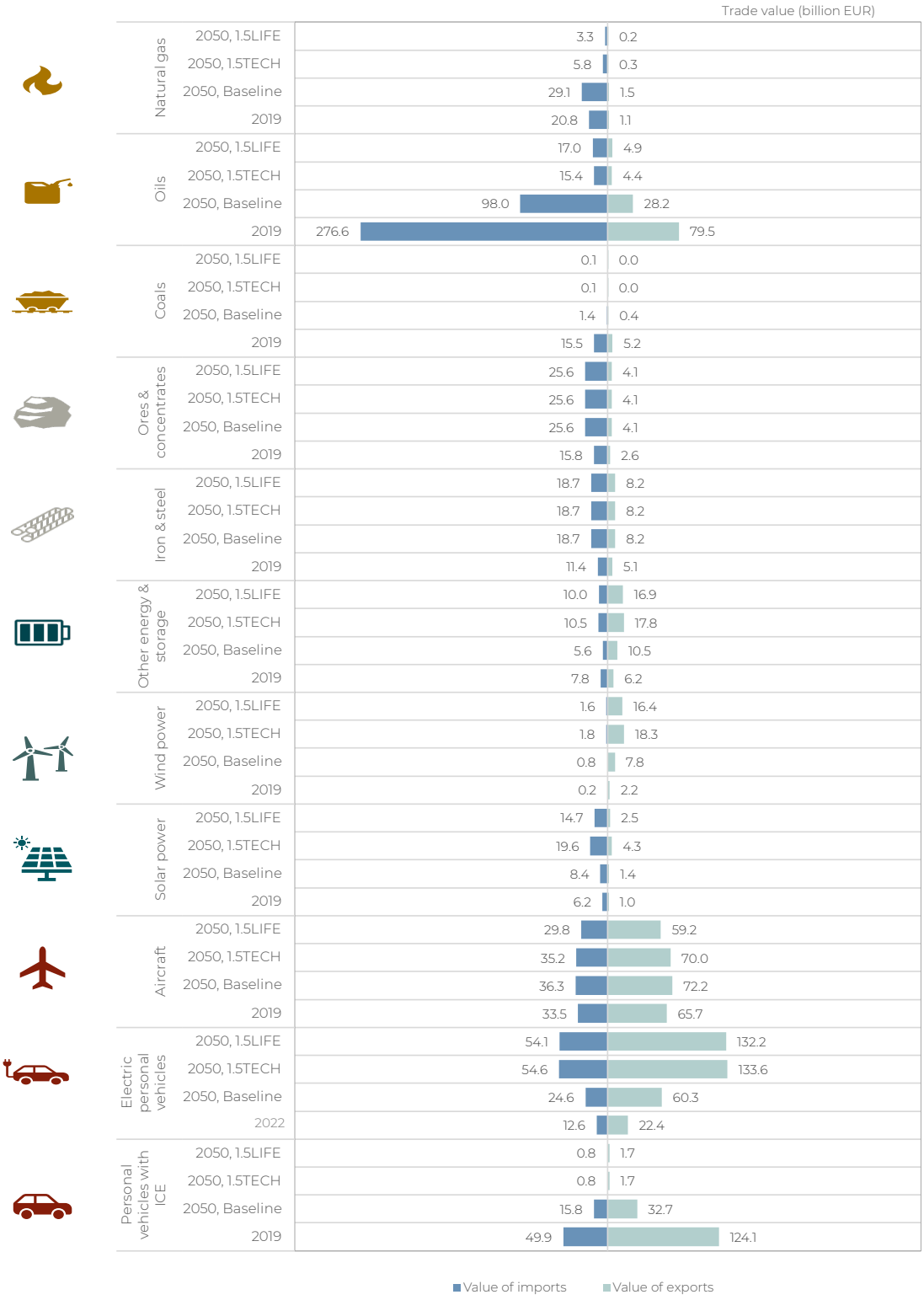
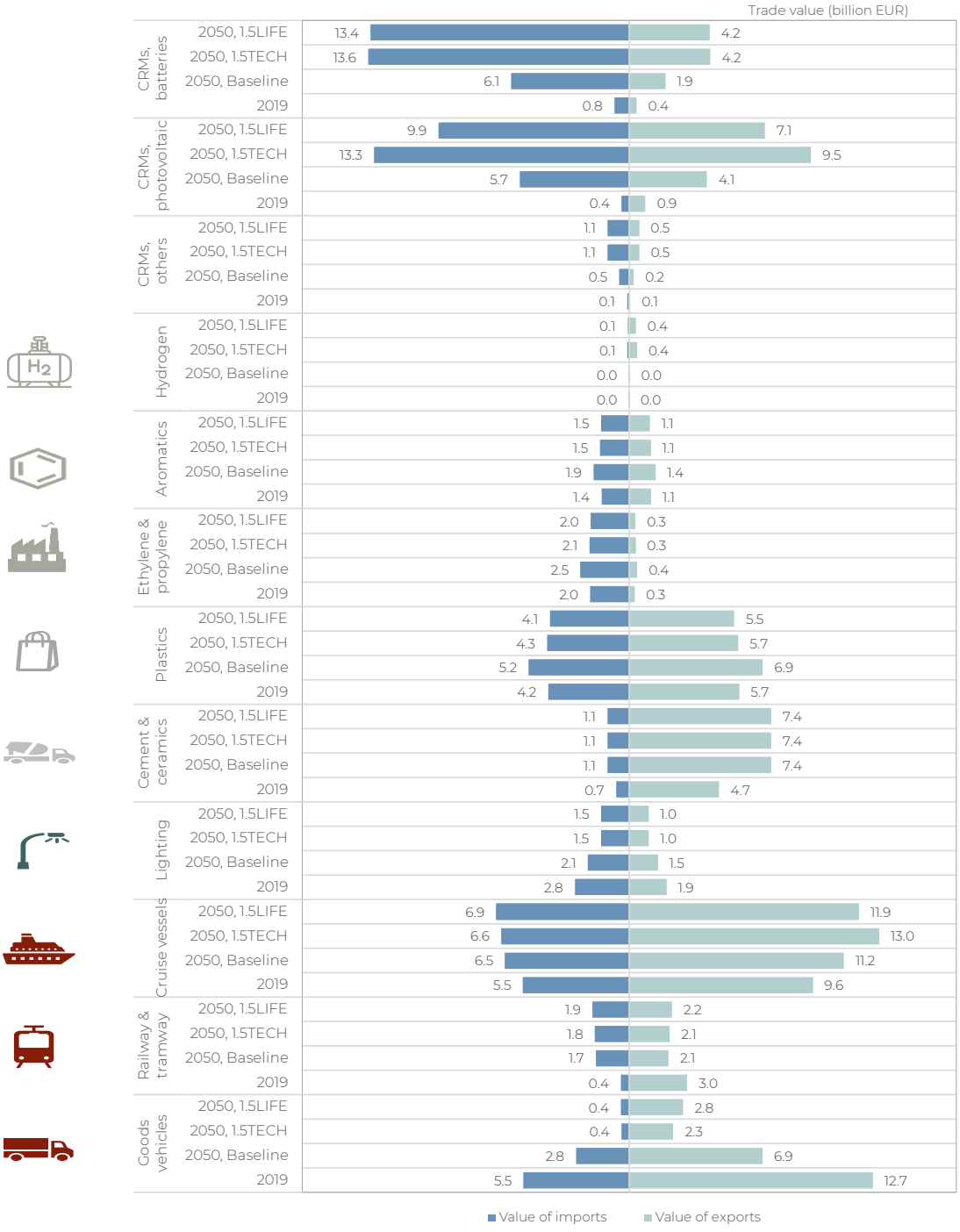


Figure 4-2 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products assuming an **optimistic** *competitive position of EU producers and different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming* **a**lignment of RoW policies with EU policies



RoW Divergence scenario and EU-Optimistic Competetitiveness scenario

This section presents the anticipated imports and exports of the highly traded climate-relevant products under the combination of the optimistic scenario for the competitiveness of EU producers and the misalignment between the EU and RoW policies' scenario. We present estimations for both import and export values in Figure 4-3 and Figure 4-4

As introduced in section 4.3, this scenario assumes that EU producers will either maintain or enhance their positive competitiveness outside the EU, while the RoW do not align their efforts with the EU's assumptions in the EU's LTS for achieving net-zero emissions (1.5 TECH and 1.5 LIFE), and *only* follow the trajectory of the EU's LTS baseline scenario.

Consequently, trade volumes of products contributing to the achievement of a net-zero economy increase compared to current values, however, not to the same extent as predicted by the *EU-Optimistic Competitiveness and RoW Alignment scenario* as the global demand of these products is lower. In practice, under this scenario, import values remain unchanged compared to the *Optimistic Competitiveness and RoW Alignment scenario*, as the EU demand is considered to be the same. Therefore, the analysis of imports presented in the section above dedicated to that scenario also applies to this scenario.

As shown in Figure 4-3, under this scenario, there is still a growth in EVs exports, soaring from 22 to 60 billion EUR. However, since exports are lower than in the EU- *Optimistic Competitiveness and RoW Alignment scenario*, this increase in exports results in a trade surplus in favour of the EU of *only* 6 billion (the *EU-Optimistic Competitiveness and RoW Alignment scenario* showed a trade surplus of ca. 80 billion EUR).

Concerning renewable energy technologies, the exports of wind turbines still experience a remarkable surge, rising from 2 billion EUR to 8 billion EUR, while imports also increase, reaching around 1.8 billion EUR. This scenario assumes that EU manufacturers of wind turbines maintain their current leading position in the global market, as detailed in Table 4.2. In the case of solar PV, exports witness a slight increase, growing from 1 billion EUR to 1.4 billion EUR in the 1.5TECH LTS. The analysis assumes that EU producers prioritise the internal market over exports. This slight increase in exports is reflected in the product category CRM photovoltaics as well, where exports escalate from 0.9 billion EUR to 4.1 billion EUR in the 1.5TECH LTS, as depicted in Figure 4-4.

Furthermore, exports of the product category of *other energy and storage* grow from 6.2 to 10.5 billion EUR. This trend is also observed in the product category CRM batteries in Figure 4-4, for which imports raise from 6.1 to 13.5 billion EUR as EU producers are projected to cover most of the internal market (which require CRM sourced from outside the EU). Exports of CRM, conversely, grow only in proportion to the demand increase outside of the EU in the baseline scenario.

Figure 4-3 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products assuming an **optimistic** *competitive position of EU producers and different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming* misalignment of RoW policies with EU policies

