FOUNDATION FOR ECONOMIC & INDUSTRIAL RESEARCH

Transition Roadmap for the Chemical Industry in Greece

April 2024

FOREWORD FROM THE PRESIDENT OF HELLENIC ASSOCIATION OF CHEMICAL INDUSTRIES

Nowadays, the Greek and the European chemical industry are both faced with one of the biggest challenges in the history of our sector, within the European Green Deal**. The sector must invest billions to change the production mode and the type of products it produces in less than 30 years, aiming at becoming climate neutral by 2050.** However, at the same time, the industry must remain competitive, despite the volatile economic environment, so that it continues to be a supplier of important value chain services at national, European and global level.

The Hellenic Association of Chemical Industries (HACI), member of the European Chemical Industry Council (CEFIC), **supports the EU Green Deal and has set as its main priority not only to transform the Greek chemical industry, but also to contribute to the establishment of a more resilient, competitive and sustainable environment for the country, the national economy and, consequently, the society.** In this Framework HACI has cosigned the Antwerp Declaration which calls for a European Strategic Agenda for Industry (European Industrial Deal) as a political priority for the next programming period.

To this end, **HACI and the Foundation for Economic & Industrial Research (IOBE) jointly drafted the national Transition Roadmap for the Greek chemical industry (national transition pathway)**, **an essential tool** that reflects the objectives and the content of the European Transition Roadmap by taking into account the existing initiatives and peculiarities of the Greek chemical industry and setting out all the critical issues to be addressed.

It is our ambition that **the national transition pathway will serve as a valuable roadmap for companies in the sector and a field of cooperation with the State, competent authorities and stakeholders at national and European level**, with a view to achieving the multidimensional transition of the Greek chemical industry.

The cooperation of all parties is the only path towards achieving the green and digital transition of the Greek Chemical Industry, in addition to remaining competitive, so that the industry continues to be a driver of sustainability, delivering innovative solutions.

ARMODIOS YANNIDIS
HACI President

FORWARD FROM THE MINISTER OF DEVELOPMENT

First and foremost, I would like to congratulate the Hellenic Association of Chemical Industries and the Foundation for Economic and Industrial Research for their comprehensive depiction of the Greek chemical industry –a sector of vital importance, as highlighted during the pandemic period, characterized by high technology and resilience– and for the development of its Transition Roadmap within the framework of the European Green Deal. This roadmap signifies a dynamic transformation towards addressing modern challenges, reflecting the commitment of the Kyriakos Mitsotakis government to strong and sustainable development and our vision for the reindustrialization of Greece in cutting-edge fields. Specifically, we focus on high-value-added sectors that contribute to our economy's competitiveness, resilience to the climate crisis, and our strategic autonomy.

The forthcoming actions of the Ministry of Development –as reflected in the new provisions of the Development Law, the updated strategy for industry, and the new innovation strategy– create investment incentives for outward orientation, green and digital transition, circular economy, innovation partnerships, and the development of modern skills, while simplifying bureaucratic procedures.

Our government is fundamentally transforming Greece into a hub of green energy and innovation, a digital hub, and a gateway for transit to Southeastern Europe. In this context, the chemical industry will play a multi-level role, leveraging emerging opportunities and competitive advantages.

It is worth noting that the Greek chemical industry has successfully responded to international challenges and has recorded developmental momentum, in contrast to the alarming decline in the EU (e.g., by 20% in Germany during the period 2019-2023). In Greece, its turnover is estimated at €3.8 billion in 2023, with exports exceeding 67%. Its contribution to GDP has returned to pre-2008 levels, employment has increased by 15% compared to 2015, and 70% of jobs are highly specialized, with wages significantly exceeding the domestic manufacturing average.

By highlighting the significant achievements of the sector, its challenges, and its opportunities in a complex international environment, this roadmap will be a valuable tool for transforming businesses. At the same time, it constitutes a solid foundation for policymaking, strengthening the creative dialogue between the state and industry.

Europe is called upon to realize that a Strong Industry means a Strong Society. The Antwerp Declaration represents a new reference point. Our government will continue to decisively highlight the need for European funding mechanisms and realistic approaches, such as promoting the market for green and circular products and limiting asymmetries with third countries.

In the stable and investor-friendly environment we have established, the Greek industry will continue to dynamically transform, creating high added value, quality, and well-compensated jobs, and serving as a link to international value chains.

We will continue at an intense pace to build together a Greece that produces, innovates, and exports. A Greece that fosters sustainable development, with high, sustainable growth rates, and fair social conditions.

KOSTAS SKREKAS
Minister of Development

The policy judgements and proposals contained in this analysis express the views of the authors and do not necessarily reflect the opinions of IOBE's members or administration.

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ABBREVIATIONS

ABS	Atypical Business Concentrations
AI	Artificial Intelligence
AR	Augmented Reality
BAT	Best Available Techniques
bcm	Billion cubic meters
BREF	Best-available-technique Reference documents
CAPEX	Capital expenditures
CBAM	Carbon Border Adjustment Mechanism
CCUS	Carbon Capture, Utilisation and Storage
CEFIC	European Chemical Industry Council
CLP	Classification, Labelling and Packaging of substances and mixtures
CMR	Carcinogenic, Mutagenic, or toxic for reproduction substances
CRM	Critical Raw Materials
CSRD	Corporate Sustainability Reporting Directive
DEP	Digital Europe Programme
DESFA	National Gas System Operator
DESI	Digital Economy and Society Index
DTLF	Digital Transport and Logistics Forum
ECHA	European Chemicals Agency
EDIH	European Digital Innovation Hubs
EDs	Endocrine Disruptor
EED	Energy Efficiency Directive
EGD	European Green Deal
EIB	European Investment Bank
EIC	European Innovation Council
EIT	European Institute of Innovation & Technology
EPAnEK	Operational Programme “Competitiveness, Entrepreneurship, Innovation”
E-PRTR	European Pollutant Release and Transfer Register
ERP	Enterprise Resource Planning
ESPR	Ecodesign for Sustainable Products Regulation
ESR	Effort Sharing Regulation
ETS	EU Emissions Trading System
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GHG	Greenhouse Gases
GVA	Gross Value Added
HDB	Hellenic Development Bank
ICT	Information and Communication Technologies
IED	Industrial Emissions Directive
IIoT	Industrial Internet of Things
INCITE	Innovation Centre for Industrial Transformation and Emissions
IoT	Internet of Things
IP	Intellectual Property
IPCEI	Important Project of Common European Interest
JMD	Joint Ministerial Decision
KPI	Key Performance Indicator
LEED	Leadership in Energy and Environmental Design
LGO	Local Government Organisation

LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LULUCF	Land Use, Land-Use Change and Forestry
MAFs	Mixture Assessment Factors
NDP	National Development Programme
NPWM	National Planning for Waste Management
NRRP	National Recovery and Resilience Plan
NSSS	National Smart Specialisation Strategy
PACT	Public Activities Coordination Tool
PARC	Partnership for the Assessment of Risks from Chemicals
PAYT	Pay-As-You-Throw
PBT/vPvB	Persistent, Bioaccumulative and Toxic/very Persistent and very Bioaccumulative
PCB/PCT	polychlorinated biphenyls/polychlorinated terphenyls
PFAS	Per-and polyfluoroalkyl substances
PIP	Public Investment Programme
PPA	Power Purchase Agreements
PWMP	Regional Waste Management Plans
R&D	Research and Development
RDP	Regional Development Programme
RDPA	Regional Development Partnership Agreement
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RED	Renewable Energy Directive
RES	Renewable energy sources
RFNBO	Renewable Fuels of Non-Biological Origin
RRF	Recovery and Resilience Facility
RRU	Recycling Recovery Units
RSC	Recycling Sorting Center
SCC	Sustainable Carbon Cycles
SCF	Social Climate Fund
SDP	Sectoral Development Programme
SET Plan	Strategic Energy Technology Plan
SFDR	Sustainable Finance Disclosure Regulation
SMEs	Small and Medium-sized Enterprises
SRIP	Strategic Research and Innovation Partnership
SSbD	Safe and Sustainable by Design
STEM	Science, Technology, Engineering, and Mathematics
TEN-E	Trans-European Networks for Energy
TEN-M	Trans-European Transport Networks
TRL	Technology Readiness Level
UN	United Nations
VR	Virtual Reality
WTU	Waste Treatment Units

FOREWARD

The European Green Deal and its framework strategies, such as the Chemicals Strategy for Sustainability, pose significant challenges to the chemical industry. Chemicals are present in almost every strategic value chain, while the role of the chemical industry in developing innovative technologies to achieve climate goals is pivotal. The Greek chemical industry today faces a multiple challenge: achieving climate neutrality in its production processes, contributing materials and products to reduce the carbon footprint in other sectors, enhancing product circularity, providing solutions for recycling, removing toxic substances, and digitalising itself. This is an industrial transformation that requires appropriate planning and significant investments that will lead to ensuring the resilience and competitiveness of the Greek chemical industry, so that the sector can effectively contribute to the policy objectives of the European Green Deal.

The green and digital transition of the Greek chemical industry aims to create a sustainable, innovative, and internationally competitive sector, aligned with the principles of environmental responsibility, digital progress, and economic growth. The intended vision for the chemical industry in Greece is to act as a model of environmental management, technological innovation, and economic prosperity. By adopting sustainability principles, digitalisation and strengthening international cooperation, the chemical industry in Greece can be transformed, contributing to a more resilient, competitive, and sustainable future for Greece.

The sector's sustainability and environmental responsibility will be enhanced by the extensive use of new energy products with zero greenhouse gas emissions as well as renewable energy sources that will reduce carbon emissions and dependency on non-renewable energy sources. Circular economy principles should be adopted by minimising waste, but also by promoting the recycling and reuse of materials throughout the entire life cycle of products. Investments in research and development of green chemistry practices are particularly important, focusing on the design of products and processes that eliminate or minimise the use and production of hazardous substances.

The chemical industry should adopt smart manufacturing processes and technologies, leveraging the Internet of Things (IoT), artificial intelligence (AI) and automation, which will improve the efficiency of production and chemical processes, reduce energy consumption, and enhance the overall operational efficiency of the sector. The collection and sharing of data within industry is crucial, especially at European level, and combined with data analysis will enhance decision-making across the value chain, from supply chain management to product development, ensuring that resource management is optimised. The digitalisation of the chemical supply chain will enhance transparency and cooperation in the sector while minimising its environmental impact.

The Greek chemical industry can support the country's economic development by creating innovation hubs and research centres dedicated to green and digital technologies in the chemical industry, strengthening cooperation between academia, industry and government agencies. The strengthening of the international cooperation of the chemical industry for the exchange of best practices, access to cutting-edge technologies and the emergence of Greece as an important player in sustainable and digital chemical production will have a positive impact. It is particularly important to create a regulatory framework that encourages private sector investment and public-private partnerships in green and digital initiatives, by incentivising businesses aligned with the objectives of the double transition. At the same time, investment in training programmes for workers in essential skills for the digital transition is needed, ensuring a trained and adaptable workforce. Finally, consideration should also be given to potential social impacts, by activating actions that minimise them.

The European Transition Pathway for the chemical industry sets the framework for defining the relevant actions of policy actors and stakeholders in the EU Member States in the coming years, so that the transition can meet the objectives pursued. The Transition Roadmap for the Greek chemical industry reflects the objectives and content of the European Transition Pathway, but at the same time considers the existing initiatives and specificities of the chemical industry in Greece, raising all critical issues and providing information on the progress towards achieving the objectives. Furthermore, it highlights the need for predictability and proper information of the regulatory framework that drives the transition, as well as the need to invest promptly to enable long-term objectives to be achieved. Finally, it aspires to motivate businesses to choose a strategy to follow, considering that each company, depending on its role in the chemical industry, should take different actions. The ambition of the National Roadmap is to be a useful tool to raise awareness of the challenges of the multifaceted transition of the chemical industry and to promote cooperation between pertinent authorities, the chemical industry, and other stakeholders at national and European level.

1 INTRODUCTION

In January 2023, the European Commission published the Transition Roadmap for the Chemical Industry in the European Union (EU)[1]. It is an action plan jointly developed by the European Commission, EU Member States, chemical industry actors and other stakeholders, which identifies the actions needed and the conditions to achieve the green and digital transitions (double transition) and improve the resilience of the chemical industry, in line with the updated EU Industrial Strategy[2]. The Transition Roadmap for the Chemical Industry contains a list of 187 actions, grouped into 8 building blocks and 26 topics, to be implemented by stakeholders within an agreed timeframe.

The European Transition Roadmap for the Chemical Industry sets the framework that will define the relevant actions of policy actors and stakeholders in the EU Member States in the years to come. At the same time, it can provide the basis for the development of corresponding national transition roadmaps, which will allow actions to be implemented more effectively, considering the specificities of the chemical industry in each EU Member State.

In this context, this **Transition Roadmap for the chemical industry in Greece** reflects the objectives and content of the European Transition Roadmap, but at the same time considers the existing initiatives and specificities of the chemical industry in Greece. The ambition of the National Roadmap is, first, to be a useful tool to raise awareness of the challenges of the multifaceted transition of the chemical industry and to promote cooperation between pertinent authorities, the chemical industry and any other interested party at national level and secondly, to provide necessary information to the European Chemical Industry Sector Operators (CEFICs) in the co-implementation process of the Transition Roadmap at European level.

In particular, the Transition Roadmap for the chemical industry in Greece has the following contents:

1. **Description of the chemical industry landscape in Greece**. This chapter analyses the latest data and the structure of the chemical industry in Greece, identifies the main specificities of the chemical industry and the characteristics that differentiate it from the rest of Europe.
2. **Existing strategies for the green and digital transition of the chemical industry in Greece**. This chapter presents the policy framework and summarises past and current strategies and/or initiatives that may contribute to the green, circular, and digital transition of the Greek chemical industry. In particular, the existing initiatives, national strategies, road maps and tools supporting the financing of investments directly or indirectly related to the chemical industry in Greece are presented and the national specificities representing advantages or obstacles in the transition (such as infrastructure, resources, etc.) are analysed. In addition, a comparison of the European Transition Roadmap and existing and/or planned national strategies and financial instruments is carried out to identify potential gaps and needs to introduce additional regulatory measures and policy objectives.
3. **Analysis of the actions needed to accelerate the green and digital transitions while achieving the resilience of the chemical industry in Greece**. This chapter examines the 187 actions mentioned in the chapters of the 8 building blocks of the European Transition Roadmap for the chemical industry, to identify those related to the chemical industry in Greece. For the selected actions, the following are considered: a) the existing potential at national level, which already contributes to the transformation and resilience of the chemical industry and how this potential can be strengthened and b) the factors that pose barriers to the transformation of the chemical industry and how to remove these barriers. This analysis identifies the necessary actions to enable the transition, is

[1] https://ec.europa.eu/docsroom/documents/54595/attachments/1/translations/en/renditions/native
[2] Com(2021) 350 final. Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery.

classified according to the implementation time horizon (short, medium and long term) and identifies the actors responsible for their implementation (European Union, government, chemical industries, industrial entities, other stakeholders).

4. **Identification of roadmaps for the chemical industry in Greece, which are oriented towards actions, technology, and regulatory framework**. This chapter identifies indicative roadmaps for the selected actions, technology, and regulatory framework, which are a central element of the transition path. The aim is to clarify the actions needed and the expected technological solutions. It also provides a full picture of the regulatory obligations that the chemical industry must comply with and stresses the importance of prioritisation/succession of regulatory milestones and ensuring consistency between regulations.
5. **Conclusions and next steps**. This chapter summarises the findings on the specificities of the chemical industry in Greece, the existing and planned policy framework, the actions to be implemented and the main actions to be taken by the government and the chemical industry. I also proposes the next steps for a national co-implementation process which may include, but are not limited to, an annual meeting of stakeholders participating in the co-implementation of the Transition Roadmap, an annual progress report to monitor progress, the establishment of dedicated working groups to monitor the high priority issues identified in the National Roadmap and an annual stakeholder survey to help implement actions and objectives of the Transition Roadmap.

2 THE LANDSCAPE OF THE CHEMICAL INDUSTRY IN GREECE

2.1 Key categories and value chain of chemicals

The chemical industry produces a multitude of chemicals, as well as intermediate and final products. The main categories of chemicals and products are **basic chemicals**, **specialty chemicals** and **consumer chemicals**[3].

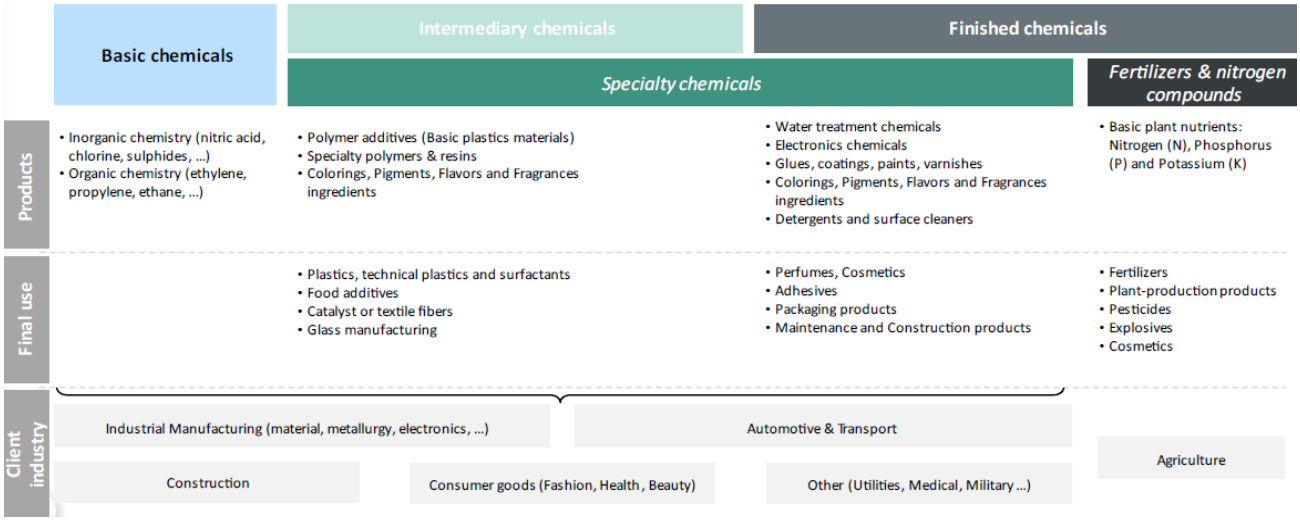
- **Basic chemicals**, produced in the early stages of the chemical industry value chain, constitute a broad category of chemicals used primarily as inputs in various production value chains, both in the chemical industry itself and in other industries. They include organic chemicals, inorganic chemicals used in the composition of products, petrochemicals, fertilisers, industrial gases, etc.
- **Specialty chemicals** are produced by chemical processes in which the basic –mainly organic– chemicals are used as inputs. As intermediate products, they typically serve specific functions in the production processes of other industries and in many cases are designed to meet the specific needs of users. To a lesser extent, they are also purchased by final consumers. They include products such as agrochemicals (insecticides, herbicides, plant growth regulators, inorganic fungicides, bactericides and seed treatment products, rodenticides, and other plant protection products), disinfectants, paints, coatings and varnishes, thermal insulation materials, inks, dyes, biofuels, etc.
- **Consumer chemicals** are sold directly to final consumers. They include a wide variety of products such as soaps, shampoos, detergents, perfumes, cosmetics, skin care preparations, creams and similar preparations, room fragrance preparations, hair preparations, oral or dental hygiene preparations, mano and other nail care preparations, cleaning ointments and powders, etc.

Chemicals and products are fundamental inputs to other economic activities, enable the development of activities and products with high value for consumers, facilitate innovation in many sectors and boost productivity. The value chain of the chemical industry is diverse and includes many different products supplying numerous end applications that are central to the Greek economy (Table 2.1). With its production range including petrochemicals, industrial medical gases, fertilisers, synthetic fibres, plastic raw materials, construction chemicals and paints, the chemical industry has a decisive influence on the activity and development of intermediate and final products across a number of industries ranging from the primary sector, the plastic-rubber industry, the food industry, the textile-clothing industry, the metal industry and constructions up to more technologically advanced industries such as pharmaceutical, automotive and electronics, as well as in the health sector. The production of consumer chemicals, such as detergents and cosmetics, is an equally important sector of the chemical industry, which complements the chemical industry's range of production activities. Furthermore, chemicals such as ammonia and hydrogen are also used as energy sources and are going to be critical to the intended transition towards a climate-neutral economy.

The most important sectors-buyers of chemicals in Greece are Plastics and Rubber production sectors, Health Services, the Agriculture sector, the Construction sector and Basic Metals production. A significant part of the chemical sales take place within the industry, while the largest percentage of chemicals sold in Greece concerns consumer chemicals.

[3] In the official statistical classification of sectors of economic activity (NACE rev.2), the chemical industry is described as "Manufacture of chemicals and chemical products" (sector NACE 20). The activities included in this sector as well as the matching of these activities to the categorization we follow in this study are presented in the Annex of the study.

Table 2.1: Chemical industry value chain



Source: CEFIC

2.2 Trends in the Greek chemical industry

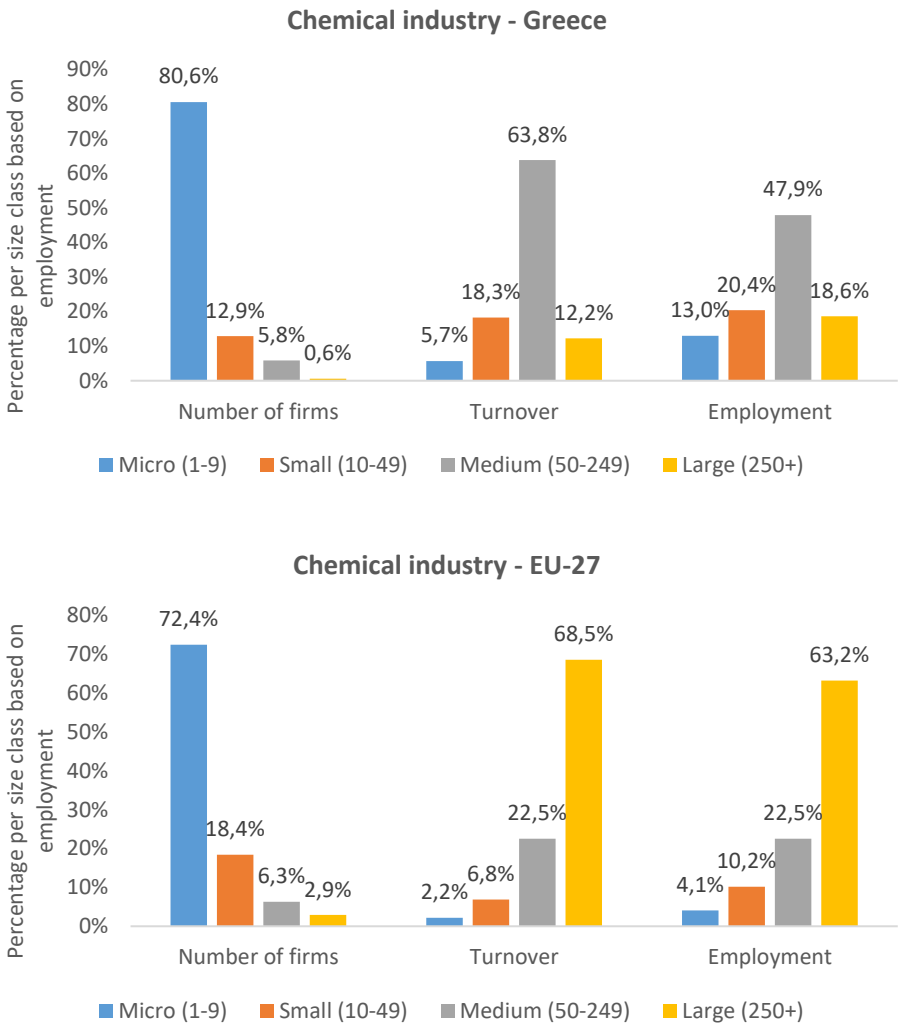
2.2.1 NUMBER AND SIZE OF ENTERPRISES

There are 960 companies active in the chemical industry in Greece, employing 12.439[4] people[5]. Most of them are engaged into activities related to the production of consumer (47 %) and specialty chemicals (34 %), such as detergents, cosmetics, construction and insulation materials, paints, and biofuels, while few micro-enterprises are active in nanomaterials. The very few largest companies are involved in the production of basic chemicals, mainly petrochemicals, inorganic fertilisers and polymers.

Almost all chemical enterprises in Greece can be classified as small and medium-sized enterprises, with only 0.6 % of the total number of enterprises employing more than 250 people. Of all the businesses in the sector, 186 (19% of the total) employ more than 10 persons, accounting for 94% of the sector's turnover, while 62 (6% of the total) employ more than 50 persons, accounting for 76% of total turnover (Graph 2.1). Similarly, in the EU-27, enterprises employing more than 50 people account for 28% of the total number of enterprises and 91% of the chemical industry's turnover. Very small chemical enterprises in Greece (employment up to 9 people), although they constitute the majority, account for only 6% of total turnover and 13% of all workers in the chemical industry (2% and 4% respectively in the EU-27). Therefore, the chemical industry in Greece includes enterprises of significantly smaller sizes compared to the EU-27, while the largest proportion of sales represents medium-sized enterprises, in which between 50 and 249 people are employed.

[4] According to the latest available Eurostat data for the year 2021.
[5] In addition, around 1,850 companies, with a turnover of 2.6 billion euros, are active in the wholesale trade of chemicals (NACE 46.75). Some 7,500 people work in these businesses.

Graph 2.1: Breakdown of number of enterprises. turnover and employees by size category of enterprises based on employment in Greece and the EU-27, 2021



Source: Eurostat, IOBE analysis

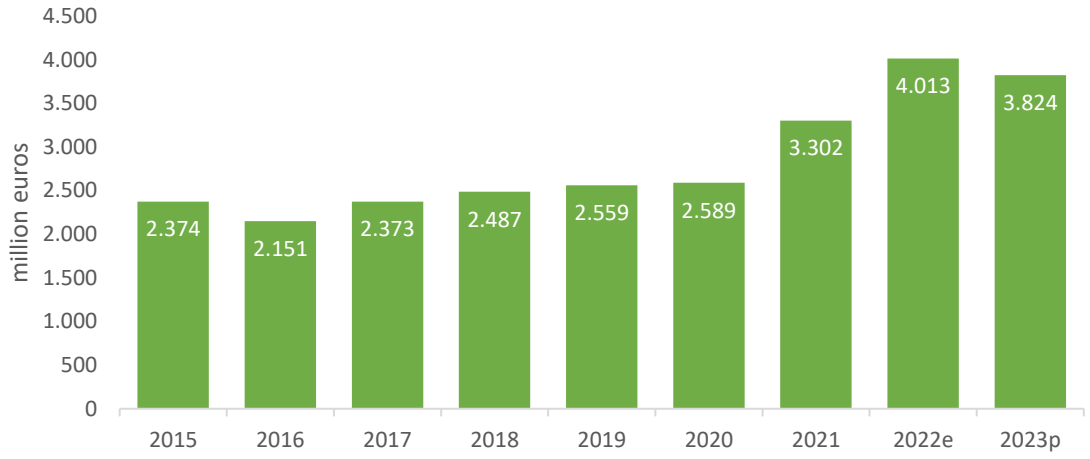
Almost two out of three chemical companies operating in Greece are located in Attica (44%) and Central Macedonia (21%). There is, therefore, a significant concentration of the sector in these regions, which are located close to consumption centres and critical infrastructure for the supply of chemical raw materials and for the export of products (e.g. production facilities and ports) and at the same time facilitate access for companies in the sector to skilled human resources. As these regions are comparatively more developed in Greece, most chemical companies are potential recipients of investment aid from national development law and EU financial resources with the lowest intensity aid, as foreseen in the EU regional aid map and lack of sufficient funds in relation to growing needs. This should be considered in the design of national industrial policy and other relevant policies that will facilitate the transition path of the chemical industry.

2.2.2 TURNOVER

The turnover of chemical companies in Greece is estimated at 3.8 billion euros in 2023, down by 5% compared to 2022, when it increased significantly due to rising energy costs and prices of chemical raw materials and products (Graph 2.2). The largest share of the turnover is specialty chemicals (1.3 billion

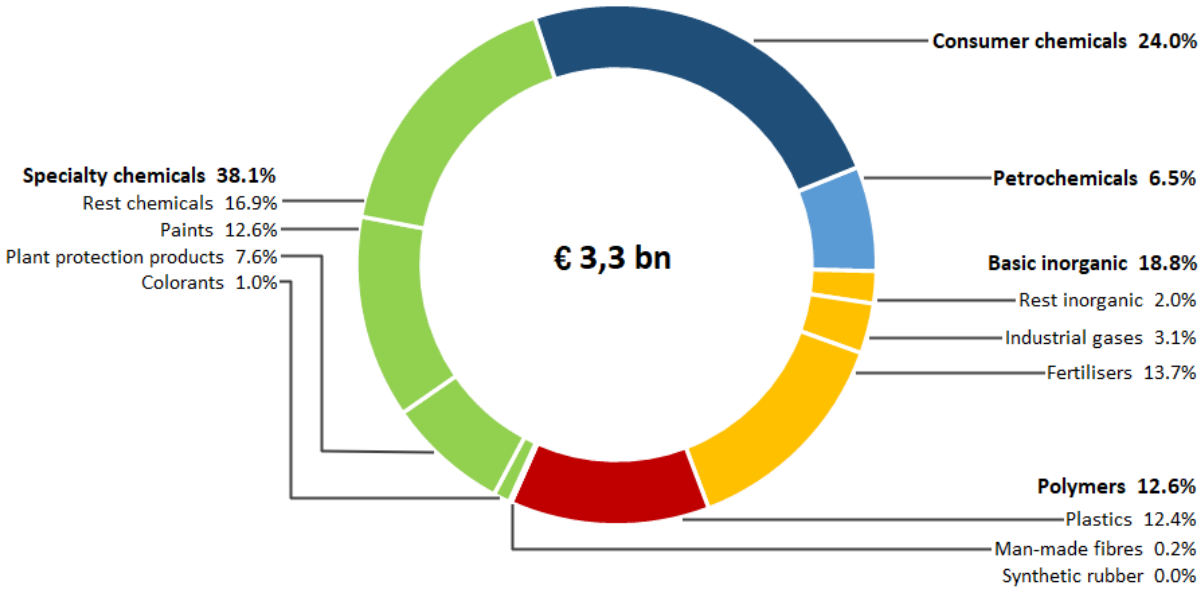
euros or 38% of the total in 2021), while the consumer chemical production sector also has a high weight with 792 million euros or 24% of the total turnover (Graph 2.3). Basic chemicals account for the remaining 1.3 billion euros or 38% of total turnover, compared to around 58% in the EU-27, suggesting a much lower growth in the production of basic chemicals in Greece, particularly in the petrochemicals and polymers sectors.

Graph 2.2: Chemical Industry turnover in Greece, 2015-2023



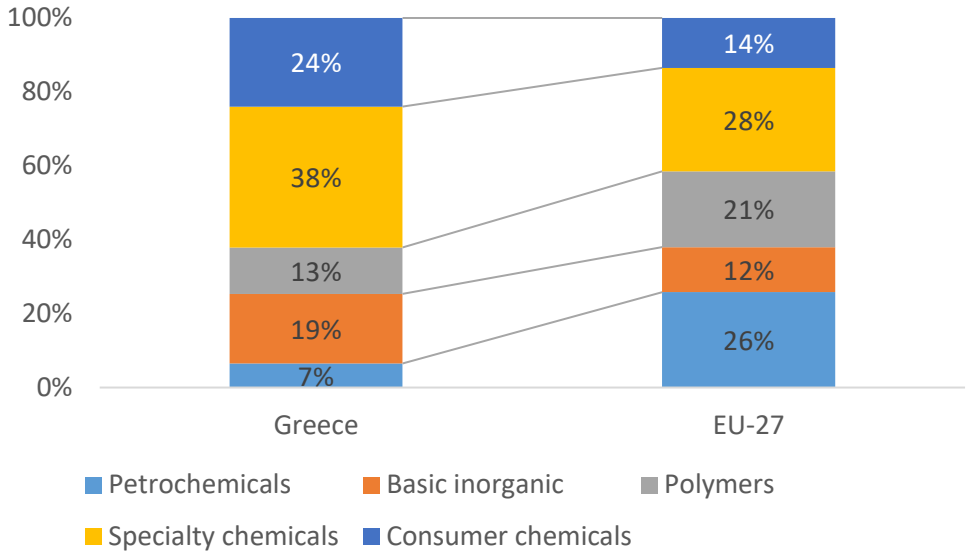
Source: Eurostat, IOBE estimates for 2022 and 2023

Graph 2.3: Chemical industry turnover by category, 2021



Source: Eurostat, IOBE analysis

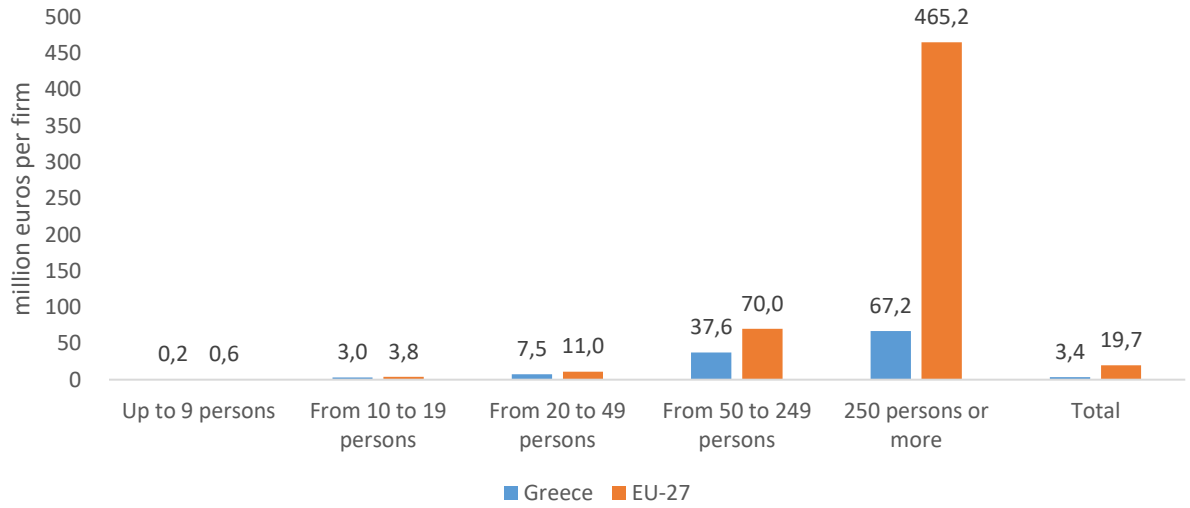
Graph 2.4: Breakdown of turnover by chemical industry category in Greece and the EU-27, 2021



Source: Eurostat, IOBE analysis

On average, the sales of companies active in the chemical industry in Greece are well below those in the EU-27 (Graph 2.5). Overall, sales per company in Greece reached 3.4 million euros in 2021, when the average in the EU-27 is 19.7 million euros. This differentiation occurs in all business size categories (based on employment), but is more pronounced, in absolute terms, in the category of large enterprises, where sales per company were 4655.2 million euros on average in the EU-27, compared to 67.2 million euros in Greece. The degree of integration, specialisation, and organisation of individual enterprises and the chemical industry, as well as the size of the markets targeted by chemical enterprises, have a significant impact on this distribution.

Graph 2.5: Average turnover of chemical enterprises in Greece and the EU-27 by employment size, 2021

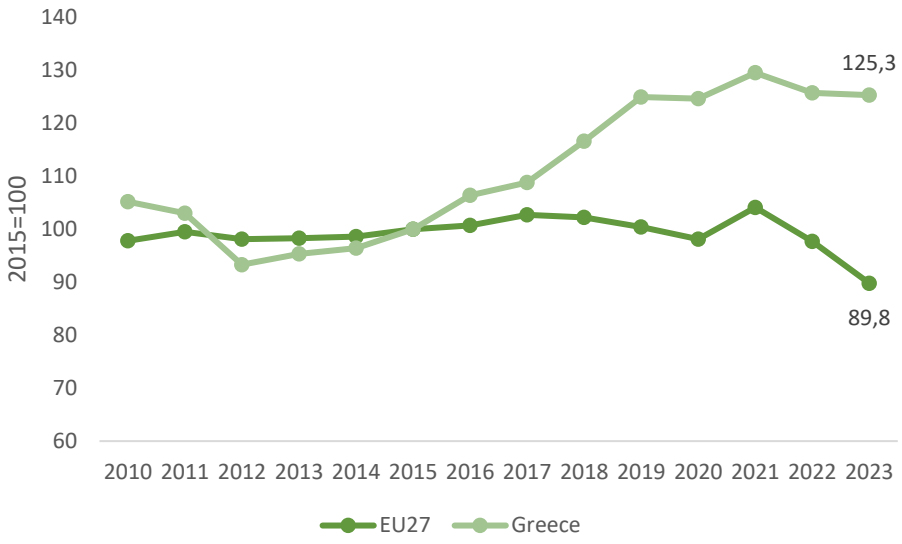


Source: Eurostat. Analysis of IOBE.

2.2.3 PRODUCTION AND PRICES

The volume index of domestic production of chemicals and products is estimated to have declined marginally in 2023 by 0.3% compared to the previous year, following a decrease of 2.9% in 2022 (Graph 2.6). However, domestic chemical production is estimated to be 25% higher in 2023 compared to 2015, with a better performance of the Greek chemical industry than the chemical industry in the EU-27, where chemical production is estimated to have declined by 8.1% in 2023 and 6.1% in 2022, while lies at a level around 10% lower than in 2015. Overall, the COVID-19 crisis and the energy crisis in 2021/2022 affected relatively mild the domestic chemical production, in contrast to the developments in the EU-27. This measurable demonstration of resilience is largely due to the structure of the chemical industry in Greece, which overall focuses on activities with lower energy intensity, as well as due to the stronger domestic demand for chemicals. The main cause is, in addition, the improved export performance of some sub-branches of the chemical industry (e.g. construction chemical materials) that strengthened their international competitiveness by overcoming successive crises, notably the economic crisis in the 2010s.

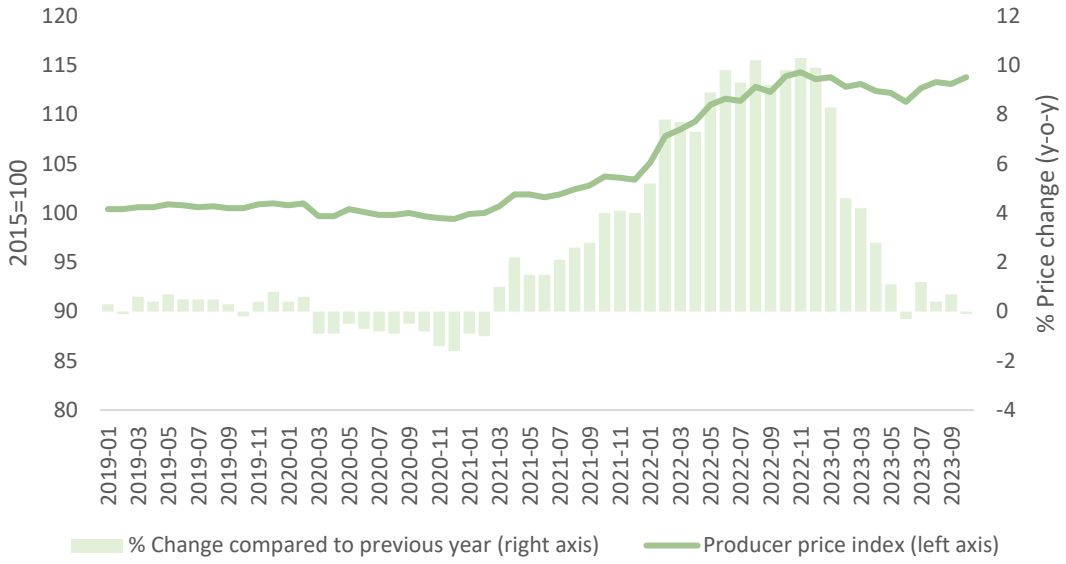
Graph 2.6: Chemical Industry Production Index in Greece and the EU-27, 2015-2023



Source: Eurostat. (e) IOBE estimation

Between the beginning of 2021 and October 2023, along the evolution of the energy crisis in Europe, chemical producer prices in Greece increased by 13.7% (Graph 2.7). The rise in prices in Greece was particularly mild when compared to the EU-27, where producer prices of chemicals increased by 31.0% over the same period. The relative normalisation of energy markets and the decline of energy prices since the end of 2022 led to a slight decline in producer prices of the chemical industry in both Greece and the EU-27.