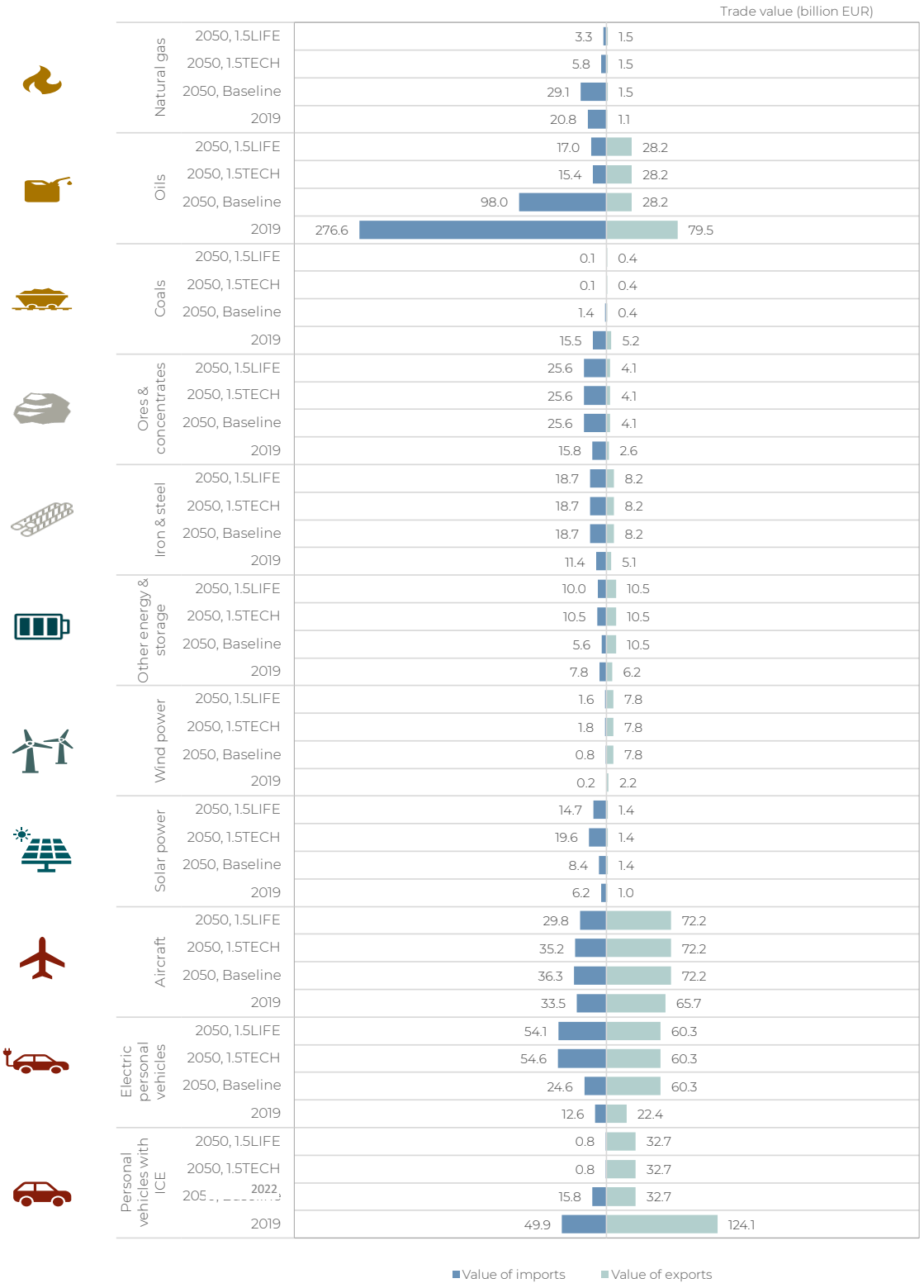
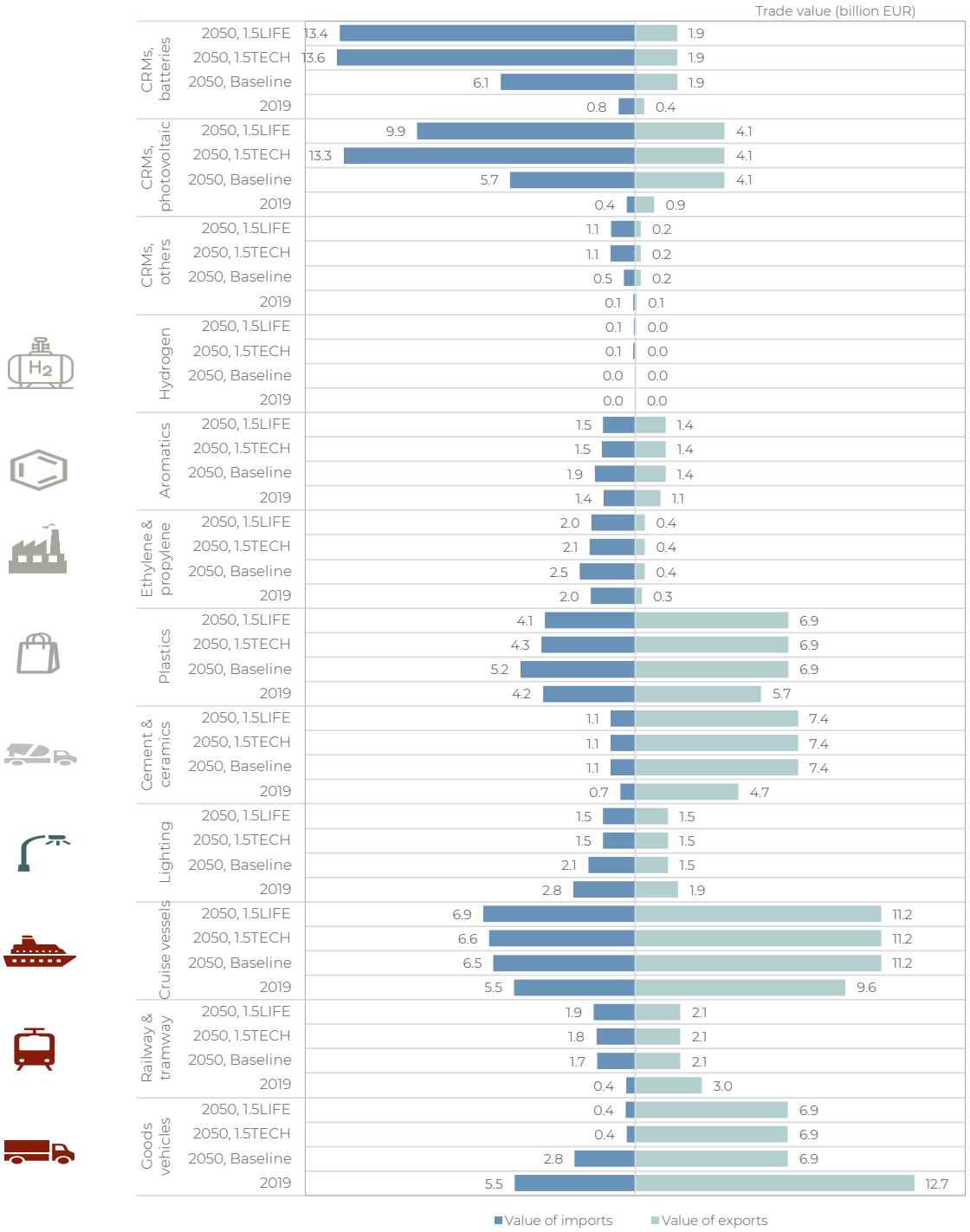


Figure 4-4 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products under assuming an an **optimistic** *competitive position of EU producers and different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming* **misalignment of RoW policies with EU policies**



4.3.2. EU-Pesimistic Competetitiveness scenario

RoW Alignment scenario and EU-Pesimistic Competetitiveness scenario

In this section, we provide a quantitative analysis of the anticipated imports and exports of highly traded climate-relevant products. This section focuses on the pessimistic scenario for the competitiveness of EU producers but alignment between the EU and RoW policies. The results are presented in Figure 4-5 and Figure 4-6.

As introduced in section 4.3, this scenario assumes that EU producers face challenges in maintaining competitiveness outside the EU. At the same time, the RoW follows a similar trajectory as the EU towards achieving a net-zero economy in line with the assumptions in the EU's LTS (1.5 TECH and 1.5 LIFE). As a consequence, notably imports of products contributing to the achievement of a net-zero economy, increase compared to current values.

Significantly, Figure 4-5 shows that in this scenario, EV imports experience a remarkable surge, soaring from 12 to ca. 156 billion EUR, while exports increase from 22 to 44 billion EUR for the climate neutrality LTS. This substantial growth in imports leads to a considerable trade deficit of approximately 112 billion EUR. This trade deficit occurs because the EU's imports of EVs would exceed considerably its exports in this scenario. By way of comparison, the *EU-Optimistic Competitiveness and RoW Alignment scenario* in the previous section showed a trade surplus of ca. 80 billion EUR.

Regarding renewable energy technologies (Figure 4-5), wind turbines' imports witness a marked surge, rising from 0.2 billion to around 2.4 billion EUR, while exports increase from 2 to 9 billion EUR (for comparison, in the *EU-Optimistic Competitiveness and RoW Alignment scenario*, exports climb to 18 billion). Similarly, solar PV imports show a substantial increase, growing from 6 billion EUR to 20 billion EUR in the 1.5TECH LTS. This sharp increase can be attributed to the incapacity of EU producers to meet the rising demand and the subsequence dominance of imported products that is assumed in this scenario. The product category *CRM photovoltaics* (Figure 4-6) trade values experience only a marginal increase (imports rise from 0.4 to 3.3 billion EUR and exports from 0.9 to 4.7 billion EUR in the 1.5 TECH LTS), as compared to the *EU-Optimistic Competitiveness and RoW Alignment scenario* (imports increase from 0.4 to 13.3 billion EUR and exports from 0.9 to 9.5 billion EUR in the 1.5 TECH LTS). This limited growth can be attributed to the anticipated lack of success in EU domestic production assumed in this scenario.

As shown in Figure 4-5, the product category of *other energy and storage*, sees a substantial increase in imports, rising from 7.8 to 38 billion EUR in 1.5 TECH LTS. In this pessimistic scenario, the EU market of lithium batteries is expected to persist in its current state of reliance on imports, as the investment programme for the production of batteries is assumed to be unsuccessful. Consequently, the observed increase in imports is directly proportionate to the growth in demand within the EU, particularly for batteries. Despite the increase of global demand of batteries (as RoW and EU policies are aligned), exports are projected to experience little growth as this scenario assumes that exports to key destination partners decline. The limited production of batteries in the EU predicted by this scenario is also evident in the relatively low import values (compared to the optimistic scenario) of the product category CRM batteries, as depicted in Figure 4-6.

Moreover, the product category *iron and steel* (Figure 4-5) experiences significant imports growth under this pessimistic scenario, increasing by approximately 45 billion EUR compared to 2019 values (this scenario assumes that the effectiveness of the CBAM in preserving the cost competitiveness of the sector is limited, resulting in a continued loss of market share for EU manufacturers). This assumption also explains the upswing in imports of the product categories *Ethylene & propylene*, *Plastics*, *Cement & ceramics* shown in Figure 4-6.

Figure 4-5 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products assuming a **pessimistic** *competitive position of EU producers and different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming* alignment of RoW policies with EU policies

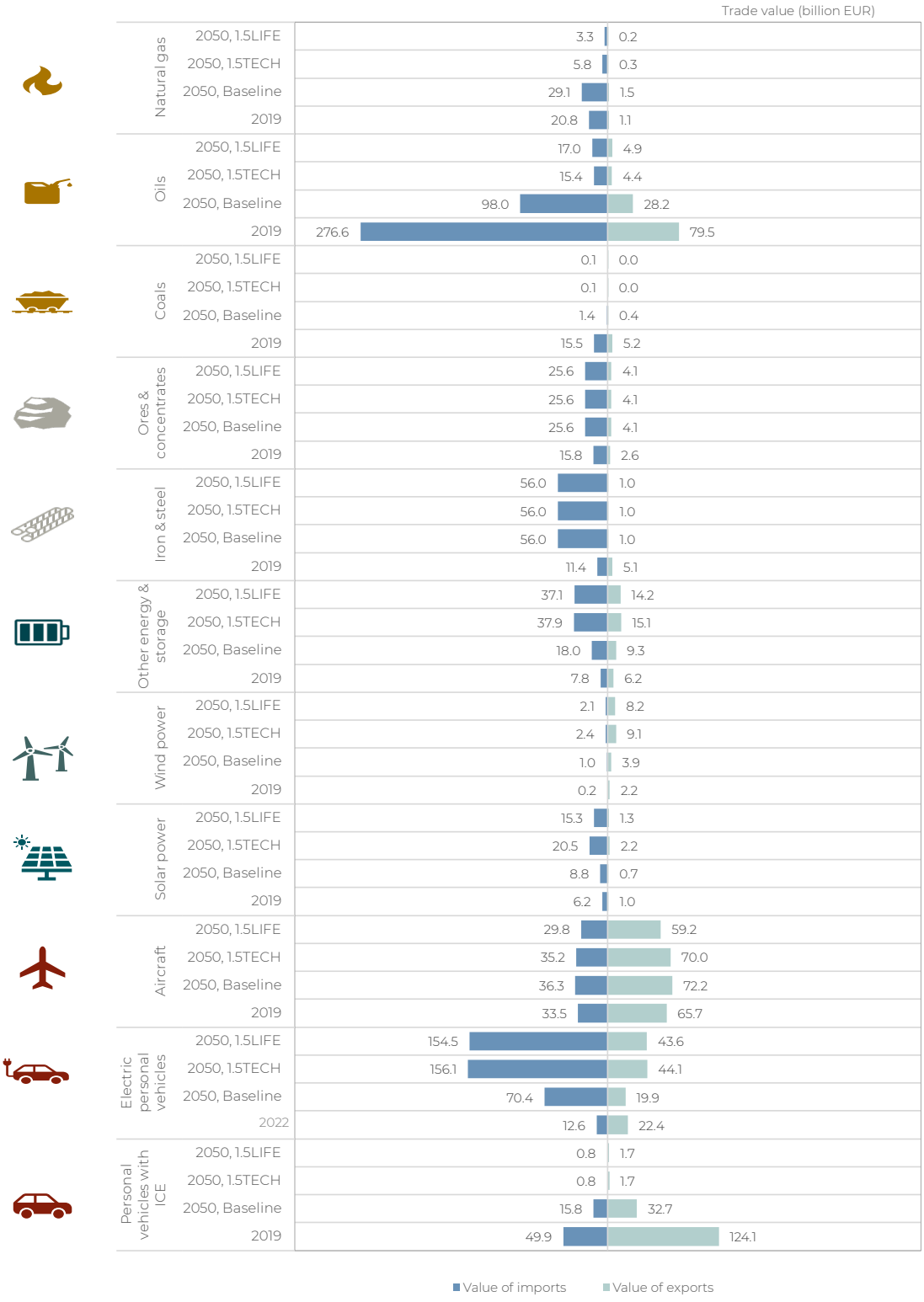
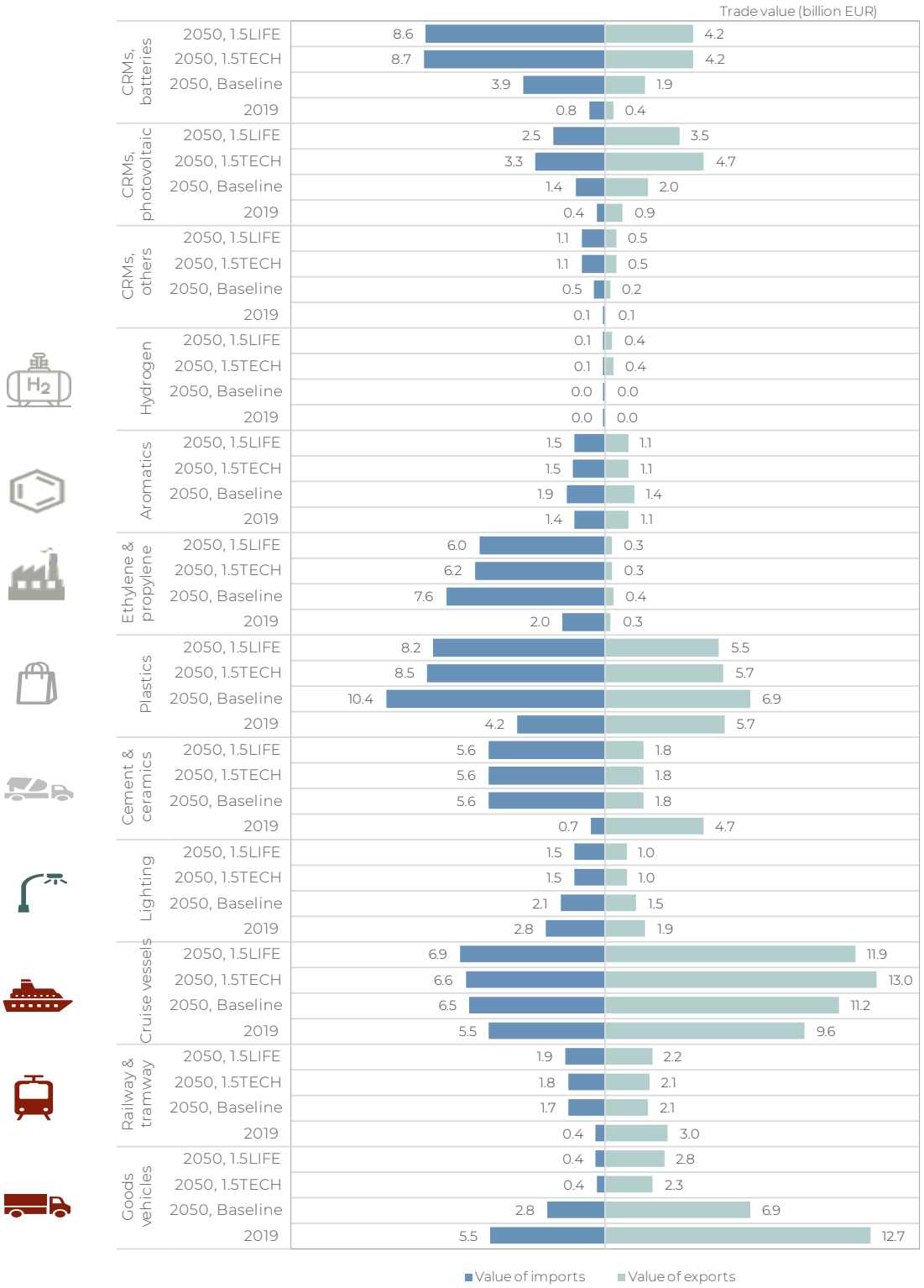


Figure 4-6 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products assuming a a **pessimistic** *competitive position of EU producers and different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming* **alignment of RoW policies with EU policies**



RoW Divergence scenario and EU-Pesimistic Competetitiveness scenario

In this section, we present a quantitative analysis of the expected imports and exports of highly traded climate-relevant products, focusing on the pessimistic scenario for the competitiveness of EU producers and misalignment between the EU and RoW policies. The results are depicted in Figure 4-8 and Figure 4-9.

As explained in section 4.3, in this scenario, EU producers face challenges in maintaining competitiveness outside the EU and the RoW do not follow a similar trajectory as the EU towards achieving a net-zero economy.

Consequently, trade volumes of products contributing to the achievement of a net-zero economy increase compared to current values, however, not to the same extent as predicted bythe *EU-Pessimistic Competitiveness and RoW Alignment scenario* as the role of EU producers in the global market is lower. *U*nder this scenario, import values remain unchanged compared to the Pessimistic *Competitiveness and RoW Alignment scenario*, as the EU demand is considered to be the same. Therefore, the analysis of imports presented in the section above dedicated to that scenario also applies to this scenario.

Figure 4-7 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products assuming a **pessimistic** *competitive position of EU producers and different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming* misalignment of RoW policies with EU policies

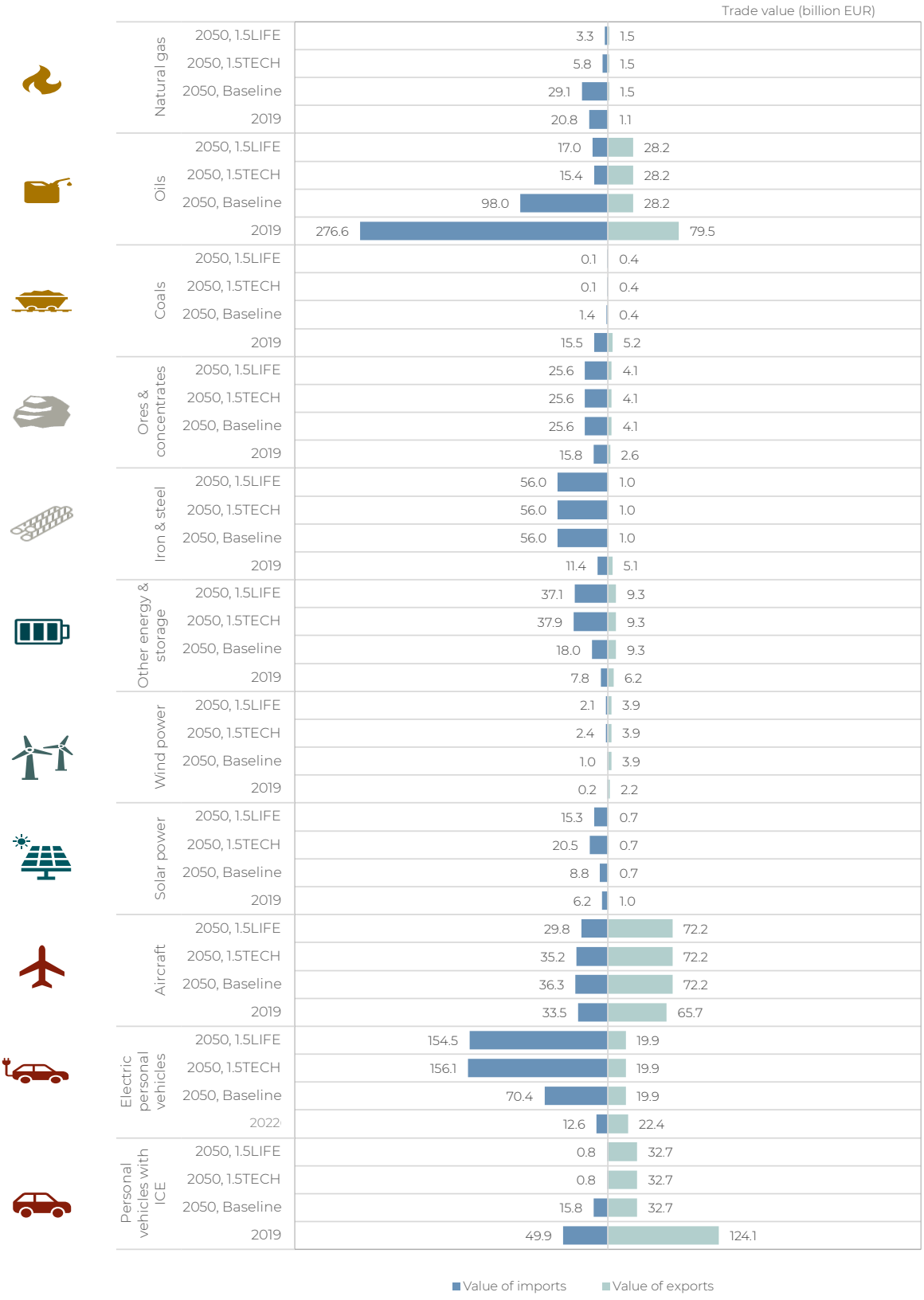
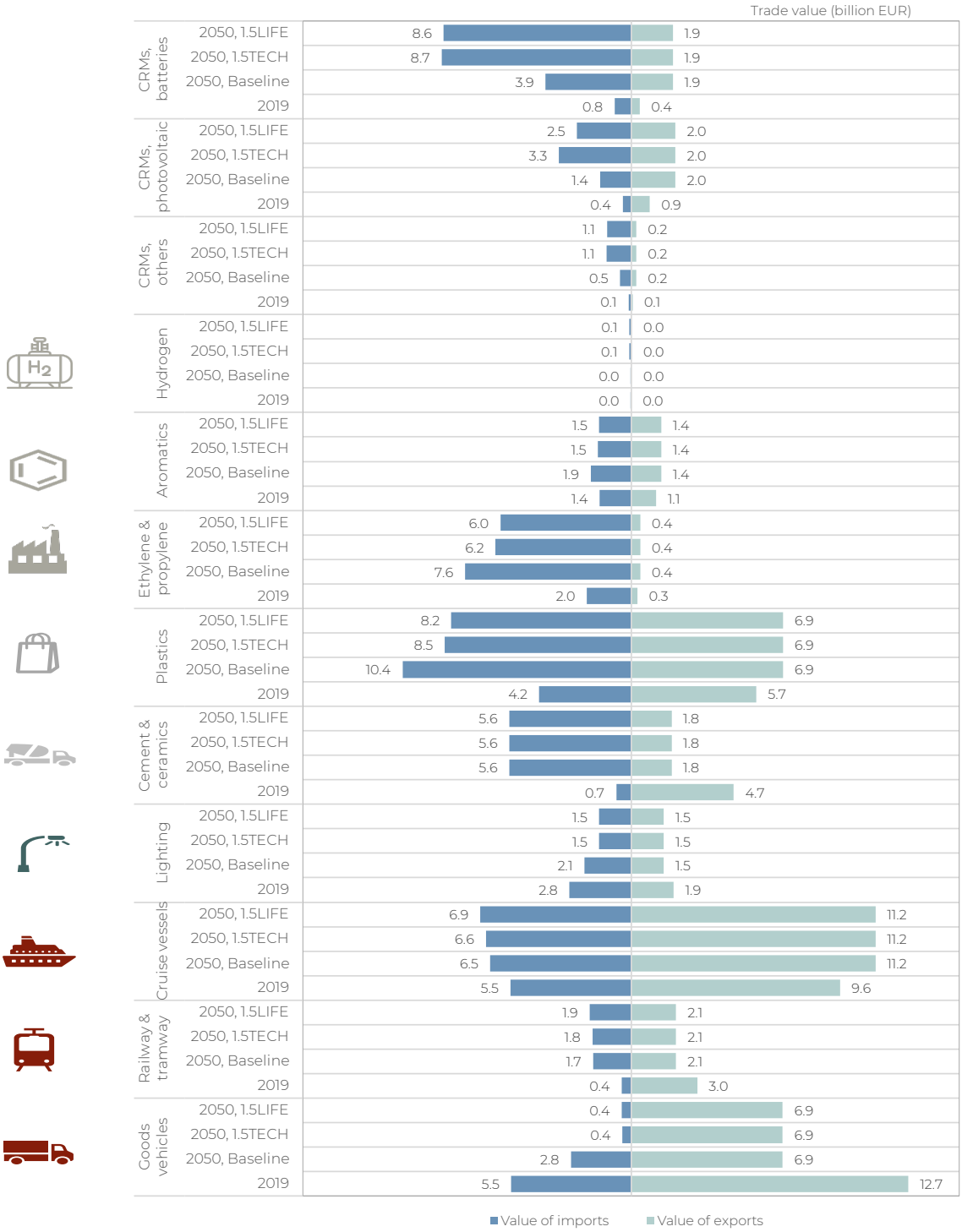


Figure 4-8 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products assuming a a **pessimistic** *competitive position of EU producers and different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming* misalignment of RoW policies with EU policies



4.3.3. Biotics products under the Alignment and Divergence scenario

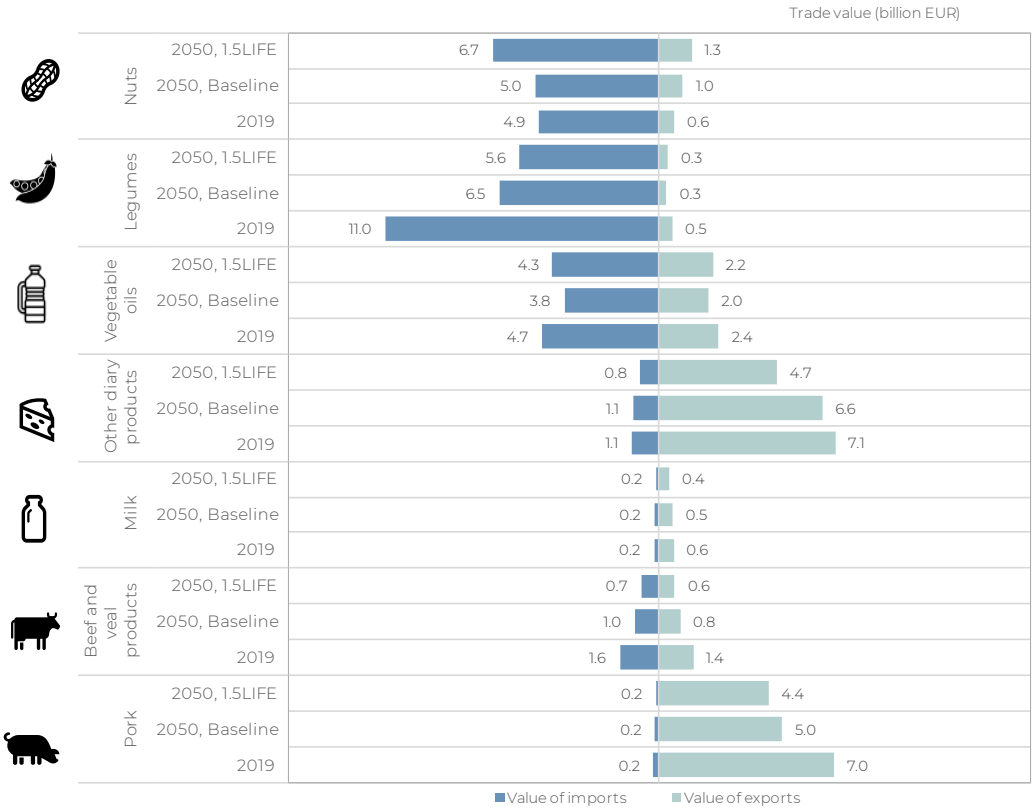
Biotic products in the EU-RoW Alignment scenario

In this section, we present the projected imports and exports of the highly traded biotic climate-relevant products in 2050 under the EU RoW Alignment scenario, compared to the baseline and to 2019 levels. This scenario assumes that RoW follows a similar trajectory as the EU towards achieving a net-zero economy in line with the assumptions in the EU's LTS (1.5 TECH and 1.5 LIFE)

As shown in Figure 4-10, notably exports and imports of biotic products that are necessary to meet the EU and global demand under the diet informing the 1.5LIFE scenario, increase compared to baseline values. This is the case of nuts, legumes and vegetable oils. The decrease in the value of imports of legumes in the 1.5LIFE LTS compared to the 2019 values can be attributed to the combination of the annual decrease of 2% in the unit price of legumes predicted by FAO and the decrease of the consumption of soybeans and soybeans residues resulting from the decrease of soya used for animal feedstock (see Annex 6 for the list of unit prices and additional calculations considered in this analysis).