Graph 2.7: Chemical Industry Producer Price Index in Greece, Jan 2019 – Oct 2023

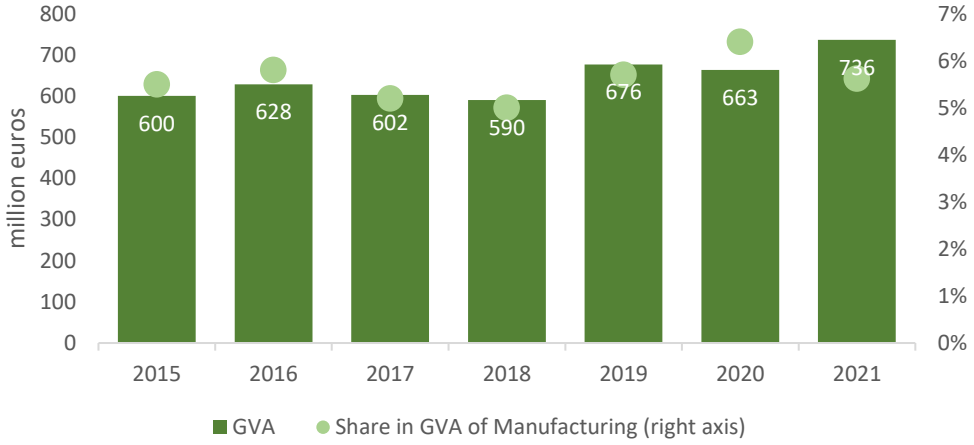


Source: Eurostat, IOBE analysis

2.2.4 GROSS VALUE ADDED

The chemical industry is one of the largest sectors of domestic manufacturing. The sector's gross value added (GVA) stood at 736 million euros in 2021, representing 5.6% of Manufacturing GVA (Graph 2.8). Compared to 2015, the GVA of the chemical industry has been enhanced, but at a rate similar to total Manufacturing, as indicated by the relative stability of its share in the GVA of Manufacturing.

Graph 2.8: Gross Value Added of Chemical Industry in Greece, 2015-2021

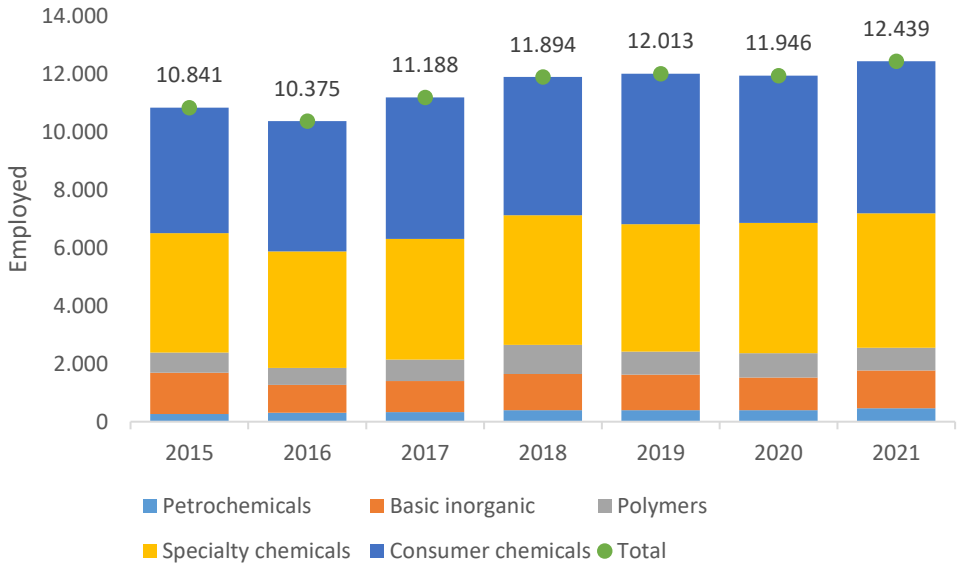


Source: Eurostat, IOBE analysis

2.2.5 EMPLOYMENT

In 2021, employment in the chemical industry in Greece reached 12.440 jobs, representing 3.4% of total employment in Manufacturing (Graph 2.9). Almost 80% of workers (9,800 persons) are employed in the specialty and consumer chemicals sectors, while the participation of the remaining sectors is smaller. Employment in the sector has recovered in recent years and is at a level 15% higher than in 2015. The majority (~70 %) of jobs in the chemical industry are for highly skilled employees and workers.

Graph 2.9: Employment in the Chemical Industry in Greece by department, 2015-2021



Source: Eurostat, IOBE analysis

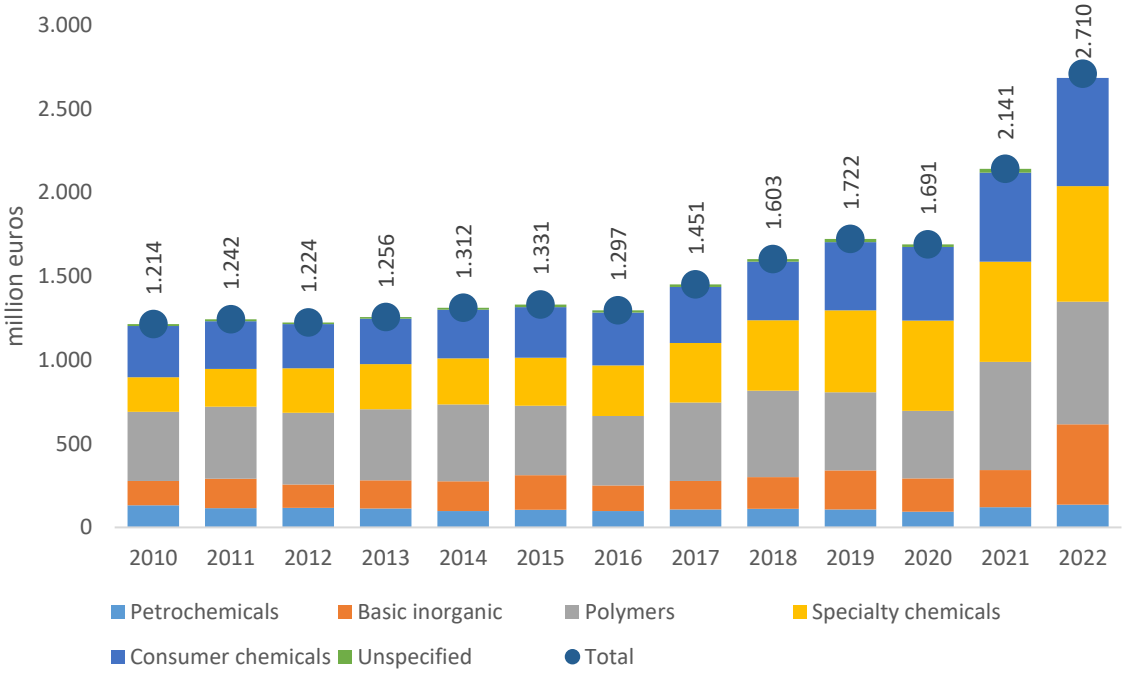
2.2.6 FOREIGN TRADE

Exports of chemicals and products reached 2.7 billion euros in 2022, a significant increase of 27% compared to 2021 and 60% compared to 2020[6] (Graph 2.10). Chemicals are one of the most important categories of Greek exports, contributing 5.0% of their total value in 2022. Polymers and specialty chemicals are the largest categories in Greek chemical exports, as in 2022 they accounted for 27% and 26% respectively of total chemical exports. Approximately ¼ of exports consists of consumer chemicals, with smaller percentages followed by basic inorganic chemicals (mainly fertilisers) and petrochemicals.

On the other hand, chemical imports reached 7.3 billion euros in 2022, up 26% from the previous year. Chemical imports accounted for 7.9% of total imports of products into Greece. Petrochemicals, specialty chemicals and polymers are the largest categories in Greek chemicals exports, with shares of 30%, 25% and 22% respectively of all chemical imports in 2022. The basic chemicals (petrochemicals, basic inorganic and polymers) account together for 63% of chemical imports, indicating the high dependence of the Greek chemical industry on imported chemicals. Overall, the trade balance of chemicals and products in Greece is in deficit, which amounted to 4.6 billion euros in 2022.

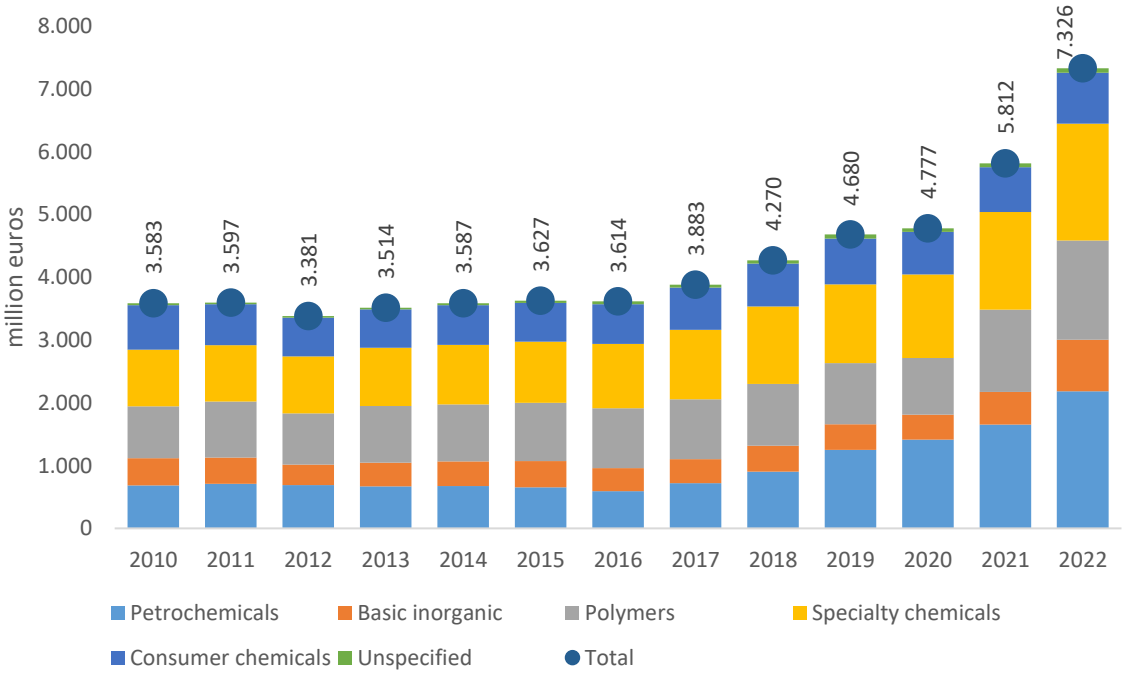
[6] This section uses the data of the International Trade Coding CPA 2008, which fully corresponds to the NACE classification of industries of economic activity. Other product classification schemes for foreign trade statistics may give different trade sizes for chemicals, as they may include more or fewer products.

Graph 2.10: Exports of chemicals and substances, 2010-2022



Source: Eurostat, IOBE analysis

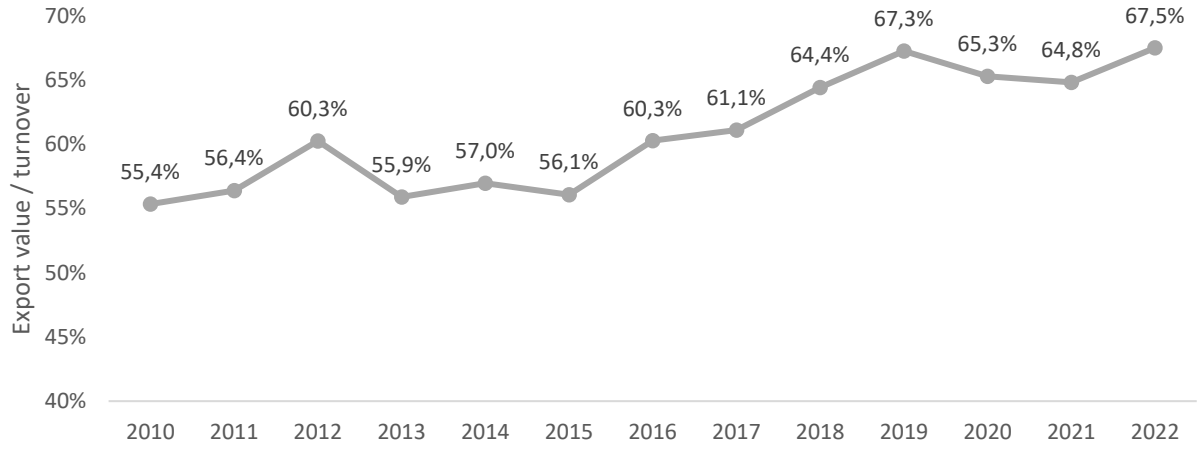
Graph 2.11: Imports of chemicals and substances, 2010-2022



Source: Eurostat, IOBE analysis

The extroversion of the chemical industry increased after 2010, with the relevant index (value of chemicals exports to turnover) standing at 67.5% in 2022 from 55.5% in 2010 (Graph 2.12). The large exposure of the industry's production to foreign markets is in principle positive, but renders ensuring the competitiveness of the domestic chemical industry even more critical, so that its contribution to the Greek economy can be maintained and/or increased in the future.

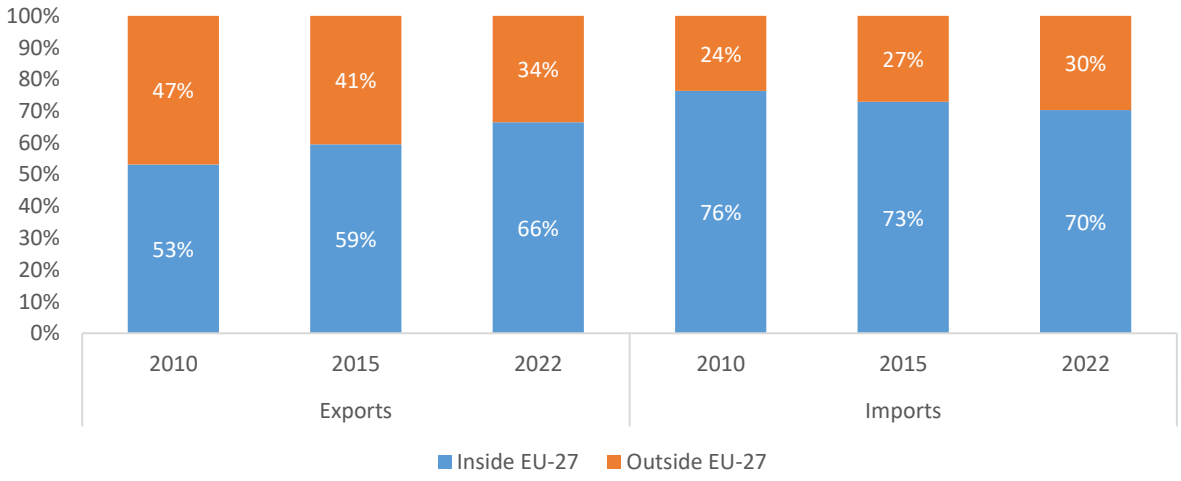
Graph 2.12: Extroversion Index of Chemical Industry in Greece, 2010-2022



Source: Eurostat, IOBE analysis

Greek chemical exports are mainly directed to other EU-27 Member States, with their share increasing to 66% in 2022 from 53% in 2010 (Graph 2.13). Similarly, imports of chemicals mainly come from other EU-27 Member States, but there is a gradual increased tendency of the share of imports from non-EU27 countries.

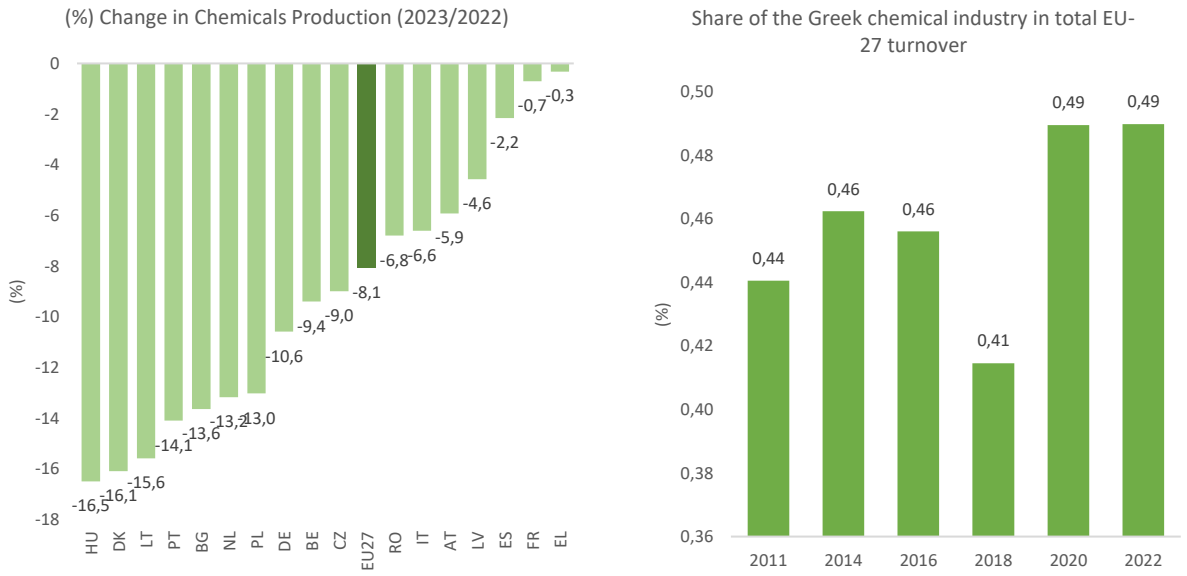
Graph 2.13: Shares of Greek exports and imports of chemicals within and outside the EU-27



Source: Eurostat, IOBE analysis

The increasing share of Greek exports to other EU-27 Member States suggests a high dependence of Greek chemical industry exports to economies that, at present, have lost their dynamism, while in the medium term they are likely to be under strong pressure due to demographic and other factors. In 2023, the Greek chemical industry showed resilience, as the production volume recorded marginal losses, in contrast to the rest of the EU-27 Member States (Graph 2.14). Combined with the very small share in the total of the European chemical production –highlighting the significant potential for growth– Greece, due to its geographical location, could reduce its trade balance deficit by increasing exports of products with a reduced environmental footprint to emerging third countries, which will also improve the European trade balance of chemicals.

Graph 2.14: Chemical production in the EU-27 in 2023 and share of Greek chemical industry in EU-27 turnover

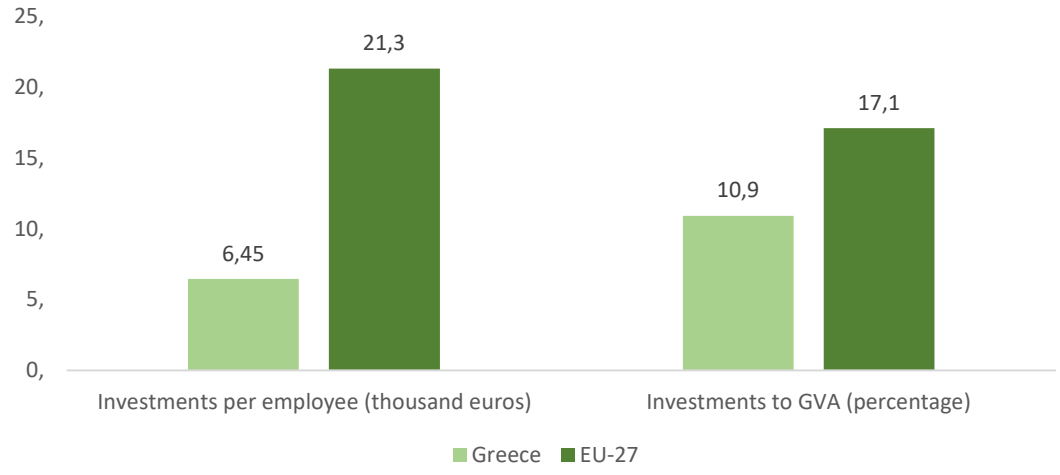


Source: Eurostat, IOBE analysis

2.2.7 Investments and Productivity

The chemical industry in Greece lags considerably in terms of investments compared to the EU-27 chemical industry. The investment per employee is estimated at 6.5 thousand euros in 2021, compared to the average of 21.3 thousand euros in the EU-27 (Graph 2.15). Moreover, the investments of the chemical industry in Greece accounted for 10.9% of its gross value added compared with 16.1% in the EU-27.

Graph 2.15: Chemical industry investment indicators in Greece and the EU-27, 2021



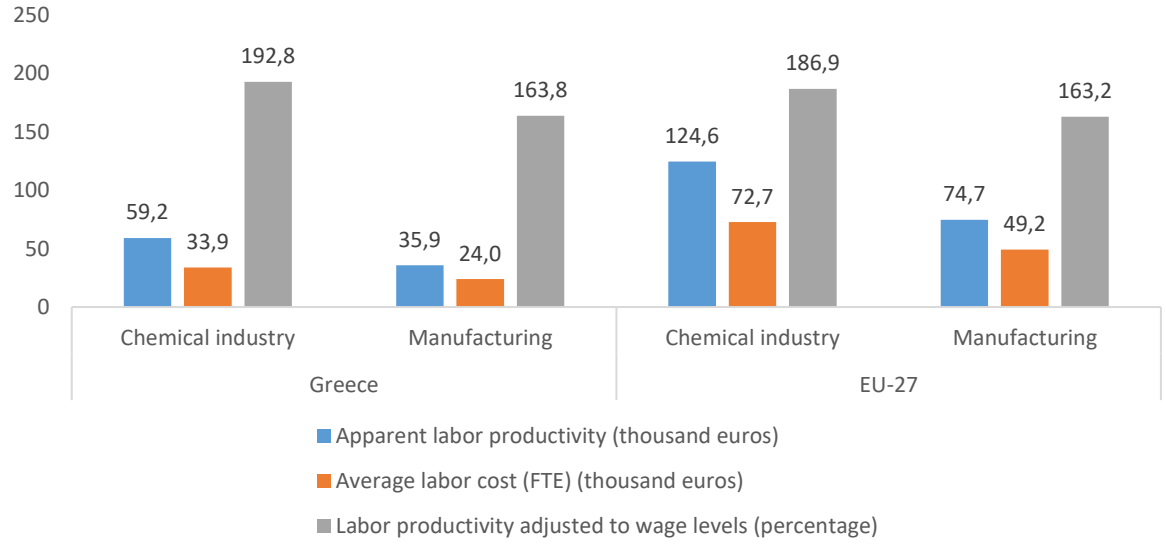
Source: Eurostat

The chemical industry in Greece has higher labour productivity[7] and higher average wages (average labour costs) than domestic manufacturing (Graph 2.16). In particular, the value added per employee in the

[7] Productivity is generally defined as the ratio between outputs and inputs of a production process. Labour productivity is closely linked to growth, competitiveness and living standards in an economy. The apparent productivity of labour is used here, which is calculated as the ratio of gross value added and the number of persons employed in the chemical industry.

chemical industry was 59.2 thousand euros in 2021, 65% higher than the average in Manufacturing (33.9 thousand euros). The difference in labour productivity is reflected in the average labour cost, which in the same year was 41% higher in the chemical industry than the average of the Manufacturing industry. The chemical industry is therefore one of the sectors of domestic manufacturing with relatively better paid jobs –most of which, as mentioned above, require high skills.

Graph 2.16: Productivity and labour cost indicators of the chemical industry, 2021



Source: Eurostat

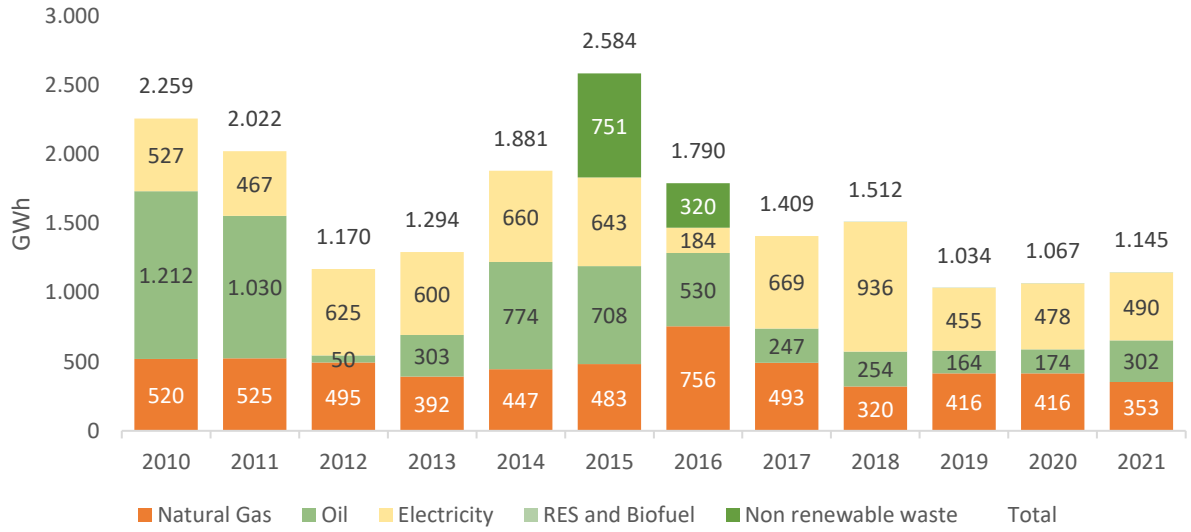
Productivity and labour costs in the EU-27 are 2.2 times higher than in Greece, but with the adjustment of productivity to wage levels the situation is balanced to a great degree. Differences in labour productivity can be attributed, inter alia, to levels of organisation, capital, technology, innovation and human resource skills in advanced chemical industries. The significant strengthening of investment by chemical companies in Greece is therefore essential both to improve productivity and wages, and to adapt to the requirements of the intended green and digital transition of the chemical industry.

2.3 Energy consumption

In 2021, energy consumption by the chemical industry[8] in Greece reached 1.145 GWh (Graph 2.17). This figure corresponds to about 4% of total energy consumption by industry in Greece in the same year and is 49% lower than in 2010. Energy consumption in the domestic chemical industry has therefore been significantly reduced, partly due to improvements in its energy efficiency. The bulk of the chemical industry's total energy consumption (490 GWh or 43% of the total) in 2021 was of electricity. The chemical industry also consumes significant amounts of natural gas (353 GWh in 2021 or 31% of total energy consumption) and petroleum products (302 GWh or 26% of total energy consumption). Consumption of petroleum products (mainly LPG) increased significantly in 2021, due to an increase in the price of natural gas that led to alternatives.

[8] This includes the pharmaceutical industry.

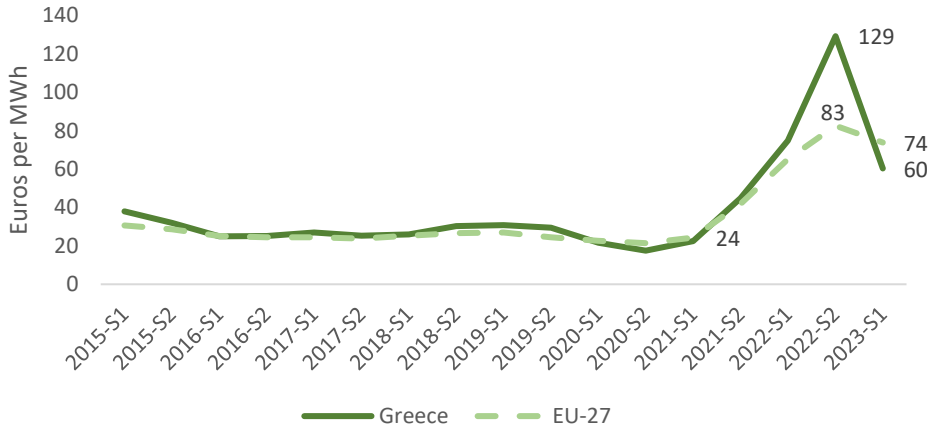
Graph 2.17: Final energy consumption per energy source in the chemical and petrochemical industry (GWh)



Source: Eurostat

The increased energy prices in Greece during the energy crisis had a negative impact on the competitiveness of the Greek chemical industry. According to Eurostat data, the average gas price in Greece (excluding VAT) for annual business consumption from 100.000GJ to 999.999GJ in 2017-2019 was between 25-31 euros/MWh (Graph 2.18). The decline in international gas prices during the COVID-19 pandemic led to a decrease in domestic gas prices to 18 euros/MWh in 2020. However, from the second half of 2021 gas prices strongly increased, and peaked in the second half of 2022, when prices reached 130 euros/MWh, a level higher by 345% compared to the average price in 2015-2019. In 2023 prices started to de-escalate, which by the first half of the year had fallen to 60 euros/MWh but remained twice as high as in the pre-2020 period. It is worth noting that gas prices followed a similar pattern in the same period in the whole EU-27, but at their peak in the second half of 2022 they were significantly lower than in Greece.

Graph 2.18: Gas prices for enterprises for Consumption from 100 000GJ to 999 999GJ - Band I3 (excluding VAT and other recoverable taxes)

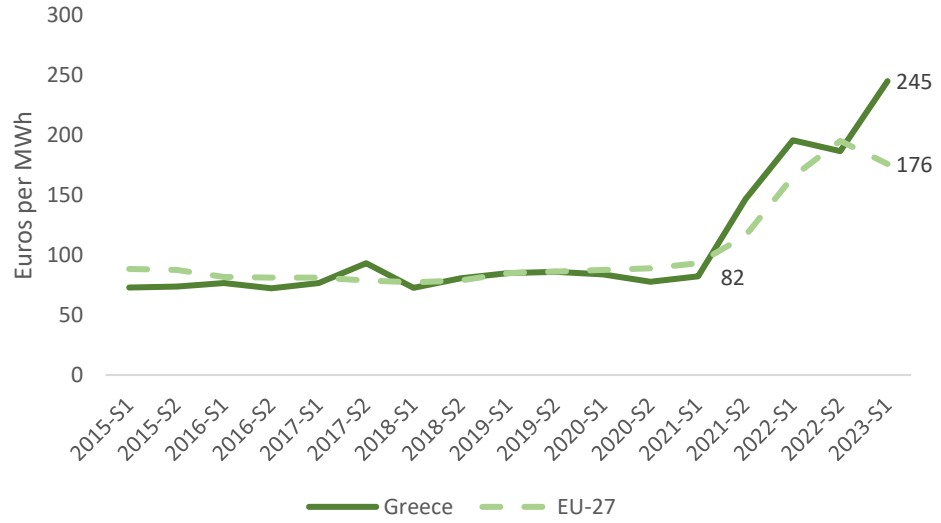


Source: Eurostat

The average electricity price in Greece (excluding VAT) for annual business consumption between 20GWh and 70GWh in the period 2017-2020 was between 72-93 euros/MWh (Graph 2.19). From the second half

of 2021, the strong increase in electricity prices peaked in the first half of 2023, when prices reached 245 euros/MWh, 210% higher than the average price in 2015-2020. Electricity prices in the EU-27 followed a similar pattern over the same period, but during the energy crisis prices in Greece were consistently higher.

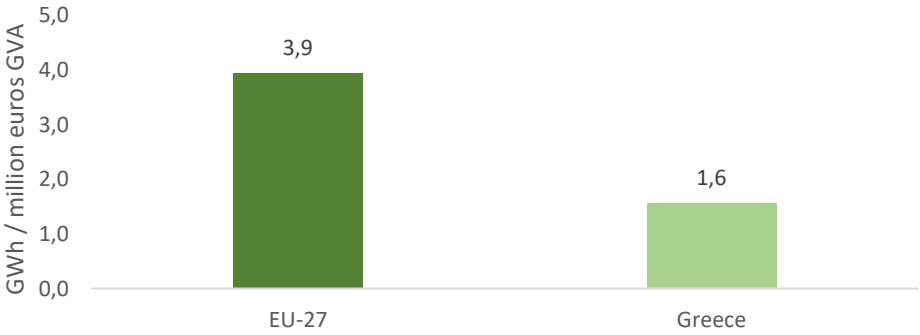
Graph 2.19: Electricity prices for enterprises for Consumption from 20000 to 69 999 MWh - Band IE (excluding VAT and other recoverable taxes)



Source: Eurostat

Compared to the EU-27, the chemical industry in Greece has on average significantly lower energy consumption intensity than the value added produced (Graph 2.20). This is due to the limited development of the key chemicals and products sector in Greece, which is energy intensive. Therefore, the path of the domestic chemical industry towards the green transition, in terms of energy efficiency and clean energy use for energy purposes, appears not to be as demanding as those in EU-27 Member States that have a highly developed activity in the production of basic chemicals. But this is not the case for the few large Greek industries that produce petrochemicals, fertilisers, raw materials such as chlorine, etc.

Graph 2.20: Final energy consumption to Gross value added in the chemical industry, 2021

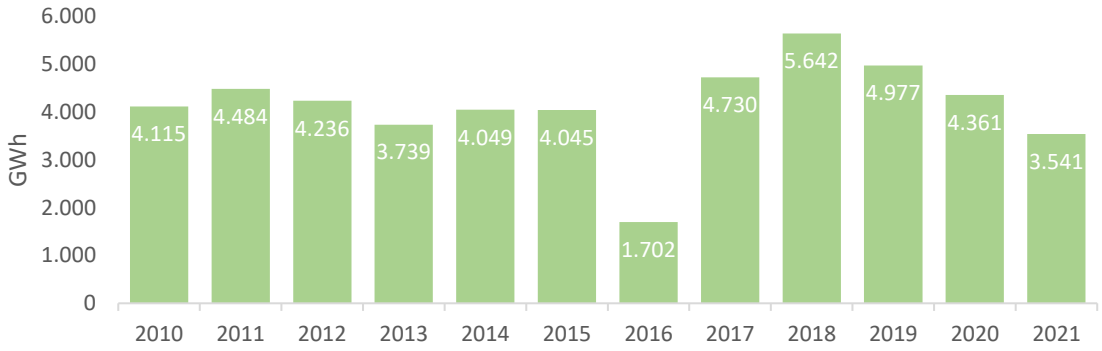


Source: Eurostat, IOBE analysis

In addition, the chemical and petrochemical industry in Greece is a major consumer of natural gas for non-energy uses (e.g. ammonia production as a fertiliser production raw material), even more than energy uses. In 2021, the gas consumption by the chemical and petrochemical industry for non-energy

uses reached 3.541GWh, i.e. more than three times higher in quantity compared to energy uses, but with a significant decrease since 2018 (Graph 2.21). This is an important parameter that affects the chemical industry, in addition to the cost of energy and CO_2 emissions, as natural gas is one of the main raw materials to produce basic chemicals and products.

Graph 2.21: Consumption of natural gas for non-energy uses in the chemical and petrochemical industry (GWh)

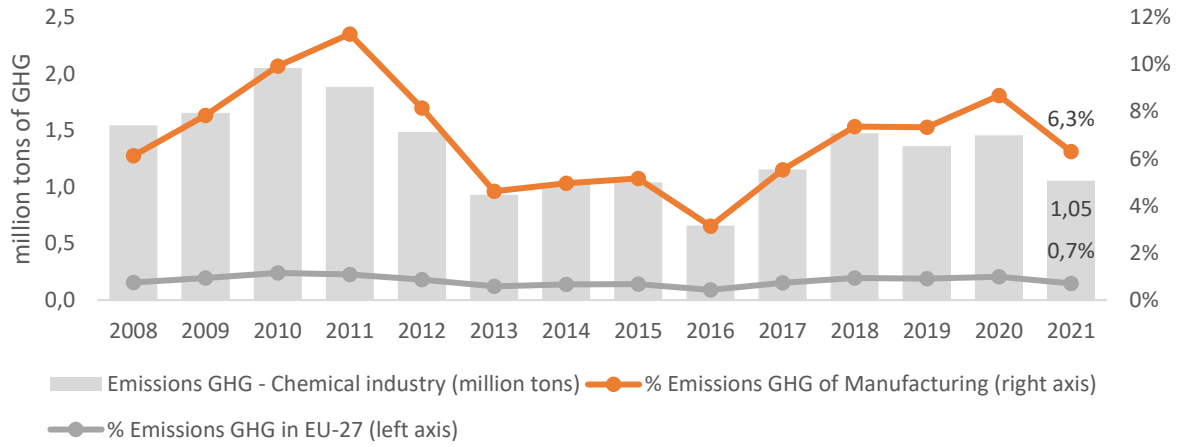


Source: Eurostat

2.4 Greenhouse gas emissions

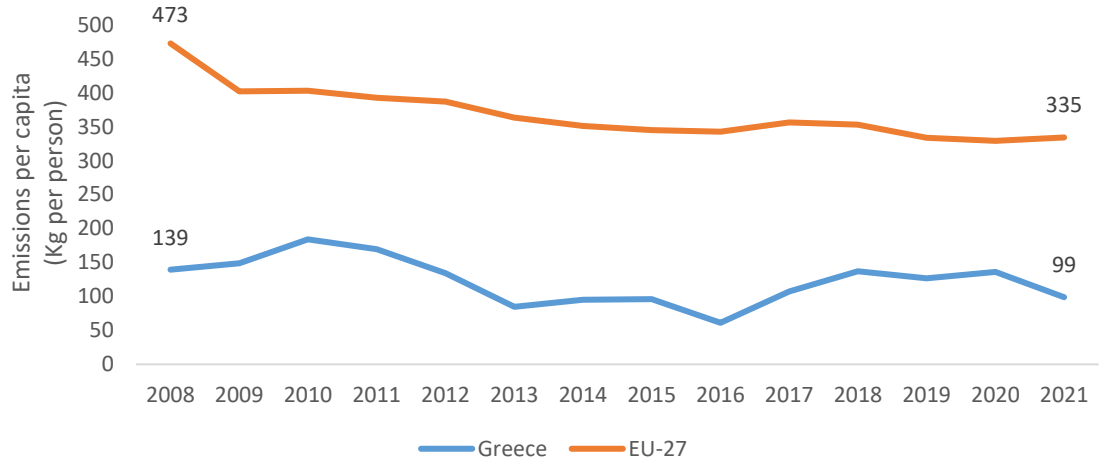
Direct greenhouse gas (GHG) emissions from the chemical industry in Greece (from production processes and fuel consumption) in 2021 were slightly above 1 million tons of CO_2-equivalent (Graph 2.22). They accounted for 1.4% of Greece's total GHG emissions, 6.3% of domestic Manufacturing emissions and 0.7% of the EU-27 chemical industry's emissions. Although year to year fluctuations appear, the overall trend in the level of GHG emissions from the chemical industry in Greece is decreasing (-32% in 2021 compared to 2008). The per capita GHG emissions of the Greek chemical industry decreased to 99kg per capita in 2021 from 139kg per capita in 2008, remaining at a level that corresponds to about one third of the relevant index for all EU-27 Member States (Graph 2.23). This level of emissions reflects the smaller size of the chemical industry in Greece and the differences in the composition of total chemical production against the EU-27.

Graph 2.22: Greenhouse gas emissions from the chemical industry in Greece (in tons CO_2 equivalent)



Source: Eurostat. Analysis of IOBE

Graph 2.23: Per capita greenhouse gas emissions from the chemical industry in Greece and the EU-27



Source: Eurostat

2.5 Summary

The chemical industry in Greece includes, on average, companies of a larger size than the average manufacturing company in Greece, which, however, are significantly lagging the respective chemical companies in the EU-27. The smaller size limits their production potential, efficiency, extroversion, funding opportunities, capacity attraction and innovation. Moreover, the fact that the basic chemicals sector in Greece is much less developed than in the EU-27 indicates a lower degree of development and vertical integration in sectors of the chemical industry, where economic efficiency is a fundamental element in tackling international competition.

The Greek chemical industry is in a development phase in recent years and has overcome the health and energy crisis with relatively small losses, following the resilience it has shown despite the intensity and duration of the Greek economic crisis. Its contribution to protecting the health of the population was highlighted during the pandemic thanks to its adequacy of disinfectants, antiseptics, medical gases, etc., verifying the international classification of the NACE 20 sector as vital in each country. However, with the level of energy prices remaining significantly higher than in the pre-crisis period, there are questions about the medium-term impact on its competitiveness.

Domestic chemical production focuses on the categories of specialty and consumer chemicals. The significance of the production of basic chemicals is less, demonstrating a high dependence on imported chemical raw materials. Prices of chemicals in Greece, in particular basic chemical products, rose in the course of 2021 and 2022, affected by stronger demand and rising raw materials and energy costs, but at a significantly lower rate than the EU-27.

The chemical industry has made a significant contribution to the added value of domestic manufacturing, while employment has increased significantly in recent years and mainly concerns highly skilled jobs. Exports of chemicals have dynamically grown in recent years, while imports have also increased, which supply the domestic industry with basic chemicals and products. The extroversion of the domestic chemical industry is high and has been strengthened in recent years, while labour productivity is higher than the average productivity in manufacturing, which is reflected in better-paid jobs, but lags significantly behind the chemical industry in other EU-27 Member States.

The Greek chemical industry focuses on activities with lower energy intensity compared to the EU-27, which also entails lower GHG emissions per capita overall. Natural gas is a critical fuel for energy use and raw material to produce chemicals by the Greek chemical industry. Significant amounts of energy consumption also refer to petroleum products and electricity. Finally, the investment intensity of the chemical industry in Greece is particularly low compared to the EU-27.

3 FRAMEWORK AND STRATEGIES FOR THE GREEN AND DIGITAL TRANSITION OF THE CHEMICAL INDUSTRY IN GREECE

3.1 Introduction

The chemical industry in Greece has faced serious exogenous disruptions in previous years, such as the economic, health and energy crisis, but has managed to recover and become more productive and extrovert. As a producer and supplier of materials for a wide range of industrial and other activities, the chemical industry is significantly affected by the conditions in its operating environment (economic fluctuations, energy prices, changes in the regulatory framework, geopolitical uncertainty, technological progress, etc.). For the Greek chemical industry, the new economic and regulatory environment, as shaped by the acceleration of the EU's path towards climate neutrality, by the EU's industrial and chemicals strategy, is linked to opportunities, but at the same time poses significant challenges.

This chapter first presents the framework of key European policies for the green and digital transition of the chemical industry and the challenges arising from it, which make ensuring and enhancing the innovation and competitiveness of the chemical industry in Greece and the EU critical factors for its future performance. Past and current strategies and/or initiatives that contribute to the green, circular and digital transitions for the chemical industry in Greece are summarised below. In particular, existing initiatives and national strategies directly or indirectly related to the chemical industry in Greece are presented and the national specificities representing advantages or obstacles to the transition are analysed. Finally, a comparison of the European Transition Roadmap and existing and/or planned national strategies is made to identify potential gaps and needs for the introduction of additional regulatory measures and policy objectives.

3.2 European Green Deal

The European Green Deal (EGD) presented in December 2019 renewed the European Union's (EU) commitment to tackling climate change and environmental challenges. EGD is a multidimensional strategy for transforming the EU "*into a fair and prosperous society with a modern, resource-efficient and competitive economy in which net greenhouse gas emissions have been reduced to zero by 2050 and where economic growth has been decoupled from resource use*".[9] The EGD covers all sectors of the economy, in particular transport, energy, agriculture, constructions and industries, such as the steel, cement, information and communication technologies (ICT), textile and chemical industries, and is accompanied by an investment plan aimed at direct financing, mobilising investment resources and practical guidance for public and private actors[10].

The increased ambition of EU to achieve climate neutrality (zero net emissions) by 2050 is reflected, inter alia, in the upward revision of the 2030 interim greenhouse gas emission reduction (GHG) target, which is considered crucial for the EU to become the first net-zero GHG emission region by 2050. In this context, in December 2020, the European Council endorsed the European Commission's proposal to revise the 2030 emission reduction target to at least 55% compared to the 1990 level –against a 40% reduction target foreseen before the adoption of the EGD. In July 2021, the European Climate Law[11], which made the emission reduction targets first by 2030 and then by 2050 legally binding, entered into force. Climate Law provides for the development of sectoral roadmaps of the European economy that will support their

[9] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52019DC0640&from=EN
[10] https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_24
[11] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:32021R1119&from=EN

decarbonisation and continuous monitoring, together with the recognition of relevant best practices at European level.

Key components of the EGD are the Biodiversity Strategy for 2030, the new EU Industrial Strategy, the Circular Economy Action Plan, the Farm to Fork Strategy for Sustainable Food, the Sustainable Chemicals Strategy, the Pollution-Free Europe Action Plan, the Hydrogen Strategy, the European Battery Alliance, etc. These components are relevant to the activity of the chemical industry, which is essential for a strong and sustainable European economy of the future, as chemicals are present in almost every strategic value chain, while the chemical industry has a key role to play in a successful development of innovative technologies to achieve climate objectives. For example, recycling processes of paper, batteries or plastics are basically chemical in nature and contribute to the circular economy. Insulating and sealing materials that provide energy-saving solutions in buildings are products of the chemical industry. The blades in wind turbines are coated with specialty chemical materials to improve efficiency, while with chemical recycling, plastic waste that cannot be mechanically recycled becomes raw material. The role of chemistry in the development of electric vehicle batteries for greater autonomy is important. The automotive industry is developing vehicle technology using organic electronics and synthetic materials that are lighter. In the Constructions sector, materials for smart grids, automatic electrical systems, insulation, smart materials such as nano-materials, coatings and other chemicals for construction are needed. In the agricultural sector, the demand for bio-pesticides and bio-pesticides will increase. Trade will increasingly require innovative packaging materials, inks, sealants and eco-friendly packaging materials that the chemical industry can offer.

On the production side, the chemical industry faces the challenge of becoming climate neutral by 2050 and contributing to the implementation of the EGD. Access to adequate and competitive low-carbon energy, the deployment of relevant infrastructure, effective protection against the risk of carbon leakage, adequate funding and the exploitation of opportunities related to sustainable materials and products are key prerequisites to ensure that the chemical industry remains competitive during the transition towards climate neutrality.

3.2.1 EUROPE'S CLIMATE TARGET FOR 2040

The EU and its Member States are committed to making the EU the first climate neutral continent by 2050. The EU Climate Law establishes a first interim target to reduce net greenhouse gas emissions by at least 55% by 2030 and requires the European Commission to propose a next interim target for 2040.

In this context, the Commission published[12] a Communication launching the process of preparing the 2040 target. In the Communication, accompanied by an impact assessment on possible pathways to achieve climate neutrality by 2050, the Commission recommends a 90% reduction in net greenhouse gas emissions by 2040. The legal proposal setting the climate target for 2040 will be the responsibility of the Commission's next mandate, following the 2024 European elections.

According to the Communication, achieving the recommended target for 2040 will require full implementation of the agreed 2030 framework, ensuring the competitiveness of European industry, a stronger focus on a just transition, a level playing field with international partners and a strategic dialogue on the post-2030 framework, including with industry and agriculture sectors. To achieve the target, all zero- and low-emission GHG solutions, including RES, nuclear and bioenergy, energy efficiency and

[12] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52024DC0063

storage, carbon capture and storage (CCU and CCS), carbon removals, geothermal energy, hydropower and all other existing and future zero-emission energy technologies, should be exploited.

The recommended climate target for 2040 corresponds to an almost complete decarbonisation of electricity from GHG emissions in the second half of the 2031-2040 decade. It also entails a faster deployment of carbon capture, which will absorb industrial carbon emissions. For industry, the target will be met by the demand for clean energy through electrification, the transition to non-fossil fuels and the implementation of new technological processes and circular economy actions.

3.2.2 EGD POLICY INSTRUMENTS

To achieve the highest emission reduction targets of the EGD, the EU climate policy instruments have been significantly revised with the 'Fit for 55' policy package announced in July 2021[13]. The Fit for 55 package reinforced eight existing acts of legislation and presented five new initiatives, in different policy and economic areas: climate, energy and fuels, transport, constructions, land use and forestry, trying to strike a balance between carbon pricing, targets, standards and support measures. In summary, it provides: a) drastically strengthening of the role of carbon pricing in four different ways: reducing the quantity of auctioned allowances, extending to new sectors, changes in energy taxation and introducing tariffs on embedded carbon emissions on imports of certain high-emission intensive products (Coal Border Adjustment Mechanism, CBAM), b) upward revision of quantitative targets in the Effort Sharing[14] and Land Use, Land-Use Change and Forestry Regulations; but also in the Renewable Energy (RES) and Energy Efficiency Directives[15] and (c) stricter CO_2 performance standards for vehicles, new infrastructure for alternative fuels and the production of more sustainable and cleaner aviation and maritime fuels.

The CBAM is a system to ensure equivalent pricing of GHG emissions of imported products to those produced under the EU Emissions Trading System (ETS), burdening the price of imports of specific products in proportion to the emissions incorporated in their production. In this way, the CBAM aims to prevent carbon leakage, i.e. the transfer of the production of carbon-intensive products from EU-based companies to third countries to benefit from more flexible standards. The implementation of the CBAM from 1st October 2023, under a transitional period until the end of 2025, affects the operation of specific manufacturing sectors as well as the competitiveness of EU Member States having trade relations with third countries. At present, the carbon price list on imports concerns cement, aluminium, fertilisers, electricity, hydrogen as well as iron, steel and other derived products. However, it is envisaged to be extended before the end of the transitional period to products falling under the ETS, such as basic chemicals and products. At the same time, this new mechanism is expected to pose a significant challenge for specific European manufacturing sectors due to strategic dependencies on imports of raw materials cover by the CBAM from third countries (e.g. automotive, metal production, etc.).

The implementation of the CBAM is estimated to have a significant impact on the cost of producing chemicals, as it is accompanied by the phasing out of the distribution of free CO_2 allowances to installations producing the products included in the mechanism. For the possible effects of CBAM on

[13] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021DC0550&from=EN

[14] The Effort Sharing Regulation establishes binding annual GHG emission targets for Member States for the period 2021-2030 (-40% compared to 2005) for emissions from most sectors not included in the ETS, such as transport, construction, agriculture and waste.

[15] The 2030 targets, as set out in relevant Directives, relate to a 42.5% share of RES in final energy consumption and an improvement in energy efficiency by 11.7% compared to a baseline scenario that does not include the implementation of additional measures. To promote green hydrogen in industry, a target was also set for 42% of the hydrogen used in industry to come from RFNBO (renewable fuels of non-biological origin) by 2030 and 60% by 2035.

relevant products within the EU, two opposing forces should be considered. On the one hand, the imposition of carbon costs on imports can enhance the competitiveness of businesses within the EU, but at the same time the phasing out of free allowances and the need to invest in reducing GHG emissions can increase their production costs. In addition, for processing sectors using imported products falling under the mechanism as raw materials, it can also lead to an increase in costs and thus affect their competitiveness especially regarding exports to third countries. At the same time, in several third countries (e.g. China, Saudi Arabia and Türkiye) a vertically integrated chemical industry is developing with advanced know-how, as evidenced by the continued loss of European chemical industry shares in the world market, increasing the risk of European factories being circumvented in markets outside the EU-27, where for demographic and geopolitical reasons the highest demand and growth dynamics are concentrated.

In addition, there is a risk of a reduction in EU production in products covered by the CBAM due to substitution of semi-processed or final products incorporating CBAM products as intermediate inputs, with imports from third countries that are more CO_2-intensive. This risk is more pronounced for sectors with complex value chains[16]. The risk of losing EU exports to third countries due to a change in relative prices and substitution by products from third countries with higher CO_2 intensity is also important for CBAM products. For semi- processed or final products produced and directed to the EU there is a risk of substitution with higher carbon-intensive imports not incurring similar carbon costs, while for sales of such products to non-EU countries there is a risk of substitution by products from third countries with higher CO_2 intensity. Another impact may be the shift of investments from the EU to third countries with less climate targets (investment leakage). Increasing emission reduction targets limits investment in production capacity with conventional technologies in the EU, while the lack of a consistent framework for carbon pricing across all links of value chains (e.g. the non-application of CBAM to semi-processed or final products) creates uncertainty and can even shift investments in climate-friendly options towards third countries. Finally, through resource shuffling, producers in third countries can increase their production using carbon-intensive products to make profits through the allocation of clean energy sources or production processes or recycling to exports to the EU to avoid CBAM costs.

3.3 EU industrial strategy

The EU Industrial Strategy[17], with priorities of maintaining the international competitiveness and resilience of European industry, ensuring a level playing field in the EU Single Market and globally, achieving climate neutrality by 2050 and shaping Europe's digital future, provides an important supporting framework for the implementation of the EGD. The strategy sets out the key drivers of Europe's industrial transformation and proposes a comprehensive set of future actions such as:

- Action plan on intellectual property and support for technological self-reliance.
- Review competition rules to respond to an economy that is rapidly changing and digitised and called to become greener and circular.
- Integrated measures to modernise and decarbonise energy-intensive industries.
- Supporting industries for sustainable and smart mobility and promoting energy efficiency.
- Ensure adequate and continuous supply of low-emission energy at competitive prices.
- Securing the supply of critical raw materials, a clean hydrogen alliance, green contracts.

[16] ERCST (2021). Border carbon adjustments in the EU: Sectoral deep dive.

[17] https://ec.europa.eu/commission/presscorner/api/files/attachment/863067/EU_industrial_strategy_en.pdf.pdf

- Refocus on innovation, investment and skills of workers, etc.

Addressing economic, social and environmental challenges leads to a transformation of the traditional operating model of the chemical industry. In this new phase, which is characterised by digitalisation and the response to the needs of sustainability and the circular economy, changes are needed for the efficient use of natural resources and raw materials, the integration of technology into production processes, the development of research activities, the change of corporate structures and products offered and the integration of the principles of sustainable development.

To address the disruption caused by the COVID-19 pandemic, the EU Industrial Strategy was updated in May 2021 to transform it towards a more sustainable, digital, resilient and globally competitive economy[18]. Within the update, the European Commission proposed the creation of a series of transition roadmaps for individual industries, identifying the actions needed to achieve the green and digital transitions, providing a better understanding of the scale, benefits and conditions required and, as has been demonstrated, actions to strengthen the resilience of industry, which is heavily affected by Russia's war against Ukraine. In this context, the European chemical industry transition roadmap has also been developed.

3.4 Chemicals Strategy for Sustainability

The EU Chemicals Strategy for Sustainability[19] was announced in October 2020. It is part of the broader context of the EGD and aims to achieve the objective of zero pollution for a toxic-free environment by stimulating innovation to produce safe and sustainable chemicals and enhancing the protection of human health and the environment from hazardous chemicals. This strategy sets out specific actions to make chemicals safe and sustainable throughout their life cycle and to ensure that they can deliver all the benefits without burdening the planet as well as the present and future generations. It foresees various innovation actions as well as investment actions that will support the chemical industry throughout this transition. Strengthening the ability and innovation of the chemical industry to deliver safe and sustainable chemicals is also crucial to support the green and digital transitions.

The strategy proposes a specific roadmap for transforming the chemical industry to attract investments in safe and sustainable products and production methods. In particular, the initiatives to strengthen health and environmental protection include:

- Phase out the use of the most harmful substances in consumer products, such as toys, childcare products, cosmetics, detergents, food contact materials and textiles, unless it is demonstrated that their use is essential for society.
- Minimising and substituting, as much as possible, the presence of substances of concern in all products, giving priority to product categories affecting vulnerable populations and those with the greatest potential for the circular economy.
- Addressing the combined effects of chemicals by better evaluation of the risk to human health and the environment of daily exposure to a wide mixture of chemicals from various sources.
- Ensuring that producers and consumers have access to information on chemical composition and safe use by introducing information requirements under the Sustainable Products Initiative.

[18] COM(2021) 350 final.
[19] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52020DC0667&from=EN

Stimulating innovation and boosting the competitiveness of the chemical industry are additional objectives of the EU Chemicals Strategy for Sustainability to seize opportunities and to enable the green transition of the chemicals sector and its value chain. This is intended to be achieved mainly by the following:

- Establish safety and sustainability criteria for chemicals by design (SSbD) and ensure financial support for the marketing and use of safe and sustainable chemicals.
- Ensure the development and use of safe and sustainable by design substances, materials and products through EU financing and investment instruments and public-private partnerships.
- Strengthen enforcement of EU rules both at borders and in the single market.
- Establish an EU research and innovation agenda on chemicals to close knowledge gaps on the impact of chemicals, foster innovation and avoid animal testing.
- Simplification and consolidation of the EU legal framework, e.g. through the introduction of the 'one substance, one evaluation' procedure, by strengthening the two key principles: "prohibition of non-registered substances" and "the polluter pays" and the introduction of targeted amendments to REACH and sectorial legislation (e.g. CLP).

The implementation of a large part of legislative and other interventions, in line with the indicative timetable of the Chemicals Strategy for Sustainability, is expected to be completed by 2024. The changes in chemicals legislation foreseen in this strategy are expected to have a significant impact on the activity of the chemical industry. According to a study by the European Chemical Industry Council[20] (CEFIC), the new legislation is estimated to affect chemicals representing 28% of the industry's turnover. Around 8% of this market will likely be replaced, while 2% will not be affected by deviation. In addition, around 6% of the market will not face pressure to withdraw from the market and will only be affected by the increased regulatory burden. This means that the changes to sectoral legislation examined in this study, when considering the possible response of businesses, could lead by 2040 to a net reduction in the product/business portfolio (in terms of annual turnover) of around 12%, equivalent to 70 billion euros of the total market in 2019. Proportionately, for the chemical industry in Greece, changes in legislation may have an impact that can reach around 300 million euros.

The analysis also showed that 74% of the products affected are commercial or consumer products. The downstream sectors that could be most affected are:

- Polymer blends and compounds, paper and paperboard products, inks and toners, which can be used for material in contact with food
- Paints and coatings
- Cleaning products
- Adhesives and sealants
- Cosmetics and personal care products
- Lubricants
- Biocidal products and plant protection products

Impacts in these areas will affect the EU ability to strengthen its strategic autonomy and value chains for chemicals that have essential uses in the health sector and/or are necessary to achieve the circular and climate-neutral economy. The companies involved in the CEFIC survey state that they could, under conditions (economic and technical feasibility, customer response, etc.) replace or reform 1/3 of the

[20] Economic Analysis of the Impacts of the Chemicals Strategy for Sustainability, December 2021

substances affected (in terms of turnover). However, it takes time to adapt and, in some cases, a long period of time for research and development of economically viable alternatives that can be placed on the market, with acceptance of generally unwilling switching costs and increasingly difficult to find professional users (e.g. painters, insulators, etc.).

3.5 Industrial Emissions Directive

The Industrial Emissions Directive was adopted in 2010 and is the EU's main regulatory tool for emissions from industrial installations. It regulates around 52.000 industrial and other facilities in Europe, many of which are manufacturing (e.g. refineries, metals, concrete, glass, chemicals, food and beverage and paper plants). It aims both at decarbonisation, given the limitation that sectors and GHG emissions that fall under the ETS are basically excluded from this Directive, and at the integrated prevention of environmental pollution (air, water and land).

Under the Directive, any installation covered by its conditions should operate only if it holds a permit issued by the pertinent national authorities. Best Available Techniques (BAT), i.e. well-established technologies and methods with the highest efficiency in terms of environmental protection, play a key role in setting permit conditions. BAT reference documents exist both at the level of sectors (e.g. cement production, food-beverage and milk industries, iron and steel production) and at the level of cross-sector activities (e.g. energy efficiency, industrial cooling systems, waste treatment).

In the context of the EGD, a proposal for the revision of the Directive was submitted in 2022, which inter alia proposes to extend its scope (e.g. addition of large-scale lithium-ion battery and mining plants), to add environmental performance limit values based also on BAT, to make the establishment and implementation of an environmental management system compulsory for firms and to tighten the emission limit values. Finally, businesses are invited to develop by 2030 a transformation plan outlining how they will contribute to creating a sustainable, clean, circular and climate neutral economy by 2050.

3.6 Green Deal Industrial Plan

The global market for mass-produced clean energy technologies is estimated to more than triple by 2030 to around 600 billion euros, (European Commission, 2023) which has increased international competition. The European Commission announced the Green Deal Industrial Plan[21], which stresses the need for the joint immediate transformation of Member States' industries to seize the opportunities that will arise, enhancing their competitiveness and contributing both to the EU leading role in the new economic reality of the zero-emission era and to the achievement of climate objectives. The plan is based on four pillars.

A predictable and simplified regulatory environment. This pillar provides for several specific arrangements or proposals on critical issues of industrial transformation, such as the Net-Zero Industry Act, the Critical Raw Materials Action, the Electricity Market Design Reform and others.

Faster access to adequate funding. The Plan recognises the strong competitive pressure on European companies from excessive subsidies granted to third countries and stresses the need to accelerate both public and private financing.

Enhancing skills. Employment in green jobs has already increased significantly over the last decade and is expected to multiply further very soon. For example, the Plan states that the battery industry alone is

[21] https://commission.europa.eu/document/41514677-9598-4d89-a572-abe21cb037f4_en

estimated to require an additional 800.000 workers by 2025. In this context, EU measures related to both skills acquisition and upskilling (e.g. the European Pact for Skills) and skills certification are presented.

Open trade and resilient supply chains. The last pillar stresses the need for international cooperation and the use of international trade to maintain the competitiveness and resilience of European industry. At the same time, it frames initiatives to address interventions from third countries that create market distortions, such as the Foreign Subsidies Regulation.

3.7 The REPowerEU plan

On 18 May 2022, the European Commission presented the REPowerEU plan[22] to address global energy market disruptions caused by Russia's invasion of Ukraine. REPowerEU is a plan to save energy, produce clean energy, diversify the EU energy supply and reduce the dependence on Russian fossil fuels, supported by financial and legal measures to build the new energy infrastructure and systems Europe needs.

The short-term measures of the plan include, inter alia: a) Common markets for natural gas, liquefied natural gas (LNG) and hydrogen through an EU energy platform, b) New energy partnerships with reliable suppliers, c) Rapid development of solar and wind energy projects combined with the deployment of renewable hydrogen to save around 50 billion cubic meters (bcm) from gas imports, d) Action Plan to increase biomethane production to save 17 bcm on natural gas imports, (e) Approval of the first hydrogen projects at EU level by summer 2022, f) EU Communication on energy savings with recommendations on how citizens and businesses can save around 13 bcm on gas imports, g) Filling gas reserves to 80% of capacity by 1st November 2022, h) EU coordination plans to reduce demand in case of disruptions in gas supply.

At the same time, the medium-term measures to be completed before 2027 concern: a) New REPowerEU national plans under the amended Recovery and Resilience Fund to support investments and reforms worth 300 billion euros, b) Strengthening industry for GHG emission reduction investments under the Innovation Fund, c) New legislation and recommendations for faster RES permitting and guidance for PPAs, d) Investments for an integrated and adapted gas and electricity infrastructure network, e) Increase the EU-wide energy savings targets from 9% to 13% for 2030, f) Increase the European renewables target from 40 % to 45 % for 2030 with an integrated "Solar Strategy" to double power from photovoltaic parks by 2025 and install 600 GW by 2050, g) Modern hydrogen regulatory framework and hydrogen acceleration program for the construction of 17.5 GW electrolysers by 2025 to power the EU industry with a domestic production of 10 million tons of renewable hydrogen. REPowerEU is endorsed by the European Commission with an evidence-based proposal for a revision of the Recovery and Resilience Plans, with an additional focus on actions supporting investments and reforms to strengthen the green transition. The projections of the plan are integrated into the EU Member States' national energy and climate plans under revision.

3.8 Transition Pathway for the Chemical Industry of the European Union

[22] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52022DC0230&from=EN

On 27 January 2023, the European Commission published the Transition Pathway for the Chemical Industry,[23] which is an action plan developed in cooperation by the European Commission with Member States, representatives of the chemical industry, as well as other stakeholders and interested parties. The Transition Roadmap is an analytical guide to the governance framework for the chemical industry to achieve the objectives of the EGD by 2050, while defining the actions and conditions needed to achieve the green and digital transitions and improve the resilience of the European chemical industry in line with the updated EU Industrial Strategy. The chemical industry faces the challenge of changing the way of production, as well as the products it will produce over the next thirty years (until 2050). Responding to this challenge requires billions of euros of investment, as its transformation has four dimensions: a) Climate neutrality, b) Circular economy, c) Sustainability of chemicals and d) Digitalisation. The Transition Pathway for the Chemical Industry contains 8 building blocks and provides a list of 187 actions, grouped into 26 topics, to be implemented by stakeholders within an agreed timeframe (Table 3.1).

Table 3.1: Building blocks and topics of the EU Chemical Industry Transition Pathway

Building block	Topics
Sustainable competitiveness	Topic 1: International competitiveness
	Topic 2: Reduction of unsustainable dependencies and supply-chain vulnerabilities
	Topic 3: Safety and sustainability
	Topic 4: Innovation and growth of SMEs
	Topic 5: New synergies
Investments and funding	Topic 6: Fund for green investments
	Topic 7: Access to funding
Support to R&I, techniques and technological solutions	Topic 8: Better conceptualisation of new techniques and technical solutions (TRL 1-5)
	Topic 9: Developing new techniques and technological solutions (TRL 6-7)
	Topic 10: Deployment of new techniques and technological solutions (TRL 8-9)
Regulation and public governance (Legislation)	Topic 11: More effective and predictable legislation
	Topic 12: Vertically and horizontally coherent legislation
	Topic 13: Effective and efficient enforcement
Access to energy and feedstock	Topic 14: Anticipate long-term needs for the supply of energy and feedstock resources
	Topic 15: Economically viable purchases of clean energy
	Topic 16: Feedstock Substitution
	Topic 17: Process and resource efficiency
Infrastructure	Topic 18: Large-scale electricity and hydrogen infrastructure
	Topic 19: Development of new and sustainable production facilities
	Topic 20: Sustainable transport of raw materials and chemical products
	Topic 21: Development of digital technologies
	Topic 22: Circularity: Recycling and re-use of infrastructure
Skills	Topic 23: Education (Re-skilling/Upskilling the workforce)
	Topic 24: Sufficient supply of jobs at technical level
Social dimension	Topic 25: Impact on workers and consumers
	Topic 26: Improve gender diversity and equality in the sector

Source: EU Transition Pathway for the Chemical Industry.

[23] https://single-market-economy.ec.europa.eu/sectors/chemicals/transition-pathway_en

3.9 National Industry Strategy

Recognising the importance of Industry for the Greek economy and society, in September 2022 the Ministry of Development and Investment presented the National Industry Strategy, together with an Action Plan[24]. The National Industry Strategy aspires to be Greece's main industrial policy tool for the next decade. It specialises and promotes the achievement of the individual objectives of the "Development Plan for the Greek Economy" which are linked to the increase of productivity and employment, while at the same time articulated in the wider context of the European Industrial Strategy and the implementation of the development plan of the EGD. The National Industry Strategy aims to further strengthen the growth dynamics recorded by industry and develops at four levels. First, it analyses the basic ecosystems of the Greek industry, identifying those with high added value, as well as those with significant development potential, such as digital and green technologies. Second, it examines innovative, niche markets with significant growth potential, competitive advantage, and high added value. Thirdly, it focuses on industrial organisation and horizontal issues relating to the organisation of industrial enterprises and the growth of SMEs. Fourth, it analyses and assists in the improvement of all horizontal structures and services that make up industry from human resource training, public administration and infrastructure to the supply chain, energy costs and financial tools.

Incorporating the guidance of the National Smart Specialisation Strategy 2021-2027, the Industry Strategy[25] also focuses on promoting industrial innovation through the creation of an enabling business environment that addresses the existing barriers and bottlenecks of the national innovation system, facilitating as well as supporting business and research-academic institutions partnerships.

At the same time, the Industry Strategy fully incorporates the guidelines of the National Strategy for the Digital Transformation of Industry,[26] focusing on the digital and technological upgrading of the domestic industry. The integration of new digital technologies brings on significant changes to the production model, redefining the industrial products produced, highlighting new business models (as-a-Service or "pay-as-you go") and reshaping the working environment.

In this direction and acknowledging the existence of different needs between domestic industrial enterprises, the technological transition for enterprises with limited digital maturity and the use of cutting-edge technologies (Industry 4.0) for enterprises with high digital maturity is promoted. At the same time, the exploitation of business opportunities arising through the digital transformation is encouraged to develop "smart" products and digital systems and technologies.

The green transformation, which has emerged as a key EU development policy, is fully endorsed by the National Industry Strategy. In this context, green entrepreneurship is promoted, exploiting opportunities for the development of new products and technologies. The Industry Strategy, specifying the guidelines of the National Energy and Climate Plan (NECP) and the National Action Plan for the Circular Economy, promotes the utilisation of RES and the improvement of the energy efficiency of the industry, with a view to reduce dependence from fossil fuels and to achieve competitive energy costs, as well as to implement circular economy models through the promotion of industrial symbiosis.

The effective implementation of the Industry Strategy requires the development of new skills and the attraction of appropriate and skilled human resources to new or traditional industrial activities. The main

[24] Ministry of Development, National Industry Strategy, September 2022.
[25] National Smart Specialisation Strategy 2021-2027,https://gsri.gov.gr/ethniki-stratigiki-exypnis-exeidikefsis-2021-2027/
[26] Digital Transformation of the Greek Industry, https://www.ggb.gr/el/node/1820

objective of the Strategy is to promote the transformation of the domestic labour market through the creation of new highly skilled jobs and to reduce unemployment in industry-related jobs. Emphasis is also placed on retraining human resources to develop appropriate skills to support investment projects for productive transformation of enterprises and reduce the risk of job losses. At the same time, the reform of the education system and the improvement of its links with industry are promoted to support the development of appropriate specialisations and skills for young people and their immediate integration into the labour market.

The Industry Strategy highlights the gaps and promotes the reshaping of the business environment by emphasising the specific needs of the Industry. It proposes the development of appropriate support structures and infrastructures, reducing bureaucracy and simplifying the institutional framework to support the domestic industry's exploitation of potential and opportunities. Within this framework, there are 7 Strategic Guidelines (SGs) with 23 sub-targets.

- **(SG1) Increasing competitiveness.** Highlighting the leading role of industry in the country's production model requires an increase in production capacity and, consequently, an increase in productive capital.
- **(SG2) Innovation.** Incorporating the guidance of the National Smart Specialisation Strategy 2021-2027, the Industry Strategy focuses on promoting industrial innovation through the creation of an enabling business environment.
- **(SG3) Digital Transformation**. The Industry Strategy fully integrates the guidelines of the National Strategy for the Digital Transformation of Industry and focuses on the digital and technological upgrading of the domestic industry.
- **(SG4) Green Transformation.** The Green Transformation, which has emerged as a key development policy of the EU, is fully adopted by the National Strategy for Industry, while the guidelines of the National Energy and Climate Plan (NECP) and the National Action Plan for the Circular Economy are specified.
- **(SG5) Human Resources and Skills**. The main objective of the Strategy is to promote the transformation of the domestic labour market through the creation of new highly skilled jobs and to reduce unemployment, especially among young people. Emphasis is also placed on retraining human resources to develop appropriate skills to support investment projects for productive transformation of enterprises and reduce the risk of job losses.
- **(SG6) Business environment**. The Industry Strategy highlights the gaps and promotes the reform of the Business Environment by emphasising the specific needs of the industry.
- **(SG7) Industry resilience**. Considering the lessons learned and the specific needs that have arisen during the pandemic crisis and the energy crisis, strengthened resilience is promoted as well as the highlighting of the role of Greek industry in achieving strategic autonomy of the EU, by limiting Europe's dependencies on third countries in particularly critical value chains where Greece has productive potential and competitive advantage. In this direction, it is a priority to manage the current energy crisis and to ensure the conditions for achieving competitive energy costs. In addition, care shall be taken to develop appropriate mechanisms to prevent and prepare industrial enterprises to respond to future crises.

The National Industry Strategy includes indicative targets for increasing the participation of industry's GVA and exports of industrial products in GDP, as well as of industrial workers by 2030 (Table 3.2).

Table 3.2: Indicators - Objectives for the Greek Industry

	Existing performance	5-year target	2030	Comparison
GVA increase in Industry (% GDP)	10.7 %	11 %-13 %	Not more than 15 %	EU-18.1 %
Increase in exports of industrial products (% GDP)	9.2 %	Not more than 15 %	Not more than 20 %	38 % (in population wise comparable countries)
Increase in industrial workers (% total employees)	8.2 %	Not more than 12 %	Not more than 14 %	EU – 15.4 %

Source: National Industry Strategy and Action Plan

3.9.1 National Industry Strategy and Chemical Industry

Within the framework of the National Strategy for Industry, parts of the chemical industry are integrated into the "Construction Materials" Ecosystem and the Specialised Market "Next Generation Materials". The Strategy also includes an assessment of the performance of the "Construction Materials" ecosystem in the areas of Innovation, Green Transformation, Digital Transformation and Human Resources and Skills.

In terms of innovation, the chemical industry is performing well by investing 8.4% of the industry's total R&D spending (2021)[27], but is significantly lagging to countries in Europe where the chemical industry is highly developed. In addition, 6.8% of chemical workers are engaged in R&D activities, accounting for 12.4% of R&D workers in the entire manufacturing sector[28]. Furthermore, 79% of industrial undertakings in the chemical sector are classified as innovative [29,30]. Regarding the green transformation, the relatively high energy consumption and environmental footprint of the chemical industry is highlighted. The chemical industry is characterised as medium to high technological intensity (medium-hi-tech)[31,32], since production processes are mainly capital-intensive. In this context, there is considerable scope for integrating digital technologies with the automation of the production process being relatively high compared to other industry sectors in Greece. Finally, it should be noted that the chemical industry, in the context of the green and digital transitions, is expected to largely integrate digital and green technologies[33]. There will therefore be a strong need for high-level human resources with cross-cutting[34] skills that can support this double transition. At the same time, ecosystem businesses also face difficulties in finding skilled craftsmen with appropriate knowledge and experience[35].

[27] ECB (2019) https://metrics.ekt.gr/datatables/182

[28] Eurostat, https://ec.europa.eu/eurostat/databrowser/view/RD_P_BEMPOCCR2__custom_8457973/default/table?lang=en

[29] Key Innovation Indicators, ECB, https://metrics.ekt.gr/sites/metrics-ekt/files/ekdoseis-pdf/2020/CISstatisics_2016-2018_el.pdf

[30] Design and Development of a Strategy for the Development and Transformation of the Greek Industry, Deliverable 2: National Industry Strategy and Action Plan

[31] High-tech aggregation by NACE Rev.2, https://ec.europa.eu/eurostat/cache/metadata/en/htec_esms.htm

[32] https://nemertes.library.upatras.gr/server/api/core/bitstreams/7a5f2ac6-bd8f-4191-8cca-ae6515eb437b/content

[33] Annual Single Market report 2021, https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en

[34] https://www.businesseurope.eu/publications/greening-economy-employment-and-skills-aspects-businesseurope-policy-orientation-note

[35] Findings from General Secretariat of Industry working groups in the context of the project "Consultant services for the delimitation of RDPA 2021-2027 funding for industry, its link to the National Strategy and its correlation with other potential funding sources".

The Specific Priorities for the "Construction Materials" ecosystem in each of the pillars of the National Strategy include:

Innovation. Enhance innovation to produce innovative materials, which will meet modern market trends and needs (New Generation Materials).

Green Transformation. The need to transform energy-intensive industries to reduce greenhouse gas emissions and energy consumption through a) Exploitation of alternative forms of energy (RES, hydrogen and biofuels), b) implementation of energy efficiency improvement solutions, c) circular economy applications and industrial symbiosis (Sharing).

Digital transformation. The digital transformation of the ecosystem requires promoting the collection and use of data, with priority in the following areas I4.0: a) Developing digital product passports to increase traceability of material flows, b) performing simulations and predictions using AI and IoT to improve the quality, efficiency, security and sustainability of the production process.

Human Resources and Skills. In the context of the double transition of the ecosystem, it is essential to attract high-level professionals with cross-cutting expertise and knowledge related to both production automation and green transformation (alternative forms of energy, energy efficiency and waste management). Priority will be to develop domestic human resources in technical specialties for which ecosystem enterprises have increased needs.

The specific priorities for the "New Generation Materials" ecosystem in each of the pillars of the National Strategy include:

Development of a niche market: Promoting a) the uptake of new generation materials for the green and digital transformation of the economy, aiming to increase domestic demand for next generation materials and achieving better performance, b) business clusters around specific demand sectors or major customers in the next generation materials sector.

Innovation: a) Strengthening innovation in the next generation materials sector with special care to upgrade the laboratory equipment of enterprises and b) modifying the framework to facilitate the transformation of a research effort (in research/educational institutions) into a business activity (spin-off).

Green Transformation: Providing incentives for the use of new generation materials in the RES sector and in particular the development of photovoltaics, wind turbine components and energy storage devices, as well as in constructions and especially in the field of improving the energy efficiency of buildings.

Digital Transformation: Promote the uptake of new generation materials by both producers of digital solutions and in the ICT sector for the development of cutting-edge technologies.

Human Resources and Skills: Incentivising the use of academics/researchers in the activities of enterprises in the sector (industrial doctorates).

Largely, however, the issues of the chemical industry are covered by the actions that concern all industrial enterprises in Greece horizontally. These actions are presented especially in the chapters of the National Strategy for Industry relating to a) the organisation of industrial enterprises and the growth of SMEs and b) horizontal structures and services affecting industry from human resource training, public administration and infrastructure to the supply chain, energy costs and available funding tools.