Conversely, commodities like beef, pork, milk and other dairy products undergo a decrease in their trade values impacting both import and export figures. This decrease is the result of the anticipated decline in consumption of animal products in the 1.5 LIFELTS.

Figure 4-9 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products under different EU-Long Term Strategies LTS (baseline, 1.5 LIFE) assuming alignment of RoW policies with EU policies



4.3.4. EU-RoW Divergence scenario

EU-Optimistic Competitiveness and RoW Divergence scenario

This section presents the anticipated imports and exports of the highly traded climate-relevant products under the combination of the optimistic scenario for the competitiveness of EU producers and the misalignment between the EU and RoW policies' scenario. We present estimations for both import and export values in Figure 4-11 and Figure 4-12.

As introduced in section 4.3, this scenario assumes that EU producers will either maintain or enhance their positive competitiveness outside the EU, while the RoW do not align their efforts with the EU's assumptions in the EU's LTS for achieving net-zero emissions (1.5 TECH and 1.5 LIFE), and *only* follow the trajectory of the EU's LTS baseline scenario.

Consequently, trade volumes of products contributing to the achievement of a net-zero economy increase compared to current values, however, not to the same extent as predicted by the *EU-Optimistic Competitiveness and RoW Alignment scenario* as the global demand of these products is lower. In practice, under this scenario, import values remain unchanged compared to the *Optimistic Competitiveness and RoW Alignment scenario*, as the EU demand is considered to be the same. Therefore, the analysis of imports presented in the section above dedicated to that scenario also applies to this scenario.

As shown in , under this scenario, there is still a growth in EVs exports, soaring from 22 to 60 billion EUR. However, since exports are lower than in the EU- *Optimistic Competitiveness and RoW Alignment scenario*, this increase in exports results in a trade surplus in favour of the EU of *only* 6 billion (the *EU-Optimistic Competitiveness and RoW Alignment scenario* showed a trade surplus of ca. 80 billion EUR).

Concerning renewable energy technologies, the exports of wind turbines still experience a remarkable surge, rising from 2 billion EUR to 8 billion EUR, while imports also increase, reaching around 1.8 billion EUR. This scenario assumes that EU manufacturers of wind turbines maintain their current leading position in the global market, as detailed in Table 4.2. In the case of solar PV, exports witness a slight increase, growing from 1 billion EUR to 1.4 billion EUR in the 1.5TECH LTS. The analysis assumes that EU producers prioritise the internal market over exports. This slight increase in exports is reflected in the product category CRM photovoltaics as well, where exports escalate from 0.9 billion EUR to 4.1 billion EUR in the 1.5TECH LTS, as depicted in .

Furthermore, exports of the product category of *other energy and storage* grow from 6.2 to 10.5 billion EUR. This trend is also observed in the product category CRM batteries in , for which imports raise from 6.1 to 13.5 billion EUR as EU producers are projected to cover most of the internal market (which require CRM sourced from outside the EU). Exports of CRM, conversely, grow only in proportion to the demand increase outside of the EU in the baseline scenario.

Figure 4-10 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products under different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming misalignment of RoW policies with EU policies and an optimistic competitive position of EU producers

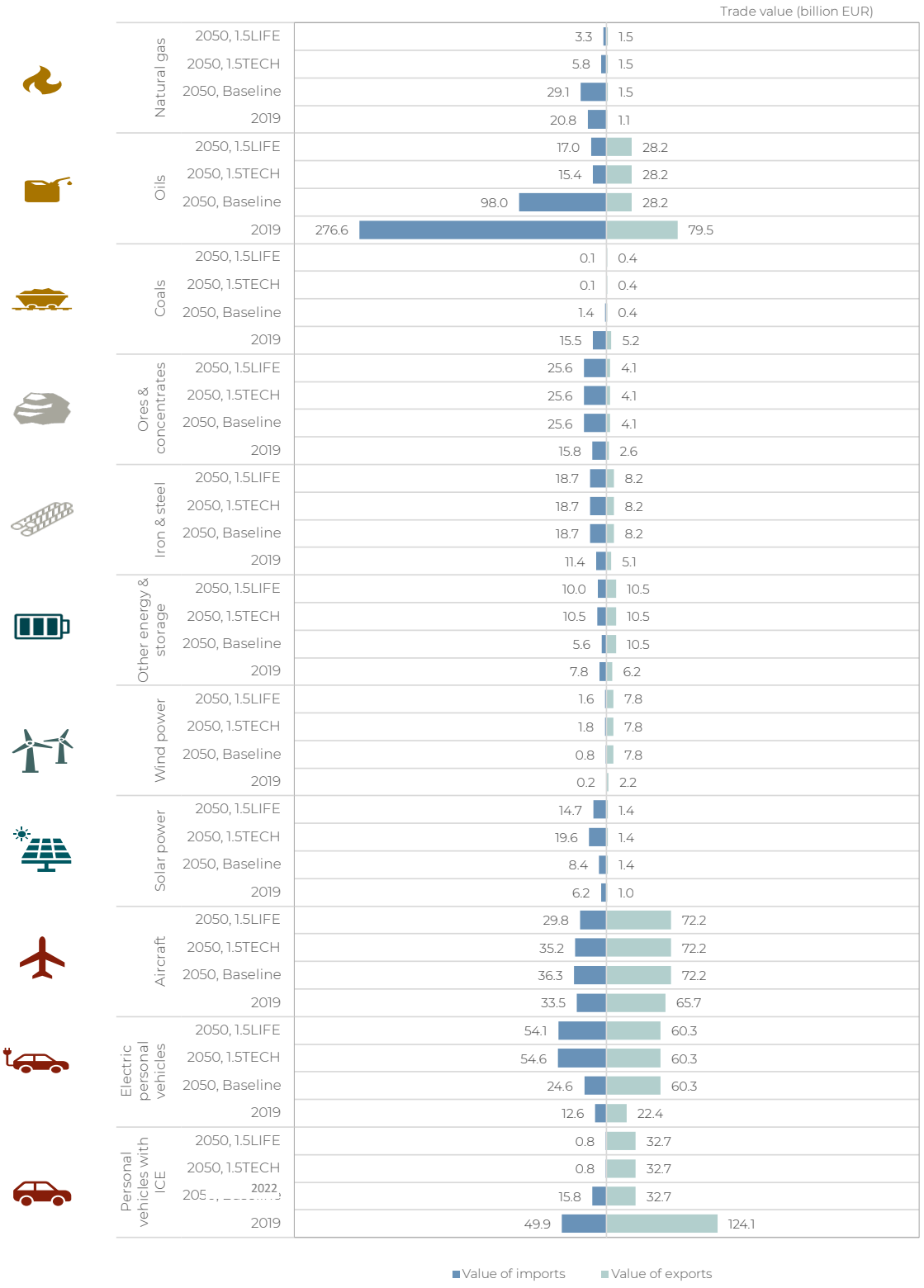
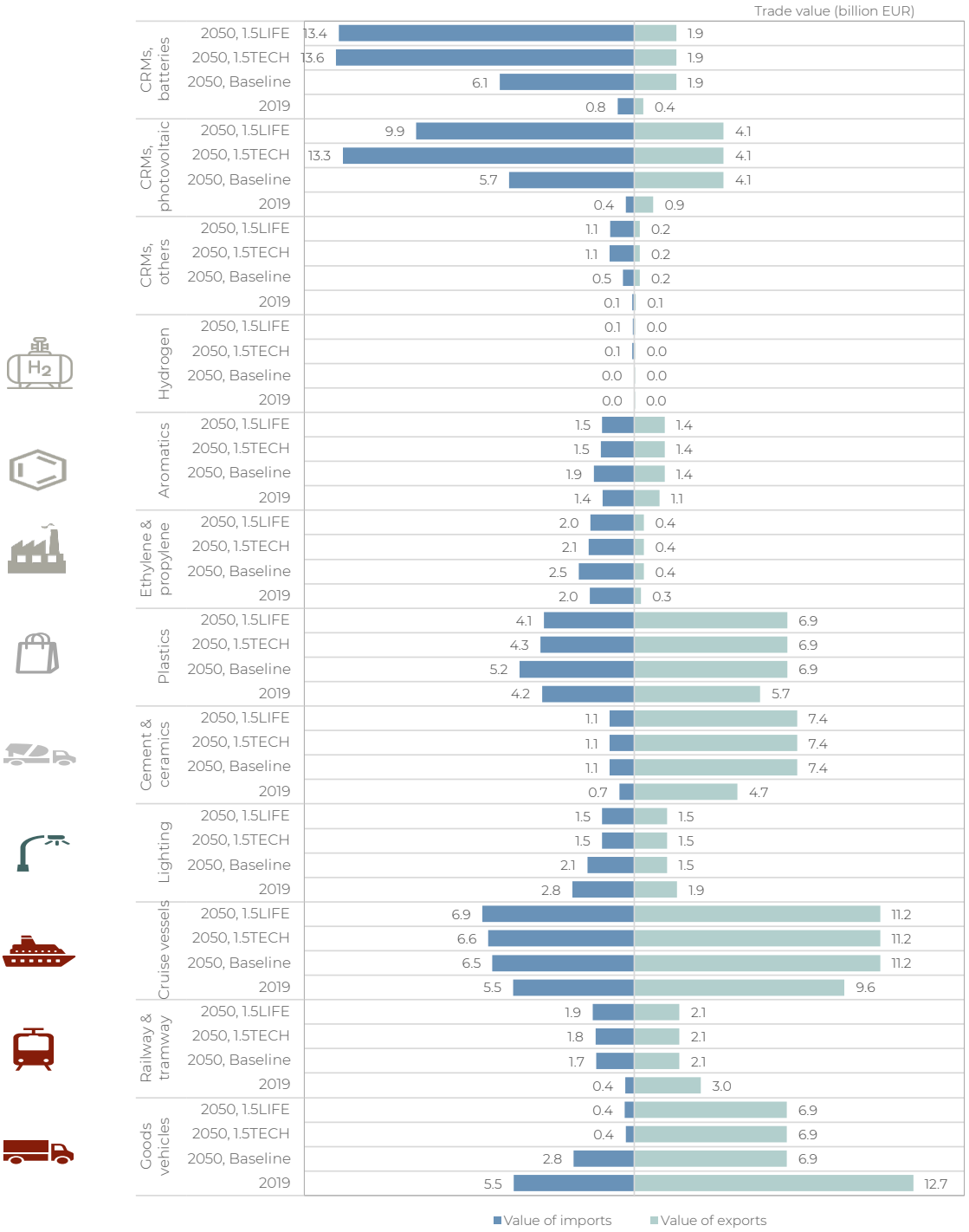


Figure 4-11 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products under different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming misalignment of RoW policies with EU policies and an optimistic competitive position of EU producers



EU- Pessimistic Competitiveness and RoW Divergence scenario

In this section, we present a quantitative analysis of the expected imports and exports of highly traded climate-relevant products, focusing on the pessimistic scenario for the competitiveness of EU producers and misalignment between the EU and RoW policies. The results are depicted in and .

As explained in section 4.3, in this scenario, EU producers face challenges in maintaining competitiveness outside the EU and the RoW do not follow a similar trajectory as the EU towards achieving a net-zero economy.

Consequently, trade volumes of products contributing to the achievement of a net-zero economy increase compared to current values, however, not to the same extent as predicted bythe *EU-Pessimistic Competitiveness and RoW Alignment scenario* as the role of EU producers in the global market is lower. *U*nder this scenario, import values remain unchanged compared to the Pessimistic *Competitiveness and RoW Alignment scenario*, as the EU demand is considered to be the same. Therefore, the analysis of imports presented in the section above dedicated to that scenario also applies to this scenario.