3.10 National Energy and Climate Plan

The National Energy and Climate Plan (NECP) is the country's energy transition roadmap, which is under review to be submitted to the European Commission by June 2024. The NECP highlights the country's priorities and development potential in terms of energy and climate change and aims to be the key tool for shaping national energy and climate policy over the next decade, considering the recommendations of the European Commission and the UN Sustainable Development Goals. The strategic pursuit is the energy and climate targets set under the revised NECP by 2030, 2040 and 2050 to be achieved in the most economically competitive way and to provide an opportunity for growth benefits for the national economy. The draft NECP revision incorporates and describes measures on the strategic priorities such as:

- **Strong growth of RES.** Development of photovoltaics and wind (and accelerating the development of offshore wind) farms by adding, further to existing ones, over 12GW by 2030 and exploiting the country's remaining hydraulic potential. Special programme to support photovoltaics on roofs, expansion of energy communities and emphasis on the development of photovoltaics on industrial and commercial roofs. Strategic importance in the development of offshore wind and ensuring positioning and network infrastructure.
- **Energy storage.** High-RES penetration should be accompanied by the development of the required storage (mainly battery and pumped storage technology) to shift excess RES energy, provision of balancing services/provision of flexibility services (e.g. fast power increase/ reduction services) and system stabilisation, contribution to capacity adequacy and network decongestion services. In addition, part of the above services will also be provided by demand response entities.
- **Energy efficiency.** Energy upgrading of buildings (acceleration, significant expansion in pace and depth of renovations, facilitation of funding), smart energy consumption management systems and changing behaviours to reduce the required energy and/or demand profile. These actions can have significant added value and employment growth. Special agreements with the industrial sector for commitments to improve energy efficiency and reduce the carbon footprint.
- **Electrification of light road transport.** Electrification in light/medium vehicles with simultaneous deployment of charging infrastructure and systems for their interaction with the electricity grid. A large part of the required investment will be directed to zero-CO_2 vehicles and to the deployment of smart charging infrastructure, ensuring the ability to manage the power provided using smart systems.
- **Climate-neutral alternative fuels.** Support the development of a domestic industry producing climate-neutral alternative fuels for transport sectors that are not technically feasible or profitable to electrify, such as shipping and possibly heavy long-distance road transport.
- **Gas fuels system.** Maintaining the gas system in the country and expanding to areas or sectors that are not supplied, subject to the gradual and ambitious use of renewable gases so that the distributed gas mix will soon have a low carbon footprint.
- **Bioeconomy.** Investments and leverage for the development of national industrial and agricultural production of advanced biofuels and biogas that will be transformed into biomethane and injected into the gas network.
- **Creating a green hydrogen economy.** Progressive development of infrastructure and production of hydrogen from RES, with priority to be used as a clean gas fuel, its utilisation by industry and the

substitution of fossil fuels in aviation, shipping and heavy-duty freight transport, as well as for long-term storage in electricity generation. There is already significant mobility in this sector, which in combination with competitive RES can develop a value chain in the country.

- **Innovation and systemic solutions in carbon capture, utilisation and storage** (CCUS) for the energy transition of the country's industry (mainly cement production, oil refining, fertiliser manufacturing). Increase of investments in the capture of CO_2 from industrial processes, its use in the production of synthetic fuels, future development of climate neutral CO_2 capture technologies and at the same time the development of CO_2 geological storage infrastructure.
- **Support new industries and business activities** developing a domestic value chain for green energy transition technologies. The aim is to maximise the benefits for domestic growth and employment from investments in the green transition and support industries to reduce their carbon footprint and energy costs.

Table 3.3: Overview of objectives of the revised NECP 2021-2050

Dimension	2021	2025	2030	2035	2040	2045	2050
Greenhouse gases without LULUCF (change since 1990)	-26%	-41%	-54%	-68%	-82%	-89%	-93%
Greenhouse gases with LULUCF (change since 1990)		-44%	-57%	-72%	-87%	-95%	-99%
RES index as % of gross final energy consumption	22%	31%	44%	65%	83%	97%	105%
Energy efficiency		-4%	-5%	-14%	-18%	-22%	-27%
Final energy consumption (mtoe)	15,2	16,6	15,4	13,7	12,7	12,0	11,5
RES-Electrification (% gross electricity consumption)	36%	58%	79%	94%	96%	96%	97%
RES-Heating/Cooling	31%	36%	46%	63%	80%	99%	100%
RES-Transport	4%	13%	29%	98%	209%	381%	584%
RFNBO (% transport fuels)	0%	0%	1.0%	11%	23%	31%	50%
Advanced biofuels (% transport fuels)	0%	0%	2.4%	10%	17%	26%	32%
Conventional biofuels (% transport fuels) – upper limit	1.70%	1.70%	1.70%	1.70%	1.70%	1.70%	1.70%

Source: NECP 2023, Draft

3.11 National Climate Law

Accelerating the green transition requires a comprehensive and coherent set of public sector reforms and investments aimed at supporting sectors of the economy, in particular industry and its sub-sectors with persistently high greenhouse gas emissions. To this end, the National Climate Law[36] aimed at accelerating the green transition of the economy, and in particular domestic industry.

The National Climate Law aims to create a framework to improve the country's adaptive capacity, climate resilience and the gradual transition to climate neutrality by 2050. To achieve the long-term objective of climate neutrality, individual climate targets for the years 2030 and 2040 are set, which relate to reducing net greenhouse gas emissions by at least 55% in 2030 and 80% in 2040 compared to 1990 levels. At the same time, sectoral carbon budgets are also established in the following areas: a) electricity and heat generation, b) transport, c) industry, d) buildings, e) agriculture and livestock farming, f) waste, g) land use, land-use change and forestry. It should be noted that the National Energy and Climate Plan (NECP) is considered in achieving the targets. The specific provisions of the National Climate Law that affect the functioning of the industry are the following:

- Preparation of sectoral carbon budgets for industry for five years. The first budgets are expected in 2024, covering the period 2026-2030.
- A mandatory GHG emission reduction target of 30% by 2030 compared to 2019 levels for activities that are likely to cause significant or very significant effects on the environment and which are not

[36] Law 4936/2022.

included in the ETS[37]. From 2026 and onwards, companies operating in the above categories are required to report annually on their emissions for the past year.

- Provision for installation of PV or thermal solar systems in new special buildings (industrial)[38] of more than 500m², corresponding to at least 30% of the coverage.

Consequently, the Climate Law encourages investments in GHG mitigation technologies as well as the energy modernisation of manufacturing facilities, which in the short term can burden businesses due to the necessary investments, but in the medium to long term it can contribute to enhancing their competitiveness and sustainability.

The National Climate Law identifies waste and the circular economy as one of the key policy pillars to achieve climate neutrality. The performance of the waste sector in terms of greenhouse gas emissions as well as the projections for subsequent periods will be audited annually through the annual progress reports. In addition, the environmental permitting dimension now considers the climate change dimension as well as issues related to the recovery and disposal of waste of projects to be licensed. The Climate Law, aiming to better record quantities of specific waste streams that have hitherto escaped management, has also brought about several changes to the dimension of administrative sanctions related to waste management and especially the cooperation between the main parties involved in alternative management of packaging.

3.12 Digital transformation

In the field of digital transformation, Greece ranks 25 out of 27 EU Member States in the 2022 edition of the Digital Economy and Society Index (DESI)[39]. However, overall, Greece has made good progress in recent years compared to other EU Member States, gradually closing the gap. Especially in digital public services, the number of active users of eGovernment services (69%) is 4 percentage points higher than the EU average (65%). Greece also made progress on the population with at least basic digital skills –with 52%, Greece is very close to the EU average (54%). As regards the integration of digital technologies into business activities, Greece's performance is below the EU average. Only 39% of small and medium-sized enterprises (SMEs) have at least a basic level of digital intensity, compared with the EU average of 55%. However, 20% of SMEs in Greece sell their goods and services online, which is above the EU average (18%).

Digital transformation is a key EU priority. Shaping policies that enhance the uptake of new digital technologies, create new opportunities for businesses, support the EU green transition and meet its 2050 climate neutrality objective, support citizens in acquiring digital skills and training workers, and contribute to the digitalisation of public services, is an imperative for the digital transition of the economy.

To this end, the Greek government adopted the Digital Transformation Bible[40], which is a record of the necessary interventions in the state's technological infrastructure, in the education and training of the population for the acquisition of digital skills, as well as in the way Greece uses digital technology in all sectors of the economy and public administration. Its main role is to set the objectives of the national

[37] https://haci.gr/ethnikos-klimatikos-nomos-ypochreosei/
[38] Special buildings in accordance with Article 2(21) of Law 4067/2012 are defined as buildings, the main use of which in more than 50% of their total building area is not residential.
[39] DESI index country profile (EL), https://digital-strategy.ec.europa.eu/en/policies/desi-greece
[40] GOVERNMENT GAZETTE 2894/B/5-7-2021

strategy for the digital transformation of the country, as well as the guiding principles, the governance model and the strategic axes of the digital transformation.

The Digital Transformation Bible identifies specific projects that affect the exercising of all areas of public policy (e.g. Health, Education, Justice, Economy, Environment, Energy, etc.) thus contributing to the modernisation of the operation of the public and private sector. Its key interventions incorporate a series of actions and projects organised in distinct strategic axes. The Digital Business is one of the key strategic axes of interventions and concerns the following:

- Boosting start-up entrepreneurship through the "ΚΕΠ-Plus" programme
- Digitalisation of all public services to businesses
- Use of IT tools for decision-making (evidence-based policy) in the public sector
- Advanced and integrated production, automation and robotics systems
- Development of digital services/systems to support start-up or scale-up
- Development of a system for valuation of digital maturity of enterprises and documentation of State aid design for the digital transformation of enterprises (Digitometer)

The industry for its successful transition to the modern digital age requires not only the support of the public sector, the digitalisation of its services, but also financial support for investments in advanced technological and digital systems, as well as the existence of human resources with appropriate digital skills. The digital modernisation of manufacturing enterprises and in particular SMEs will also contribute to the green transition, energy savings and the production of innovative products, significantly improving the international competitiveness of manufacturing. Domestic manufacturing companies are invited to invest in advanced technology systems, such as:

- Internet of Things (IoT) and Industrial Internet of Things (IIoT)
- 3D Printing Additive Manufacturing
- Big Data and Data Analysis
- Robotics
- Augmented Reality (AR) and Virtual Reality (VR)
- Cloud computing
- Cybersecurity

Greece published in October 2021 its Operational Programme for Digital Transformation (2021-2027)[41] under the EU Cohesion Policy, which will help implement the Digital Strategy. Greece is also involved in a wide range of European initiatives and programmes, such as the Technical Support Instrument (TSI) and the Horizon 2020 (Horizon 2020) research and innovation funding programme that contribute to the country's digital transformation.

3.12.1 Digital Transformation of the Greek Industry (Industry 4.0) – Action Plan for the "Digitalisation of the Greek Industry"

The national strategy for the digitisation of Greek industry is a coherent national plan where all stakeholders (public sector, industrial ecosystem as a whole and research and innovation entities) will work together to achieve the digital transformation of the Greek industry[42]. The vision for the Greek industry is "*to emerge as an innovative, internationally competitive and extrovert industry, making the*

[41] "Digital Transformation 2021-2027", https://www.digitalplan.gov.gr/file/ppsimet-sfc2021-prg-2021el16ffpr002-1-2.pdf
[42] https://www.ggb.gr/el/node/1820

most of digitalisation and continuous integration of new technologies and applications Industry 4.0". The implementation of this vision will be achieved by achieving the following priorities and strategic objectives for the industry:

- Increase the digital maturity of the Greek industry.
- Digital reskilling and training of industry's human resources.
- Strengthening applied research and development, innovation and industrial production potential.
- Support the transition of the industry to a zero-emission and low environmental footprint model.
- Create a collaborative industrial ecosystem to accelerate the digitalisation and growth of medium-sized as well as of small-medium-sized industrial enterprises.
- Strengthening the internationalisation and extroversion of the Greek industry, contributing to international, European and local value chains.
- Increase the ability of the industry to respond to the specific needs of the environment but also to crises/changes that may arise in the future.
- Increase the contribution of industry to the entire Greek economy.

The strategy focuses on the challenges and opportunities offered by the technological and operational toolbox of the 4th Industrial Revolution (Industry 4.0) for the transformation of the productive and manufacturing base in Greece, in line with the needs and requirements of the new production and business model for an innovative, green and internationally competitive and extrovert industry. It concludes with the proposal for action at national level based on six (6) horizontal and three (3) vertical pillars of actions, with comprehensive packages of proposals and initiatives (Table 3.4). In doing so, it attempts to contribute to:

- The coherent National Strategy for the Digital Transformation of the Greek Industry as an integral part of the National Strategy for the Digital Economy.
- The processes for shaping the New National Business Discovery Process and the New Smart Specialisation options.
- The design of actions and initiatives under the new Partnership Pact and "EPAnEK 2021-2027", the Recovery and Resilience Fund (RRF) and the National Development Programme.
- Strengthening the National Innovation System and National Digital Infrastructures
- The development of new techniques and other skills and capabilities.
- Creating a more business-friendly digital environment for manufacturing and businesses in general with a focus on specific fields and technologies.
- The creation of integrated business plans in the areas of smart manufacturing, construction materials and circular economy.
- The design of targeted and integrated interventions for SMEs and the development of enhanced production relations at the level of ecosystems and value chains.

Table 3.4: Pillars of the strategy for the digitalisation of the Greek industry

Implementation pillars	High priority areas
Human Resources Digital Skills	Smart Manufacturing Technologies
Innovation and start-ups in the Digital Age	Structural Materials
Collaborations and synergies	Circular Economy
Industrial standards	
Regulatory environment	
Tools to accelerate investments in digital technologies	

3.12.2 National Smart Specialisation Strategy 2021-2027

The National Smart Specialisation Strategy (NSSS) was adopted in June 2022[43]. The NSSS was designed at national level considering the country's regional specialisations. It aspires to play an important role in the country's development, by setting strategic goals that enhance extroversion and the integration of new ideas, promote innovation and attract technological investment through overcoming barriers, improving the regulatory framework and developing better management ability.

The National Smart Specialisation Strategy is characterised by the identification of strategic intervention areas (priorities), which is based both on the analysis of the strengths and potential of the economy and on the Business Discovery Process in which stakeholders are involved. The NSSS takes a broad view on innovation and attempts to support effective monitoring mechanisms.

The NSSS 2021-2027 identifies eight priority areas (Agro-food Chain, Life Sciences, Health, Medicine, Digital Technologies, Sustainable Energy, Environment and Circular Economy, Transport & Supply Chain, Materials, Constructions & Industry, Tourism, Culture and Creative Industries).

The vision of the Smart Specialisation Strategy is the transition to a new development model, socially, economically and environmentally sustainable, based on knowledge and its exploitation through the production of products and services of high added value, with the prospect of integration into International Value Chains.

This vision is broken down into five strategic objectives: 1. Increasing the production of new knowledge, 2. Effective use and dissemination of new knowledge, 3. Technological modernisation – adoption of innovations, 4. Development, Networking & Internationalisation of Greek Enterprises, 5. Increase extroversion – Participation in Research, Technological and Business International Value Chains.

To achieve the strategic objectives of the NSSS, actions are identified, which fall within the following 8 areas of intervention: Human Resources (Research & Production), Research and Innovation Infrastructures, Mechanisms, Innovation Support Services & Structures, Research and Production Connection, Digital Transformation, Regulatory Framework (Legislation, Administration, Taxation, Promotion of Public Sector Innovation, Promotion – Publicity).

3.13 Circular Economy Action Plan

The National Action Plan for the Circular Economy, adopted in April 2022 (Government Gazette, Series I, No 84/3-5-2022), records the current situation in relation to Greece's position on waste management and circularity, and also describes the characteristics of the system that act as obstacles to the transformation of the linear economy into a circular economy.

The Action Plan aims at adopting the circular economy model covering all relevant value chains and compatible with the corresponding European institutional framework for 2021-2025. Furthermore, it acknowledges that to successfully implement the circular economy model, design must be integrated and based on systemic approaches. It therefore defines several interministerial procedures and recognises the role of specific actors in the implementation of the project.

The plan is structured on five pillars that include a) sustainable production and industrial policy, b) sustainable consumption issues, c) waste reduction while improving its value (upcycle), d) specific actions for products that need to be addressed as a priority and e) some other horizontal actions. The last two

[43] https://gsri.gov.gr/wp-content/uploads/2022/07/%CE%95%CE%A3%CE%95%CE%95-2021-2027-V.1.0.pdf

pillars include 66 actions with a time horizon 2021-2025, addressing production, consumption, waste management, horizontal governance issues but identifying products of high importance for the circular economy that need to be addressed as a matter of priority.

The action plan provides for a monitoring framework for its implementation, coordinated by the Secretariat-General for Natural Environment and Water of the Ministry of Environment and Energy. The general and special secretariats of the competent ministries, the National Council of Circular Economy Agencies and the Interministerial Committee on Circular Economy participate in the monitoring of the project. In addition, a new observatory for the Circular Economy is foreseen to monitor the evolution of the transition to the Circular Economy through specific indicators, as well as to evaluate the action plan over time. In this context, specific indicators that will be useful for monitoring the implementation of the plan are expected to be developed.

3.14 National Planning for Waste Management

The recent National Waste Management Plan (NWMP) for 2020-2030 was adopted in September 2020 and amended in April 2023[44]. The amendment of the NWMP was deemed necessary to adapt it to new developments in the circular economy as well as to changes in the criteria for financing waste management infrastructure, with a view to ensuring the financing of the infrastructure from the RDPA 2021 – 2027.

It is the latest strategic and political plan to address the country's institutional issues in the field of solid waste management. The NWMP, which covers the period 2020-2030, aims to implement the hierarchy of waste management options, with a view to reducing landfill, which is the current most widespread practice and strengthening other more preferred practices. Through this, it is expected to reduce the waste of the Greek economy while at the same time increase the quality and value of discarded materials, which will now re-enter the system following the principles of the circular economy.

The new NWMP covers the management of municipal waste (municipal solids, urban sludge), industrial waste (hazardous and non-hazardous, but not those under alternative management or other categories), agricultural waste, other hazardous waste (waste containing asbestos, packaging of hazardous substances, waste containing polychlorinated biphenyls and polychlorinated PCB/PCT[45]), excavating waste, construction and demolition waste, as well as waste from alternative management (lubricants, end-of-life vehicles, vehicle and industrial accumulators, electronic and electrical equipment, vehicle tyres) and, finally, waste of sanitary units. Regarding plastics or certain specific categories thereof, either separately collected or recovered after treatment in RSC/WTU/RRU[46], the revised National Plan also provides the possibility for further utilisation, through chemical recycling in appropriately licensed facilities instead of thermal recycling.

For the implementation of the policies and guidelines of the NWMP, Regional Waste Management Plans (RWMPs) are drawn up, describing the specific targets for circularity.

[44] (GOVERNMENT GAZETTE, SERIES A, NO 94) 19.4.2023. Approval of amendments to the National Waste Management Plan (ESDA) – Amendment to Act No 39/31.8.2020 of the Council of Ministers (Government Gazette, Series A, No 185).
[45] Substances that were widely used until the mid-1970s and which have been shown to have significant negative effects on human health as well.
[46] RSC: Recycling Sorting Center. WTU: Waste Treatment Units. RRU: Recycling Recovery Units.

The plan estimates the amounts of waste expected to be generated in the Greek economy in 2025 and 2030. This exercise links the quantities and the course of the national economy and can be a first attempt to adopt relatively effective goals.

The main objectives of the NWMP concern both horizontal management methods and the need to improve performance in the management of specific waste streams by 2030, the success of which is also linked to the need to increase alternative management systems. For several of the 2030 targets, intermediate targets are set for 2025. Achieving the objectives of the NWMP requires a series of upgrades to the existing infrastructure system and to the legislative framework. It is envisaged to create a consolidated institutional framework which, together with the upgrading and provision of interoperability between existing electronic registers, will ensure the reliability of the data collected.

Table 3.5 Indicative objectives of the NWMP

- Separate collection of recyclable materials and biowaste
- Preparing for re-use and recycling of produced MSWs at a rate of 55% by weight by 2025 and 60% by weight by 2030
- Packaging Waste Recycling: 65% by weight by 2025 and 70% by weight by 2030
- Landfill rate below 10% by 2030
- Treatment of mixed waste in modern waste plants
- Creation of energy utilisation units for the residue (3 or 4 units)
- Elimination of uncontrolled disposal by early 2021 – restoration of landfills by 2022
- Mandatory separate collection of bio-waste by 31/12/2022
- Reuse, recycling and recovery 70% by weight of excavation and demolition waste
- Inclusion of additional streams in the alternative management regime with new objectives.
    - Mandatory separate collection for metals, paper, plastic, glass, textiles, mattresses, furniture, expired medicines and hazardous waste from households.
    - Specific current for plastic beverage bottles up to 3 litres – a recycling target of 77% by weight by 2025 and 90% by 2029 according to Directive EU/2019/904
- Focus on reducing industrial waste.
    - Adoption of industrial symbiosis solutions.
    - Establishment of hazardous waste management plants and landfills
- Reducing plastic wastes pollution and tackling marine pollution.
    - Implementation of the Single-use Plastics Directive EU/2019/904
- Development of a network for the collection of biodegradable agricultural waste.
    - Separate collection and recovery of plastics used in agriculture.
    - Focus on greenhouse plastics and plant protection product packaging.

Source: NWMP

The NWMP also stresses the importance of informing all parties involved throughout its implementation. This will be achieved through continuous dialogue and the creation of horizontal synergies. In addition, circular consumption and consumer awareness practices are being promoted and incentives are expected to be created to encourage consumers to adopt principles of circularity in their daily lives.

The implementation of the new NWMP and the achievement of the targets in 2025 and 2030 will also be supported by the implementation of specific economic tools. Indicatively, the use of a landfill fee is preferred, to turn landfill into a non-economically advantageous practice and to start using programs “Pay as you throw” (PAYT). In addition, a reduced tariff for pre-selected biowaste is proposed in relation

to mixed waste, while corresponding incentives are expected to be given to reduce the treatment of mixed.

In the information dimension, the NWMP provides for the establishment of a system for the recording and accounting of waste and the cost of related services for local authorities. In this way, information on management costs will be more easily accessible to local policy decision-makers, who will be able to make better informed decisions. In addition, citizens will be aware of the type and cost of the services concerned thereby creating substantial incentives to reduce landfill, sorting at source and recycling.

The amendment to the NWMP adopted in April 2023 aims to create an integrated, coherent and modern network of waste management infrastructure, based on the principles of proximity and self-sufficiency, using the best available techniques to achieve high recovery and recycling rates. This is to be achieved through the timely and effective absorption of all available resources of the current financial framework 2014-2020, as well as the use of the resources of the new financial framework 2021-2027 in targeted eligible actions and infrastructures that will ensure the transition to a sustainable and circular economy.

3.15 Tools to support investments funding

To increase the funding of investments made by companies in areas of strategic importance for Greece and the EU, funding programmes and support tools have been put in place. Depending on how they are managed and financed, these programmes and tools can be classified into three categories (Graph 3.1).

Graph 3.1: Tools to support investment funding

Community programmes (such as Horizon Europe, LIFE and InvestEU) leverage resources from the European Union's multiannual financial framework and are managed centrally at EU level. The co- Co-funded programmes, such as the Regional Development Partnership Agreement (RDPA) 2021-2027 and the National Recovery and Resilience Plan Greece 2.0, utilise structural funds and other Community sources, combined with resources from the state budget. Finally, investments are financed exclusively from national resources, through the National Development Programme 2021-2025 and the new Development Law (Law 4887/2022). Below, some key features of these programmes are presented and how they can support an investment in the manufacturing sector in Greece.

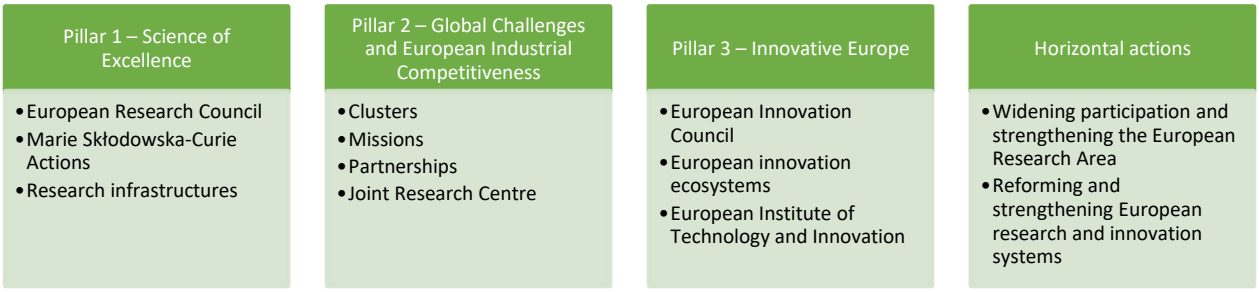
3.15.1 HORIZON EUROPE

Horizon Europe (Horizon Europe) is the new framework programme of the European Union (EU) for funding research and innovation for the period 2021-2027. It is the largest direct funding programme of

the EU. Direct funding programmes resources come from Member States' national contributions to the EU budget and are provided directly from the EU budget through public calls managed at EU level.

Horizon Europe has a total budget of 95.5 billion euros. Its main objective is to address global challenges and industrial modernisation through coordinated research and innovation efforts. The programme is therefore directly related to the financing of manufacturing enterprises that innovate or collaborate with research teams. The programme consists of 3 pillars, horizontal actions and specific programmes (Graph 3.2). The pillars of the Programme include the budgets of European organisations supporting research and innovation, such as the European Research Council, the European Innovation Council and the European Institute of Technology and Innovation.

Graph 3.2: Structure of Horizon Europe



Source: horizoneurope.gr

These organisations have established their own funding tools and programmes, providing significant support to research groups active in European universities and research organisations. The first and third pillars of the programme (Excellence Science and Innovative Europe respectively) also include actions that finance the development and interconnection of research infrastructures and innovation ecosystems.

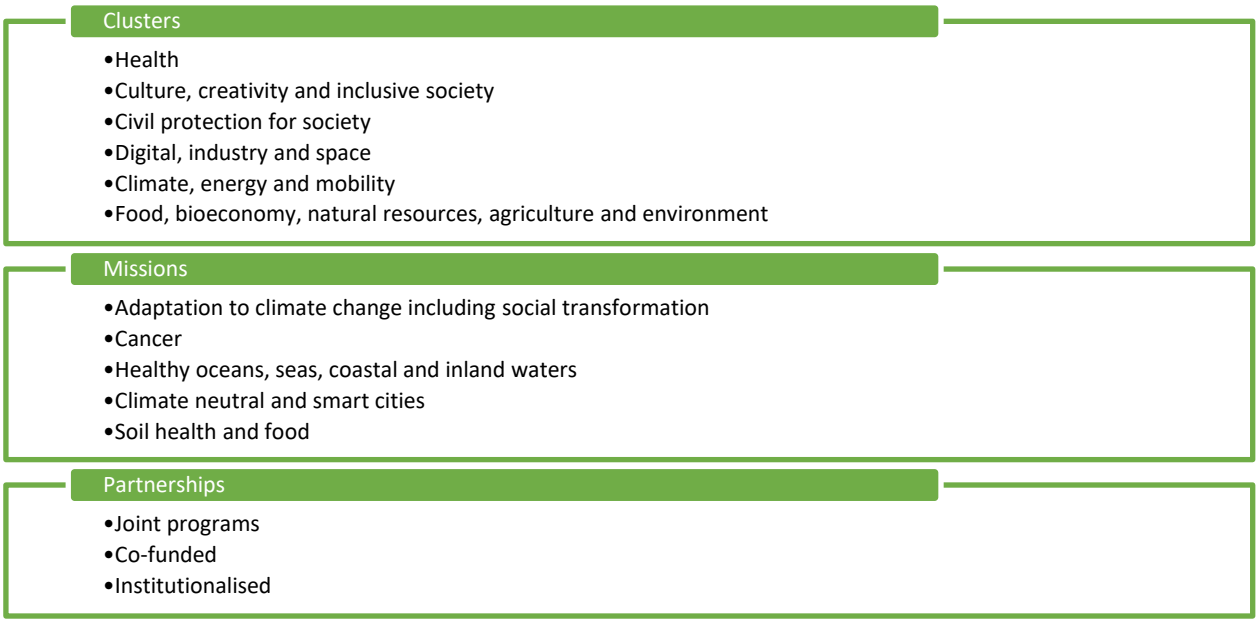
Of particular interest to private sector enterprises are the actions under Pillar 2 of the Programme, entitled 'Global Challenges and European Industrial Competitiveness'. In addition to the budget of the EU Joint Research Centre, it includes programmes aimed at addressing global challenges grouped into six clusters (Graph 3.3).

Industry is directly part of one of these clusters (digital technologies, industry and space), with a total budget of 15.3 billion euros. The objectives of the cluster include supporting the digitalisation and transformation of European industry, as well as contributing to ensuring European industrial leadership and autonomy in technologies and resources. Investment initiatives that can involve manufacturing enterprises in specific sectors, such as the processing of medicines, health equipment, food, etc., can be included in other clusters on health (with a budget of 8.2 billion euros), food, bioeconomy, natural resources, agriculture and the environment (8.9 billion euros), climate, energy and mobility (15.1 billion euros) etc.

The second pillar of the programme also includes the financing of missions with a maximum total budget of 600 million euros. These are initiatives that serve as an umbrella framework to promote concrete solutions to particularly important objectives, combining resources from different clusters and other pillars of the Programme and developing synergies with national initiatives. Pillar 2 includes the financing

of partnerships with public and private entities to jointly develop and implement a research and innovation programme.

Graph 3.3: Clusters, Missions and Partnerships under Horizon Europe Pillar 2



Source: horizoneurope.gr

Horizon Europe is an important opportunity for a partnership between domestic manufacturing companies with research institutions in Greece and abroad, which has not been exploited as fully as possible, as the share of private enterprises participating in the programme is relatively low in Greece. Compared to other sectors of the Greek economy, Manufacturing ranks third based on the number of enterprises that participated in the previous respective EU programme Horizon 2020.[47]

The programme is implemented through grants to entities and consortia of legal entities (private and public enterprises, Civil Society organisations, local authorities, research institutes, universities, etc.) established in an EU Member State or in other countries associated to the Programme. Consortia shall submit funding proposals in response to specific calls published by the project managing authorities. Proposals are assessed in terms of excellence, impact and quality and effectiveness of implementation. The funding covers staff, travel and accommodation costs for project implementation, infrastructure and equipment necessary for the project, costs for subcontractors, other costs related to the project (e.g. events, publications) and indirect costs, and depending on the call it is financed from 60% to 100% of the total eligible costs of an action.

Several projects with Horizon Europe funding have already been developed in relation to the chemical industry. The Partnership for the Assessment of Risks from Chemicals (PARC) programme[48] supports innovation in chemical risk assessment and is a co-funded collaboration of Horizon Europe with a total budget of 400 million euros over 7 years (starting May 2022). The aim of the PARC is to create a pan-European research and innovation programme to support EU and national chemical risk assessment and

[47] EY & IOBE (2023). The contribution of European direct funding sources to the economic development of Greece. http://iobe.gr/research_dtl.asp?RID=284
[48] https://www.eu-parc.eu/

risk management entities with new data, methods, tools, networks and skills to address current, emerging and new chemical safety challenges.

The IRISS project[49] is a three-year project, starting on 1st June 2022, funded by Horizon Europe. It has a total budget of 4.3 million euros, of which around 3.5 million euros comes from the EU, with additional funding from the University of Birmingham and the Swiss Federal Materials Science and Technology Laboratories. This project aims to connect, synergy and transform the Safe-and-Sustainable-by-Design (SSbD) community in Europe and globally towards a life-cycle approach. In cooperation with industry, roadmaps will be developed to implement research and innovation, but also to demonstrate the needs in the policy area. The project focuses on value chains for textiles, constructions, electronics, energy, automotive, packaging and perfumes, and responds to the fulfilment of the EU Green Deal, the EU Chemicals Strategy for Sustainability, and the UN Sustainable Development Goals.

The Open Innovation Test Beds (OITBs[50]), supported by Horizon Europe with 319 million euros, address the challenges of industrial transformation in the context of the European Green Deal and Europe's Industry Double Transition, supporting the scaling up and diffusion of technologies. The basic services provided by OITBs are the development, testing and upgrading of the technology to move from the laboratory validation to a higher technology readiness level (TRL) before entering the competitive market. Potential users of OITBs come mainly from industry, in particular SMEs, which seek support for the development and integration of innovative technologies towards the commercialisation of new products, processes and services, while ensuring feasibility and compliance with the regulations.

In 2023, Horizon Europe funded 3 themes for advanced materials and nanomaterials, and one coordination and support action, referred to in the SSbD framework, as well as 3 specific themes for the development of SSbD tools:

- Bioinspired and biomimetic materials for sustainable textiles
- Smart sensors for the purchase of electronic devices
- Advanced materials (nano- and bio-based) for sustainable agriculture
- Coordination and knowledge sharing in material development communities
- Innovative methods for safety and sustainability assessments of chemicals and materials
- Integrated approach for the impact assessment of safe and sustainable chemicals and materials
- Computational models for the development of safe and sustainable by design chemicals and materials

In 2024 there will be an invitation with 2 themes for advanced materials and 1 theme for SSbD.

M-ERA-NET 3[51] represents an important ecosystem of 49 public funding organisations from 35 countries issuing joint calls for materials research and innovation. This network covers several thematic research and innovation priorities, including sustainable advanced materials for energy, health applications or advanced electronics.

The EU NanoSafety Cluster[52] aims at maximising synergies between European-level projects related to the safety of materials and technologies allowed by using nanoforms, including toxicology and ecotoxicology aspects, exposure assessment, interaction mechanisms, risk assessment and

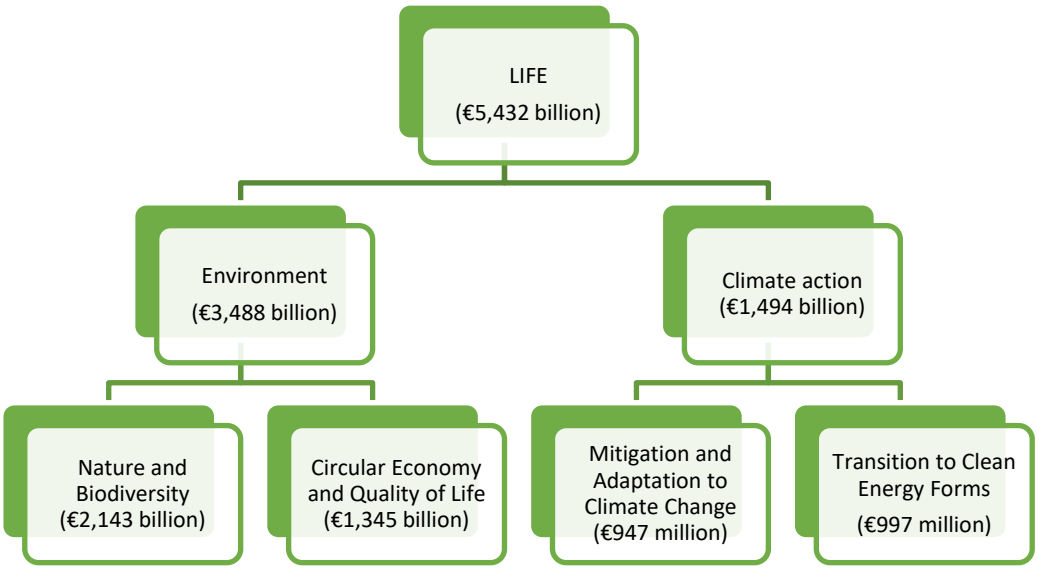
[49] https://iriss-ssbd.eu/iriss
[50] https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/key-enabling-technologies/chemicals-and-advanced-materials_en#making-it-happen---projects-and-partnerships
[51] https://www.m-era.net/
[52] https://www.nanosafetycluster.eu/

standardisation. Cluster is an initiative of the European Commission's Directorate-General for Research and Innovation (DG RTD), which finances these projects.

3.15.2 LIFE PROGRAMME 2021-2027

Life 2021-2027 operates in a similar way, as a direct funding programme, where support resources are allocated through competitive procedures at European Union level. It offers another important opportunity for domestic manufacturing companies to participate in projects to develop innovative green technologies. With a total budget of 5.4 billion euros, it is the most important funding tool of the European Union dedicated to the Environment and Climate Action. The overall objective of the Programme is to contribute to the shift towards a sustainable, circular, energy-efficient, renewable-based, climate-neutral and climate-resilient economy. It includes two areas: environment and climate action (Graph 3.4).

Graph 3.4: The structure of the LIFE 2021-2027 programme



Sources: European Commission, LIFE Programme. EY & IOBE (2023), The contribution of European direct funding sources to the economic development of Greece.

The Environment sector, with a total budget of 3.5 billion euros, includes actions for nature and biodiversity (2.1 billion euros), as well as actions on the circular economy and quality of life (1.3 billion euros). Climate Action (1.9 billion euros) includes climate change mitigation and adaptation projects (947 million euros), as well as clean energy transition actions (997 million euros). Any public or private entity established in the EU, except for individual enterprises, can benefit from the LIFE Programme by submitting a proposal as a coordinating beneficiary or as a co-beneficiary. The available budget per project financed varies in the range of 2 to 5 million euros. The eligible costs are equivalent to those covered by Horizon Europe. The funding rate amounts to 60% to 95% of the total project budget.

3.15.3 OTHER DIRECT FUNDING PROGRAMMES

The current Multiannual Financial Framework 2021-2027 includes a few more direct funding programmes, some of which can also involve domestic manufacturing companies. Indicatively, the Innovation Fund, with a total budget of 10 billion euros, finances demonstration projects of innovative technologies and processes that achieve greenhouse gas emission reductions in energy-intensive industries (steel, aluminium, cement, glass, chemicals, paper, etc.), as well as projects on carbon capture

and utilisation or storage (CCU or CCS), innovative renewable energy production and energy storage. In addition, the European Defence Fund finances projects aimed at promoting a competitive defence industrial base in Europe. The digital sector is supported by the Digital Europe and Connecting Europe Facility programmes, with the latter including projects in the energy and transport sectors. Finally, opportunities to finance projects in which healthcare manufacturing enterprises can participate is provided by the EU4Health Programme.

3.15.4 INVESTEU

The InvestEU Programme consists of 3 strands – a fund, an investment advisory hub and a portal for networking projects and investors (Graph 3.5). The fund offers direct and indirect financing to public and private sector investment projects. It has been operational since 2022 and brings together in the same context different EU funding programmes, created under the Investment Plan for Europe, known as the 'Juncker Plan'. Project financing from the fund is carried out by implementing partners, including the European Investment Bank Group (EIB Group), as well as financial institutions (development banks, commercial banks, investment funds, microcredit institutions, etc.) of EU Member States. Depending on the size of the investment and the entity implementing it, the final recipients shall apply for funding either to the main implementing partner (EIB Group) or to a local implementing partner.

Graph 3.5: The structure of the InvestEU Programme

Source: European Commission, The EU budget for the future.

As part of the operation of the fund, the European Commission shall conclude specific guarantee agreements with the implementing partners. The guarantee provided by the European Commission, with the resources of the fund, allows implementing partners to offer financing solutions on favourable terms (longer duration, lower interest rate, higher amounts, etc.), reducing the risk taken by investors. This promotes investment in strategic sectors of the economy, mobilising significant private resources.

The budgeted guarantee of the fund amounts to 26.2 billion euros. It is distributed in 4 policy areas as follows:

- Sustainable infrastructure - 9.9 billion euros
- Research, innovation and digitalisation - 6.6 billion euros
- Small and medium-sized enterprises - 6.9 billion euros
- Social investment and skills - 2.8 billion euros

In addition, each Member State may contribute part of its contribution to a national programme implementation strand, where resources can be directed to specific national priorities that the country may have. Together with the private resources of investors and promoters, the fund is expected to mobilise a total of 650 billion euros for additional investments.