Figure 4-12 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products under different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming misalignment of RoW policies with EU policies and a pessimistic competitive position of EU producers

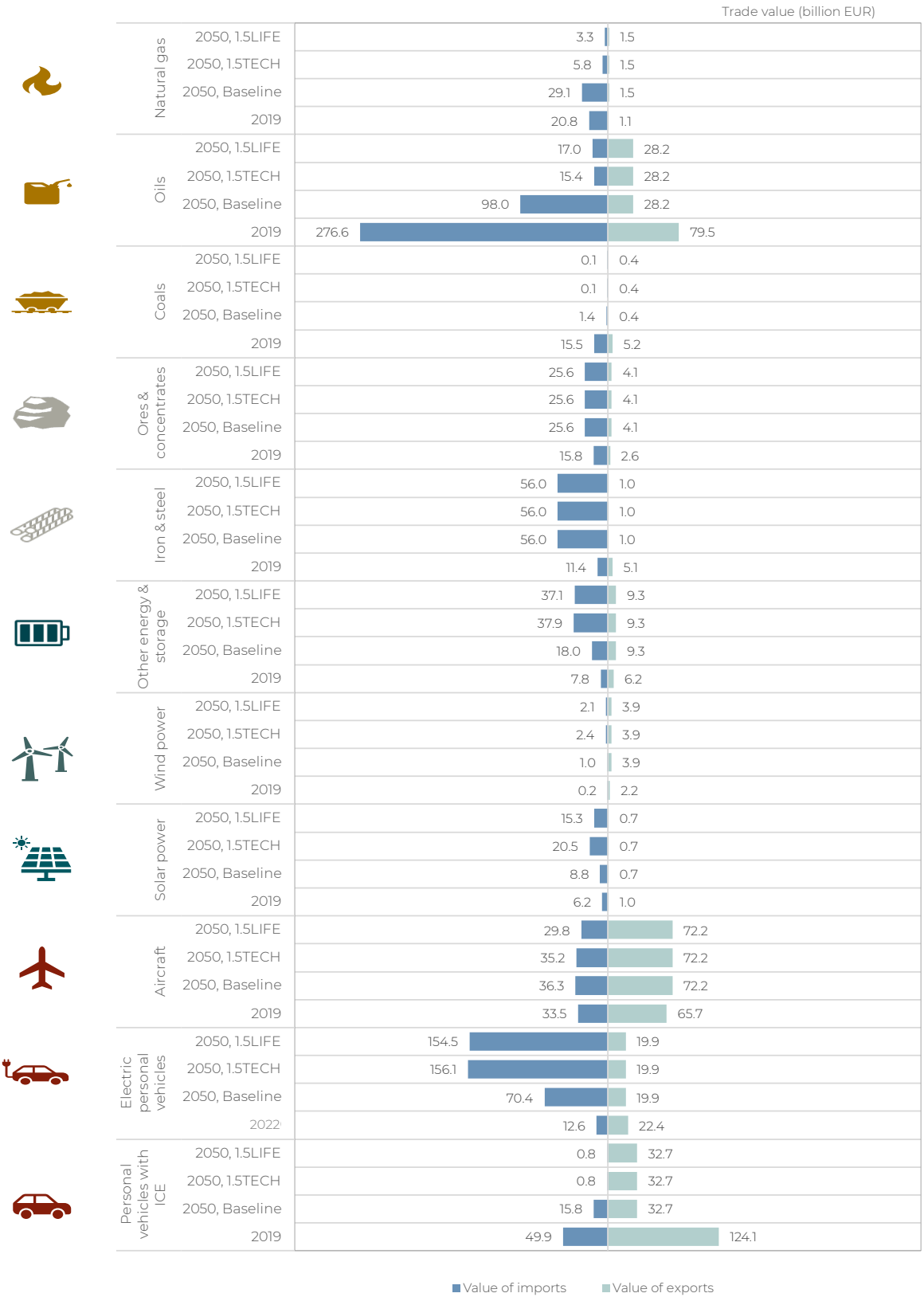
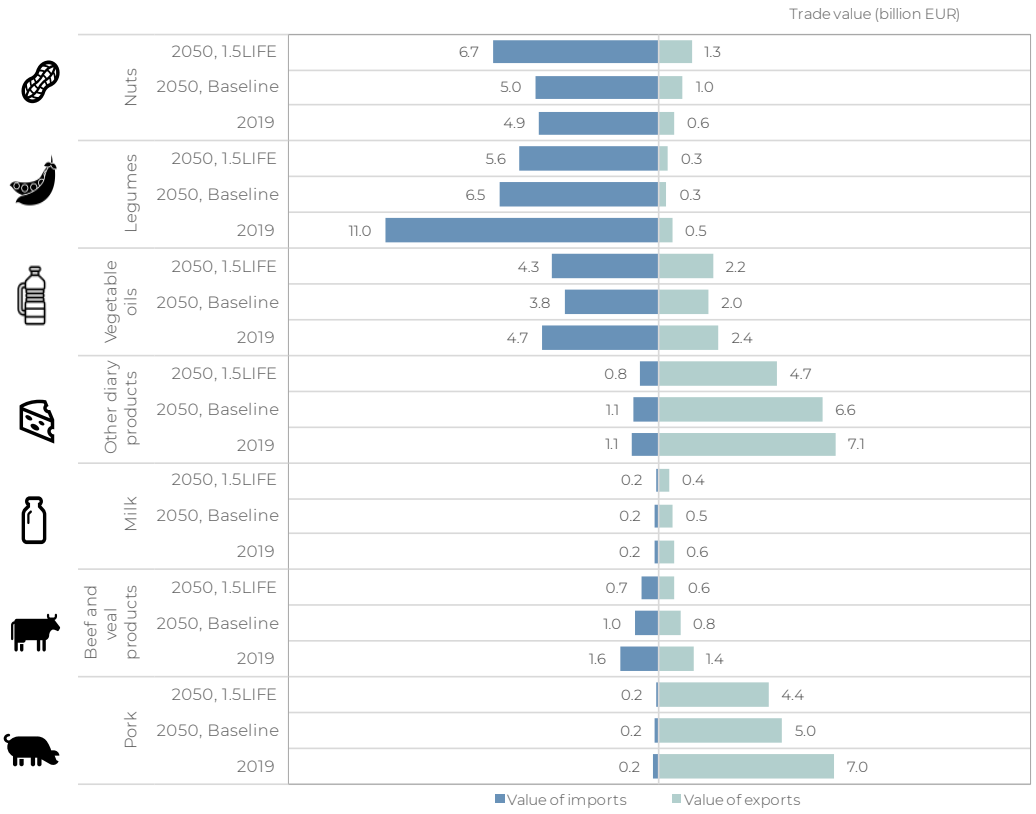


Figure 4-13 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products under different EU-LTS (baseline, 1.5 LIFE) assuming alignment of RoW policies with EU policies



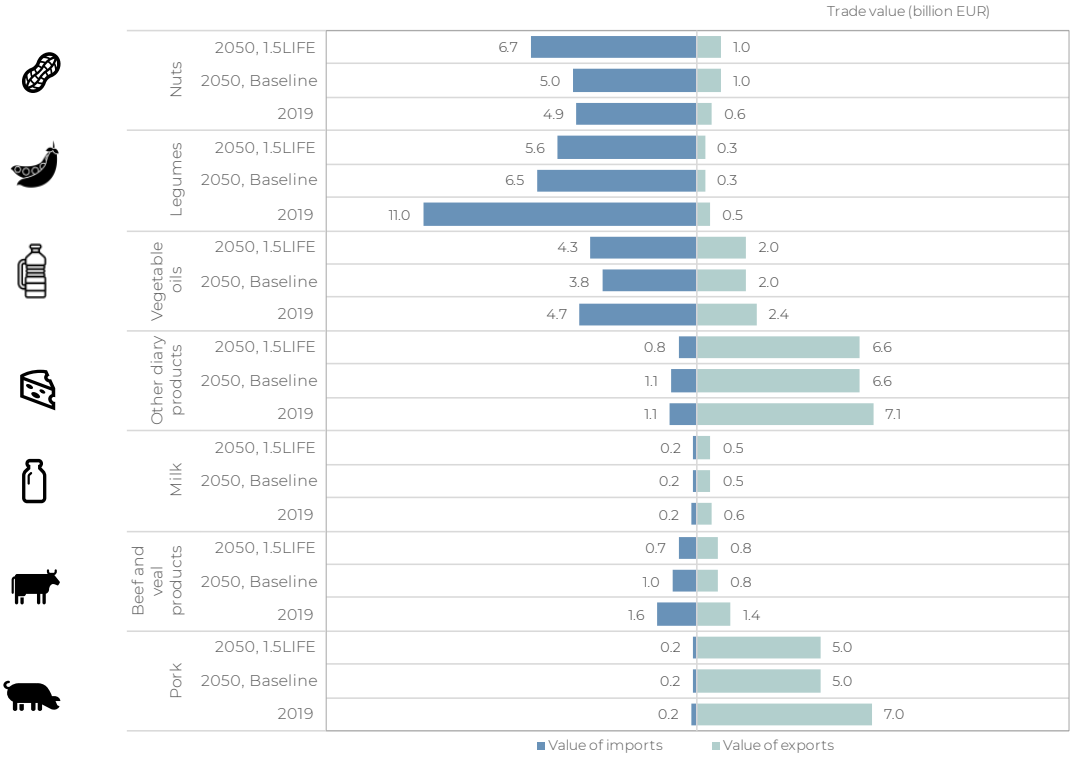
Biotic products in the EU-RoW Divergence scenario

In this section, we present the projected imports and exports of the highly traded biotic climate-relevant products in 2050 under the EU RoW divergence scenario.

As shown in Figure 4-11, the value of exports for all products, except for nuts, decreases compared to the 2019 values. This decline can be attributed to several factors, primarily the annual decrease in unit prices for most of these products. This decline outweighs the increase due to a change in diet that favours plant-based products.

It is worth noting that the export value of nuts shows a different pattern in comparison to other products. The export value of nuts remains stable or experiences a marginal change, suggesting that nuts continue to hold their value in the global market despite the overall downward trend seen in other product categories. This is because our analysis considered the unit price of nuts to remain stable (see Annex 6 for the list of unit prices and additional calculations considered in this analysis).

***Figure 4-14 Projected extra-EU27 trade values in 2050 (billion EUR) for selected products under different EU-LTS scenarios (baseline, 1.5TECH and 1.5 LIFE) assuming* misalignment of RoW policies with EU policies**



4.3.5. Conclusions on the impacts of EU climate policies on trade

When considering each scenario individually, i.e. the comparison between the 1.5TECH or 1.5LIFE scenarios with the baseline, it can be seen that **the EU transition of the EU towards a net-zero GHG emissions economy**, i.e. the comparison between the 1.5TECH or 1.5LIFE scenarios with the baseline, results in:

- A **considerable improvement of the EU trade balance** in the Optimistic scenarios:
  - EUR +98 to +104 bn. in the Optimistic x Alignment scenario;
  - EUR +65 to +81 bn. in the Optimistic x Divergence scenario;
- A **neutral to positive effect on the EU trade balance** in the Pessimistic scenarios:
  - EUR +4 to +18 bn. in the Pessimistic x Divergence scenario;
  - EUR -6 to +11 bn. in the Pessimistic x Alignment scenario.

Similarly, these tables bring the conclusion that the 1.5LIFE scenario yields better results than the 1.5TECH scenario in the Divergence scenarios (EUR +16 bn in the Optimistic and Pessimistic scenarios), while the opposite holds true for the Alignment scenarios (EUR -6 bn. in the Optimistic scenario and EUR -17 bn in the Pessimistic scenario).

In terms of **geography**, the consequences foreseen in the volumes and the nature of the goods being traded by the EU lead to the following conclusions:

- A reduced role for the countries from which the EU currently imports its fossil fuels (Middle East, Russia, Nigeria, Australia);
- A larger role for those from which the EU will import the raw materials underpinning the transition to a net-zero GHG emissions economy (China, United States).

These results relate to the products being considered in this study only, i.e. those that are likely to be affected by EU policies to mitigate climate change, and with a large trade volume. Under the hypothesis underpinning this study, namely that the trade in the other products remains unaffected by EU climate policies, these results constitute the approximation that we propose of the overall consequences of EU climate policies on the international trade of the EU.

4.3.6. General conclusions: priority sectors for trade policy

The climate-relevant products which the EU has strong interests to defend in international trade negotiations, in the context of a transition to net-zero GHG emissions economy, are those where:

- The traded volumes are anticipated to be large in 2050 in this context of a transition to net-zero economy;
- The impact of climate policy on the trade position of the EU is also anticipated to be large.

Products where the EU has offensive trade interests

The products where the EU has **offensive** trade interests are identified as those where:

- The competitive position of EU producers is **strong**; and
- The **global** market is anticipated to **grow** in a context of transition to a net-zero GHG emissions economy;

meaning that EU producers have an interest in the opening up of new export markets, and require protection from unfair international competition on the EU Internal Market.

Based on the figures above, these products can be identified as follows:

- Abiotic products:
    - wind power;
- Biotic products: none.

The EU has strong competitive positions for some products with high GHG intensity, whose global market would grow in a scenario of divergence between the climate policies of the RoW and of the EU. It could hence be considered that the promotion of their exports could make sense if some technology enabled them to decarbonise. Such products include:

- aircraft;
- personal vehicles with internal combustion engine;
- milk and dairy products;
- pork (to a lesser extent).

Considering the technical uncertainties surrounding the decarbonation of these sectors, this study does not propose trade instruments supporting the exports of high GHG emissions intensity products.