Besides the financing strand, the programme contains two further investment support tools. Through the InvestEU Advisory Hub, it provides technical assistance to investment projects seeking funding. In particular, it supports public and private sector entities to prepare, develop, structure and implement investment projects. At the same time, the programme's dedicated portal (InvestEU Portal) allows networking to investors looking for investment opportunities and entities seeking investment resources to implement projects.

3.15.5 RDPA 2021-2027

The "Regional Development Partnership Agreement" (RDPA or "ΕΣΠΑ") is the largest and most well-known tool for financing investment projects in Greece. The current RDPA 2021-2027, with a total budget of 26.2 billion euros was adopted by the European Commission on 29 July 2021. The support from the European Structural Funds amounts to 20.9 billion euros and the remaining 5.3 billion euros corresponds to the national contribution to the programme through the country's state budget. The new RDPA 2021-2027 includes support priorities like the productive potential of the economy, infrastructure, human skills and social protection. In particular, 30% of the resources of the RDPA 2021-2027 are earmarked for actions to move towards a "more social" Greece. A high share of resources also has targets for a "greener" (27%) and "smarter" (20%) Greece.

The programme is implemented through 8 sectoral programmes, 13 regional programmes and the maritime, fisheries and aquaculture programme. The main changes compared to the previous RDPA 2014-2020 include the new Competitiveness Programme, with a budget of 3.9 billion euros and business support actions, the distinct programme for digital transformation, with enhanced resources (943 million euros total budget) and a new managing authority, as well as the distinct programme for the environment, climate change and energy (3.6 billion euros).

Specifically, to support green investments and accelerate the green transition, the Environment and Climate Change programme, with a total budget of 3.61 billion euros, aims to promote the clean energy transition and use RES to minimise greenhouse gas emissions. In addition, actions aimed at adapting to climate change, preventing and managing risks related to both the impacts of climate change, effective management of solid waste and water, integrating circular economy considerations, as well as biodiversity conservation and the sustainable use of natural resources, can be supported by resources from this programme.

For the digital transition of businesses, the Digital Transformation programme, with a total budget of 943 million euros, aims to provide new and upgraded public digital services and applications to businesses and citizens, to ensure the interoperability of digital systems and services, to develop digital platforms to support business activity, to ensure ultra-fast connectivity, as well as to meet human resource skills needs in support of the country's digital transformation, focusing on the uptake and integration of cutting-edge technologies.

Of particular importance for the development of human resources and the filling of job vacancies is the Human Resources and Social Cohesion programme[53], with a total budget of 4.21 billion euros. The programme aims at a more social and inclusive Greece, through the implementation of the European Pillar of Social Rights[54], in line with Policy Objective 4 of the Programming Period 2021-2027. The

[53] Programme "Human Resources and Social Cohesion", New RDPA 2021-2027
[54] COM(2021) 102 final

Programme, among others, serves national employment and education policies. Improving access to employment, enhancing the employability of human resources, as well as ensuring high quality and effectiveness of education and lifelong learning systems are some of the objectives of the Programme. In detail, the programme includes interventions to modernise and strengthen the mechanisms for monitoring the performance of education policies and linking education systems to the labour market, as well as to improve the quality and efficiency of the education system in terms of skills acquisition, completion of studies and linking to the needs of the labour market. In addition, the programme foresees systemic actions to upgrade vocational education and training, and develop skills in modern areas such as sustainable growth, blue economy, climate change, etc.

The Competitiveness Programme is the tool to implement the National Smart Specialisation Strategy (NSSS) linking research and innovation with entrepreneurship and enhancing national and regional strengths. With a total funding of approximately 3.9 billion euros, of which 3.1 billion euros comes from Community funds from the ERDF and ESF+ Funds, the programme strategy is complementary to the REACT-EU interventions and the Recovery and Resilience Facility (RRF), and is organised in 4 main axes: a) strengthening R&I, b) enhancing entrepreneurship and competitiveness, c) improving access to finance for businesses, and d) developing human capital in the context of growth transformation.

Within the framework of the Competitiveness Programme, the "Research-Innovate" action, with a budget of 300 million euros, aims at linking research and innovation with entrepreneurship and enhancing the competitiveness, productivity and extroversion of enterprises to international markets, with a view to transitioning to quality innovative entrepreneurship and increasing domestic added value. The action will concern research and innovation projects that are part of one of the following interventions.

Intervention		Indicative public expenditure (million euros)
I.	Research and Development by Businesses	60
II.	Partnerships of Enterprises with Research Organisations	180
III.	Exploitation of research results	39
IV.	Seal of Excellence for Businesses	21

Intervention I is addressed to existing SMEs or Business Groups in which at least one is SMEs. Intervention II concerns partnerships of existing firms, irrespective of their size, with research organisations, where the main beneficiaries being the firms. Intervention III concerns existing individual SMEs and Intervention IV concerns SMEs that have received the Seal of Excellence for research and development projects.

3.15.6 National Recovery and Resilience Plan

The unprecedented conditions created by the COVID-19 pandemic have made it necessary to strengthen the resilience of the European economy through emergency financing tools. In this context, in May 2020, the European Commission presented the NextGeneration EU project, which was approved in principle in July of the same year by EU Member State leaders. The total budget of the programme amounts to 807 billion euros, most of which concerns the Recovery and Resilience Facility (RRF), with 724 billion euros. Out of the total budget of the fund, 338 billion euros are provided to Member States in the form of grants, and the rest in the form of loans. Repayment of loans by Member States is planned to start in 2028 and last until 2058.

To receive funding from the Programme, each country submits a relevant plan, which shall include a report with funding targets and a reform plan. The National Recovery and Resilience Plan Greece 2.0 was approved by the European institutions on 13 July 2021. Together with the resources from REpowerEU adopted in November 2023, it raises 36.2 billion euros (Table 3.6). In total, it is expected to mobilise 72.6 billion euros in total investment in the country. It includes more than 100 investments and 68 reforms, with an implementation horizon at the end of 2026. The pillars of the NRRP Greece 2.0 include the green and digital transitions, as well as actions to support private investment, economic transformation, employment, skills and social cohesion.

As part of the plan and specifically for the digital upgrading of businesses, the pertinent ministries of finance and digital governance implement through a digital platform[55] the action "Digital Transformation of Small and Medium-sized Enterprises", with a total budget of 445 million euros. The action concerns the enhancement of the digital maturity of the country's small and medium-sized enterprises (SMEs) to modernise their productive, commercial and administrative operations.

Table 3.6: Recovery Fund Budget by Pillar

Pillars	Recovery Fund Budget (million euros)	Total investment resources mobilised (million euros)
1. Green Transition	6.018	11.283
2.Digital Transformation	1.935	2.070
3. Employment, Skills, Social Cohesion	5.226	5.307
4. Private investment and economic transformation	5.311	9.614
Sum of grants	**18.491**	**28.274**
Loans*	**17.728**	**44.320**
Total investment resources	**36.219**	**72.593**

Source: Greece 2.0 National Recovery and Resilience Plan. European Commission, IOBE Assessments. *Loans support private investment by providing companies with access to finance through loans, equity support for SMEs and the InvestEU programme, and will be complemented by reforms to reduce administrative burdens and improve the regulatory framework.

The programme will implement investments in technologies and services that promote the digitalisation of small and medium-sized enterprises, such as electronic payments, e-sales and e-invoicing applications, digital advertising tools, teleworking systems, business analytics, upskilling, data backup and disaster recovery services, artificial intelligence, Internet of Things, provision of integrated solutions for contactless services, cybersecurity systems, cloud infrastructures and services, templates and software of industrial data platforms and upgrades of cash registers and POS.

The action to support small and medium-sized enterprises, with a view to their overall support for their digital transformation, is divided into three sub-programmes of State aid:

- Programme I: "Digital SME Tools". The 180 million euros programme provides cheques (vouchers), available for the acquisition –through purchase or lease– of new digital products and services, to enhance the digital maturity of the country's small and medium-sized enterprises (SMEs), using various digital tools.
- Programme II: "Development of Digital Products and Services". The 100 million euros programme supports digital investments, in the form of a non-repayable grant of between 200 thousand and 2 million euros, for the development of cloud infrastructure and services.

[55] https://digitalsme.gov.gr

- Programme III: “Digital Transactions”. The 165 million euros programme strengthens the adoption of modern digital tools that support the processes of invoicing, issuing tax documents and making electronic payments.

Actions of interest to the manufacturing sector are also included in other pillars of the NRRP. In particular, the green transition pillar includes investments aimed at the renovation of the existing building stock (Axis 1.2 of the NRRP), which includes industrial buildings, while the Axis reforms include the creation of new spatial planning for RES, industry, tourism and aquaculture. In Axis 1.3 for the transition to a green and sustainable transport system, it is envisaged to support the development of industrial production units and R&D departments in technologies related to electric mobility (vehicles, chargers, etc.) and carbon capture and storage. Actions to strengthen R&D expenditure in industrial enterprises are also included in Axis 4.5 (Promotion of research and innovation) of the project, through the increase of staff in existing and new innovative enterprises and the creation of incentives for the establishment of new R&D centres in the country.

Accordingly, Axis 4.6 (Modernising and improving the resilience of key sectors of the country’s economy) foresees reforms and facilitation of investments in key economic sectors, including domestic industry. In particular, the Industry 4.0 transformation programme will be accelerated and the smart production sector will be promoted, as well as the development of a new generation of industrial parks. It also includes the provision of debt capital to enterprises at reduced financing costs stemming from the borrowing facilitations of the Recovery and Resilience Fund. Emphasis is placed on advanced and digitally controlled industrial equipment, production control systems and the development of industrial partnerships to enhance production and cooperation in the industrial ecosystem.

A characteristic feature of the supports which do not take the form of a loan facility, both the NRRP and more traditional public financing tools, such as the RDPA, is their targeting almost exclusively at small and medium-sized enterprises. SMEs play an important role in job creation and are clearly essential in a modern economy, especially when they compete in international value chains. Moreover, until recently, it has been perceived that supporting large companies makes it difficult to ensure a level playing field within the EU common market. Increasing protectionism internationally, the energy crisis and the growing need for strategic autonomy, however, have led to a revision of this approach and the establishment of support mechanisms and large enterprises in strategic sectors. This development poses serious challenges in ensuring competitive financing of large enterprises in countries such as Greece, to which even large companies still do not have access to most financial instruments.

3.15.7 National Development Programme 2021-2025

The National Development Programme (NDP) was established by Law 4635/2019 (Government Gazette, Series I, No 167) in order to adopt an integrated system for the planning, management, monitoring and control of interventions financed from the national resources of the Public Investment Programme (PIP). For the first implementation period of the programme (2021-2025), the total budget is 10 billion euros. The development objectives of the NDP 2021-2025 follow five axes –smart growth, green growth, social development, infrastructure development and extroversion. The funded actions are part of 20 Sectoral Development Programmes (SDPs), 13 Regional Development Programmes (RDPs) and the Special Programme for Natural Disasters.

3.15.8 DEVELOPMENT LAW (LAW 4887/2022) AND OTHER TOOLS

An important tool for financing investment projects of enterprises in the manufacturing sector and other private investments are the State aid schemes, which were established through the new Development Law 4887/2022. The objectives of the thematic schemes of the Development Law include increasing private investments, supporting new entrepreneurship, supporting less-favoured areas of the country and areas included in the Just Development Transition Plan, as well as improving competitiveness in areas of high added value. The new Development Law aims at a dynamic and sustainable economy with green growth at the cutting edge, enhancing competitiveness, transformation of production, employment and regional convergence.

In particular, 13 thematic State aid schemes have been established, including the special scheme for manufacturing and supply chain sectors. Schemes are also established for the digital and technological transformation of businesses, the environmental upgrading of businesses, support for new entrepreneurships, research and applied innovation, business extroversion, large investments, European value chains, etc. Each scheme has an annual budget of 150 million euros, broken down by region and type of incentive.

In this way, the support of investment projects relating to activities in the circular economy and sustainable development and adopt technologies that contribute to the protection of the environment and the energy upgrading of enterprises can be supported by the new law. In addition, the “Digital and Technological Transformation of Enterprises” scheme aims to strengthen investment projects aimed at the technological upgrading of existing units, the introduction of new digital functions and processes and the combination of production methods with modern information and communication technology. The aim of the scheme “Digital and Technological Transformation of Enterprises” of the new law is to strengthen investment projects that promote digital and technological transformation, as well as the use of “Industry 4.0” technologies and upgrade the relevant skills of human resources.

The main forms of aid include tax exemptions, grants, leasing and subsidies on the cost of employment created. The grants are mainly for small and micro-enterprises, while medium-sized and large enterprises receive their support through the remaining three types of incentives. A scoring of investment proposals is foreseen based on specific qualitative characteristics such as competitiveness, quality and green entrepreneurship.

The maximum aid intensities are differentiated by company size and region based on the Regional Aid Map established for Greece for the period 2022-2027. In particular, for large enterprises the maximum aid intensities range from 15%-25% for the non-predefined areas (Western Sector of Athens, East Attica, West Attica and Piraeus), while in the predefined areas of the map range from 40% to 60%. The maximum aid intensities may be increased by 10 percentage points for medium-sized enterprises and by 20 percentage points for small enterprises for initial investments with eligible costs of up to 50 million euros.

So far, two rounds of the Processing - Supply Chain regime have been announced. The first round was launched in July 2022, while the decision on the allocation of aid to the pertinent entities for the year 2022 was adopted in December 2023. The call for the second round was issued in May 2023 and the decision on the allocation of resources for the year 2023 is expected to be adopted in 2024. Regarding the other support schemes, there have been launched two rounds of the scheme for Aid for Tourism Investments and one of the Entrepreneurship 360 and agri-food schemes - Primary Production and Processing of Agricultural Products - Fisheries.

One reason explaining the length of time to launch State aid schemes is related to the need for co-responsible sectoral policy actors to work together. Moreover, as it is purely national funding, the overall amount of funding faces budgetary constraints. The limited availability of national resources may also explain the relatively high proportion of the budget of aid granted in the form of a tax exemption (50% of the Manufacturing – Supply Chain for 2022). This form of aid has reduced attractiveness for enterprises compared to subsidies and grants, as it requires sufficient profits to exploit the aid.

In addition, restrictions on the amount of aid per investment and every three years apply to each company and group of companies. As a result of the above delays and restrictions, it appears that in many cases the aid limits allowed under the Regional Aid Charter are not exhausted and the possibility of supporting domestic entrepreneurship through the development law is not fully exploited.

It is worth noting, first, that the final aid is reduced to 80% of the initial aid when the investment is not implemented in a business park. This is the case at a time when business park development processes are lagging, and the majority of manufacturing enterprises (including the chemical industry) continue to operate in informal industrial concentrations. Secondly, that the 45% ceiling for building expenditure in the total business plan budget remains in the development law, despite the surge in construction costs due to inflation, green certifications (e.g. LEED) and stricter legislation on safety/hygiene/accessibility of human resources. This is the case while facilities in the chemical industry and other industries due to unavoidable use and flammable substances need ever more modern electromechanical equipment, fire safety and larger production sites for the installation of automated lines, storage of raw materials and auxiliary materials in response to more frequent exogenous supply disruptions, as well as the provision of customised flexible solutions to meet reasonably different requirements on international markets.

In addition to the development law, tax incentives for companies making green and digital investments, which aim to enhance competitiveness, extroversion and attract investment, are an important tool for aid. In particular, expenditure on green economy, energy and digitalisation is deducted from the gross revenues of small and medium-sized enterprises, with the exception of those active in the primary agricultural production, fisheries and aquaculture sectors, at the time of their implementation, increased by 100%. The surcharge shall also apply to the depreciation cost of the assets of small and medium-sized enterprises acquired with a view to strengthening the green economy, energy and digitalisation, provided that the undertaking does not apply an increased deduction of depreciation costs. The aid shall be granted in accordance with State aid rules and shall relate to expenditure incurred and fixed assets acquired in the tax years 2023 to 2025. However, due to the long duration of the double transition, this measure, which gives flexibility to businesses, could become permanent and the de minimis limitation lifted, although from 1 January 2024 the threshold was increased from 200 to 300 thousand euros.

3.16 Correlation of national strategies with the EU chemical industry transition pathway

As a general finding, the key building blocks of the EU chemical industry transition map and several of its priorities are satisfactorily covered by the relevant national strategies/road maps and financial instruments existing in Greece (Table 3.7). All strategies and actions can make a significant contribution to the sustainable competitiveness of the chemical industry in Greece, while the investment funding framework is supportive, as it places particular emphasis on the issues of green transformation and digitalisation, infrastructure, research and innovation and the strengthening of human resources skills.

In practice, however, achieving the objectives and making real use of European and national resources requires: (a) adapting them to changing needs and monitoring the implementation and results of each

strategy and (b) strengthening particular priorities/actions specific to the chemical industry, notably in the fields of growth in a feasible way and transforming it into convergence not only with the European average, but also global correlations, strengthening its resilience against adverse disruptions in the supply chain and energy and raw materials costs, access to alternative raw materials, sustainable transport of chemical raw materials, the regulatory framework that governs it, as well as ensuring the financial instruments and tools that will support the next programming periods, from 2028 onwards, the green and digital transition of the chemical industry and in Greece, as this will be a long-term process.

To this end, the allocation at national level of European resources for the current programming period in a way that responds to the changing needs of extrovert manufacturing companies and the pressing compliance timetable, such as those faced by the domestic chemical industry, is considered imperative. In a revised spirit and a reform holistic approach they need without further delays in calls and controls, no obsolete constraints, flexible and effective funding tools.

Table 3.7: Correlation of national strategies with the building blocks of the EU chemical industry transition pathway

	Sustainable competitiveness	Investments and funding	Support to R&I, techniques and technological solutions	Regulation and public governance (Legislation)	Access to energy and feedstock	Infrastructure	Skills	Social dimension
National Industry Strategy	●		●			●	●	
National Energy and Climate Plan	●				●	●		●
National Climate Law	●			●	●		●	
Digital Transformation of the Greek Industry	●		●			●	●	
National Smart Specialisation Strategy 2021-2027	●		●			●	●	
Circular Economy Action Plan				●	●	●		
National Plan for Waste Management	●			●	●	●		
Horizon Europe	●	●	●			●		
Life Programme 2021-2027	●	●	●			●		
Other direct funding programmes	●	●	●			●		
InvestEU	●	●	●			●		●
RDPA 2021-2027	●	●	●			●	●	●
National Recovery and Resilience Plan	●	●	●			●	●	●
National Development Programme 2021-2025	●	●				●		
Development law	●	●				●		

Source: IOBE analysis.

3.17 Greek industries in the green transition

3.17.1 "ERHYRA" - A RENEWABLE HYDROGEN PRODUCTION PLANT

"ERHYRA" is the project for the construction and operation of an innovative renewable hydrogen production unit. It is a project funded by the Clean Hydrogen Partnership, coordinated by Motor Oil with the participation of 9 partners from 7 countries (Italy, France, Germany, Spain, Netherlands, UK, Greece) and has a duration of 5 years[56]. "ERHYRA" presents on an industrial scale an innovative system for the

56 https://www.moh.gr/news/enarxi-tou-enosiakou-ergou-ephyra-gia-tin-kataskevi-kai-leitourgia-kainotomou-monadas-paragogis-ananeosimou-ydrogonou/

production of hydrogen (30MW) from renewable energy sources using advanced electrolysis technology. The large-scale electrolysis process will be integrated into the industrial operations of the Motor Oil refinery in Ag. Theodoros Korinthias. As part of the project, renewable hydrogen supply of current processes to the refinery and other industrial units in the wider region is planned, while part of the production will be directed towards the production of zero-emission fuels. Industrial integrated production of renewable hydrogen will be developed around the principles of sustainable development and circular economy, as the electrolysis system will be combined with: (a) electricity generation from renewable sources, (b) innovative waste heat harvesting technology, (c) environmental optimisation of water use, (d) utilisation of oxygen produced in the refinery's current operations, (e) creation of digital twin and (f) development of a specialised energy management system.

The "EPHYRA" project is expected to contribute effectively to achieving the objectives for electrolysis technologies as reflected in the Clean Hydrogen Partnership's Research and Innovation Strategy Agenda. At the same time, it will boost the production of renewable hydrogen at the lowest possible cost, thereby promoting the renewable hydrogen economy in the EU, the decarbonisation of industry and the uptake of zero-emission fuels. The "EPHYRA" project will be implemented by a strong partnership of stakeholders with proven research, innovation and industrial capacities. Project partners are Motor Oil (Greece) – Coordinator, the National Centre for Research and Technological Development (CERTH), the German Aeronautics Centre (DLR), the French company ENERTIME, the Aragón Institute of Technology (ITAINNOVA), the Dutch company New Energy Coalition (NEC), the Dutch company SoluForce, the Italian RINA Consulting, the Greek company Envirometrics and Siemens Process Systems Engineering as a partner from the United Kingdom.

3.17.2 "IFESTOS" - LARGE-SCALE CARBON CAPTURE UNIT

"IFESTOS" is a large-scale pioneering project of the TITAN Group's carbon capture and reduction of CO_2 emissions selected by the EU Innovation Fund aiming at carbon neutrality[57]. In the third call for proposals for large-scale projects, in which the EU will invest over 3.6 billion euros, 'IFESTOS' was among the 8 selected projects out of 98 applications in its category across Europe.

This project, the largest of its kind in Europe, will further promote the implementation of the Group's CO_2 reduction programme, accelerate the industry's green transition and make a decisive contribution to promoting carbon capture technologies in Europe. "IFESTOS" envisages the construction of a large-scale carbon capture plant at the Titan plant in Kamari, Viotia, near Athens. This installation will enable the reduction of CO_2 emissions in cement production and offer innovative, green construction materials. The demand for these materials is constantly increasing as they contribute to the creation of a sustainable and climate-friendly residential environment. Titan will produce about 3 million tons of zero-carbon cement per year to meet the growing needs for green construction.

The Kamari plant will be equipped with cutting-edge carbon capture technologies. Depending on the relevant regulatory and permitting framework, the operation of these technologies can lead to annual avoidance of greenhouse gas emissions of more than 1.9 million tons of CO_2, making Kamari one of the largest carbon capture installations in Europe. The project will be part of an ecosystem of projects combining carbon capture installations with transport and storage infrastructure. Titan has already signed Memoranda of Cooperation with potential partners and will continue the maturation of the project.

[57] Titan, https://www.titan.gr/el/newsroom/nea-kai-deltia-typou/neo?item=1652

3.17.3 "TRIERES" - PROJECT FOR THE CREATION OF A SMALL HYDROGEN VALLEY

The project "TRIERES" is co-funded by Horizon Europe and the Clean Hydrogen Partnership. The project coordinator is Motor Oil[58]. A total of 26 partners from five countries (Greece, Cyprus, Austria, the Netherlands, Egypt) participate in this project which has a duration of 58 months.

The aim of the project is the creation of a Small-Scale Hydrogen Valley, with a geographical reference to the Motor Oil Refinery in Ag. Theodoros Korinthias, i.e. a hydrogen ecosystem in Greece, interconnecting the green hydrogen production unit developed there by the company under the EPHYRA project, with potential off-takers businesses, technology providers, academic and research institutions, entities of the wider public sector and local authorities. The project provides an important opportunity for the implementation of hydrogen pilot projects (urban buses, passenger cars, shipping, power plant) as well as for studies on the use of hydrogen for existing or future applications, while there will be synergies with existing and future hydrogen valleys in the EU (Netherlands, Austria, Cyprus) and Egypt. The data collected from both the pilot projects and the studies will be used to communicate the benefits of hydrogen to the wider society as well as the crucial role it is expected to play in the efforts towards European climate neutrality, energy security and the change of the country's energy mix.

3.17.4 "IRIS" - CONSTRUCTION AND OPERATION OF A SYSTEM FOR THE CAPTURE, USE AND STORAGE OF CO_2 AND THE PRODUCTION OF E-METHANOL

The "IRIS" project of the company Motor Oil concerns the construction and operation of a Carbon Capture, Utilisation and Storage system and e-methanol production at the Refinery of Agioi Theodoroi. It is funded with 127 million euros from the Innovation Fund of the European Union. The "IRIS" project is among the 41 selected out of 239 proposals submitted under the second round of large-scale calls of the EU Innovation Fund, and only the third for a Steam Methane Reformer in Europe.

The "IRIS" project will integrate several innovative industrial processes at a scale that has not been previously implemented in an independent refinery. In particular, the project will contribute to a significant 25% reduction in the refinery's CO_2 emissions, and thus to the achievement of the decarbonisation targets of the industry. At the same time, it is envisaged to set up an innovative e-methanol production plant produced from the available renewable hydrogen and part of the captured carbon dioxide, one of the first plants to be created in Europe. Furthermore, the project falls under the umbrella of Motor Oil Group's strategic plan "Blue Med" for the development of a hydrogen value chain in Greece, as now, at the quantities of renewable hydrogen produced by the 30MW electrolysis plant under development of the "EPHYRA" project under development (supported by the Clean Hydrogen Partnership and the members of Hydrogen Europe and Hydrogen Europe Research under Grant Agreement No 101112220) will be added sufficient quantities of low carbon footprint hydrogen that will respect the prescribed limits of the EU Taxonomy Regulation.

The start of construction of the project, once all the necessary individual agreements have been completed and the final investment decision is taken by the company, is expected to start in mid-2025 with three years of completion, so that it will be operational by mid-2028, according to the timetable approved by the European Commission.

[58] Motor Oil, https://www.moh.gr/news/episimi-enarxi-tou-emvlimatikou-ergou-dimiourgias-mikris-koiladas-ydrogonou-trieres/

3.17.5 PRINOS STORAGE PROJECT

The project aims to become the first industrial/commercial CO_2 storage hub in the Mediterranean[59]. DESFA's (National Gas System Operator) contribution to the project includes the construction of an exclusive CO_2 pipeline connecting businesses in Attica. Carbon dioxide captured by the two plants could be directed to Prinos' CO_2 depot, which is expected to be ready by the end of 2025 or early 2026. Energean's "Prinos CO_2" geological storage project, with the support of DESFA which will undertake the transfer of CO_2 emissions from the capture points, i.e. industrial installations, is in the process of being integrated into Projects of Common Interest (PCI's) since it successfully passed the technical assessment.

The Prinos depot will be able to start operations with a storage capacity of up to 1 million tons of CO_2 per year by the end of 2025 and increase two years later to 2.5 to 3 million tons. The prospect of operating the depot in the Prinos Basin, a project with a total budget of 1 billion euros, has attracted the interest not only of the domestic industry, but also of units from the Balkans and Italy. DESFA proposes the development of a core CO_2 transport pipeline and a central export facility that will concentrate the pollutants of the industrial plants (CCS Hub) of Attica, a project worth 500 million euros. Then the gaseous pollutants will be liquefied, temporarily stored in facilities in Elefsina so that they can then be transported by ships to Prinos. "Prinos CO_2" project is expected to be the first industrial commercial CO_2 storage hub in the Mediterranean and expected to contribute to the strengthening of the energy transition and decarbonisation path of part of Greek industrial emissions by 2030.

3.17.6 IPCEI HY2TECH

The European Commission adopted in July 2022 the Important Project of Common European Interest ("IPCEI"), "IPCEI Hy2Tech" to support research, innovation and first industrial development in the hydrogen value chain[60]. The project was jointly prepared by fifteen Member States: Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Italy, the Netherlands, Poland, Portugal, Slovakia and Spain, all of which can be supported by up to 5.4 billion euros in public funding. An additional 8.8 billion euros in private investment is expected to be mobilised. A total of 35 companies with activities in one or more Member States are being supported to implement 41 projects, creating more than 20.000 jobs across Europe. This IPCEI will cover a wide part of the hydrogen technology value chain, including production, storage, transport and distribution as well as final users' applications development contributing to the development of major technological breakthroughs.

Greece participates with 2 projects from B&T Composites (H2CAT project) and Advent (Green Hipo project). For Greece, the European Commission has approved aid of up to 800 million euros in public expenditure, including the availability of resources.

3.18 Promotional factors and obstacles in the transition of the chemical industry in Greece

The success of all strategies contributing directly or indirectly to the green and digital transition of the chemical industry will be assessed by the extent to which they will promote and ultimately lead to its intended transformation, maintaining its competitiveness and resilience to external disturbances. This

[59] DESFA, https://www.desfa.gr/userfiles/5fd9503d-e7c5-4ed8-9993-a84700d05071/P2_Sardi_Energean.pdf

[60] Major Projects of Common European Interest are strategic projects in different sectors of the economy which require joint investment by public authorities and industrial enterprises from many EU Member States and can have a particular value in sustainable economic growth, employment and competitiveness of industry and the economy due to their positive spillover effects on the single market and society as a whole.

section examines factors that contribute positively to the initiation of this effort for the chemical industry in Greece, but also factors that constitute obstacles, which should be surmounted[61].

Following the multi-year economic crisis, the Greek economy has stabilised in recent years and despite the adverse conditions of the lingering crises, it is achieving positive dynamics with growth rates above the EU-27 average, boosting investment and exports. Financing conditions for the economy are improving and the difference in borrowing costs vis-à-vis the EU-27 average has narrowed with the country's return to investment-grade status. At the same time, several financial instruments are available focusing on the green and digital transitions. The reform effort continues at various levels (digitisation of the state, research and innovation, education, etc.), while the use of the resources of the Recovery and Resilience Fund and other European funds maintain positive expectations. Except for energy-intensive sectors such as petrochemicals, mineral fertilisers and industrial gases, the energy crisis has had a limited impact on the chemical industry in Greece (compared to the EU-27), and mobilised investments to enhance security of gas supply with an impact on the whole region of South-East Europe.

Greece is committed to achieving climate neutrality and has significant renewable energy potential to achieve its energy and climate targets. It has also acknowledged the importance of developing networks and international energy interconnections and has taken relevant initiatives. Major pilot projects are being implemented in the direction of green hydrogen production, while planning of and an institutional framework for the development of the biomethane and synthetic fuels sector are imminent. At the same time, investments have also been launched in the field of carbon capture, storage and use. These sectors are of particular interest to the chemical industry, both as energy and as sources of alternative raw materials. The potential in research and innovation spending is also positive, as the distance to the EU-27 has been significantly reduced.

As it has become clear, chemical companies in Greece must meet the climate neutrality objectives to the extent they concern them, but also to contribute with innovative solutions to the objectives of other sectors of the economy. In a relatively brief period of time, they need to meet the requirements of the ongoing Sustainable Chemicals Strategy and at the same time achieve their digital transformation. The chemical industry in Greece should invest in changes that are imperative, but also demonstrate resilience in terms of its competitiveness and especially extroversion. The starting point for the transition is lagging due to the divestment during the economic crisis, in the expenditure on research and development, the low level of which is a long-term problem of Greek Manufacturing, the high cost of compliance with the regulations, which is prohibitive for companies below a specific size, while the high concentration of energy and raw materials markets makes businesses relatively vulnerable.

Chemical companies in Greece are mainly SMEs and face the same challenges as larger companies, but with fewer human and financial resources, shortages of skilled personnel and a secondary role in developing synergies with other companies. In Greece there is a shortage of large industrial ecosystems existing in other countries, while infrastructure is also lagging (e.g. inability to optimise product transport due to lack of infrastructure such as mass transport by electric train). The size of the domestic market is small, while competition from imports is strong. Also, the cost of capital is higher, permitting, despite progress made, presents difficulties, and the degree of research and innovation is low, which also affects export possibilities. Many SMEs have limited information on existing financial tools and there is difficulty

[61] The analysis of these factors is based on data collected through a questionnaire from a sample of entities and companies in the chemical industry in Greece.

in identifying and exploiting funding opportunities, either due to lack of information or due to limitations of the tools themselves.

In any case, SMEs have the flexibility and adaptability to change. Of course, it is a great challenge to find resources and synergies in innovation beyond the issues faced by SMEs regarding the need to adapt quickly to the multiple requirements of European legislation. It is therefore necessary for European legislation to consider the challenges of small and medium-sized enterprises. As the European Commission itself has acknowledged, SMEs are disproportionately affected by the increasingly stricter regulatory framework in relation to larger companies, and this is the case to a greater extent in Greece. Indicatively, the number of small businesses in the sector, without a predisposition to mergers and lack of collaborative culture (e.g. in terms of raw materials, by-products, waste, etc.), implies a small scale reflected in low R&D and limited ability to comply with the regulatory framework. Moreover, there are still significant objective obstacles to mergers and acquisitions (justice rendering and permitting to ensure the solvency of a new scheme, inefficient operation in separate non-modern buildings, untrained staff), even though tax and financial incentives have been made available that are not exploited so that medium-sized and large companies in the sector generally prefer organic growth. Moreover, the time-consuming bureaucracy and the low level of awareness of European tools that require international cooperation limits access to funding. The geographical structure of chemical companies, such as the concentration of activity in Attica and Central Macedonia, makes it difficult for SMEs to receive state aid. At the same time, even larger and more modern businesses have to manage the general challenge of "brain drain" in highly skilled positions.

Digital solutions are a one-way street to monitor the objectives of the green transition and to develop tools to achieve the targets. Digital technology and its integration into business operations across the spectrum, from recording and monitoring to big data/cloud services/AI is also a key factor in the success of the transition. However, people with specialised skills are needed. The role of digitalisation is therefore assessed as very positive, decisive and essential, as it is estimated that without digital technologies the pace of transition will be low. It should be noted, however, that the role of digital solutions, although very important and essential for the implementation of the transition, is not a substitute for chemistry and matter. In particular, digital solutions offer chemical companies the following advantages:

- They help significantly to monitor the actions of the chemical industry in a measurable and accurate way and facilitate the everyday life of businesses (design, management and evaluation of operational actions, the ability to automate data flows and the provision of ever more digital services by management).
- They can play a key role in many aspects in a chemical industry, from energy efficiency and waste reduction at the plant to reducing the environmental footprint thanks to cloud sharing files and the hybrid teleworking model in different segments.
- When adopted by companies with a digital strategy and overall transformation, they can contribute to achieving climate goals and improving competitiveness.
- Critical role in some activities, such as developing new molecules and materials or optimising empirical production processes. An indispensable but ancillary role at a more general level to accelerate, ensure quality and release human resources throughout the chemical industry value chain.

The objective of the green and digital transitions is particularly demanding for chemical companies, as the creation of infrastructure for the application of green technologies has not been sufficiently

advanced, but also the legislative framework that will protect EU producers from entering non-EU competitors. The recent energy crisis has shown that the EU needs to be shielded from the risks of dependence on imports of essential raw materials and products, but also that there is a need to protect European production to achieve autonomy and resilience in periods of crisis.

Among the major challenges of the chemical industry in Greece is the financing of the green transition high cost, even in pressuring timelines, when competing third countries that do not follow similar compliance practices and their public opinion is not mature to adopt more expensive green solutions. Implementing a large-scale effective sustainability practice, while maintaining competitiveness, is a major challenge. Therefore, based on the above, the needs for interventions are highlighted in the following areas:

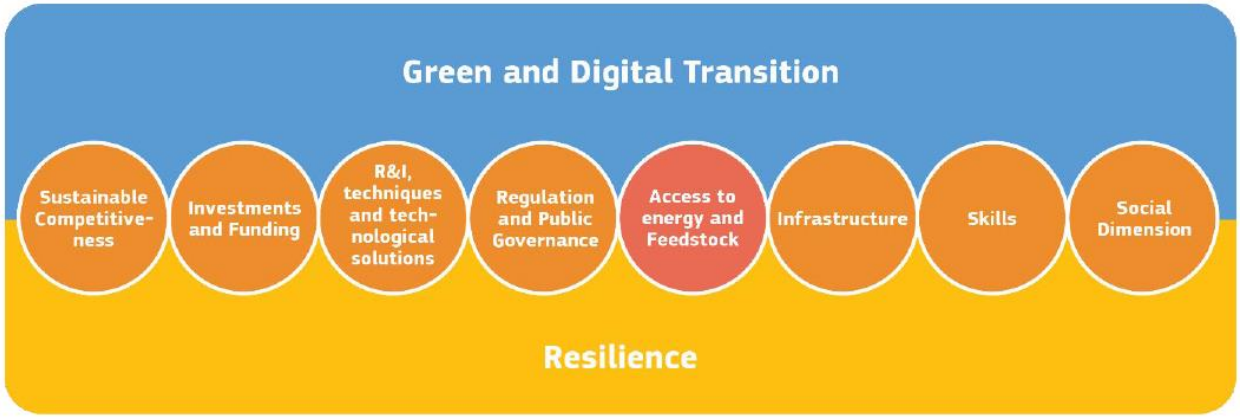
- Appropriate organisation, strategy and planning with economic evaluation.
- Ensure healthy competition throughout the value chain.
- Achieving equal or lower costs of “green” products compared to conventional ones.
- Easy and fair access to investment and financing, considering the different structure of the Greek geography, society and economy compared to Central European countries that contributed most to the development of the European strategy and related financial tools.
- Developing the necessary infrastructure (including digital), enhancing research and innovation with continuity, consistency and application in the production and maturation of technological solutions.
- Availability of clean energy at competitive prices for industry.
- Availability of materials and products that will allow for the reduction of the environmental footprint.
- Availability of human resources with the right skills and responsiveness of employees to the multiple challenges (new technologies, legislation, etc.).
- Implementation of a regulatory framework that does not impose a disproportionate burden of compliance on businesses.
- Embracing the double transition as an inevitable development by businesses, in particular SMEs, for their survival and information to make investments compatible with the double transition.
- Cooperation between enterprises and government entities and support of the transition from all the actors and businesses involved, so that everyone moves at the same speed towards the new reality.
- Flexibility and adaptability of the political system, both at national and European level to make the transition effective.
- Inform society about the necessity, benefits and challenges of the transition through continuous dialogue.

4 ACTIONS FOR THE RESILIENCE AND ACCELERATION OF THE TRANSITION OF THE CHEMICAL INDUSTRY IN GREECE

4.1 Introduction

This chapter examines the actions mentioned in the chapters of the building blocks of the European Transition Pathway for the chemical industry, to identify those related to the chemical industry in Greece. The eight building blocks of the transition map are presented in (Graph 4.1). For the selected actions and objectives in each building block, consideration shall be given to a) the existing dynamics at national level, which already contribute to the transformation and resilience of the chemical industry and how these dynamics can be strengthened and b) the factors that pose barriers to the transformation of the chemical industry and how to remove these barriers. This analysis identifies the necessary actions to enable the transition, are classified according to the implementation time horizon (short, medium, and long-term) and identify the actors responsible for their implementation (European Union [EU], government [EL], chemical industries and industry operators [CI]. In addition, relevant priorities of the National Industry Strategy are presented for each building block of the transition roadmap, which significantly reinforces the effort to achieve the objectives of the transition.

Graph 4.1: The eight building blocks considered for the development of the chemical industry transition roadmap



Source: Transition Pathway for the Chemical Industry in Europe

The Annex lists additional actions, which were considered to be of lower priority for the chemical industry in Greece, either because of the structure of the domestic chemical industry, or because they are actions to be implemented on EU initiative. These actions, however, could be considered in the next steps of the implementation of the National Chemical Industry Transition Roadmap.

4.2 Sustainable competitiveness

The chemical industry in Greece, as in the EU, faces inter alia strong international competition, increased energy and raw materials costs, as well as unfair competition from imports from third countries of certain products that do not meet the safety and sustainability standards of products produced within the EU. Combined with the small size of enterprises and the low level of investment and productivity, these factors aggravate the competitiveness of the Greek chemical industry. The competitiveness of the chemical industry in Greece could in principle be strengthened by the implementation of the actions of the National Strategy for Industry, which promote the growth of SMEs and enhance their internationalisation, through incentives and support for expansion into new markets.

The health and energy crisis highlighted the strengths of the Greek chemical industry, which, due to its structure, had less losses than the chemical industry in the EU. Energy policy responded with major initiatives that strengthened energy security and shielded the country against future risks, without underestimating the impact of increased energy and raw materials costs. There is a clear targeting and actions of the country's energy policy to enhance energy security, with main priorities: a) enhancing the diversification of energy sources and energy import routes, b) reducing energy dependency and highlighting the country as a regional energy hub, c) promoting flexibility systems, storage and demand response systems and ensuring the country's capacity adequacy, d) preparedness of the country and stakeholders to deal with the restriction or interruption of energy supply and e) increasing the resilience of critical energy infrastructure. These priorities are particularly positive for the sustainable competitiveness of the Greek industry, including the chemical industry, in the coming years, which requires the reduction of existing ones and the avoidance of new unsustainable dependencies of the supply chain in energy resources and raw materials.

In addition, to promote the international competitiveness of the Greek chemical industry it is appropriate to identify key performance indicators (KPIs) and sustainable development indicators to measure and compare the international competitiveness of the chemical industry and progress towards climate neutrality. Gradually, and in line with the Sustainable Chemicals Strategy, a market for sustainable products should be created through the development, promotion and marketing of "safe and sustainable by design" (SSbD) substances and materials by supporting the relevant EU financial instruments and private investment instruments, in particular towards SMEs, as well as through public-private partnerships, so that the transition to new products can take place in better cost terms and preserve the strengths of the Greek and European chemical industry.

Reducing the unsustainable dependencies and supply chain weaknesses of the Greek chemical industry will also come through actions that enhance energy efficiency and support chemical companies in the design and implementation of circular industrial process, including the development of a market for plastic waste and secondary raw materials, which will enhance its resilience and autonomy.

At the same time, the Sustainable Chemicals Strategy calls for strengthening the safety and sustainability of chemicals and materials. To ensure the circularity of chemicals, in addition to strengthening cooperation in value chains, the particularities should be considered in each step of the life cycle when developing chemicals and materials. To this end, the European Commission is developing a detailed framework and criteria for developing new chemicals and materials, optimising or redesigning production processes and use of substances. The aim of this framework is to improve safety and sustainability and to ensure that industrial processes are SSbD, which will promote economic growth and foster innovation in substances, mixtures and materials. The chemical industry in Greece, as a predominantly downstream

user of key chemicals, should participate in the pilot phase of the SSbD framework, in actions to improve cooperation in value chains under European programmes, as well as implement the Ecodesign Regulation for Sustainable Products, as part of the Circular Economy Action Plan.

These actions in the medium term may include investing in reverse logistics, where feasible given the structure of the chemical industry in Greece, the state of the basic infrastructure and the geography of the country, e.g. islands and mountainous locations, to ensure that materials are not turned into waste. It should be noted that although such practices are developed in advanced industrialised countries, in Greece businesses and the market do not have the critical size and the volume of reverse flows in the chemical industry is particularly limited. However, such practices are gradually being integrated, but difficulties in the development of the collection network (mainly by retail) should be addressed.

For the sustainable competitiveness of the Greek chemical industry, a systematic objective should be to strengthen innovation and the development of SMEs, through actions such as strengthening cooperation with the ecosystem of start-ups that is developing in the country, supporting the successful implementation of the European Network of Innovation Hubs[62], strengthening SME initiatives within the framework of the European Innovation Council and supporting both compliance with legislation and financing of new technologies.

The sustainable competitiveness of the chemical industry will also be enhanced by maintaining existing and developing new synergies, both at plant level and by integrating projects in the chemical industry with projects in other sectors. Synergies between the chemical industry and the waste or other energy-intensive industries, such as cement and energy, will be crucial for increasing circularity, resource efficiency and energy efficiency. There is also a need to improve chemical design processes and to adopt a unified “life cycle” approach by increasing cooperation between different value chains with final product manufacturers.

No doubt synergies are important with multiple advantages, great opportunities can be created considering the strong presence of chemicals in supply chains and their role in the circular economy. Through European programmes such as Horizon Europe, chemical companies work with other industries. In Greece, existing bureaucratic obstacles and limited cooperation with educational institutions have an inhibitory effect. Chemical companies in Greece recognise the need for synergies, but the legislative framework has not yet evolved to facilitate this by providing the necessary safeguards. Factors that make partnerships difficult, in addition to the lack of a culture of cooperation, include intense competition between similar companies, the understaffing of businesses, but also the excessive opportunity costs at the level of administration faced by chemical companies due to successive crises (economic, health, logistics, energy, inflationary). Furthermore, cross-sectoral projects that could qualify as Important Projects of Common European Interest (IPCEI) are relatively limited in Greece, but there is a relative mobility.

More generally, in Greece, partnerships between industrial companies are limited, although steps have been taken to change the perception on collaborations. The best opportunities are presented through new projects, especially in innovation ecosystems, but further actions are needed to strengthen the collaborative environment. Therefore, actions such as facilitating information exchange between chemical companies, increasing cooperation to reduce investment risk and supporting the development

[62] The aim of the network is to provide support, unified services and personalised advice to SMEs, as well as to public sector organisations, in order to achieve the digital transition.

of innovation-focused partnerships will have a positive impact on the sustainable competitiveness of the chemical industry in Greece.

Table 4.1 presents in more detail the actions to enhance the sustainable competitiveness of the chemical industry in Greece, the responsible implementing actors and the timeframe for implementation.

Table 4.1: Actions for sustainable competitiveness

Actions	Actors	Timeframe
TOPIC 1: International competitiveness		
1.1 Drive international competitiveness		
• Set key performance indicators and sustainable development indicators	Industry and EU/EL	S
1.2 Promote the market for sustainable products		
• Develop, commercialise, deploy and promote the uptake of SSbD substances and materials	Industry and EU/EL	S
TOPIC 2: Reduction of unsustainable dependencies and supply chain vulnerabilities		
2.4 Increasing resource efficiency		
• Apply 'energy-efficiency first' as a key principle and prevent losses of materials by increasing circularity according to the '3R' principle (reduce, re-use, recycle), without hampering the implementation of new low-carbon processes (e.g. electrification, CCU (carbon capture and utilisation), CCS (carbon capture and storage), etc.)	Industry	S/M
• Support the circular economy. Take into consideration whole value chains when designing 'circular' industrial processes and ensure that all raw materials are included in these processes (including plastic waste, biobased/biomass products and CO/CO2 emissions) to close loops, ensure resource efficiency and reduce dependencies, with public policy supporting 'end-of-waste' concept	Industry and EU/EL	S/M
TOPIC 3: Safety and sustainability		
3.1 Develop a detailed and workable framework and criteria for ensuring that industrial processes are SSbD		
• Participation of Greek industry in the testing phase of the SSbD framework	Industry and EU/EL	S/M
3.2 Improve collaboration in value chains		
• Engage in Hubs4Circularity as well as a Circular Cities and Regions Initiative (Horizon Europe)	Industry and EU/EL	S
• Use data spaces to improve resource allocation, supply chain resilience and the manageability of circular processes	Industry and EU/EL	S/M
• Set up and invest in 'reverse logistics' to ensure that materials are not turned to waste	Industry and EL	M
3.3 Support substitution to safer chemicals as well as product design and re-design		
• Implement and enforce the Ecodesign for Sustainable Products Regulation (ESPR), as part of the new circular economy action plan (CEAP)	EU/EL	S/M
TOPIC 4: Innovation and growth of SMEs		
4.1 Strengthen cooperation with the start-up ecosystem		
• Support SMEs in their supply chains also by connecting to EIT Knowledge and Innovation communities	Industry	S
• Improve communication by fostering information exchange to promotion success stories	Industry and EU/EL	S
4.2 Support the successful implementation of the network of European Digital Innovation Hubs (EDIH)[63]		
• Provide information to and encourage SMEs to make use of the digitalisation support services provided by the EDIH network	Industry and EL	S/M
4.3 Strengthen initiatives with SMEs under the European Innovation Council (EIC)		
• Encourage SMEs to make use of open innovation test beds, which can bring both co-development and the testing of new substances and advanced materials within the reach of companies and users	Industry and EL	M
• Further support access for SMEs to national funding opportunities, which can complement funding received from the EIC programme	EU/EL	M
4.4 Support compliance with legislation and funding for new technologies		
• Communicate on funding opportunities	Industry	S
• Promote access to risk finance, in particular for SMEs and start-ups, and consider facilitating industrial research, e.g. through increased building of skills at local and regional level	EU/EL	S/M
TOPIC 5: New synergies		
5.1 Facilitating the exchange of information		

[63] Greece participates in the Network with 4 Hubs, which are funded through the Digital Europe Programme 2021-2027 (DEP) with 9.3 million euros for 3 years. Three more Hubs can participate in the Network without European funding, as they have received the EU Seal of Excellence. The Greek Hubs of the Network will be active in technological areas such as: Artificial Intelligence, Cybersecurity, Internet of Things, 5G, big data analysis, blockchain etc. in combination with policy areas such as health, rural development, e-government, etc.

• Maintain the Euroclusters initiative, which aims to create partnerships of cluster organisations	EU/EL	S
• Facilitate cooperation in value chains and sectors through the ongoing revision of antitrust rules	EU/EL	S
5.2 Increase collaboration to de-risk investments		
• Increase the number of joint projects to de-risk investments (e.g. joint projects on CCS and the electrification of crackers)	Industry	S
• Increase cross-border projects on the generation and supply of energy and feedstock, such as grids, pipelines, renewable carbon, and CO2 transport	EU/EL	M
• Consider incentivising processes that would increase the value of industrial waste and the CO2 emissions it generates	EU/EL	M
5.3 Support the development of partnerships for innovation		
• Ensure shared access to the research and technology infrastructures as part of the European Research Area	EU/EL	S
• Undertake joint cross-sectoral projects that could qualify as important projects of common European interest (IPCEIs)	Industry	S
• Strengthen and develop synergies with all players in the chemicals value chain	Industry	M
• Support new data-driven business models based on Common European Data Spaces	Industry and EU/EL	M
RELEVANT PRIORITIES OF THE NATIONAL INDUSTRIAL STRATEGY		
• Development of clusters between industrial enterprises of the construction materials ecosystem where a large enterprise will be at the core around which the collaborating SMEs will develop their operations • Enhancing the extroversion of enterprises of the construction materials ecosystem, promoting strategic partnerships with intensive final-users in foreign markets • Promoting the growth of SMEs mainly by strengthening business-to-business cooperation schemes (e.g. partnerships, consortia, networks) and mergers and acquisitions • Strengthening the internationalisation of SMEs by incentivising and supporting expansion into new markets • Promote the uptake of new generation materials for the green and digital transformation of the economy, with the aim of increasing domestic demand for next generation materials and achieving better performance • Promoting business clusters around specific demand sectors or large customers in the next generation materials sector		

Note: [Industry]: Actions initiated by or with the participation of the chemical industry and its sectoral entities. [EU]: Actions initiated by or with the participation of the European Union/Commission. [EL]: Actions initiated by or with the participation of the Greek government. [S]: Short term (actions that need to start as soon as possible). [M]: Medium term (actions to start by 2030). [L]: Long term (actions to start and be completed by 2050).

4.3 Investments and funding

The chemical industry has significant fixed assets, but long-term planning and high capital investments are needed to ensure their sustainability. In particular, the transition to a climate-neutral, safer, zero pollution and circular chemical industry requires significant investments in research and innovation, as well as high (capital and operation) costs to replace fixed assets, modify production processes, and purchase energy and raw materials from alternative sources. A key challenge for the implementation of these investments is to address the risk associated with the development of new solutions and the risk of failure during scale-up on an industrial level, due to possible changes in the regulatory framework and uncertainty about the economic return on investments. Therefore, the management of existing assets of chemical enterprises and their conversion/replacement with more viable alternatives should be supported in a multifaceted manner, considering the large investment cycles of the chemical industry and the need for pilot production or demonstration plants. In this context, in addition to financial support, actions should be taken to speed up the permitting procedures for the necessary investments and to consolidate investor confidence.

It is estimated that the investments across the EU needed to develop the first commercially usable low-carbon and circular technologies in the chemical industry are in the order of 218-238 billion euros[64]. It is also estimated that additional investment of the order of trillions is needed to fully deploy these technologies across Europe, including electricity generation, supply chains and transport. At the same time, ensuring the operation of industrial installations based on low-carbon technologies will require on average an additional investment of 3.9-5.5 billion euros per year[65]. The gradual transition from one system to another will require to some extent the operation of parallel production systems, with investments required in both systems for a period (transition cost). In the transition paths considered, investments increase by 76–107% compared to a baseline scenario where current production processes are maintained. Therefore, proportionately, the investments required in the Greek Chemical Industry to achieve the green transition by 2050 –without considering the current under-investment vis-à-vis the EU-27 average– should on an annual basis range from 141 to 166 million euros, i.e. significantly higher than the current level of around 80 million euros per year[66].

Significant progress has been made in recent years in simplifying industrial investment permitting procedures and removing the bureaucratic burden of approving an investment before implementation. However, the permitting system has not yet reached the point where the focus of the permitting is on the operating conditions of an investment rather than on time-consuming pre-authorisations. In any case, clarity in the spatial planning context, the further simplification of legislation and the reduction of bureaucracy and rendering justice in a reasonable time, which have been blocking over time, are sought. Therefore, there are opportunities for significant improvement, shifting the attention of the State from permitting to supervision of operation, strengthening control mechanisms in human resources, sound monitoring and evaluation tools, multiple internal control structures and harmonisation of practices, and continuous training of human resources. Consideration could also be given to prioritising authorisations for energy transition technologies/investments, as well as to undertake permitting procedures by certified external agencies, which are appropriately accredited and notified in the EU, and can approve the permit, while assuming the responsibility for it.

[64] See Processes4Planet SRIA, October 2021.
[65] See European Commission, 2021. ERA industrial technology roadmap for low-carbon technologies in EIIs, p. 53.
[66] Investments by the chemical industry in Greece in 2021.

Public funding can reduce investment risks and incentivise when regulation is not sufficient to promote investment. Actions should therefore be taken to facilitate access to national and European funding mechanisms and to increase grants linked to EGD. The available funding mechanisms for the chemical industry in Greece were presented in the previous chapter. In relation to European funds supporting green and digital transformation, it is worth noting that the ETS Innovation Fund supports commercial demonstration and the risk reduction of innovative low-carbon technologies, including projects in the chemical sector. Relevant resources are also available through other funds, such as the Just Transition Fund, the Recovery and Resilience Fund and the Modernisation Fund, while the European Social Fund is suitable for investment in human resources education. SMEs face particularly high investment costs for adopting new environmental technologies, while they tend to have access to funding on less favourable borrowing terms than larger companies in the same sector, so they are often exposed to a higher risk of failure, particularly when investing in innovative products and processes. In any case, it is necessary to strengthen communication channels for European and national funding opportunities, together with the development of a coordinated funding platform and support from public pertinent authorities that will allow for a higher success rate in SMEs access to public funding. The implementation of the relevant measures of the national industry strategy such as the creation of targeted funding programmes in cooperation with the Hellenic Development Bank (HDB), the simplification of the procedure for submitting proposals and evaluation in co-funded programmes and the reform of the institutional framework governing depreciation on fixed assets and compliance/training costs would also contribute positively.

An important initiative in this context is the conclusion of a Memorandum of Understanding for the promotion of innovation and the enhancement of entrepreneurship, between the Hellenic Association of Chemical Industries (HACI) and the Hellenic Development Bank (HDB). In particular, this cooperation concerns:

- Shaping the conditions for accelerating collaborations of Greek companies for the creation of international competitive schemes.
- Access of HACI members to digital networking platforms with international ecosystems, with the primary objective of extroversion, raising investment funds and seeking trading partners.
- Study and development of assessment criteria for the development of automated methods of qualitative and quantitative evaluation of operational plans, as well as control of the application of hybrid financial instruments combining loans, guarantees, co-funding, grants and equity participations.
- Cooperation between HACI and HDB to design and implement various financial tools for the safeguarding of the intellectual property rights of enterprises and the commercial implementation of relevant university research programmes.

Table 4.2 presents in more detail the actions to strengthen the investments and funding of the chemical industry in Greece, the responsible implementing actors and the timeframe for implementation.

Table 4.2: Actions for investments and funding

Actions	Actors	Timeframe
TOPIC 6: Green Investment Fund		
6.3 Manage and convert existing assets		
• Facilitate and accelerate permitting procedures for plant investments and participate in communities of practice on permits	EU/EL	S
• Support (incl. financial) for retrofits and transformation that aim at effective and innovative low-carbon technologies and sustainable solutions	EU/EL	M
TOPIC 7: Access to funding		
7.1 Strengthen communication channels for European funding		
• Communicate on funding opportunities	Industry	S
• Increase skills-building at local and regional levels to support SMEs in funding opportunities	Industry and EL	S
• Help industry to become frontrunners in sustainable innovations	Industry and EU/EL	S
• Keep informing Member States on the existing funding opportunities and conditions	EU/EL	S/M
7.2 Provide a coordinated platform for funding		
• Cooperate with the public sector to complement public-private partnerships for R&I. Provide a broad and open platform to draw up strategic roadmaps and efficiently coordinate research, development and innovation investment plans for technologies in particular ecosystems (see updated industrial strategy), including national use of Recovery and Resilience Facility	Industry	S
• Consider cutting red-tape (at EU and national level), and improve coordination to facilitate access to funding for industry through a 'single window' approach[67]	EU/EL	S
RELEVANT PRIORITIES OF THE NATIONAL INDUSTRIAL STRATEGY		
• Creation in cooperation with the Hellenic Development Bank of targeted funding programmes and tools through funding instruments based on the needs of industrial enterprises • Creation of multidisciplinary special-purpose funds for the management of venture capital • Simplification of the procedure for submitting proposals to co-funded programmes • Simplifying the procedure for evaluating proposals and reducing waiting time for final decisions • Overhaul of the institutional framework governing depreciation of fixed assets (mainly machinery and mechanical equipment) to incentivise investments in industry		

Note: [Industry]: Actions initiated by or with the participation of the chemical industry and its sectoral entities. [EU]: Actions initiated by or with the participation of the European Union/Commission. [EL]: Actions initiated by or with the participation of the Greek government. [S]: Short term (actions that need to start as soon as possible). [M]: Medium term (actions to start by 2030). [L]: Long term (actions to start and be completed by 2050).

[67] An approach that allows parties involved in trade and transport to submit standardised information and documents to a single point of entry to meet all regulatory requirements related to imports, exports and transit.

4.4 Support to Research & Innovation, techniques and technological solutions

The importance of timely deployment of appropriate technologies to reach the market is essential to achieve the green and digital transformation of the chemical industry. The chemical industry has the privilege of contributing to the development of technologies that will accelerate the green transition, such as hydrogen production, energy storage, carbon capture and utilisation and chemical recycling. Financing the development of technologies is an important parameter, as the transition requires not only simple changes and modifications, but radical technological interventions in most chemical industries. However, it still takes time to develop and to mature the technologies leading to the transition. The adoption of new technologies in Greece is slow mainly because the size of the market targeted by businesses in Greece is small and the investment (CAPEX) is not reinforced without supporting financial tools. Moreover, the producers of basic chemicals have a more crucial role in the development and adoption of new technological solutions, a sector that is less developed in Greece.

At the pre-commercial level and especially in enabling widely applicable technologies and of high development cost, there is only the choice of collaborative development through co-funded action programmes. Commercially and in specialised technologies, there is practically only the choice of individual action leading to a protected technology/knowledge – collaboration can occur between alike enterprises with a geographical or other distance (preventing effective competition between the cooperating enterprises). In any case, cooperation between the chemical industry and research organisations seems to be a one-way street, while funding for research projects under the auspices of universities and research centres is also crucial.

Once technical solutions reach an industrial scale, they must be commercialised and monitored. Scale-up requires, in addition to monitoring, corrective actions. The current organisation of the public administration is not sufficient to meet these requirements quickly and therefore it will be necessary to create appropriate protocols and/or standards to be applied by businesses and certified by third parties. Furthermore, some of the technical solutions (e.g. the use of green hydrogen) are required to achieve green energy adequacy. Proper evaluation of the performance of each technical solution, strategy and targeting, development of synergies within the ecosystem throughout the value chain, training on new technologies, evaluation of each technical solution and possible optimisation can contribute positively.

Good examples of corporate practices in Greece include: a) the execution of a series of “innovation hubs” programmes, where start-up companies and research teams present their ideas, providing the necessary publicity and the possibility of commercialisation and b) at a later stage of the chemical value chain, the digitisation of chemical labels with only the key elements, notes and warnings on the label, thus ensuring the immediate updating of labels at every change and the minimisation of paper throughout the production, storage and distribution of labels. In general, best practices are available and developed, but the right conditions for the operation of value chains need to be created. At the European level, the chemical industry best practices to demonstrate in energy saving, chemical recycling, etc.

At the level of policy measures, as a good practice, Greece applies the 200% over-depreciation measure for innovation-related R&D costs submitted to the General Secretariat for Research and Technology, without a certain duration of the measure or de minimis rules, as is the case for digital/green expenditure.

The chemical industry can enhance its sustainability by adopting new technical and technological solutions that will be developed within a well-supported R&I policy framework. However, there are obstacles at different stages of R&I, which should be addressed by targeted actions.

At the stage of designing new technical and technological solutions, the exchange of know-how in the implementation of the SSbD logic will play an important role considering existing initiatives (e.g. IRISS[68], PARC[69]) and innovative safety tests to improve the quality, efficiency and speed of chemical risk assessments. The use of digital maturity assessment frameworks should be promoted for successful digital transformation. To the extent possible, the chemical industries in Greece should be involved in these actions.

At the stage of the development of new technologies, especially regarding energy and raw materials from renewable sources and the circular economy, it is proposed to promote synergies and partnerships while, at the same time, providing regulatory and financial support by appropriate instruments depending on the Technology Readiness Level (TRLs) such as the Innovation Fund and the Horizon Europe programme.

In the implementation phase of technical and technological solutions, the role of permitting and commercialisation processes, including the exchange of information through the Innovation Centre for Industrial Transformation and Emissions (INCITE)[70], as well as the assessment of the potential for cooperation between future potential users to address the investment gap and the timely roll-out of innovative technologies on the market, is important.

The relevant priorities of the National Industry Strategy, such as boosting innovation in the sector, modifying the framework to facilitate the transformation of a research effort into a business (spin-off), funding research and innovation in SMEs and promoting their access to technological infrastructures, as well as setting up clusters of industrial innovation, will also contribute positively.

Table 4.3 presents in more detail the actions to support R&I, techniques and new technological solutions for the chemical industry in Greece, the responsible implementing actors and the timeframe for implementation.

[68] IRISS is the international ecosystem to accelerate the transition to SSbD materials, products and processes.
[69] The Chemical Risk Assessment Partnership (PARC) aims to develop a next-generation chemical risk assessment to protect human health and the environment. Supports the European Union Chemicals Strategy for Sustainability and the ambition of the European Green Deal on Zero Pollution with new data, knowledge, methods and tools, know-how and networks.
[70] The Innovation Centre for Industrial Transformation and Emissions (INCITE), established under the revised Industrial Emissions Directive (IED), identifies emerging techniques worldwide for decarbonisation, decontamination and/or increasing circularity in large agro-industrial installations.

Table 4.3: Actions to support Research & Innovation, techniques and technological solutions

Actions	Actors	Timeframe
TOPIC 8: Better conceptualisation of new techniques and technical solutions (TRL 1-5)		
8.1 Promote safety and sustainability-assessment approaches		
• Share expertise in the implementation of SSbD frameworks considering existing criteria initiatives	Industry and EL	S
8.2 Promote the use of Digital Maturity Assessment Frameworks		
• Share knowledge on and encourage the use of digital maturity assessment frameworks	Industry and EU/EL	S/M
TOPIC 9: Developing new techniques and technological solutions (TRL 6-7)		
9.1 Foster collaboration and partnerships		
• Increase cooperation between research institutions and universities and industry, fostering applied research and targeting key enabling technologies for industry	Industry	S
• Engage in public-private partnerships (e.g. Processes4Planet, Circular Bio-based Europe) to develop and demonstrate energy efficiency and climate neutral, circularity and zero pollution chemical industry processes	Industry and EU/EL	M
9.2 Support for development		
• Co-implement the strategic research and innovation plan (SRIP) for safe and sustainable chemicals and materials to guide future R&I priorities	Industry and EU/EL	S
TOPIC 10: Deployment of new techniques and technological solutions (TRL 8-9)		
10.1 Permitting and commercialisation		
• Active involvement of INCITE on emerging processes or techniques for decarbonisation, depollution and/or increasing circularity in the sector	Industry and EU/EL	S
• Assess the potential for – and design the scope of – cooperation among future potential users to address the investment gap so that innovative low-carbon technologies can timely be brought to the market	Industry and EU/EL	M
• Support the development, commercialisation, deployment and uptake (including through 'market pull' and pre-commercial procurement) of new techniques and technological solutions	EU/EL	M/L
RELEVANT PRIORITIES OF THE NATIONAL INDUSTRIAL STRATEGY		
• Enhancing innovation in the field of "new generation materials" with special care to upgrade the laboratory equipment of enterprises • Modify the framework to facilitate the transformation of a research effort (in research/educational institutions) into a business activity (spin-off) • Funding research and innovation in SMEs and promoting their access to technological infrastructures • Creation of industrial innovation clusters with a significant number of SMEs (with a geographical or operational correlation) at the centre with potential involvement of research/educational institutions and/or large enterprises		

Note: [Industry]: Actions initiated by or with the participation of the chemical industry and its sectoral entities. [EU]: Actions initiated by or with the participation of the European Union/Commission. [EL]: Actions initiated by or with the participation of the Greek government. [S]: Short term (actions that need to start as soon as possible). [M]: Medium term (actions to start by 2030). [L]: Long term (actions to start and be completed by 2050).

4.5 Regulation and public governance (Legislation)

Chemicals follow strict European legislation and many categories, such as construction chemicals, follow demanding standards. Some chemical industry sectors in Greece face unfair competition from illegal imports of products with lower standards from neighbouring third countries, or through Bulgaria. A typical example is refrigeration gases (F-gases), for which, although in quota, imports from Türkiye or via Türkiye are uncontrolled. Market control is therefore a very important factor in the operation of competition and the quality of products placed on the market, particularly as regards products imported from third countries outside the European Union. With major changes to REACH and CLP, there is growing concern about whether the EU is ready to control its borders and impact on the competitiveness of its businesses in third countries (e.g. in containers made of recycled content that will not withstand the stresses of distant maritime or inaccessible land transport). The chemical industry in Greece supports the establishment of modern standards that will ensure the quality and safety of products and contribute to the protection of investments and the competitiveness of the chemical industry. The main regulatory barriers faced by chemical companies in Greece include:

- The limited digitalisation of public administration leading to the preservation of bureaucracy
- Late harmonisation on a case-by-case basis with European legislation and the operation of the energy market.
- The plethora of regulatory requirements and continuous renewal/update, which requires continuous monitoring. Non-compliance is very likely as something can escape attention and this entails fines. Even full compliance, however, entails high costs.
- Market control issues.
- The limited and fragmented involvement of businesses in the creation of regulatory rules/legislation.
- The application of regulatory rules requires preparation, time and costs that are not always considered, resulting in insurmountable weaknesses.
- The dispersion of the permitting framework into more than one ministry, resulting in delays due to the need for Joint Ministerial Decisions (JMD).

Moreover, exporters in the sector face ambiguity and law plurality, not only in different requirements of each third country, but also in EU countries that follow different national standards (e.g. in drinking water, fire protection), resulting in disproportionate compliance costs and individual European country measurements and certificate issuance.

Data collection and access is key to ensuring that the regulatory framework is based on a strong and realistic starting point. There are examples of the operation of databases such as ECHA for chemicals that companies themselves produce the data part of which is publicly available considering confidentiality requirements. The Industrial Emissions Directive (IED) applies to the operation of manufacturing, where the point emissions of specific pollutants emitted by manufacturing throughout Europe are recorded. Digitalisation offers excellent solutions in managing data relevant to the climate, circular economy, etc. Furthermore, access to data by avoiding excessive bureaucracy can be achieved:

- Through the Industry Associations of all production sectors there can be a grouping of data and information that will help reduce bureaucracy.
- By collecting/accessing data directly in a digital environment, educating civil servants and creating appropriate infrastructure.
- By developing traceability and correct procedures, as well as adopting lean management to avoid excessive bureaucracy and accumulation of useless data.

- By creating a communication and business interface.
- Making use of the available data collected over time and the new digital technologies for data collection and exploitation.

The new legislation under the European Green Deal covers all aspects of the operation of the chemical industry. However, a number of challenges will need to be addressed, including the lack of predictability for the timelines of new legislative proposals, the lack of coherence between European and national legislation ("vertical" cohesion) and the lack of legislative harmonisation across economic/industrial sectors or across entire value chains ("horizontal" cohesion). To this end, a more effective and predictable legislation would help, with the help of industry in terms of definitions, concepts and methods. In addition to initiatives to be taken at EU level, the chemical industry in Greece and the pertinent authorities may also contribute with proposals, gathering information and monitoring towards strengthening the vertical and horizontal coherence of legislation.

Effective and efficient enforcement of existing legislation is particularly important, especially in relation to products from third countries that do not comply with EU standards, as well as for products made available through online sales with very limited information towards users. It is proposed to establish uniform conditions and frequency of controls for certain products, but also to explore the use of digital tools to support market and customs authorities' surveillance. Implementation of the legislation can also be improved by promoting synergies, public-private partnerships, as well as by creating specific support for SMEs to implement the legislation.

The relevant priorities of the National Industry Strategy will also positively contribute, such as the digitalisation of all public services to businesses, the simplification of procedures at high administrative costs for industrial enterprises, and the training and education of government officials based on new needs and with a focus on improving digital skills.

Table 4.4 presents in more detail the actions on regulation and public governance related to the chemical industry in Greece, the responsible implementing actors and the timeframe for implementation.

Table 4.4: Actions on regulation and public governance

Actions	Actors	Timeframe
TOPIC 11: More effective and predictable legislation		
11.1 Definitions and concepts		
• Continue to engage actively in the work of public authorities proposing the definition of key concepts mentioned in recent EU legislation and policy documents (CSS, IED, etc.)	Industry	S
11.2 Methods		
• Propose targeted amendments to the REACH Regulation as per the CSS, including reform of the REACH authorization and restriction processes based on key findings from its practical implementation	EU/EL	S
• Continue to consider the 'think-small-first' principle giving full consideration to SMEs at the early policy development stage	EU/EL	S/M
TOPIC 12: Vertically and horizontally coherent legislation		
12.1 Horizontal coherence of legislation		
• Propose to remove legislative obstacles for the re-use of data. Better streamline the flow of chemical data between EU and national authorities. Extend the principle of 'open data' and the relevant transparency principles from the EU's food-safety sector to other pieces of chemical legislation	EU/EL	S
12.2 Vertical coherence of legislation		
• Continue to update PACT (the Public Activities Coordination Tool) to provide an up-to-date overview of all planned and ongoing initiatives on chemicals by authorities across different pieces of legislation	EU/EL	S
• Suggest technical guidance to promote harmonised implementation and better enforcement of legislation on occupational safety and health	Industry	M
TOPIC 13: Effective and efficient enforcement		
• Consider developing analytical methods to support enforcement. Increase available resources for enforcement	Industry and EU/EL	S
• Share for Member States consideration, successful non-regulatory-enforcement measures (e.g. voluntary actions, schemes and stewardship initiatives) that make the enforcement of legislation more efficient and more effective	Industry	S
• Use of the he Recovery and Resilience Facility to invest in strengthening market-surveillance infrastructures and digitalization	EU/EL	S/M
RELEVANT PRIORITIES OF THE NATIONAL INDUSTRIAL STRATEGY		
• Digitalisation of all public services to businesses • Simplification of procedures with high administrative costs for industrial enterprises through the National Program for the Simplification of Procedures • Digitalisation and simplification of public procurement procedures • Developing markets for green products through Green Public Procurement • Upskilling/training of government officials based on new needs and with a focus on improving digital skills		

Note: [Industry]: Actions initiated by or with the participation of the chemical industry and its sectoral entities. [EU]: Actions initiated by or with the participation of the European Union/Commission. [EL]: Actions initiated by or with the participation of the Greek government. [S]: Short term (actions that need to start as soon as possible). [M]: Medium term (actions to start by 2030). [L]: Long term (actions to start and be completed by 2050).

4.6 Access to energy and feedstock

Access to energy is crucial for the operation of the chemical industry as a significant part of the energy input is also consumed as a feedstock in addition to being used as an energy source. Green electricity and green hydrogen will be the main sources of energy to achieve the energy transition and carbon footprint reduction targets of the chemical industry. Green hydrogen is essential to produce green ammonia which is the main raw material to produce nitrogen fertilisers. Today this need is met using natural gas, which should be gradually replaced by other sources. It should be noted that ammonia, which is a product of the chemical industry, is also promoted as an energy carrier, which will affect both the price of fertilisers and therefore food, as well as all chemicals as it will be an energy product.

The production of alternative fuels, such as green hydrogen, requires large amounts of electricity from RES, while electrification of the industry's production processes will further increase electricity consumption. To achieve climate targets, the chemical industry should gradually move away from fossil-based raw materials and switch to alternatives such as biomass, waste and CO_2. In order to reduce greenhouse gas emissions, new business models, such as chemical leasing, and more efficient production processes should be adopted by improving design, reducing waste, using more efficient materials, reducing over-specification of products and encouraging the use of higher chemical intensity. Process efficiency can be complemented at plant and installation level by implementing other optimisation measures, such as energy recovery, while industrial symbiosis will facilitate the implementation of certain options, for example through the exchange of materials or energy flows to integrate heat into the production process.

To support the transition of the chemical industry, it is first appropriate to anticipate long-term needs for the supply of energy and feedstock to ensure the uninterrupted production of chemicals and products. At the European level, annual electricity demand from the chemical industry is estimated to increase significantly and could quadruple by 2050 compared to the current level. The total demand of the chemical industry for biomass is also expected to increase significantly by 2050, but the same is true for several other sectors, such as transport and heating. With a view to keeping biomass prices at reasonable levels, biomass availability should be ensured for different applications indicating the need to coordinate policy and action areas to meet demand.

According to the National Energy and Climate Plan (NECP), green hydrogen needs will be met by domestic production, given the country's renewable potential. Hydrogen will be directed primarily to those areas of use which cannot be directly electrified, such as heavy road transport, maritime and aviation, as well as certain industrial applications (steel, cement, refineries, ammonia production, etc.). In the field of industrial applications that cannot be directly electrified, relevant applied research on hydrogen-based solutions will be encouraged. At the same time and as research progresses, reducing the carbon footprint of these sectors will be achieved by capturing and storing CO_2. For hydrogen production, the NECP includes the installation of 3GW of additional RES by 2030.

The final targets for hydrogen production are, however, under investigation. It is estimated that for 2030 the total production of green hydrogen will reach at least 0.92TWh, corresponding to a capacity of approximately 300MW of installed electrolysis systems. The total consumption of green hydrogen is estimated at 63.6TWh/year by 2050, but the largest proportion (about 70%) is estimated to be consumed to produce synthetic hydrocarbons for use in transport. As far as hydrogen transport infrastructure is concerned, there is already a planning by DESFA to develop a network of hydrogen-only transport pipelines, which will connect the estimated main demand centres in Greece, enabling imports and

exports of green hydrogen to and from neighbouring countries. The main hydrogen transport network in Greece has been integrated into the European Hydrogen Backbone network of European gas network operators, which enables Greece to act as a hub in the wider region to import green hydrogen from North Africa and the Middle East and export it to other European countries. However, the implementation and maturation of these infrastructures will not be possible until technologically the form in which hydrogen will be used in final-uses (gaseous or liquid derivatives) and the location of production and use is determined.

In Greece there are 99 biogas power plants with a total installed capacity of 116MWe, while there is no biomethane production. The biomass categories used are livestock waste (cattle, pig farms, sheep, goats, chickens), agricultural residues (from winter cereals, e.g. durum and common wheat, oats, rye, vetch, triticale), agro-industry waste (cheese milk), food waste (e.g. from restaurants) and municipal organic waste. The above raw materials can be used to produce biogas/biomethane. According to a CEA study[71], the total theoretical biomass potential from livestock manure, cereal straw, agro-industrial waste and the organic fraction of municipal solid waste amounts to 28.2 million tons/year, with a total biomethane potential of 1.148 billion m³ or 11.069TWh (Table 4.5)[72].

Table 4.5: Theoretical biomass potential and biomethane energy content per feedstock in Greece

	Biomass	Energy content of biomethane	
Type of biomass	***Tons/year***	***m³/year***	***MWh/year***
Livestock	23.969.935	726.846.217	7.008.106
Agricultural	1.002.930	242.685.210	2.339.922
Agro-industrial	1.150.815	16.287.673	157.042
Municipal solid waste	2.086.089	162.237.088	1.564.258
Total	**28.209.769**	**1.148.056.188**	**11.069.328**

Source: NECP (2024), draft.

Furthermore, the maximum degree of actual utilisation of theoretical potential cannot be higher than 30%. Therefore, the maximum biomethane production is set at the level of 3.3TWh/year, when according to the NECP, biomethane in 2030 will be 2.1TWh/year. In any case, it is necessary to develop a national action plan on the collection and treatment of biomass to produce biomethane and other materials for use either as feedstock to produce renewable hydrogen or renewable fuels.

In relation to the supply of clean electricity required in chemical installations, in Greece infrastructure is not sufficient to manage energy generation investments by industry, while the permitting system is lagging especially in terms of acceptance of new technologies. Accelerating the process of developing the essential infrastructure requires accelerating studies to strengthen clean electricity grids/infrastructures, promoting a flexible institutional framework for clean energy by providing particularly rapid permitting and multiple synergies possibilities, as well as simplifying the process of recognising clean electricity generation by chemical industries, which have “special” processes for zero carbon footprint electricity generation. Priority could also be given to small renewable energy production projects that typically self-consume the energy produced with as much simultaneity as possible, to provide more time for the necessary investments in transmission and distribution networks, including international interconnections. In this context it is necessary: a) a thorough investigation into the possibility of self-generation with RES, maximising energy savings and the spatial and economic potential of each

[71] Christos Zafiris, CRES, “Biomethane in Greece: Potential and Perspective”, Thessaloniki 23.5.2023

[72] It should be noted that the estimated potential refers to the anaerobic digestion method only, which is the most mature and lowest cost process. In the future, it is envisaged to reduce costs by developing the production method through the process of gasification of solid biomass and methanisation of the resulting synthesis gas, which can provide additional amounts of biomethane.

enterprise, b) the symbiotic development of RES with neighbouring enterprises and c) the possibility of integrating RES through stochastic determination of the electrical space and combination with energy storage mechanisms (electrical and thermal) 'behind the meter'. To ensure the adequacy of the electricity system with an increasing share of intermittent renewable energy sources, there should be legislative flexibility in terms of location and investment in energy storage, appropriate "tools" and methodologies for monitoring and forecasting generation/consumption of RES, enhancing the capacity to generate and store electricity from RES, investments in High and Medium Voltage grids and international interconnections. Relevant actions for the above are referred to in the National Industry Strategy and the National Energy and Climate Plan.