Products where the EU has defensive trade interests

The products where the EU has **defensive** trade interests are identified as those where:

- The competitive position of EU manufacturers is **weak** or **declining**; and
- The **EU** market is anticipated to **grow** in the context of transition to a net-zero economy.

so that EU producers have an interest in protecting the EU Internal Market from excessive external competition.

Based on the analysis above, these products can be listed as follows:

Abiotic products:

- steel;
- batteries;
- solar power;
- electric personal vehicles;

Biotic products:

a. nuts;

b. legumes;

c. vegetable oils.

5. Current state and anticipation of the income from EU climate-relevant foreign direct investment (FDI), under scenarios of a transition to a net-zero GHG-emissions economy

5.1. Overview

This chapter describes the anticipation of the income flows stemming from Foreign Direct Investment (FDI) in some selected sectors related to major climate-related goods and services, in the context of a transition to a net-zero economy. These sectors are:

- crude petroleum and natural gas extraction and associated mining support service activities;
- manufacture of coke and refined petroleum products;
- electricity, gas, steam and air conditioning supply.

The results of this chapter rely on publicly available data that suffers from numerous gaps, and hence on several assumptions and extrapolations, which are explicitly described below. The conclusions drawn should hence be used with considerable caution

5.2. Data

OECD Statistics were used as source for data on FDI.[25] To the best knowledge of the authors, despite insufficient data, this database is the best for information on FDI. An important reason for this is that the Benchmark Definition 4th Edition (BMD4) for FDI, separates the investment related to "Special Purpose Entities" (SPEs) from the investment made by other economic operators. SPEs are legal persons set up for tax purposes, and have, hence, no economic reality and distort the statistics of investment flows. SPEs were excluded from the collected data, in order to concentrate on real economic flows.

The specific location under which the data can be found is "Globalisation › FDI statistics according to Benchmark Definition 4th Edition (BMD4) › FDI Income › FDI income by industry BMD4 › FDI income by industry BMD4". From here data on all EU Member States which are also part of the OECD.[26], was retrieved. Data on FDI positions was also considered, however, it lacked the necessary indicators to disentangle FDI within the EU from FDI to the non-EU Member States.

The specific indicators that were selected for the analysis are listed in Table 5-1 below:

Table 5-1 Indicators used for the FDI flows in the OECD Statistics database

Indicator	Selection
Reporting country	22 EU Member States[27]
Measure	US Dollar
	Reported currency
Type of FDI	All

[25] OECD Statistics *(last updated in December 2022)*
26 Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain and Sweden.
27 Same list as above.

Indicator	Selection
Type of entity	Resident Operating Units (non-SPEs)*
Accounting entry	All
Level of counterpart	All
Partner country/territory	World
	EU27 (Excluding the United Kingdom)
	G20 countries excl. European Union
Economic activity	FDI_T - All FDI activities
	B06_09 - Extraction of crude petroleum and natural gas; mining support service activities
	C19 - Manufacture of coke and refined petroleum products
	D35 - Electricity, gas, steam and air conditioning supply
Time	2010-2019

5.3. Sectors relevant for the analysis of Foreign Direct Investment

Whilst OECD Statistics offers a wealth of economic activities in which FDI is directed, this data remains at a high level of aggregation (typically 1-digit NACE classification, e.g. "agriculture, forestry and fishing"). Therefore, in many categories the impact of climate policy will vary across included products. The database does not offer an option to disaggregate the data and, hence, most economic categories were excluded from our analysis. The only ones assessed were:

- FDI_T – Total FDI activity
- B06_09 – Extraction of crude petroleum and natural gas; mining support service activities;
- C19 - Manufacture of coke and refined petroleum products;
- D35 - Electricity, gas, steam and air conditioning supply.

Within these sectors of economic activity, a clear impact of climate policy on the volume of consumption can be expected:

- A decline in the consumption of "crude petroleum and natural gas" (B06_09) and of "coke and refined petroleum products" (C19);
- An increase in the consumption of electricity, which is the main component of "Electricity, gas, steam and air conditioning supply" (D35).

5.3.1. Treatment of the FDI Data

Figure 5-1 Analytical steps to model the development of FDI

The downloaded raw data for each economic activity consists of two pillars:

- Inward (DI) and outward (DO) flows from one EU Member State to all other countries
- Inward (DI) and outward (DO) flows from one EU Member State to the EU27 (excl. the UK)

Rather counter-intuitively, income from "Inward flows" describes the income resulting from an "inward investment", and hence refers to an income transferred **from** the EU Member State **to** the **foreign owner** of an invested asset located in that EU Member State.

Reciprocally, income from "Outward flows" describes the income resulting from an "outward investment", and hence refers to an income transferred **to** the owner, in the EU Member State, of an invested asset, which is located **abroad**.

It is important to remark that the data set is highly incomplete, especially the years prior to 2016. Furthermore, several EU Member States only report total FDI, instead of data disaggregated per economic activities. Lastly, the raw data does not contain values for FDI to non-EU countries.

This absence was remedied by calculating the totals for intra-EU FDI and for all FDI across all available countries in 2019, using the 'total FDI' data category. 'Total FDI' in 2019 was used for this purpose, as it is the year with the highest completeness of data. Nevertheless, it is a skewed estimation, because only 10 EU Member States reported their intra-EU FDI for this year. With these sums the proportions for FDI of the EU to and from the rest of the world were calculated, by subtracting, for these EU Member States where this data was reported, the intra-EU FDI income flows from the total for all countries. The result of the subtraction constitutes the FDI income flows to and from outside of the EU for these reporting countries (the "extra-EU FDI income flows"). The ratio of the "Extra-EU FDI income flows" as approximated by this calculation to the total FDI income flows was then applied to the FDI data for all countries available in the database for the two following sectors, where meaningful economic activity within the EU Member States exists, possibly attracting FDI from external sources:

- 'manufacture of coke and refined petroleum products';

- 'electricity, gas, steam and air conditioning supply'.

With respect to the 'extraction of crude petroleum and natural gas; mining support service activities', the economic activity in the EU is meaningless, so that the simplifying assumption was made that the full value of FDI income of EU Member States in that sector is in relation to countries outside the EU.

For each of these sectors, the latest available year of data was used, for as many EU Member States as possible. This figure was calculated for each economic activity and each directional flow and then served as the basis for modelling. The tables below show for which Member States data was available:

Table 5-2 Data availability for 'Extraction of crude petroleum and natural gas; mining support service activities'

Member States included	Member States with blanks and '0' throughout the data set
Czech Republic (only '0' for outward flows)	Austria
Denmark	Belgium
Estonia	France
Finland	Hungary
Germany	Ireland
Greece	Luxembourg
Italy	Portugal
Latvia (only '0' for outward flows)	
Lithuania (only '0' for outward flows)	
Netherlands	
Poland	
Slovakia (no reporting for outward flows)	
Slovenia (only '0' for outward flows)	
Spain	
Sweden	

Table 5-3 Data availability for 'Manufacture of coke and refined petroleum products'

Member States included	Member States with blanks and '0' throughout the data set
Belgium	Austria
Czech Republic (only one value in the data set)	France
Denmark	Ireland
Estonia (only '0' for outward flows)	Latvia
Finland	Luxembourg
Germany	Portugal
Greece	
Hungary	
Italy	
Lithuania (only '0' for outward flows)	
Netherlands	
Poland	
Slovakia (only '0' for outward flows)	
Slovenia (only '0' for inward flows)	
Spain	
Sweden	

Table 5-4 Data availability for 'Electricity, gas, steam and air conditioning supply'

Member States included	Member States with blanks and '0' throughout the data set
Austria	France

Member States included	Member States with blanks and '0' throughout the data set
Belgium	Ireland
Czech Republic	Portugal
Denmark	
Estonia	
Finland	
Germany	
Greece	
Hungary	
Italy	
Latvia (only '0' for inward flows)	
Lithuania	
Luxembourg	
Netherlands	
Poland	
Slovak Republic	
Slovenia	
Spain	
Sweden	

*Table 5-5 EU Member States with a different most recent year than 2019**

Extraction of crude petroleum and natural gas; mining support service activities			Manufacture of coke and refined petroleum products**			Electricity, gas, steam and air conditioning supply**		
	Inward	Outward		Inward	Outward		Inward	Outward
Denmark	2018	2017	Denmark	2017		Slovakia		2018
Estonia		2018	Finland		2015	Sweden	2013	2018
Finland	2016		Slovakia	2016				
Lithuania	2013							
Slovakia	2018							

*Does not contain information on blank cells or countries reporting 0, as these cases do not enter the calculation for the summary figure.

**Adjusted based on estimation of the percentage of RoW FDI within Total FDI.

5.4. Current situation of the income from climate-relevant EU Foreign Direct Investment (FDI)

Due to the described problems with the available data, the results of this study on FDI are *highly inconclusive*. For the reasons given in section 3.2.2, it is impossible to give a comprehensive the current state description of climate-relevant EU FDI. Particularly challenging here are the incompleteness and high level of aggregation.

As mentioned above, we summarized the data based on the most recent year for which data was available. For most Member States who reported data, the most recent year was 2019, exceptions are listed in the table below.

The resulting summary figures across Member States who reported data are:

Table 5-6 FDI Total flows per sector based on most recent available year (in mio. $)

Current State Economic Activity	Income generated from: Inward FDI (in mio $)	Outward FDI (in mio $)	Outward – Inward (in mio $)
Extraction of crude petroleum and natural gas; mining support service activities	339,94	11.054,07	10.714,13
Manufacture of coke and refined petroleum products	2.361,47	2.440,93	79,46
Electricity, gas, steam and air conditioning supply	2.276,59	3.325,16	1048,57
Total	4.978	16.820,16	11.842,16

5.5. Anticipation of income from FDI in the 3 selected sectors for 2050

The expansion/contraction factors for each of the three selected economic activities, based on the long-term scenarios, are based on the same assumptions as those for the corresponding products, as listed in Table 4-3:

Table 5-7 Expansion/contraction factors of consumption in the sectors considered for FDI

Expansion/contraction factors				
Economic Activity	% Annual demand growth, baseline (2015-2030)	% Annual demand growth, baseline (2030-2050)	% Annual demand growth, 1-5 TECH (2030-2050)	% Annual demand growth, 1.5 LIFE (2030-2050)
Extraction of crude petroleum and natural gas; mining support service activities	-1,8%	-1,1%	-9,3%	-10,3%
Manufacture of coke and refined petroleum products	-3,4%	-4,7%	-14,1%	-15,6%
Electricity, gas, steam and air conditioning supply	1,3%	1,1%	4%	3,1%

The two above tables resulted in the following model outputs for FDI in 2050, based on the same method as in Chapter 4. The difference with this method is that no competitiveness factor is taken into account, since Foreign Direct Investment is deemed to take place on an open market with all players sharing very close investment conditions. Hence, no distinction is being made between an Optimistic and a Pessimistic scenario. :

Table 5-8 Model outputs for 2050, Baseline

2050, Baseline Economic Activity	Income generated from: Inward FDI (in mio $)	Outward FDI (in mio $)	Outward – Inward (in mio $)
Extraction of crude petroleum and natural gas; mining support service activities	221,98	7.218,49	6.996,51
Manufacture of coke and refined petroleum products	618,17	638,97	20,8
Electricity, gas, steam and air conditioning supply	3.252,76	4.750,95	1.498,19
Total	4.092,91	12.608,41	8.515,5

Table 5-9 Model outputs for 2050, 1.5 TECH, under two scenarios (Alignment vs. Divergence) regarding the policies of the Rest of the World (RoW)

20150, 1.5 TECH scenario + Alignment	Income generated from:		
Economic Activity	Inward FDI (in mio $)	Outward FDI (in mio $) with RoW	Outward – Inward (in mio $)
Extraction of crude petroleum and natural gas; mining support service activities	39,33	1.278,86	1.239,54
Manufacture of coke and refined petroleum products	77,22	79,82	2,6
Electricity, gas, steam and air conditioning supply	5.755,09	8.405,82	2.650,73
Total	5.871,64	9.764,5	3.892,87

20150, 1.5 TECH scenario + Divergence	Income generated from:		
Economic Activity	Inward FDI (in mio $)	Outward FDI (in mio $) with RoW	Outward – Inward (in mio $)
Extraction of crude petroleum and natural gas; mining support service activities	39,33	7.218,49	7.179,16
Manufacture of coke and refined petroleum products	77,22	638,97	561,75
Electricity, gas, steam and air conditioning supply	5.755,09	4.750,95	- 995,14
Total	5.871,64	12.608,41	6.745,77

Table 5-10 Model outputs for 2050, 1.5 LIFE

2050, 1.5LIFE scenario + Alignment	Income generated from:		
Economic Activity	Inward FDI (in mio $)	Outward FDI (in mio $) with RoW	Outward – Inward (in mio $)
Extraction of crude petroleum and natural gas; mining support service activities	31,38	1.020,46	989,08
Manufacture of coke and refined petroleum products	54,48	56,31	1,83
Electricity, gas, steam and air conditioning supply	4818,18	7037,39	2.219,21
Total	4.904,04	8.114,16	3.209,12

2050, 1.5LIFE scenario + Divergence	Income generated from:		
Economic Activity	Inward FDI (in mio $)	Outward FDI (in mio $) with RoW	Outward – Inward (in mio $)
Extraction of crude petroleum and natural gas; mining support service activities	31,38	7.218,49	7.187,11
Manufacture of coke and refined petroleum products	54,48	638,97	584,49
Electricity, gas, steam and air conditioning supply	4.818,18	4.750,95	- 67,23

2050, 1.5LIFE scenario + Divergence	Income generated from:		
Economic Activity	Inward FDI (in mio $)	Outward FDI (in mio $) with RoW	Outward – Inward (in mio $)
Total	4.904,04	12.608,41	7.704,37

The Table 5-11 below summarises the total effects of EU climate policy on the FDI income in the three sectors which we considered.