The chemical industry should be able to procure green electricity at competitive prices. Both chemical processes and hydrogen production have particularly increased demands on electricity. The chemical industry is both a major producer and a major consumer of hydrogen. The most frequent method of producing hydrogen in the EU, by reforming natural gas or the bottom fraction of crude oil, causes significant amounts of CO_2 emissions, while other technologies such as methane pyrolysis or photoelectrocatalysis are currently under development. It is also important to address regulatory barriers to the supply of green electricity for hydrogen production for own consumption, but also to prioritise direct electrification over the use of hydrogen, which is currently less energy efficient. For example, it has been estimated that annual hydrogen production in Europe via electrolysis would require 290TWh of electricity (approximately 10% of production in Europe). For Greece, the requirements are estimated at 4.7TWh, representing about 8% of electricity consumption in 2019[73].

Regarding green ammonia, Greece is a gateway for Europe. For this reason, the legal framework for the storage and handling of ammonia will need to be modernised, the construction of an interconnection pipeline with neighbouring countries, as well as the installation of ammonia decomposition plants, will need to proceed. To implement such a project, capital-intensive installations such as new technology ammonia production plants need to be strengthened.

The difference in costs between zero-emission chemical production technologies and other more polluting alternatives remains significant. Reducing this gap could be achieved through many options, such as coal differences contracts, by subsidising EU producers to cover the cost difference between zero-carbon and more polluting technologies, and by concluding long-term clean energy contracts (PPAs). The latter is a priority of industrial and energy policy, and in this context the Greek Energy Exchange promotes the development of a new platform supporting "green" bilateral contracts (PPAs), with an emphasis on standardising contracts to make them available to smaller businesses as well.

Different types of biomass can be used to produce chemicals, for example from sugars or vegetable oils. The value chains created to produce bio-based chemicals and materials include a set of technologies that enable the processing of a wide range of biomass feedstock in a range of high-value products. Innovative process technologies can improve the rate of use of residual biomass for chemical production.

Organic and inorganic waste can be used as an alternative raw material for chemical production, such as organic waste for biofuel production, while the reuse of solid waste, such as plastics and metals, is strategically important to achieve circular economy objectives. Chemical recycling technologies break down the chemical structure of polymer waste and other input materials into monomers and chemical

[73] G. Kakoulaki, I. Kougias, N. Taylor, F. Dolci, J. Moya, A. Jaeger-Waldau, Green hydrogen in Europe - A regional assessment: Substituting existing production with electrolysis powered by renewables, Energy Conversion and Management, Volume 228, 15 January 2021, 113649

building blocks, which are then converted into valuable secondary raw materials, with outflows also including chemicals and other products, some of which are fuels.

Carbon from CO_2 collected is a possible alternative to its supply from minerals. CO_2 and CO capture technologies are the key technologies for decarbonising energy-intensive industries, including the chemical industry. These technologies have a particularly significant potential for applications in the chemical sector, but they still face some challenges.

In Greece, the availability and accessibility of alternative feedstock could be improved by:

- Identification/quantification of needs and interconnection with suppliers.
- Creation of modern centers for the collection and processing of flows so that they are usable. Plastics is a typical example where opportunities to increase engineering and the development of chemical recycling can be created. The concentration of the chemical industry in Attica and Thessaloniki, however, takes it away from the waste streams of primary production.
- Improving basic infrastructure (e.g. designing new motorways) with central planning considering the reduction of the cost of recycling logistics to make it economically viable.
- Through organised and better regulated formal recycling streams with more substantial incentives or less disincentives for companies to recycle. Such incentives for industrial enterprises could be (a) the exclusion of sheltered waste sorting sites, to make them recyclable, from the coverage factor of an initial investment or building expansion, b) subsidisation of the employee's wage costs available for sorting and cleaning of recyclables, through more flexible with fewer restrictions Green Transition programmes in the current RDPA.
- Strengthening domestic production and disposal of alternative feedstock, including waste streams, by strengthening relevant actors and synergies between industries.
- More comprehensive information to businesses through their sectoral agencies by creating a portal for the supply/demand of alternatives by category.
- Investments in the industry of alternative feedstock.
- Use of process systems engineering tools, which allow the "sorting" of alternative materials and their processing into products of fair functionality and sustainability (Safe and Sustainable by Design).

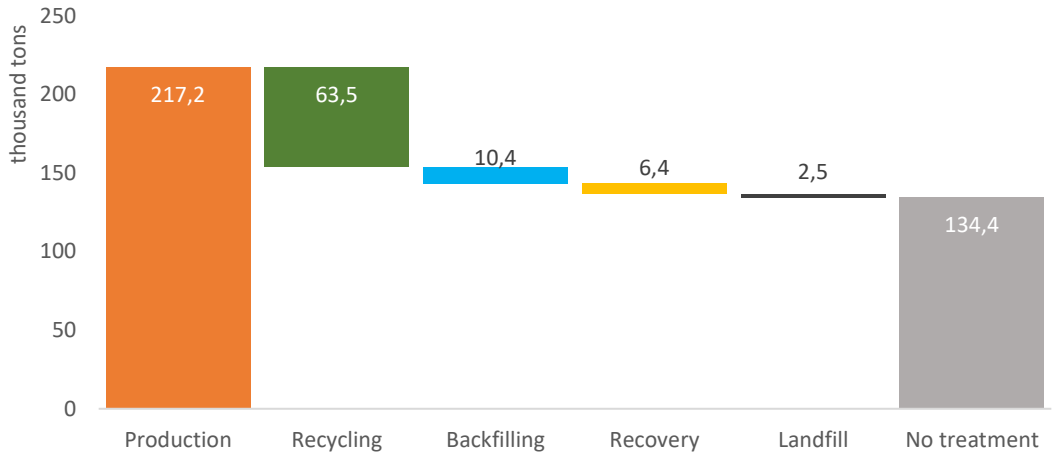
The demand for recycled feedstock depends on their quality and cost relative to non-recycled feedstock. The supply of alternative feedstock in Greece is limited but could respond to an increase in demand by implementing regulations on the mandatory use of a percentage of recycled feedstock. Availability is mainly limited to packaging materials, although the degree of substantial packaging recycling in Greece is low, particularly as regards plastic[74], while there are also issues regarding the quality of the materials to be recycled.

Indicatively, the production of plastic waste in Greece in 2020 amounted to 217.2 thousand tons, of which 38.1 % was processed: 63.5 thousand tons (29.2%) of plastic waste was recycled, 10.4 thousand tons (4.8%) were used in backfilling operations, 6.4 thousand tons (3.0%) for energy recovery and 2.5 thousand tons (1.1%) were driven for landfilling. As regards plastic packaging recycling, the NWMP has set a target of 50% by 2025 and 55% by 2030, up from 37.6% in 2019[75].

[74] It is noted that chemicals such as inorganic basic chemicals (e.g. sodium hypochlorite for water and space disinfection) are not reused.

[75] Plastic waste management in Greece is also carried out through transactions with other countries. In particular, over the past decade the trade balance of plastic waste for recycling has been positive, suggesting that exports exceed imports. Exports

Graph 4.2: Production and flows of plastic waste in Greece, 2020



Source: Eurostat.

However, there is considerable scope for the expansion of sorting facilities as well as available recycling technologies. Obstacles are the adequacy of space for the expansion of sorting facilities in crowded areas, the co-operation of Local Government Organization (LGO) in the provision of recycling bins to businesses and their frequency of collection routes, and significant investment costs for implementation and incentives for the use of recycled materials are required. The requirements will eventually impose the establishment of modern technological facilities for the treatment of recycling streams.

Furthermore, to develop a healthy and sustainable market for recycled raw materials in Greece, it is necessary to promote the relevant legislative framework and the permitting of materials classified as waste or by-products. In this context, it is necessary to:

- Accelerate the certification methodology for the whole supply chain, but especially for recycled PP and PE produced, as it is a key prerequisite for the techno-economic assessment of chemical recycling investments (plastics pyrolysis)[76].
- Financing of chemical recycling investments (such as pyrolysis).
- Additional incentives for municipal waste collection and separation and recycling of packaging materials instead of incineration/burial.
- Incentives for recycling at source.

This will allow them to gradually replace primary raw materials in the production process cycle. Therefore, there is considerable scope for the development of recycling and reuse, as new materials that will have to be recycled will also arise. This requires mapping and directional development of the industry.

exceeded 60 thousand tons in 2022, while imports were close to 40 thousand tons. In both foreign trade flows, most quantities are directed to or originated from EU countries.

[76] Chemical recycling includes a range of innovative technologies that, based on the point of their outputs in the plastic supply chain, can be distinguished in Purification, Depolymerisation and Feedstock Recycling. With these technologies, plastics can be degraded into basic chemicals and raw materials, resulting in improved recycling rates, the supply of virgin quality raw materials in the plastic supply chain, and the reduction of plastic waste that is landfilled or incinerated as it is difficult to recycle, such as membranes and laminated plastics. Feedstock recycling involves thermal processes that turn polymers into simpler molecules to form the raw material for petrochemical-type processing. The main processes are Pyrolysis for PE, PP, PB, PS and PMMA plastics, Gasification (Gasification) for plastics of all types, and Hydrothermal Treatment (HTT) for PET, CFRP, PCB, polycarbonate polymers, styrene-butadiene polymers, polylactic acid polymers and certain types of nylon. Feedstock Recycling products are key chemicals, such as hydrocarbons, which by further processing can produce polymers for their reuse in the petrochemical industry.

More efficient production of materials could help reduce CO_2 emissions throughout the value chain by improving design, reducing waste in the production of chemicals, using higher-efficiency materials, reducing excessive standards and encouraging higher intensity of chemical use. The chemical industry should also consider implementing new business models, such as the rental of chemicals, to address overconsumption of chemicals by charging customers based on functions performed by chemicals rather than the volume of chemicals purchased. Process intensification can contribute significantly to resource and energy efficiency and catalysts are key factors for higher selectivity and reduced energy consumption, so further innovation in intensified unbundling technologies and their control technologies is needed to enhance higher selectivity of reactions. Process efficiency can also be enhanced at installation and location level by implementing other optimisation measures, such as energy recovery. Industrial symbiosis will facilitate the implementation of some of the above-mentioned options, for example by exchanging material or energy flows for the use of heat while further use of digital technologies could play an important role in the efficiency of production processes.

Table 4.6 presents in more detail the actions to enhance the access of the chemical industry to energy and feedstock, the responsible implementing actors and the timeframe for implementation.

Table 4.6: Actions for access to energy and feedstock

Actions	Actors	Timeframe
TOPIC 14: Anticipate long-term needs for the supply of energy and feedstock resources		
• Estimate the future needs for energy and alternative feedstock to ensure continued production of chemicals	Industry and EU/EL	S
TOPIC 15: Economically sustainable supply of clean energy		
15.1 Channel investments for clean energy		
• Adopt a social climate fund to support small business in the transition (REPowerEU)	EU/EL	S
• Channel investments to players committed to the green transition and to becoming 'frontrunners' in the use of novel sustainable technologies	Industry and EU/EL	S/M
• Strengthen the funding and de-risking measures (e.g. contracts for difference, robust investment-protection policies) to support the deployment of green and smart technologies and the sourcing of clean energy up to demonstration plants and first-of-their-kind plants – e.g. via the Innovation Fund	EU/EL	M
15.2 Ensure the competitive supply of clean energy		
• Reassess electricity-market rules with the aim of making electrification cost-competitive for energy intensive Industries	EU/EL	S
• Implement the EU solar strategy to double solar photovoltaic capacity	EU/EL	S/M
• Consider setting up 'go-to' areas for renewables with shortened and simplified permitting processes	EL	S/M
15.3 Improve Power Purchase Agreements (PPAs)		
• Set up EU certifications and standards for feedstock (addressing energy and chemicals, including hydrogen)	Industry and EU/EL	S
• Set up risk-sharing facilities to support micro-firms & SMEs	EU/EL	S
• Introduce an electricity-price system for industry that ensures internationally competitive energy prices and supports the transition towards climate neutrality. Consider increasing the number of renewable-energy PPAs	EU/EL	M/L
TOPIC 16: Feedstock substitution		
16.1 Identify and develop new and sustainable sources of feedstock		
• Increase reporting of scope-3 GHG emissions and explore opportunities to use feedstock from waste and recycled materials	Industry	M
• Consider promoting projects on turning alternative sources into valuable feedstock inputs, partly through joint agreements & interdisciplinary cooperation; ensuring SMEs participation	EU/EL	S/M
• Accelerate the market deployment of existing circular and bio-based solutions (whether they are mature or innovative) – e.g. via the Innovation Fund	Industry and EU/EL	S/M
16.2 Biomass as an alternative feedstock		
• Create a balance and prioritisation between the different uses of biomass by providing a set of sustainability criteria (e.g. considering deforestation risk) and develop concrete incentives for the use of these criteria	Industry and EU/EL	S/M
• Further improve methodologies to monitor the environmental performance of biomass as a feedstock	Industry and EU/EL	S/M
• Increase the efficiency and transparency of biomass supply chains	Industry and EU/EL	M/L
16.3 Waste as an alternative feedstock		
• Suggest improvements on transparency – and ending restrictions on transparency – in the use of 'substances of concern' to clean up material cycles (ESPR) at national level	Industry	S
• Advocate for promotion of early international cooperation on standards to prevent potential barriers to market access barriers from arising	Industry	S

• Advocate for chemical recycling as a complementary option for waste that cannot be recycled mechanically, if it causes less environmental burden than incineration and virgin plastic production	Industry	S
• Increase the recyclability of products to boost the use of upcycled resources instead of virgin materials	Industry	S/M
• Phase out the most harmful substances from consumer products, unless they are essential for society, as per the CSS	Industry	S/M
16.4 CO_2 as an alternative feedstock		
• Consider using circular carbon sourced from CO_2 as a feedstock	EU/EL	S/M
• Support the economic and technological development of CO_2 as a feedstock	EU/EL	S/M
TOPIC 17: Process and resource efficiency		
• Promote industrial symbiosis as a commonplace approach for advancing the circular economy	Industry and EU/EL	S/M
RELEVANT PRIORITIES OF THE NATIONAL INDUSTRIAL STRATEGY		
• Ensuring energy efficiency and achieving competitive energy costs with special attention to the needs of industrial enterprises active in energy-intensive sectors • Developing alternative supply channels and strengthening EU strategic autonomy especially in critical raw materials (CRMs) as identified by the European Commission • The need to transform energy-intensive industries to reduce greenhouse gas emissions and energy consumption through: A. Exploitation of alternative forms of energy (RES, hydrogen and biofuels) B. Implementation of energy efficiency improvement solutions C. Applications of circular economy and industrial symbiosis (Sharing) • Promoting the improvement of the energy efficiency of industrial SMEs and the use of alternative forms of energy • Boosting the development of green products and services • Ensuring the country's energy adequacy through the development of alternative supply channels for energy imports • Managing the energy crisis through support measures for industrial enterprises with special attention to those active in energy-intensive sectors • Upgrading the infrastructure of the electricity transmission network to allow for the reception and distribution of new generation of electricity, which can be produced by industry • Aid to industrial enterprises for the establishment of self-generation power stations (net metering) through RES • Reform of the institutional framework to promote the creation of energy communities by industrial enterprises • Reform of the institutional framework for the conclusion of a power purchase agreement (PPAs) • Simplification of the permitting framework and development of appropriate spatial planning for the development of RES • Promoting industrial symbiosis for the development of biofuel production and use • Promoting investments to improve the energy efficiency of industrial plants		

Note: [Industry]: Actions initiated by or with the participation of the chemical industry and its sectoral entities. [EU]: Actions initiated by or with the participation of the European Union/Commission. [EL]: Actions initiated by or with the participation of the Greek government. [S]: Short term (actions that need to start as soon as possible). [M]: Medium term (actions to start by 2030). [L]: Long term (actions to start and be completed by 2050).

4.7 Infrastructure

In Greece, there have been shortages over time in logistics infrastructure, especially port infrastructure, rail infrastructure, freight and bulk storage. The country's ports are key gateways for imports and exports of products, but access to them (mainly by road) presents difficulties and high costs, while chemical storage tanks in port areas are insufficient to serve the needs.

Shortages of transport and storage infrastructure have a significant impact on the chemical industry in Greece, as despite the geographical location of the country close to emerging markets and its function as a gateway to Europe, they lead to increased costs and limit the potential to achieve economies of scale. In addition, shortages of international electricity and green hydrogen interconnections, as well as prototype technologies for the chemical industry, make the immediate decision to implement green transition projects precarious.

Insufficient rail transport affects the competitiveness and delivery times of raw materials and the promotion of final products. Also, the transport of products that in other countries are bulk (e.g. in tanks), is carried out using smaller packaging resulting in a higher carbon footprint, losses of product and low productivity. In general, the supply of raw materials and the supply of final products are negatively affected. The problem of illegal imports due to the weakness of control infrastructure is one of the biggest in the sector, as there is huge trafficking and imports of illegal and falsified products, creating unfair competition.

As the chemical industry in Greece is heavily dependent on imported raw materials, strengthening infrastructure in ports with storage and rail transport is imperative. Given the concentration of about 50% of chemical production in Attica and Central Greece, there is also a need for the construction of additional road infrastructure, such as the Elefsina-Thiva-Yliki motorway, to facilitate transport and export activity. As regards waste, opportunities are created through the creation of infrastructures for the collection, treatment and disposal of waste and secondary materials to serve the objectives of the circular economy (including through a material logging and management platform using the existing electronic waste register). Provision should also be made to facilitate the transport and temporary storage of waste and by-products intended for re-use in the sites to be used, to provide more incentives and less disincentives for businesses to recycle, to improve end-of-waste processes where necessary, as well as cooperation between private and public sectors. The National Strategy for Industry includes a number of priorities which seek to remove the above obstacles.

There are also shortages in electricity networks that support the development of RES, in recycling infrastructure, in the organisation of industrial areas with modern infrastructure, in the development of value chains as the demand for synergies and pipeline networks for the transport of raw materials in gaseous or liquid form increases. There is also a need for development for hydrogen networks and CO_2 transport and storage pipelines.

Access to energy and raw materials is essential and can be ensured through the construction and/or expansion of the necessary infrastructure, in particular electricity, hydrogen, waste, CO_2 and biomass. Appropriate infrastructure will also enhance both industrial symbiosis and better integration of processes within industrial clusters, such as capture, storage and transport of CO_2 from emission installations to the chemical industry. The development of such structures is slowed down mainly by the lack of infrastructure and slow procedures for the approval and authorisation of infrastructures and processes.

The expansion of the electricity grid is essential for access to low-carbon energy. Network bottlenecks need to be strengthened, as well as cross-border interconnections, to allow the free flow of energy between countries. The European Clean Hydrogen Alliance[77] supports the large-scale deployment of clean hydrogen technologies by 2030, while Directive 2023/2413 (Renewable Energy Directive III[78]) imposes a 42% share of green hydrogen (RFNBO) in the industry's total hydrogen consumption. The chemical sector is projected to be one of the largest industrial consumers of clean hydrogen, while the chemical industry already produces quantities of hydrogen used in internal production processes. The country should ensure that the necessary infrastructure is in place to provide green hydrogen at every point of consumption, to achieve the objective of the Directive (including upgrading its gas networks). This will also contribute to the preparation of the national hydrogen strategy, which is expected.

The design and construction of a demonstration plant and the development of industrial-scale solutions are important challenges for the development of many technologies and often requires cooperation between different industries and partners at regional and cross-border level. The returns on these investments are uncertain, and the design of each project is difficult mainly by long and complex permitting procedures, which create additional uncertainty. This raises questions about the viability of the chemical plant itself and about ensuring the provision of resources for its operation. In this context, pilot projects for the development of sustainable infrastructure should be launched and permitting should be accelerated.

Interconnecting rail infrastructure would significantly help the transport of raw materials and chemicals. The development of such infrastructure is also hampered by the lack of an integrated system for the management of international rail-freight traffic and capacity. European regulations have been adopted to support the development of both energy interconnections and energy infrastructure (TEN-E) and to increase the use and efficiency of freight transport (TEN-T), which can help address the problems.

The digital transformation of the chemical industry and the development of available technologies will shorten the path towards the objectives of the double transition. The pace of development and adoption of digital technologies such as artificial intelligence, automation, smart sensors, and robotics should be increased, which will boost every stage of production from product and process design to logistics and production. There is a need for new digital platforms to enable the exchange of information on chemicals and products, which should be designed in a way that ensures the protection of confidential business information.

Access to important alternative sources of raw materials will be improved through the development of recycling and material reuse infrastructure. This will require investments both in the collection and sorting stages and in the organic and inorganic waste value chains. The low-price competitiveness of recycled materials, as well as the lack of comprehensive legislation on incineration, landfilling and transport of waste, are inhibiting. The development of CCU and CCS technologies also requires the expansion of reliable infrastructure for the transport and storage of CO_2. Such projects are supported by the Innovation Fund, which could however be developed in the context of local industrial symbiosis (Hubs4Circularity), where CO_2 produced by an energy-intensive industry can be used by a nearby chemical facility.

[77] https://single-market-economy.ec.europa.eu/industry/strategy/industrial-alliances/european-clean-hydrogen-alliance_en
[78] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202302413

Table 4.7 presents in more detail the actions for the enhancement of infrastructure, the responsible implementing actors and the timeframe for implementation.

Table 4.7: Actions for infrastructure

Actions	Actors	Timeframe
TOPIC 18: Large-scale electricity and hydrogen infrastructure		
18.1 Enable the free flow of energy between countries		
• Identify preliminary hydrogen-infrastructure needs by March 2023, based on the TEN-E Regulation (REPowerEU)	EU/EL	S
• Abolish electricity-grid bottlenecks and increase the number of cross-border interconnectors	Industry and EU/EL	M
18.2 Develop separate hydrogen infrastructure at EU level		
• Re-dedicate current gas pipelines and refineries and construct new pipelines dedicated to hydrogen Infrastructure	Industry and EU/EL	M
• Invest in new harbour-storage capacity in key EU ports or in relocating industrial harbours to more suitable locations	Industry and EU/EL	M
• Support and drive investments in appropriately sized dedicated hydrogen grids (including local grids, highly interlinked grids, high-capacity grids and digitalised grids) with an extended electricity grid to support hydrogen	EU/EL	M
• Develop a certification system for the import of low-carbon hydrogen	Industry and EU/EL	M
TOPIC 19: Development of new and sustainable production facilities		
19.1 Develop recycling facilities and bio-refineries (and exploit synergies with the chemical industry)		
• Launch pilot projects to develop sustainable infrastructures	Industry and EU/EL	S/M
19.2 Accelerate and improve permitting		
• Facilitate and accelerate approval procedures for production plants and products, notably via the ongoing revision of the IED	EU/EL	S/M
• Publish an annual comparative report to identify Member States' best practices in planning and permitting law; create an exchange of best practices	EU/EL	S
TOPIC 20: Sustainable transport of raw materials and chemical products		
20.1 Increase the availability and capacity of multi-modal terminals that are close to industrial clusters		
• Support investment in rail and inland waterway transport through public-private partnerships	Industry	S
• Develop a framework for trusted, secure and resilient B2B transport and logistics for data sharing (DTLF)	EU/EL	S
• Set up sustainable and resilient value-chain logistics for the sustainable supply of alternative feedstock (e.g. following the 'Hubs4Circularity' concept (Horizon Europe) and the EU global gateway strategy)	Industry	M
• Support the development of a multi-modal single European transport area through the Cohesion Fund (TEN-T)	EU/EL	M
20.2 Improve the use of rail transport		
• Adopt a legislative package on greening freight transport (REPowerEU)	EU/EL	S
• Improve reliability, rail punctuality, and rail infrastructure coordination between different national railway systems	EL	S
TOPIC 21: Deployment of digital technologies		
21.1 Deploy safe, high-speed and reliable digital infrastructure		
• Development of an open data platform data space for chemicals to ensure seamless access and combination of data and tools complying with GDPR, IP, confidential business information and access rights (CSS and SRIP)	Industry and EU/EL	S
• Consider drawing up standards for both data interoperability and governance to protect confidential business information based on the developments in the context of common European Data Spaces	Industry and EU/EL	S
• Provide data on product carbon footprints for chemicals, and feed-in data for wider sectoral KPIs being developed within the CSS in alignment with the Digital Product Passport	Industry and EU/EL	S/M
21.2 Deploy technologies to improve chemical manufacturing processes and data gathering		
• Extend partnerships with innovative actors offering digital solutions	Industry	S/M
TOPIC 22: Circularity: Recycling and re-use of infrastructure		
22.1 Set a regulatory framework for the transport of waste		
• Ensure the harmonised EU implementation of the Basel Convention through the Waste Shipment Regulation	EU/EL	S
22.2 Improve the management of logistics for waste feedstock		
• Increase the coordination of waste-management infrastructure with Hubs4Circularity (Horizon Europe) (e.g. mechanical treatment of waste management)	EU/EL	S
• Use the Innovation Fund to support the deployment and upscaling of CCS technologies and infrastructure, aimed at capturing, transporting, and storing CO_2 emission	EU/EL	S
• Implement the Waste Framework Directive and Waste Shipment Regulation; encourage cooperation between municipalities	EL	S
• Enforce the regulation of illegal imports to avoid contamination of the recycling loop	EL	S
• Invest in the management of waste feedstock	Industry	M
RELEVANT PRIORITIES OF THE NATIONAL INDUSTRIAL STRATEGY		
• Simplifying the permitting process especially in the areas of spatial planning, urban planning and environmental permitting, with a view to reducing red tape and speeding up procedures • Reforming the institutional framework for the establishment and operation of Business Parks to ensure attractiveness for businesses and their financial viability • Operational and environmental remediation of atypical business concentrations (ABC)		

- Creation of new generation business parks with appropriate digital and environmental infrastructure
- Promoting industrial symbiosis through the creation of an appropriate institutional framework and infrastructure as well as strengthening the entrepreneurial culture of cooperation
- Reform of the institutional framework governing the operation of industrial ports
- Expansion and upgrading of railway and road network to improve the interconnection of Business Parks with airports, ports, railway stations and land borders of the country
- Promoting the development of supply chain businesses through the creation of large and modern logistics centers
- Promoting the automation of the Supply Chain through the exploitation of robotics, blockchain, and autonomous vehicles applications
- Promoting the replacement of the transport fleet by electric means
- Promoting digital transformation even for SMEs with very limited digital maturity in areas of low technological intensity, through the installation and upgrading of basic equipment and functions (e.g. software, ordering and procurement systems, administration systems, etc.)
- Informing entrepreneurs and SME executives about the benefits and potential of digital technologies
- The digital transformation of the construction materials ecosystem requires promoting the collection and use of data, with priority in the following areas I4.0: A. Development of digital product passports to increase traceability of material flows B. Performing simulations and predictions using AI and IoT to improve the quality, efficiency, security and sustainability of the production process

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4.8 Human resources skills

The majority of companies active in the chemical industry in Greece are small and medium-sized enterprises with a limited number of employees, making it impossible to have specialised personnel for each operational sector. This creates the need for a workforce with a variety of skills, many of which are not technical, as would be expected for work in the industry. In particular, SMEs are more likely to lack not only capacity in mechanical equipment, but also sufficient human resources in R&D and regulatory affairs, so that they can meet the strict timelines and requirements set by the regulatory framework. The lack of staff indirectly also affects the innovative potential of chemical companies, as human resources are shifted to work to ensure regulatory compliance so that businesses do not inadvertently reach a point of incomplete compliance. The necessary increase in jobs and the necessary training and integration times for young workers is hampered by the difficulty of finding qualified human resources and adequately informed about the positive career prospects in domestic manufacturing in general.

In any case, the chemical industry in Greece is trying to monitor international events and harmonise the skills of its personnel. However, several technical issues need to be updated and financial tools strengthened to keep up with international practices.

Workers in the chemical industry are recognised as being highly trained because of the skilled work they provide. However, there is a mismatch in specialisations mainly related to digital skills (e.g. computer science and data analysis), specialised scientists in fields such as biotechnology, polymers, etc., while problems are reported even in finding unskilled staff. In the field of green energy, which is rapidly growing, there is a need for the development of special skills, both for executives already employed in the chemical industry and for new executives who are preparing in higher education institutions. Mismatches also refer to technical specialisations in R&D, production, procurement, infrastructure maintenance, mainly in STEM skills. Skills mismatches affect more sectors of the chemical industry with a lack of know-how in Greece, e.g. chemical recycling. For this reason, attracting relevant investments and know-how will be beneficial. The evolution of technology and consequently of the production equipment requires operators and maintainers with knowledge of the use of electronic and not electromechanical equipment. In regional operations, specialisation in energy, materials, operational resource planning (ERP), flow automation are requested and are not fully covered, as a significant part of the potential is now outside Greece due to greater interest and compensation. In any case, brain drain and observed labour market mobility act negatively at the expense of smaller businesses regardless of the chemical industry sector.

The chemical industry is working to increase corporate training and promote the lifelong learning of its staff. The Hellenic Association of Chemical Industries (HACI) supports its members by providing specialised training on cutting-edge issues such as sustainability and upcoming changes to chemical legislation. The members of the Association show particular interest in the training of their executives, but greater mobility is observed in larger enterprises. More generally, chemical companies and industry entities in Greece promote the training of their executives on specialised topics with repeated internal corporate training programmes per sector of occupation, by conducting continuous specialised training of technical personnel, through the networking of enterprises and dissemination of relevant information, by organising thematic workshops, by systematically strengthening and increasing training hours for all staff, including in digital transformation issues, as well as by covering part of or the total cost of postgraduate and professional programs. In terms of planning and policy there are some public initiatives

to enhance skills development with limited results at present. The framework for organising such programmes by public entities is not particularly attractive to potential participants.

SusChem Greece operates as a Network Partner in the project https://iriss-ssbd.eu, whose purpose is to create a permanent community to promote and implement the principle of Safe and Sustainable by Design in Research and Innovation of the chemical industry. This work creates a body of knowledge and information that will be disseminated to this community. Another good example is the Industrial Doctorate Program of the University of Patras and the equivalent of SEV in collaboration with eight Universities.

The National Strategy for Industry includes important priorities for enhancing the human resources of the chemical industry, such as reducing non-wage costs, better linking the education system with the labour market, reforming the curricula of higher and vocational education, linking the productive sector with expatriate executives and scientists to create a contact network, developing vocational education and training in technical specialisations recording high demand, promoting reskilling and retraining, providing incentives for the use of academics – researchers in the activities of enterprises in the sector (industrial doctorates), etc.

Some SMEs have limited capacity to upskill and reskill their workforce, while SMEs in general are particularly exposed to the risk of losing employees after completing vocational training, which is often a significant investment for a company. Building on relevant national and European strategies, programmes and actions, as well as stakeholder partnerships will help to explore existing and emerging skills needs in the chemical industry.

To support the transition of the chemical industry, skills development should focus on sustainability. In this context, it is appropriate to develop a roadmap for required skills and identify potential gaps, sectoral training on green and sustainable chemistry, regulation and safety of chemicals, participation in the EU strategy for sectoral cooperation in the field of skills, and the development of a compensation scheme for SMEs contributing to vocational education. Actions to adapt education at all levels will also be particularly important, making use of all available national and European tools and initiatives.

In addition, more effective training approaches are necessary for the rapid integration of young workers into the labour market, by modernising teaching methods and training programmes. Given their great importance in vocational training, SMEs should play a central role in achieving these objectives. The chemical industry in Greece has, as mentioned, shortages of skilled workers, especially in technical areas, digital/computing fields, R&I, chemical safety and regulation, etc. Reskilling workers should be a priority to avoid job losses, and special attention should be paid to training university students on the regulatory aspects and safety of the chemical industry, as well as actions to enhance the attractiveness of the chemical industry.

In conclusion, the number, scope, importance and duration of training is such that it imposes a significant burden on enterprises either directly or indirectly due to fatigue and/or absence of trained workers from their daily tasks. To this end, it is proposed that these costs can be included in an over-depreciation scheme (e.g. 200%), submitted to the Ministry of Labour and offset against regular contributions to the insurance funds. Moreover, in the context of the current programming period 2021-2027, significant European resources for education and training have been provided and in the same extent student internships could be included, provided, of course, that it is paid in connection with the minimum wage.

Table 4.8 presents in more detail the actions to enhance the skills of the chemical industry's human resources, the responsible implementing actors and the timeframe for implementation.

Table 4.8: Actions on human resources skills

Actions	Actors	Timeframe
TOPIC 23: Education (Re-skilling/upsklling the workfoce)		
23.1 Develop skills with a sustainability focus		
• Develop a roadmap for skills, including the social dimension	Industry and EU/EL	S
• Set up sector-specific training, including training on green and sustainable chemistry, chemicals regulation, and safety	Industry	S
• Identify and address SSbD skills mismatches and skills gaps in the field of SSbD in the chemical industry. Ensure appropriate skills at all levels – including in vocational and tertiary education, in research, in industry, and among regulators	Industry and EU/EL	S
• Participate in the EU blueprint for sectoral cooperation on skills, including the Blueprint Alliance on energy-intensive industries/industrial symbiosis	Industry	S
• Develop a more effective compensation scheme for SMEs that contribute to vocational education	Industry and EU/EL	S/M
23.2 Adapt secondary, post-secondary and university education		
• Contribute to the activities of the European Year of Youth in cooperation with national associations of chemical employers	Industry	S
• Adapt university curricula to industry needs, by adding courses on regulation, sustainable chemistry, green chemistry and the principles of SSbD to university programmes in chemistry. Adapt apprenticeships and vocational education and training programmes to teach future-proof knowledge	EU/EL	S/M
• Develop and ensure broad science, technology, engineering and mathematics (STEM) education across all education sectors	EU/EL and social partners	M
• Make use of tools and initiatives under the European Skills Agenda, such as the EU Pact for Skills	EU/EL	M
TOPIC 24: Sufficient supply of jobs at technical level		
24.1 Increase corporate training		
• Foster/organise regional training programmes and centres where in-company training is difficult (e.g. in small companies), in line with existing programmes.	Industry and EU/EL	S
• Further promoting of lifelong learning	EU/EL	S
• Forecast and address the challenges connected to skills needed to introduce new technologies, with full contribution from workers' representatives (including digital skills)	Industry	S/M
• Provide company-based training and reskill workers so they are prepared for the professions of the future. Link this training to job-to-job transition plans.	Industry	S/M
• Provide in-company training opportunities, career paths, and apprenticeships.	Industry	S/M
• Invest in the re-skilling of workers, especially by ensuring financial support for SMEs	Industry	M
24.2 Increase the attractiveness of the sector		
• Ensure good communication by company managers with their workers, notably about the risks linked to the transition. This will reduce existing uncertainties and help workers to embrace the transformation of the industry in which they work	Industry	S
• Provide attractive employment conditions, such as flexible working hours, digital technologies, job sharing, etc.	Industry	S
• Increase the exposure of young scientists to R&D carried out in industry as well as in academia. 'Industry led' research is also science that should be given equal value/status in education	EU/EL	M
RELEVANT PRIORITIES OF THE NATIONAL INDUSTRIAL STRATEGY		
• Promoting interventions to reduce non-wage costs to increase employment in industry • Promoting the link between the education system and the labour market through institutions such as apprenticeships and traineeships • Reforming higher and technical/vocational education curricula based on new labour market needs • Promote the interconnection of the productive sector with expatriate executives and scientists to create a contact network • Development of vocational education and training in technical specialisations in high demand from industry • Promoting reskilling and retraining based on new needs arising in the face of green and digital transformation. In this context, with emphasis also on the increase of ICT professionals • Create programmes to develop appropriate knowledge and skills for refugees and migrants to promote their employment in industry • In the context of the double transition of the construction materials ecosystem it is necessary to attract high-level professionals with cross-cutting expertise and knowledge related to both production automation (specialisation in the use of BIM) and green transformation (alternative forms of energy, energy efficiency and waste management). • Development of domestic human resources in specialised technical specialisations sector where the enterprises of the construction materials ecosystem present increased needs • Promoting continuing vocational training of workers in SMEs for the development of digital skills and capabilities to use new technologies in general • Training and information, through the Special Secretariat for the Management of Private Debt (EGDIX) of entrepreneurs and executives, especially micro and small enterprises, on the basic principles and knowledge of economic education and business administration to tackle financial illiteracy • Incentivising the use of academics – researchers in business activities in the sector (industrial doctorates)		

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4.9 Social dimension

The transition of the chemical industry in Greece is expected to have social impacts on consumers and workers, through changing production and consumption patterns, changing job demands and the impact of digitalisation. Consumers will face increased costs of supplying alternative/recycled products, while jobs in new innovative items will be accompanied by a reduction in traditional sectors. The increasing cognitive requirements for the specialised technologies developed and the introduction of digital technologies are expected to modify jobs in the chemical industry and create the need for continuous education (upskilling, reskilling) and soft skills development.

The transition of the chemical industry will induce changes in the energy mix and the mix of raw materials, both of which will be influenced by the entrepreneurship patterns that will prevail in the coming years (more inclusive and more distributed, centrally as they are today, or possibly both). As regards the supply and use chain of products, no major change is expected, except for reverse logistics for end-of-life products. Jobs in the chemical industry are not expected to change dramatically (in number and nature), except for the focus on professionals in Sustainability and Information Technology and the need to work together many specialties in Research and Innovation, to implement the Safe and Sustainable by Design Principle. Finally, a shift towards natural and renewable raw materials and recovered materials from end-of-life products will mean a need for procurement skills currently identified in the primary and recycling sectors. Consumers are expected to become more selective in the products they consume and the requirement for safety and sustainability information (e.g. on labels or their electronics respectively). A major change in Greece, which affects entire regions, is the energy transition, which affects (in terms of jobs) mainly Western Macedonia and the Central Peloponnese. Areas where the geographical location and structure of their economy allows for economically sustainable circular economy practices, e.g. biomethane from agricultural/stock-farming waste, are expected to be favoured by contributing positively to regional development. The country has mainland areas (e.g. Chalkidiki) and islands (e.g. Lesvos, Chios, Naxos, Crete) with a notable such mixed activity, where such practices can contribute to a sustainable tourism profile.

The European Green Deal and the EU Digital Strategy pay particular attention to supporting regions, industries, workers, households and consumers who will face the greatest challenges stemming from the social impact of the double transition. This impact varies depending on the sector, occupation and region and will entail a shift in jobs between industrial sectors, as well as changes in investment standards and staff numbers. This requires appropriate anticipation of change and socially responsible restructuring with particular attention to regional cohesion, the impact of the sector on the workforce and consumers and improving gender equality and diversity in the sector.

The green transition must be fair and inclusive, paying particular attention to supporting workers, households and consumers facing the greatest challenges. Consumers will soon have several options for sustainable products but higher costs of production and compliance with the regulatory framework will ultimately be borne by consumers and thus reinforcing inflationary pressures, so possible negative social consequences should be avoided and distributed rationally. In this context, responsible information to the public is important to avoid generalised perceptions of corporate greenwashing and greedflation, when stemming from other root causes than corporate control (e.g. greenflation, more pronounced/more frequent geopolitical shocks). In any case, it is necessary to monitor the impact on workers and consumers, assess the economic impact, keep citizens informed, implement active employment policies, focus on workers' safety, etc., with the role of policy makers being crucial in balancing challenges and effectively planning and allocating financial resources.

Gender equality, inclusion and diversity are among the EU fundamental values. In an area where gender imbalances have historically existed, such as the chemical sector, initiatives should be taken to improve overall diversity and equality.

Table 4.9 presents in more detail the actions to strengthen the social dimension of the transition, the responsible implementing actors and the timeframe for implementation.