Table 5-11 Overview of the total effects of EU climate policy on the FDI income in the three sectors considered

Economic Activity	Inward FDI (in mio $)	Outward FDI (in mio $)	Outward – Inward (in mio $)
Total current state	4.978	16.820,16	11.842,16
Total 2050 Baseline	4.092,91	12.608,41	8.515,50
Total 2050 1.5 TECH with RoW Alignment	5.871,64	9.764,5	3.892,87
Total 1.5 LIFE with RoW Alignment	4.904,04	8.114,16	3.209,12
Total 1.5 TECH with RoW Divergence	5.871,64	12.608,41	6.745,77
Total 1.5 LIFE with RoW Divergence	4.904,04	12.608,41	7.704,37

Under all scenarios, the FDI income for these three sectors remains positive in 2050.

By comparison with the baseline scenario, the transition of the EU towards a net-zero GHG emissions economy deteriorates the FDI income flows of the EU from these three sectors. This deterioration is stronger in the "Alignment" scenario (EUR -4.6 to -5.3 bn) compared to the "Divergence" scenario (EUR -0.8 to -1.8 bn). However, the magnitude of this deterioration remains small compared to the strongly positive changes that these policies generate in the trade of goods (summarised in § 4.5.3 above).

The reason for this deterioration is that the FDI flows of inward FDI in the sector of 'Electricity, gas, steam and air conditioning supply' grow because of the transition of the EU towards a net-zero economy, whereas those from outwards FDI in fossil fuels (extraction and processing) are reduced, more strongly so in an "Alignment" scenario where the Rest of the World (RoW) follows the same trajectory as the EU away from the usage of fossil fuels.

We recommend caution however in the interpretation of these results, as they only address the three sectors in which the granularity of the sector data we had access to (from the OECD) was sufficient to draw clear conclusions regarding the evolution of production capacity (and hence of investment), in a context of a transition of the EU to a net-zero economy. In all other sectors of the economy, an evolution of the income flows from FDI will take place as a consequence of this transition. However, this evolution will be mixed, at the coarse scale of the sectors used in the statistics of the OECD (generally: 2-digit NACE codes), with the investment volumes in some categories of productive assets (and hence the income flows generated by these assets) growing with the demand of the goods produced by these assets, and others decreasing.

6. Options for a long-term EU trade policy supporting its industrial interests and climate objectives

6.1. Structure of this chapter

In the preceding chapters of this report, the potential effects of EU climate mitigation policies on EU trade and investment competitiveness in selected sectors have been assessed. The aim of this section is to identify a range of trade policy instruments and explore how they can be used to promote both the EU's climate objectives and EU competitiveness in the longer term. It does so by, first, summarising the views of stakeholders as expressed in the survey (section 6.2). Thereafter, a brief overview of available trade policy instruments is provided (section 6.3), before more detailed recommendations for EU trade measures aimed at supporting the identified priority sectors for trade policy are presented (section 6.4).

6.2. Views of stakeholders from climate change-mitigating goods industry

This section expands upon the views of stakeholders in the sector of climate change-mitigating goods, based on results of the survey mentioned earlier in this report in section 4.4.2. For more detailed information, please refer to Annex 8 to see the full results of the survey.

6.2.1. Views on the competitiveness of EU climate change-mitigating goods sectors

Horizontal comments on EU competitiveness

Depending on the sector (solar power to wind power and electric vehicles) and the position (current, near-future, long-term) they are in, an overwhelming majority of respondents across the spectrum indicated that Europe is losing competitiveness in product design and manufacturing, facing increasingly aggressive market opponents, such as Chinese competitors, who are moving at a very fast pace, increasingly closing the gap. This was attributed to the availability of cheaper goods from China due to subsidies. Additionally, it was also mentioned that European manufacturers have been struggling with innovating technologies, while simultaneously ensuring prices are low for consumers, but also high enough to cover the cost of inflation. Respondents also said that it depends on whether the EU industry is able to lead on industrialisation of relevant innovations (e.g. efficiency tandems, recycling/circularity) and not just work in laboratories. Respondents further added that this would require investments from industry into research and innovation and political support (similar to the US Inflation Reduction Act) to be considered.

Solar power

According to respondents for solar power, the competitive position of EU manufacturers compared to non-EU ones (such as China), in the long-term future will be determined by their capacity to respond to the challenge of lowering electricity generation costs and increasing power plant efficiency, as well as enabling easier and faster permitting opportunities for EU manufacturers. Despite concentrated solar power being stronger than other sectors, respondents mention that the sector is encountering many difficulties. These difficulties are imposed by technological (modularity and standardisation) and non-technological (tendering process) framework conditions in the EU having a direct impact on the design of products of power plants. Additionally, respondents indicate that the number of relevant patents from China is steadily increasing, clearly indicating the increasing competition from non-EU manufactures.

With respect to PV cells, solar-grade silicon ingots and wafers, respondents' comments mentioned that if competitive energy prices would be ensured not only for the short term, but also for the medium and long term, then European cells, ingots and wafers producers could have the possibility to produce more competitively.

Regarding **solar glass**, respondents indicated that European-produced solar glass is less competitive due to energy prices in Europe. In addition, the current duty for imported glass enhances the low level of competitiveness for the European glass industry, but at the same time duty free regime for the solar PV modules imported from Eastern Asia, including China diminishes the competitiveness conditions for the European produced PV modules.

Wind power

Respondents highlighted concerns about the prevailing threat to widen the cost gap if imported products are not included in the CBAM. Additionally, respondents mentioned that while product manufacturing in the EU will have a good position in terms of product reliability in the near future, it is still difficult to compare it to real product performance figures in China. According to respondents, the Chinese wind turbine OEMs and gearbox suppliers are targeting new markets linked to the Belt & Road initiative, which results in a growing presence in Asia, the Middle East, Africa and Latin America. With wind energy continued to be a strategic focus in China's five-year plans, their wind energy supply chain continues to adapt to meet these goals, increasing pressure on international players (such as European players) and making supply from more expensive regions increasingly difficult. Additionally, respondents have also mentioned that the industry must focus on developing sustainable and scalable regional supply chains without sacrificing reliability or quality.

Electric vehicles

Stakeholders' comments mentioned that further public research and innovation support is necessary considering the magnitude of the global competition to advance electric vehicles (specifically the case in the United States) and the geopolitical implication of securing lithium and other critical raw materials needed for electric vehicles. It was further indicated that France and Germany are in competition with China, U.S., Canada and New Zealand to develop intellectual property rights and extraction techniques for this critical feature of batteries.

Hydrogen

In terms of product design, the respondents rated the current competitiveness of EU manufacturers to be equal to that of its main competitors. According to respondents, the reasons behind this is that the Chinese manufacturers have concentrated on alkaline electrolysers, whereas Europeans are mostly concentrating on PEM electrolysers. Further comments to elaborate upon this were not provided. In terms of manufacturing electrolysers, the respondents indicated that the current competitiveness of EU manufacturers was weak. They further elaborated that although demand through pilot projects is ramping up, there is little visibility on what future demand will look like and how governments will be able to provide support. As an example, a respondent mentioned that the US Inflation Reduction Act provided a stable framework that would support better long-term investment decisions, so that US-based manufacturers are likely to gain in competitiveness, due to the size of their domestic market.

Battery storage systems

According to respondents, CATL, LG Chem, Tesla and other Asian manufacturers have the lead in designing batteries and their systems. Additionally, respondents also mentioned that the design of the market throughout Europe is not homogenous and that there are only few markets where battery storage systems can compete and offer solutions at the right prices. The small size and fragmentation of the EU market leads to losses of economies of scale and hence of competitiveness for EU manufacturers.

Other renewable energy

According to respondents, the European **geothermal** industry has a strong degree of leadership, but needs a robust internal market to consolidate, notably when it looks to export its services. Additionally, comments also mentioned that global competitors are quite active and are supported by a robust network of export agencies, this includes US, Japan, and China, all of whom are becoming increasingly strong competitors in the global geothermal market.

In terms of product design for **biomass**, the respondent's response to the survey indicated an equal level of competitiveness expected in the long-term, compared to non-EU competitors. However, in the case of product manufacturing, a strong level of competitiveness is expected in the long term. Respondents' comments mention that it will still be essential to put emphasis on local manufacturing capabilities to further strengthen the position of biomass in Europe.

In terms of product design of **tidal systems**, there was only one response where the respondent indicated that the current level of competitiveness is strong. Within the comments, the respondent indicated that while Europe presently holds leadership in tidal technologies, additional policy support is required to safeguard it. The respondent attributes it to the fact that besides China, competition is rising around the globe, with a massive amount of investment from the US, along with Canada and UK also paving the way for the creation of a market, with the setup of market incentives such as revenue support. There were no responses regarding the relative position of product manufacturing of tidal systems.

According to respondents, Europe has a long-standing competitive advantage in **wave energy** due to early investments in research and development. However, this advantage is being challenged by outside competitors that wish to catch up on the development of wave energy. Respondents stated that the US is currently investing $100 million dollars each year to boost the development of marine energy. The latest statistics indicate that competitors outside of Europe have deployed more wave capacity over the last five years than Europe.

6.2.2. Views on related trade policy measures and trade liberalisation

The stakeholders of the sector of climate change-mitigating goods consulted in the survey shared almost unanimously the views that they disagree with the measures proposed regarding trade liberalisation. The only few exceptions were the representatives of the sectors of utility scale PV and of distributed solar PV. In both these cases, respondents have agreed with the implementation of measures such as lower tariffs or higher quotas compared to conventional goods of the same category, as well as other measures such as the elimination of non-tariff barriers. In addition to this, for both utility scale PV and distributed solar PV there was an equal number of respondents that indicated they were either neutral or agreed to the enforcement of intellectual property rights owned by EU-based companies in the sector. For a more detailed description of the results, please see Annex 8.8.4 and Annex 8.8.5.

6.3. Toolbox of trade instruments and rules

A diverse set of trade instruments is available that the EU can use to support its climate interests while safeguarding industrial competitiveness interests. Annex 9 provides a description of main instruments, their potential use and relevant multilateral rules. Table 6-1 presents a summary, listing examples of trade measures that could be taken to promote climate change mitigation and EU competitiveness. The following section provides more detailed recommendations for an EU trade policy supporting its industrial interests and climate objectives on the basis of the findings on the EU's sectoral competitiveness as determined in the previous chapters.

Table 6-1: Summary table of trade policy measures to promote climate change mitigation and EU competitiveness effects

Trade policy area	Examples of measures to promote climate and EU competitiveness
General WTO rules	• Negotiate changes to WTO rules allowing higher import tariffs (and other trade measures) for climate policy purposes: list climate change mitigation in GATT Art. XX; establish legality of NPR-PPMs on grounds of climate change • Push for "climate waiver" under Art. IX.3-4 of the WTO Agreement
Import tariffs	• Negotiate inclusion of separate climate change-mitigating goods in HS • Negotiate low import tariffs by EU trading partners on climate change-mitigating goods • Apply low MFN import tariffs on inputs needed to produce climate change-mitigating goods • Apply high import tariffs by the EU on goods related to high GHG emissions • Apply low MFN import tariffs on climate change-mitigating goods
Subsidies	• Subsidies for producers of climate change-mitigating goods and more broadly decarbonisation of the economy to reduce costs of R&D or production of climate change-mitigating goods or climate services • Subsidies for consumption of climate change-mitigating goods and services • Subsidies for EU producers subject to higher emissions standards in the EU than in third countries • Bilaterally and multilaterally negotiate on abolishing and banning of climate-damaging subsidies • Bilaterally and multilaterally negotiate harmonised climate subsidy policies to avoid subsidy race

	• Negotiate multilaterally to clarify WTO legality of certain climate change mitigating subsidies (e.g. export tax rebates for indirect taxes related to climate change mitigation)
Technical barriers	• Further develop climate mitigation related standards and technical regulations in the EU, especially for new and growing industry segments; harmonise these internationally • Reduce technical barriers in third countries through harmonisation of technical regulations or establishment of international standards both for climate change-mitigating goods and climate change-mitigating production processes (including NPR-PPMs) • International streamlining of procedures to certify energy efficiency and emission standards • Bilaterally or multilaterally negotiate harmonised conformity assessment to simplify licensing or verification procedures for imported climate change-mitigating goods by third countries • Further development and expansion of carbon labelling requirements in the EU
Quantitative import restrictions	• Internationally coordinate import restrictions/bans on climate-damaging products
Export restrictions	• Negotiate agreements with alternative suppliers of essential inputs needed for climate mitigation actions (e.g. Critical Raw Materials) to diversify supply; • Challenge export restrictions that violate WTO rules • Negotiate stronger disciplines on export restrictions • Internationally coordinate restrictions (taxes, bans) to the export of climate-damaging goods
Trade defence instruments	• Use countervailing duties, concentrating them deliberately against products benefitting from climate-damaging subsidies provided by third countries
Public procurement	• Determine new key climate change-mitigating goods and services to be procured publicly to ensure demand • EU rules for setting minimum standards or granting preferences related to GHG emissions or other climate change-mitigating effects in EU public procurement • Negotiate procurement rules in bilateral agreements to ensure EU access to green procurement measures taken by third countries
Trade agreements	• Use trade agreements as forums for discussing climate action with EU trading partners • Establish, strengthen and use trade agreements' TSD chapters and committees, and assess, monitor and evaluate climate impact of agreement implementation to address potentially higher GHG emissions from increased trade between the parties
Trade-related climate measures e.g. to address carbon leakage	• Adopt non-discriminatory carbon border adjustment measures to counter carbon leakage (the EU has already done this through the CBAM) • Negotiate establishment of global carbon markets or similar global coordination effort in climate fora • Negotiate agreement or clarification, within the WTO regulatory framework, on the principles and features of trade related climate measures

6.4. Options for a long-term EU trade policy in a transition to a net-zero economy scenario

The analysis in this report has shown that the EU's offensive trade interests with respect to major climate-change mitigating products are limited to wind power, complemented by products with smaller markets, such as biogas and biomethane technology. Conversely, defensive interests, where EU competitiveness is more limited in 2050, according to the tested scenarios, concern a larger variety of products: These comprise most notably batteries, solar power and electric personal vehicles among abiotic products, and nuts, legumes, and vegetable oils among biotic ones.

In accordance with the different competitiveness positions of EU industries, the following recommendations are structured into offensive and defensive trade measures and are focused on addressing the interests of the identified priority sectors. Other trade policy measures supporting EU climate objectives are not presented here, as they do not follow from the preceding analysis.[28]

6.4.1. Offensive trade policy measures

Improving market access in third countries for globally competitive EU products constitutes the main offensive trade policy interest. As noted above, based on the findings in this study, such trade measures would be particularly called for in relation to wind power.

28 Some of these are mentioned in the toolbox of trade instruments in Annex 9.

Potential trade measures would include the following:

- Ensuring zero or low import tariffs for EU products in third country markets: this could be achieved, first, through *bilateral trade negotiations* between the EU and key trading partners in the context of FTAs. However, considering the WTO requirement that FTAs must comprise substantially all trade, negotiations about the tariff liberalisation of only specific products such as wind power are no option. Also considering that the range of climate change-mitigating products where the EU rather has defensive interests is relatively large, initiating negotiations for a broad FTA with the purpose of enhancing market access for wind power (and some smaller sectors) alone does not appear to be a preferred option. At the same time, decisions on whether or not to negotiate trade agreements are typically not based on climate considerations alone. Accordingly, whenever a decision is taken by the EU to negotiate a new trade agreement, or modernise an existing one, the European Commission should ensure that the sectors, like wind power, where the EU has an offensive interest, are among the priority sectors where the EU seeks duty-free market access.

  A second option to reduce import tariffs in third country markets is through a *multilateral (or plurilateral) agreement* on the liberalisation of trade in climate change-mitigating products. Discussions at the WTO on an environmental goods agreement have so far not been successful, including as a result of differences in opinion about the definition of "environmental goods".[29] Thus, an option could be to distinguish between climate change-mitigating goods and other environmental goods, potentially increasing the likelihood of reaching a plurilateral or multilateral agreement on climate-change-mitigating goods.

  Generally, the importance of improving market access through tariffs cuts for EU wind power and other climate change-mitigating products may be somewhat limited because most tariffs are already low: According to OECD estimates, globally, tariffs on environmental goods dropped to below 2% by 2016 (see WEF, 2022). However, tariffs vary substantially across individual products and countries. For example, import tariffs for wind-powered generating sets (HS 8502.31) originating in the EU are 2.5% in the USA, 5% in China, and 7.5% in India. This shows that EU measures aimed at reducing tariff barriers in third countries do constitute an important element in the mix of trade policy instruments to be pursued.

- Ensuring that technical regulations and standards for wind power, as well as associated conformity assessment procedures do not constitute barriers to exports: As described above, survey respondents noted that the development of globally harmonised standards is important to facilitate trade in wind power systems. These observations align with findings in the literature. For example, De Melo and Solleder estimated that "the average uniform protection from NTBs [non-tariff barriers] when combined with tariffs is 4 (APEC list) to 10 times (WTO list) greater than the average uniform protection from tariffs alone" (de Melo and Solleder, 2019, p. 16). Accordingly, ensuring that NTBs, notably technical regulations and standards, do not become a market access barrier for EU exports of wind power systems and other climate change-mitigating products is as, if not more, important as addressing third-country tariffs. Measures could be taken both unilaterally, bilaterally and multilaterally. Among *unilateral measures* to be considered is the further development of high safety and efficiency standards for wind power systems to ensure that production retains the competitive edge.

  Probably as important are measures that could be taken in cooperation with third countries, be it in the framework of *bilateral* or *multilateral* agreements. Examples of such negotiations and agreements would include the harmonisation of technical regulations or establishment of international standards, or the negotiation of mutual recognition agreements (MRAs) on wind power standards & regulations, as well as on conformity assessment procedures.

- Opening up foreign public procurement markets: With energy generation being driven by the public sector in many countries, government procurement markets constitute a sizeable

29 Lists of environmental goods have been developed by various organisations over the years without an international agreement having been reached (e.g., Steenblik, 2005; Bellmann and Sugathan, 2022; WEF, 2022). Some of the EU's more recent EU FTAs, e.g. with New Zealand, also include lists of "green goods" (and services) covering those related to energy efficiency, renewable energy generation. But a common understanding continues to be absent.

share of the market for renewable energy generation, including wind power. Accordingly, ensuring that EU producers can access third countries' public procurement markets is important. This can be achieved through the *negotiation of bilateral agreements*, including trade agreements with public procurement chapters (now standard for the EU's modern trade agreements) or separate procurement agreements. In principle, negotiations on the opening up of public procurement markets for wind energy (and other climate change-mitigating products) could also take place in a plurilateral or multilateral context, such as the WTO's Government Procurement Agreement (GPA) or the above-proposed agreement on trade in climate-change-mitigating goods. However, considering that the GPA was renegotiated relatively recently (in 2012) and that the groundwork for a broader agreement on trade in climate change-mitigating goods would need to be laid, bilateral agreements would likely be faster and easier to negotiate.

6.4.2. Defensive trade policy measures

For the larger group of products for which the EU has defensive interests, the purpose of trade policy measures will be to support them, through WTO compliant actions, in (re-)gaining competitiveness to withstand fair import competition and develop export competitiveness. It should be noted that defensive measures also benefit those sectors where the EU already has an offensive interest, as they help ensure that the sectors continue to have a competitive edge. For example, the wind energy sector also benefits from high subsidies and other support measures in third countries, and defensive trade policy measures as proposed in this section should therefore also be extended to this sector.

Including because the range of EU products and sectors that need protection is larger than those sectors where an offensive interest is already present, the range of trade measures to be contemplated is also broader. The following defensive measures are recommended to be considered by the EU:[30]

- Removing EU import tariffs on inputs for production of climate change-mitigating products: This measure would reduce the cost of EU firms for the production of such goods, thereby increasing profits and/or reducing the price of the final product. In essence, where not already in place, tariff escalation along the value chain should be applied. For example, inputs for batteries would be duty free to reduce costs for EU battery production, and tariffs on batteries (e.g. for EVs) would be subject to low tariffs to provide some degree of protection while keeping costs low for EU production of EVs. The precise setting of tariffs would need to be determined in collaboration with industry representatives in order to determine the key inputs as well as their availability and cost in the EU.

- Ensuring availability of critical raw materials needed for climate change-mitigating products: Going beyond the cost of inputs for the production of climate change-mitigating products, the availability of such inputs must be guaranteed. In this regard, the high concentration of the supply of critical raw materials in few countries, with China standing out, is a matter of concern, in particular in view of recent policies by supplying countries (beyond China) to restrict the exports of such raw materials. For example, Indonesia banned exports of nickel, an important input for batteries, in January 2020 – a move found to be in violation of WTO rules by the WTO panel upon a complaint made by the EU (European Commission, 2022d). Also, in December 2022 Zimbabwe banned the export of raw lithium (Marawanyika and Ndlovu, 2022).

  Trade measures to reduce the risk of unavailability of supply include:

  - The diversification of suppliers through the negotiation of agreements, including investment agreements, facilitating access to critical raw materials from alternative suppliers. The Critical Raw Materials Club of like-minded countries proposed by the Commission may facilitate this;
  - Challenging export restrictions that violate WTO rules under the WTO dispute settlement mechanism;

30 Some measures, which restore competitive disadvantages stemming from EU climate policies, such as the CBAM, are not addressed here although they are trade-related.

- Multilateral negotiations aimed at strengthening disciplines on export restrictions and ensuring the availability of critical raw materials for climate change-mitigating goods and their production.

The EU has already used, or foresees the use of these and other, including domestic, measures, inter alia within the framework of the recently proposed European Critical Raw Materials Regulation.[31]

- **Providing subsidies for R&D and production of climate change-mitigating goods:** Production subsidies for climate change-mitigating goods and more broadly decarbonisation of the economy can address several challenges for EU competitiveness. First, they can help reduce costs of R&D or production of such goods (like renewable energy technologies and production, or energy storage), thereby expanding current and/or future output and reaping economies of scale so that producers become more competitive; subsidies are justified in the context of climate change-mitigating goods production as such goods have positive externalities (i.e. mitigating climate change) that lead to under-supply of such goods; this market failure can be corrected through subsidies.

  Second, subsidies can cushion EU producers that are subjected to the EU's climate-friendly production standards which increase production costs and hence put producers at a competitive disadvantage. Subsidies that cover the cost differential can re-establish the level playing field for such producers with competitors producing at lower cost under less demanding standards. An example could be EU steel production.

  And third, EU subsidies can counter subsidies provided by third countries and corresponding distortions, called subsidy race – although for this last objective, countervailing measures are the more appropriate instrument (see below).

  Although in theory, EU production subsidies for climate change-mitigating goods can be well justified – in particular for the products identified in this report as facing competitive pressures and hence calling for defensive measures – practical considerations regarding the determination of the legality (under EU state aid and WTO rules), scope, level, conditions, and other operational issues are extremely difficult and would require detailed studies and consultations with the relevant industries, going well beyond the scope of the present report.

- **Protecting EU production against harmful effects of subsidies provided by third countries:** To some extent, the competitiveness of EU sectors is negatively affected by subsidies that are provided by third countries to their corresponding sectors. China's support to various renewable energy sectors and others producing climate change-mitigating projects, as well as the US Inflation Reduction Act (IRA), which subsidises production and investment in renewable technology in the US, are examples of such distorting subsidies. To address these, in line with the WTO Agreement on Subsidies and Countervailing Measures (SCM Agreement), in the presence of subsidies (whether prohibited or actionable), the EU has the choice of taking the case to the dispute settlement procedure of the WTO or imposing, following the required procedures, countervailing duties. Both routes can in principle also be pursued simultaneously, although no double remedy can be imposed for the same situation at the same time. The EU is already using these avenues and should continue doing so in the future.

7. General conclusions and proposals for further action

The main conclusions that we can draw from this study are the following:

- The transition of the EU towards a net-zero GHG emissions economy is anticipated to **improve** the international trade balance of **climate-relevant goods**, i.e. (1) whose production,

31 For more information on this Commission initiative, see European Commission (2023).

consumption and/or use generate a large volume of GHG emissions, (2) who substitute functionally for them but generate less GHG emissions or (3) who reduce the GHG emissions of other goods. This improvement is anticipated to be considerable (EUR +65 to +104 bn) under an Optmitistic scenario regarding the international competitiveness of EU manufacturers. The effect remains meaningfully positive (EUR +4 to +18 bn) in 3 of the 4 sub-cases of the Pessimistic scenario, and only moderately negative (EUR -6 bn.) in one sub-case. We made the hypothesis that the international trade balance of other goods is not affected by the transition of the EU to a net-zero economy;

- The transition of the EU towards a net-zero economy is anticipated to **deteriorate moderately** (by EUR -0.8 to -5.3 bn) the international trade balance of **Foreign Direct Investment (FDI) income** of the three sectors (Extraction of fossil fuels,; Refineries or production of coke; Supply of electricity and other energy-related fluids) for which the available statistics provide data with a granularity level that is fine enough to draw conclusions on the impact of the transition of the EU towards a net-zero economy;
- The stakeholders in the sector of **climate-change mitigating goods** are almost unanimous in their **reluctance** to engage in **trade liberalisation** negotiations;
- The only climate-change mitigating good where **offensive** trade interests have been identified is that of **wind power**. For this product, we suggest that the EU pursue the following **goals** in **international trade negotiations**:
    - Ensure zero or low import tariffs for EU products in third country markets;
    - Ensure that technical regulations and standards for wind power, as well as associated conformity assessment procedures do not constitute barriers to exports;
    - Open up foreign public procurement markets;
- The climate-change mitigating goods where **defensive** trade interests of the EU were identified are:
    - Abiotic products: **steel**; **batteries, solar power, electric personal vehicles**;
    - Biotic products: **nuts**; **legumes**; **vegetable oils**.

  For these product, we suggest that the EU pursue the following **goals** in **international trade negotiations**:

    - Remove EU import tariffs on inputs for production of climate change-mitigating products;
    - Ensure availability of critical raw materials needed for climate change-mitigating products;
    - Protect EU production against harmful effects of subsidies provided by third countries.
- In addition to these defensive trade measures, we suggest that the EU provide **subsidies** for **R&D** and **production** of climate change-mitigating goods.

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