Table 4.9: Actions on the social dimension

Actions	Actors	Timeframe
TOPIC 25: Impact on workers and consumers		
25.1 Regional cohesion		
• Monitor and assess the environmental and economic impact of chemical production in the region	Industry	S
• Inform the public about the impacts and risks linked to the transition. This will reduce existing uncertainties and help encourage the public to embrace the transition	Industry	S
• Support active regional labour market policies, including policies to increase workers' skills	EU/EL	M/L
25.2 Safety and social security of workers		
• Continue to adapt safety protocols before introducing new technologies	Industry	S
• Develop 'job transition plans' (based on social lifecycle assessments (e.g. SEE balance), and dialogue at company, local and sectoral levels)	Industry	S
• Take business decisions with workers' representatives involved to ensure that the decisions incorporate occupational safety and health, work organisation, training needs etc.	Industry	S
• Share best practices and develop synergies among sectors on clean and smart production processes	Industry and EU/EL	S/M
TOPIC 26: Improve gender diversity and equality in the sector		
• Follow-up on the outcomes of the 2022 report on equal participation of women in the EU chemical industry and on the e-platform 'Children – Care – Career'	Industry	S
• Further implement the EU gender-equality strategy, with policy objectives and actions to make significant progress by 2025 towards a gender-equal Europe	EU/EL	S
• Encourage women into chemistry and chemical engineering programmes and raise awareness of careers for women in the chemicals industry at high schools	Industry and EU/EL	M

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5 ROADMAPS FOR THE TRANSITION OF THE CHEMICAL INDUSTRY IN GREECE

5.1 Introduction

This chapter identifies indicative roadamps for the selected actions, technology and regulatory framework, which are a central element of the transition path. The aim is to clarify the actions needed and the technological solutions to be expected. It also provides a full picture of the regulatory obligations that the chemical industry must comply with and stresses the importance of prioritising/sequence of regulatory milestones and ensuring consistency between regulations.

For the development of the chemical industry roadmaps in Greece, the key themes of the eight building blocks aimed at achieving the double transition and resilience of the chemical industry have been used. The key issues were prioritised according to a timetable. The result is a roadmap consisting of three components:

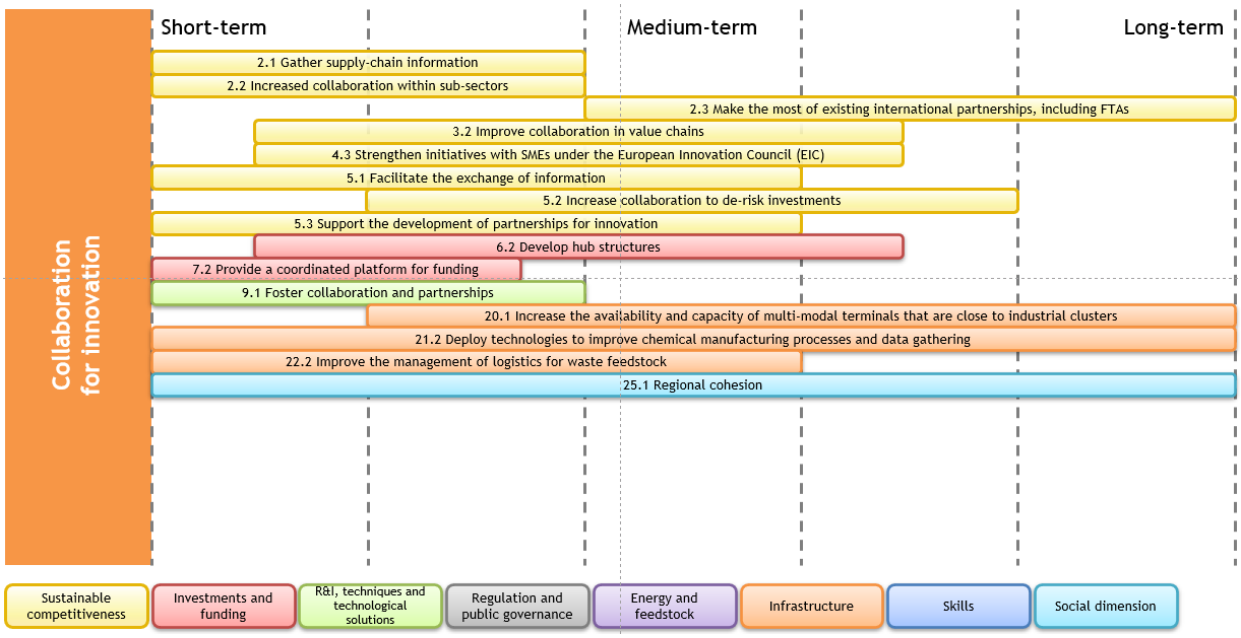
- An action-oriented component, grouping themes into three horizontal dimensions: a) cooperation on innovation, b) supply of clean energy and c) diversification of feedstock
- A technological component that provides an overview of the different topics related to technology as a contribution to the double transition and resilience. The basis of this roadmap is the SET Action Plan[79], its supporting actions and EU initiatives.
- A regulatory component that brings together existing legislation that influences developments in the chemical industry.

By implementing actions identified under each theme, the chemical industry will accelerate the double transition and improve its resilience, sustainability and circularity, in line with the European Green Deal.

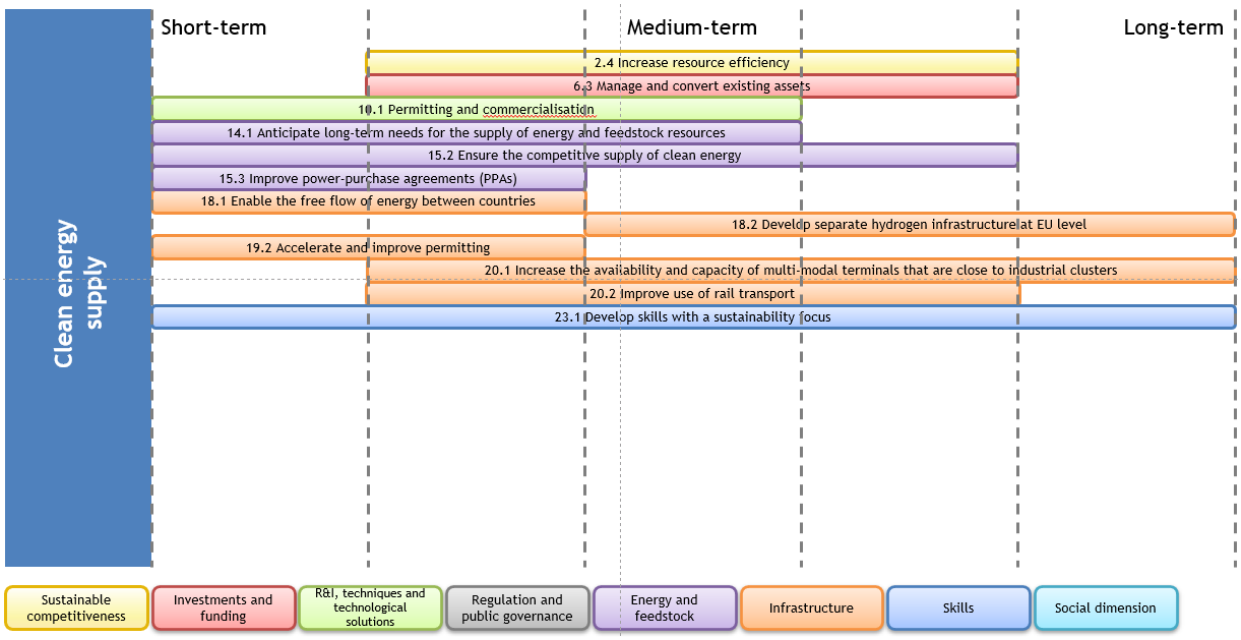
[79] The overall objective of the SET Plan is to provide a common vision, objectives and coordination to accelerate the development and deployment of efficient and economically competitive clean technologies and to strengthen the EU geopolitical resilience and security of energy supply.

5.2 Action-oriented Roadmap

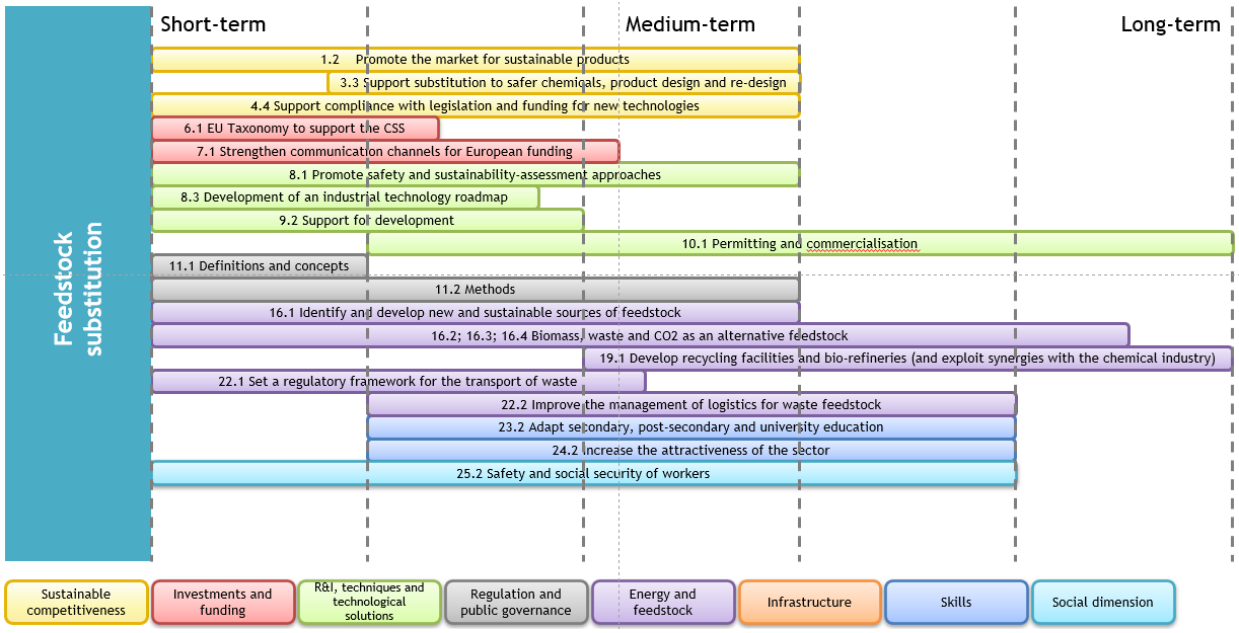
Cooperation on innovation and technology development will foster the transformation of the chemical industry. The actions aimed at facilitating cooperation on innovation are presented in the chart below.



The supply and availability of clean energy is a critical factor in the transformation of the chemical industry. The actions aimed at facilitating clean energy supply in Greece are presented in the chart below.



The substitution of feedstock is a key aspect that needs to be developed to achieve the objectives of the transition. The replacement of feedstock using fossil carbon is necessary and will be driven by the development of current technologies and the development of new ones. The following diagram presents the actions aimed at substituting feedstock to produce chemicals.


Feedstock substitution
Short-term
Medium-term
Long-term
1.2 Promote the market for sustainable products
3.3 Support substitution to safer chemicals, product design and re-design
4.4 Support compliance with legislation and funding for new technologies
6.1 EU Taxonomy to support the CSS
7.1 Strengthen communication channels for European funding
8.1 Promote safety and sustainability-assessment approaches
8.3 Development of an industrial technology roadmap
9.2 Support for development
10.1 Permitting and commercialisation
11.1 Definitions and concepts
11.2 Methods
16.1 Identify and develop new and sustainable sources of feedstock
16.2; 16.3; 16.4 Biomass, waste and CO2 as an alternative feedstock
19.1 Develop recycling facilities and bio-refineries (and exploit synergies with the chemical industry)
22.1 Set a regulatory framework for the transport of waste
22.2 Improve the management of logistics for waste feedstock
23.2 Adapt secondary, post-secondary and university education
24.2 Increase the attractiveness of the sector
25.2 Safety and social security of workers
Sustainable competitiveness
Investments and funding
R&I, techniques and technological solutions
Regulation and public governance
Energy and feedstock
Infrastructure
Skills
Social dimension

5.3 Technology Roadmap

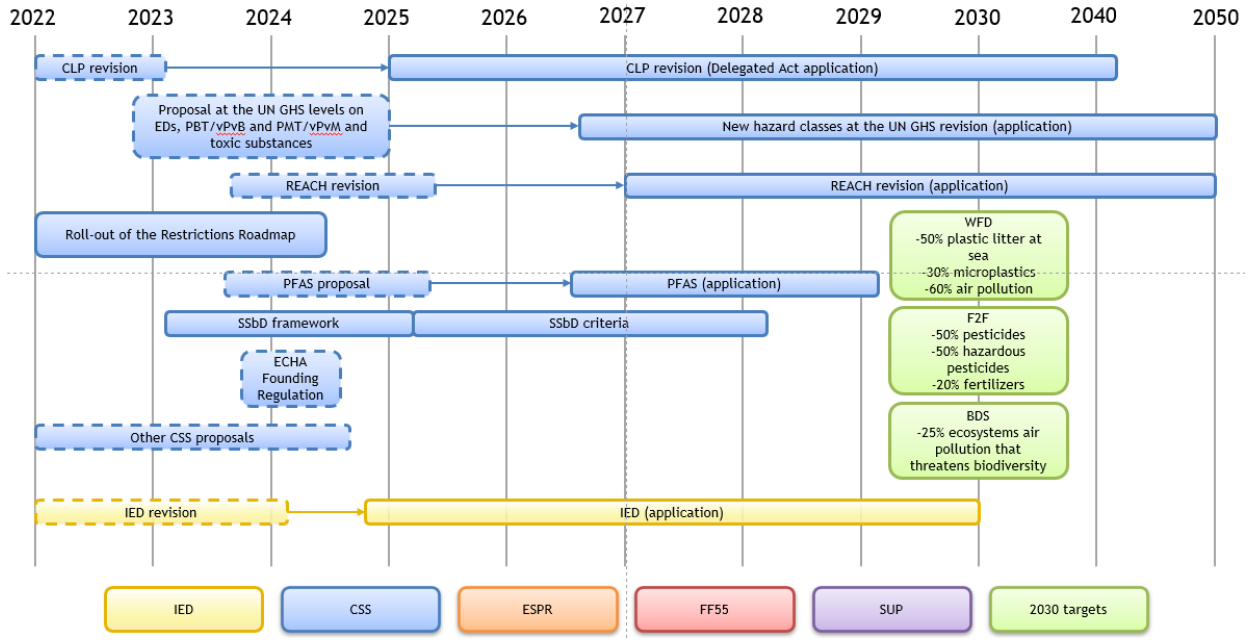
The SET Action Plan[80] prioritises the technologies to be developed to achieve the objectives of resilience and double transition. The table below summarises general EU initiatives and actions in support of the SET Action Plan.

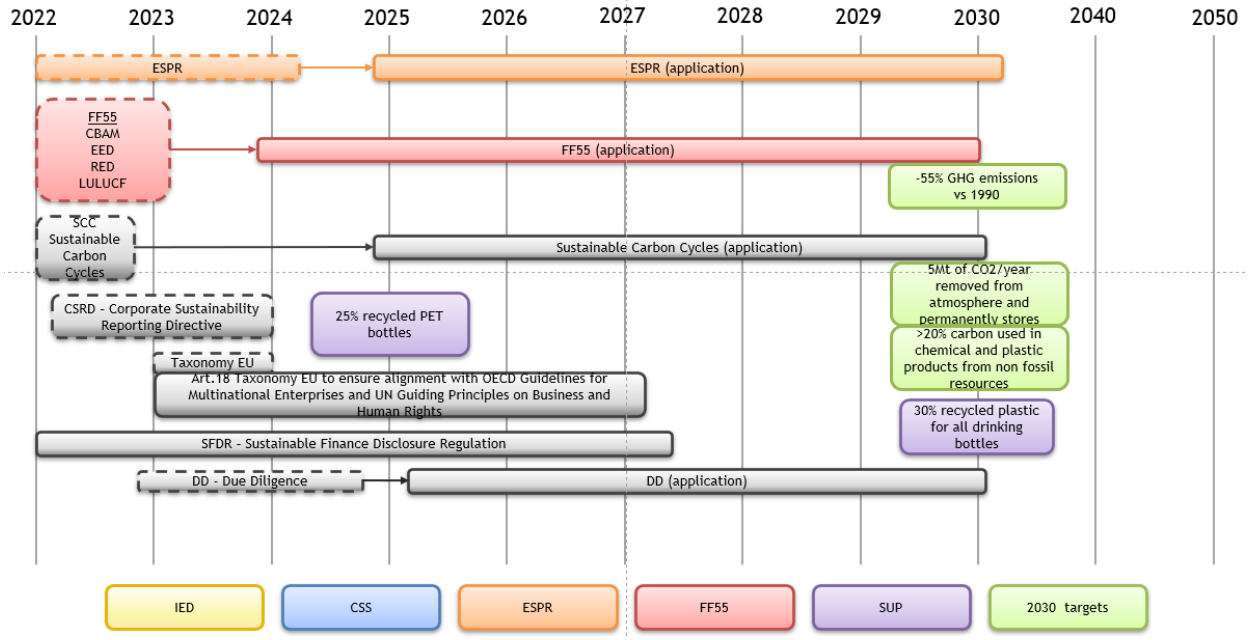
TECHNOLOGY	ISSUES	EU INITIATIVES
1. Electrification	14 Anticipate long-term needs for the supply of energy and feedstock resources	• REPowerEU • RES Directive • TEN-E Regulation • Directive Energy efficiency
	15.1 Channel investments for clean energy	
	15.2 Ensure the competitive supply of clean energy	
	15.3 Improve power-purchase agreements (PPAs)	
	18.1 Enable the free flow of energy between countries	
	20.1 Increase the availability and capacity of multi-modal terminals that are close to industrial clusters	
	20.2 Improve use of rail transport	
2. Hydrogen	6.3 Manage and convert existing assets	• European Clean Hydrogen Alliance • Carbon-free hydrogen and gas purchase package
	15.1 Channel investments for clean energy	
	15.2 Ensure the competitive supply of clean energy	
	18.2 Develop separate hydrogen infrastructure at EU level	
3. Biomass	4.3 Strengthen initiatives with SMEs under the European Innovation Council (EIC)	• Revision of the RES Directive • Industrial Emissions Directive • INCITE
	8.1 Promote safety and sustainability-assessment approaches	
	9.1 Foster collaboration and partnerships	
	16.2 Biomass as an alternative feedstock	
	19.1 Develop recycling facilities and bio-refineries (and exploit synergies with the chemical industry)	
4. Waste	3.2 Improve collaboration in value chains	• Hubs4Circularity • Waste Framework Directive • Landfill Directive
	3.3 Support substitution to safer chemicals as well as product design and re-design	
	8.1 Promote safety and sustainability-assessment approaches	
	11.1 Definitions and concepts	
	16.3 Waste as an alternative feedstock	
	22.1 Set a regulatory framework for the transport of waste	
	22.2 Improve the management of logistics for waste feedstock	
5. CCU & CCS	6.3 Manage and convert existing assets	• Hubs4Circularity • Sustainable Coal Cycles
	9.2 Support for development	
	16.4 CO2 as an alternative feedstock	
	22.2 Improve the management of logistics for waste feedstock	
6. Efficiency procedures	3.2 Improve collaboration in value chains	• REPowerEU • Industrial partnership • Revision of the Industrial Emissions Directive
	3.3 Support substitution to safer chemicals as well as product design and re-design	
	5.1 Facilitate the exchange of information	
	5.3 Support the development of partnerships for innovation	
	6.3 Manage and convert existing assets	
	17 Process and resource efficiency	
	19.1 Develop recycling facilities and bio-refineries (and exploit synergies with the chemical industry)	
	20.1 Increase the availability and capacity of multi-modal terminals that are close to industrial clusters	
	21.2 Deploy technologies to improve chemical manufacturing processes and data gathering	
	25.2 Safety and social security of workers	

[80] https://energy.ec.europa.eu/topics/research-and-technology/strategic-energy-technology-plan_en#revision-of-the-set-plan

5.4 *Regulatory Roadmap*

The review of existing legislation related to the chemical industry includes information and assumptions on current legislative and non-legislative procedures as proposed by the European Commission. The timetable for this roadmap is indicative, especially for those proposals whose content has not been finalised. However, the Regulatory Roadmap aims to be a tool to help decision-makers and other stakeholders in the chemical industry. In the figures below, the frames surrounded by a dotted border indicate the timeline for the estimated development and approval of each proposal. The frames with solid border indicate the estimated implementation schedule. We assume that the relevant legislation, where necessary, will be transposed in accordance with the deadlines laid down in national law.





PFAS (Per- and Polyfluorinated Substances) - additional elements - COM(2020) 667 final[81]:

1. Restriction under REACH for all non-essential uses including in consumer products.
2. Add PFAS where possible as a group in the review of annexes of the Environmental-Quality Standards Directive and Groundwater Directive.
3. Proposal to address the emissions of PFAS from the waste stage including through the revision of the Sewage Sludge Directive.
4. Address the presence of PFAS in food by introducing limits in the Food Contaminants Commission Regulation.
5. Address PFAS concerns at a global scale via proposals under the Stockholm Convention and the Basel Convention.

REACH revision - additional elements - COM(2020) 667 final:

1. Authorisation and restriction processes + requirements for registration.
2. Amend Article 68(2) to include professional users.
3. Introduce MAFS (Mixture Assessment Factors) in Annex I.
4. 'One substance, one assessment' process.
5. Draft a restrictions roadmap of CMRs (Carcinogenic, Mutagenic or toxic to Reproduction), EDs (Endocrine Disruptor), PBT/vPvB (Persistent, Bioaccumulative and Toxic/very Persistent and very Bioaccumulative - persistent, bioaccumulative and toxic/very bioaccumulative), immunotoxicants, neurotoxicants, substances toxic to organ-specific and respiratory sensitisers.
6. Amend REACH Article 57 to add EDs, PMT and vPvM substances to the list of substances of very high concern.

Other proposals (according to Annex CSS):

1. 2021: EU Strategic Framework on Health and Safety at work - Occupational safety and health in a changing world of work - COM(2021) 323 final[82].
2. 2022: EU repository of human and environmental health-based limit values.
3. 2023: Creation of an open platform on chemical-safety data and tools for accessing relevant academic data.
4. 2023: General proposal to: (i) remove legislative obstacles to the re-use of data; (ii) streamline data flows across legislation; and (iii) extend the open-data and transparency principles from the EU food-safety sector to other pieces of chemical legislation.
5. 2023: Proposals to allow EU and national authorities to commission testing and monitoring of substances as part of the regulatory framework.

IED revision - additional elements - COM(2022) 156 final[83]:

1. Permits – reviewing and updating permits, depending on the status of the receiving environment, and/or planning measures to comply with environmental-quality standards, objectives, plans and programmes under water legislation.
2. More detailed reporting of pollutants at installation level.
3. Indirect release of polluting substances – clarifying the rules that apply to the indirect release of polluting substances into water through urban wastewater treatment plants.
4. Fostering innovation will help address persistent chemical substances and substances newly identified as being of concern, including PFAS, microplastics and pharmaceuticals.

[81] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52020DC0667
[82] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021DC0323
[83] https://environment.ec.europa.eu/publications/proposal-revision-industrial-emissions-directive_en

5. BREFs – 'exchange of information' process under the IED to draw up and review best-available-technique reference documents (BREFs). These BREFs should take account of the identification of substances of concern under EU water legislation. In particular, these include 'watch lists' of substances for groundwater and surface water, and substances identified as possibly posing a significant risk to or via the aquatic environment at EU level.
6. Setting additional and updated criteria to support the EU Taxonomy on sustainable investments.
7. List of pollutants replaced by Annex II on pollutants of E-PRTR (European pollutant release and transfer register) Regulation (as amended).
8. Strengthened provisions on sanctions, and a specified minimum content of penalties.
9. Extension to large-scale battery production (manufacture of lithium-ion batteries with a production capacity of 3.5 GWh or more per year) and mining.

Package Fit For 55 - additional elements - COM(2021) 550 final[84]:

1. CBAM[85] broadening of the scope to include organic chemicals, plastics, hydrogen, ammonia and indirect emissions.
2. EED[86] - Energy Efficiency Directive: Annual energy-savings obligations for MSs of more than 0.8% (2021-2023) & annual energy savings obligations for MSs of more than 1.5% (2024-2030).
3. RED[87] – Revision of the Renewable Energy Directive to increase the binding EU minimum share of renewable energy sources in final energy consumption to 40% by 2030, in effect doubling the share of renewable energy sources in the energy mix over the course of a single decade (2021-2030). The proposal would also set a comprehensive framework for the deployment of renewable energy sources across all sectors of the economy, with a particular focus on sectors where progress has been slow (transport, buildings and industry). The binding EU headline target of 40% would be supported by a series of higher EU and national targets for these different sectors, and the promotion of hydrogen consumption in transport and industry.

Energy taxation[88]: main changes include the following points:

1. Fuels will start being taxed according to their energy content and environmental performance rather than their volume, helping businesses and consumers alike to make cleaner, more climate-friendly choices.
2. According to this ranking, conventional fossil fuels, such as gas oil and petrol will be taxed at the highest rate and electricity at the lowest rate.
3. Products are categorised for taxation purposes in a simplified way to ensure that fuels most harmful to the environment are taxed the most.
4. Exemptions for certain products and home heating will be phased out (thus, fossil fuels can no longer be taxed below minimum rates).
5. Fossil fuels used as fuel for intra-EU air transport, maritime transport and fishing should no longer be fully exempt from energy taxation in EU.

Effort Sharing Regulation (ESR)[89]

LULUCF proposal[90] for:

[84] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021DC0550
[85] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021PC0564
[86] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021PC0558
[87] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021PC0557
[88] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021PC0563
[89] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021PC0555
[90] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021PC0554

1. moving away from the 'no-debit' rule (where GHG emissions cannot exceed GHG removals within the sector) from 2026;
2. increasing the carbon-sink potential to deliver GHG removals in the current decade;
3. strengthening Member States' obligation to submit integrated mitigation plans for the land sector;
4. improving monitoring requirements using digital technologies supported by the European Environment Agency and the Copernicus programme;
5. alignment with other key biodiversity and bioenergy policy initiatives;
6. expanding the scope of the regulation to cover the whole land sector from 2031 by including non-CO2 emissions from the agriculture sector, and
7. setting a value on mitigation actions by introducing a carbon-removal certification scheme and the possibility to trade in certificates.

Social Climate Fund (SCF)[91].

[91] https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:52021PC0568

6 CONCLUSIONS AND NEXT STEPS

6.1 Introduction

This chapter summarises the findings on the specificities of the chemical industry in Greece, the existing and planned policy framework, the actions to be implemented and the main actions to be taken by the government and the chemical industry. The next steps for a national co-implementation process are also proposed.

6.2 Main findings

The chemical industry in Greece includes companies that are significantly lagging in size than the corresponding chemical companies in the EU-27. The smaller size limits their production potential, efficiency, extroversion, funding opportunities, capacity attraction and innovation. Also, the basic chemicals sector in Greece is much less developed than in the EU-27, indicating a lower degree of growth, vertical integration and competitiveness.

The chemical industry in Greece is in a development phase in recent years and has overcome the health and energy crisis with relatively small losses. Domestic chemical production focuses on the categories of specialty and consumer chemicals. The gravity of the production of basic chemicals is less, demonstrating a high dependence on imported chemical raw materials. The chemical industry in Greece, except for large enterprises, focuses on activities with lower energy intensity compared to the EU-27 average, which also implies lower GHG emissions per capita overall.

The chemical industry has made a significant contribution to the added value of domestic manufacturing, while employment has increased significantly in recent years and mainly concerns highly skilled jobs and comparatively good wages. Exports of chemicals have been dynamic in recent years, while imports have also increased, which supply the domestic industry with basic chemicals and products. The extroversion of the domestic chemical industry is high and has been strengthened in recent years, while labour productivity is higher than the average productivity in manufacturing, which is reflected in better-paid jobs, but lags significantly behind the chemical industry in other EU-27 Member States. Finally, the investment intensity of the chemical industry in Greece is particularly low compared to the EU-27.

Following the multi-year economic crisis, the Greek economy has stabilised in recent years and despite the adverse conditions of the recurrent crises (health, energy), it is achieving positive dynamics with growth rates higher than the EU-27 average, boosting investment and exports. The financing conditions of the economy are improving and the difference in borrowing costs against the EU-27 average tends to narrow especially with the return of the country to investment grade status. The reform effort continues at various levels (digitisation of the state, research and innovation, education, etc.), while the use of the resources of the Recovery and Resilience Fund and other European funds maintain positive expectations. The energy crisis has on average had a relatively limited impact on operating costs, but a significant burden on the cost of raw materials, especially basic chemicals. The energy crisis has also mobilised investments to enhance the security of natural gas supply.

Greece is committed to achieving climate neutrality and has significant renewable energy potential to be harnessed to achieve its energy and climate targets. It has also recognised the importance of developing networks and international energy interconnections and has taken relevant initiatives. Major pilot projects are being implemented in the direction of green hydrogen production, while planning and institutional framework for the development of the biomethane and synthetic fuels sector is imminent.

At the same time, investments are being launched in carbon capture, storage and use technology. The dynamics in research and innovation spending are also positive, with a significant reduction in the gap against the EU-27.

At the starting point for the green transition the chemical industry is lagging due to the divestment during the economic crisis, in spending on research and development, the low level of which is a long-standing problem of Greek Manufacturing, the high cost of regulatory compliance, which is made prohibitive by a company size and below, while the high concentration of energy and feedstock markets makes businesses vulnerable.

Chemical companies in Greece are mainly SMEs and face the same challenges as larger companies, but with fewer human and financial resources, shortages of skilled personnel and a secondary role in developing synergies with other companies. In Greece there is a shortage of large industrial ecosystems that exist in other countries, while infrastructure is also lagging. The size of the domestic market is small, while competition from imports from neighbouring countries that do not apply the strict European legislation is strong. Moreover, the cost of capital is higher, the permitting of installations, despite the progress made, presents difficulties and delays, and the level of research and innovation is low, which also affects export possibilities. Many SMEs need systematic information on existing funding tools so that there is no difficulty in identifying and exploiting funding opportunities.

A major challenge is to find resources and synergies in innovation beyond the issues faced by SMEs regarding the need to adapt quickly to the multiple requirements of European legislation. The number of small businesses in the industry, with no disposition to mergers and a lack of collaborative culture, implies a small scale reflected in low R&D and limited regulatory compliance. Moreover, the high degree of bureaucracy and the difficulty of informing about the existence of European tools that require international cooperation limits access to funding. At the same time, even the largest and most modern businesses must deal with the problem of “brain drain” in highly skilled positions.

The main building blocks of the EU chemical industry transition pathway and several of its priorities are satisfactorily covered by the relevant national strategies/road maps and financial instruments existing in Greece, but weaknesses and shortcomings in implementation are addressed. The set of strategies and actions can make a significant contribution to the resilience of the Greek chemical industry during the green transition, while the investment funding framework is supportive, as it places particular emphasis on the issues of green transformation and digitalisation, infrastructure, research and innovation, and strengthening human resources potential. However, it is necessary to: a) monitor the implementation and results of each strategy and avoid potential distortions and b) strengthen specific priorities/actions specific to the chemical industry, notably in the areas of strengthening its resilience against adverse and increasingly occurring disruptions in the supply chain and energy and feedstock costs, access of the chemical industry to alternative feedstock, sustainable transport of chemical feedstock, its regulatory framework, as well as ensuring the financial instruments and tools to support the green and digital transition of the chemical industry in Greece in the coming programming periods, as this will be a long-term process.

To this end, the allocation at national level of European resources for the current programming period in a way that responds to the changing needs of extrovert manufacturing companies and the pressing compliance timetable, such as those faced by the domestic chemical industry, is considered imperative.

The Transition Roadmap of the chemical industry in Greece identifies the necessary actions to enable the transition, classifies them according to the time horizon for implementation and identifies the actors responsible for their implementation. Additional actions, which were considered to be of lower priority for the Greek chemical industry, either because of its structure or because they are actions to be implemented with an EU initiative, could be addressed in the next steps of the implementation of the National Transition Roadmap. In any case, in the context of the building blocks and actions of the transition roadmap of the Greek chemical industry, the need for interventions in particular in the following areas is highlighted[92]:

- Ensure healthy competition throughout the value chain.
- Achieving equal or lower costs of "green" products compared to conventional ones.
- Easy and fair access to investment and funding.
- Development of the required infrastructure, including digital.
- Strengthening research and innovation with continuity, consistency and application in the production, and maturation of technological solutions.
- Availability of clean energy at competitive prices for industry.
- Availability of materials and products to reduce the environmental footprint.
- Availability of human resources with the right skills and responsiveness of employees to the multiple challenges (new technologies, legislation, etc.).
- Implementation of a regulatory framework that does not impose a disproportionate burden of compliance on firms.
- Information for chemical companies to make investments compatible with the double transition.
- Cooperation between enterprises and government entities and support the transition from all stakeholders and firms.
- Inform society about the necessity, benefits and challenges of the transition through continuous dialogue.

The competitiveness of the Greek chemical industry is suffering from increased energy and feedstock costs, unfair competition from imported products that do not meet EU safety and sustainability standards and is exacerbated by both the small size of firms and the low level of investment and productivity. Sustainable competitiveness can be enhanced by creating a market for SSbD substances and materials, adopting circular industrial processes, investing in reverse logistics as well as improving partnerships, especially SMEs, in value chains and other energy-intensive industries to increase circularity, resource efficiency and energy efficiency.

The double transition requires radical technological interventions in most chemical industries with timely deployment of appropriate technologies. The development and maturation of such technologies, however, takes a lot of time. Their adoption in Greece is also delayed mainly due to the small size of the market while the current organisation of public administration is not sufficient. At the stage of designing new techniques and technological solutions, the exchange of know-how in the application of SSbD logic and the cooperation of the chemical industry with research organisations will play an important role.

The Greek chemical industry faces regulatory barriers that include the limited digitalisation of public administration, late harmonisation on a case-by-case basis with European legislation, the functioning of the energy market, the plethora of regulatory requirements and their continuous renewal/update, as

[92] Table 7.4 in the appendix presents indicative initial short-term actions.

well as delays in permitting due to increased bureaucracy. Data collection and access is key in creating a reliable regulatory framework while digitalisation offers excellent solutions in managing data relevant for the climate, circular economy, etc. In addressing these issues, more effective and predictable legislation would help, the creation of specific support for SMEs for the implementation of the legislation with the assistance of industry in terms of definitions, concepts and methods, etc.

The chemical industry should procure green electricity and raw materials at competitive prices. However, the difference in costs between zero-emission chemical production technologies and conventional solutions remains significant. Reducing this gap could be achieved through carbon difference contracts, but also by adopting long-term clean energy (PPAs) contracts. Infrastructure in Greece is not sufficient to manage energy production investments by industry, while the permitting system is lagging especially in terms of acceptance of new technologies. This requires speeding up studies on grid/infrastructure strengthening, promoting a flexible institutional framework and simplifying the process of recognising clean electricity generation.

To meet climate targets, the chemical industry will need to switch to alternative raw materials such as biomass, waste and CO_2, as well as to adopt new business models and more efficient production processes. It is important to anticipate long-term needs for the supply of energy and feedstock to ensure the uninterrupted production of chemicals and products. The supply of alternative raw materials in Greece is limited but could be strengthened by implementing regulations on the mandatory use of a percentage of recycled raw materials, better organising and regulating official recycling streams, and setting up modern collection and treatment centres for these streams.

In Greece, there have been shortages over time in logistics infrastructure, especially port infrastructure, rail infrastructure, freight and bulk storage. There are also shortages in electricity networks that support the development of RES, in recycling infrastructure, in the organisation of industrial areas, in the development of value chains, while there is a need to develop hydrogen networks, CO_2 transmission and storage pipelines, as well as international electricity and green hydrogen interconnections. At the same time, the pace of development and uptake of digital technologies that will enhance every stage of production should be increased and there is a need for new digital platforms to enable the exchange of information on chemicals and products.

The chemical industry in Greece consists mainly of SMEs with a limited number of employees, resulting in a lack of qualified personnel for each operational sector. There is a mismatch in specialisations mainly in digital skills, in specialised scientists in fields such as biotechnology and polymers, and there are also shortages of unskilled staff. For SMEs, there is limited capacity for upskilling and reskilling of their workforce while at the same time being particularly exposed to the risk of losing workers after completion of vocational training. Meeting these needs requires, inter alia, the development of a roadmap for required skills and the identification of potential gaps, sectoral training on green and sustainable chemistry, regulation and safety of chemicals, participation in the EU strategy for sectoral cooperation in the field of skills, and the development of a compensation scheme for SMEs contributing to vocational education.

The transition of the chemical industry should be fair and inclusive, paying particular attention to supporting workers, households and consumers that will face the greatest challenges. Consumers will have several options for sustainable products, but they will have to bear the higher costs of production and compliance with the regulatory framework. Addressing these obstacles requires monitoring the impact on workers and consumers, assessing the economic impact and continuously informing citizens,

with the role of policy makers being crucial in balancing challenges as wells as the efficient planning and allocation of financial resources.

The double transition of the chemical industry requires significant investment in research and innovation, as well as high costs (capital and operation) for the replacement of fixed capital, modification of production processes, and purchases of energy and feedstock from alternative sources. A key challenge for the implementation of these investments is to address the risk associated with the development of new solutions and the risk of failure in transfer to industrial scale production. In addition to financial support, actions should be taken to speed up the permitting procedures for the necessary investments and to consolidate investor confidence. In recent years, the bureaucratic burden of approving an investment before implementation has been reduced, but the permitting system remains time consuming. This requires clarity in the spatial planning framework, further simplification of legislation, reduction of bureaucracy and rendering justice in reasonable time. Public funding can reduce investment risks and incentivise, in which case actions should be taken to facilitate access to national and European funding mechanisms and increase grants linked to EGD. In any case, information on European and national funding opportunities is necessary, together with the development of a coordinated funding platform and support from the public pertinent authorities, which will facilitate access to public funding for chemical companies, in particular SMEs.

Finally, it is worth noting that the problems and needs of the chemical industry in Greece, as described in this Transition Roadmap, are part of a broader framework of reflection on the future of the European industry, which is called upon in a highly competitive international environment, to invest in its transformation and maintain its competitiveness in order to actively participate in the implementation of the European Green Deal. On 20 February 2024, the 'Antwerp Declaration' was published in which 73 heads of industrial enterprises from 20 industries in the energy-intensive industries ecosystem expressed their full support for a European Industrial Agreement, which would complement the European Green Deal and maintain high-quality jobs for European workers in Europe. The Declaration underlines that it is an important challenge to invest in achieving the EU climate objectives, amid adverse economic conditions and increasing international competition, including the attraction of industrial investments. A competitive European industry, based on a European Industrial Agreement, is a prerequisite for the successful implementation of the EU Green Deal. In this context, the Declaration calls on the Member States, the European Parliament and the European Commission to:

- Place the Industrial Deal at the heart of the new European strategic agenda for 2024-2029.
- Include strong public funding with a Clean Technology Development Fund.
- Make Europe a globally competitive energy provider.
- Focus on the infrastructure that Europe needs.
- Ensure sufficient levels of feedstock in the EU.
- Boost demand for net-zero carbon, low-carbon and circular products.
- Exploit, strengthen, revitalise and improve the Single Market.
- Make the Innovation Framework "smarter".
- Adopt a new lawmaking spirit.
- Ensure that the governance structure allows for achieving results.

The actions included in the Declaration to achieve these objectives include:

- Simplifying the State aid framework by reducing the risk of private investment by supporting both CAPEX and OPEX.
- Implement a competitive tax framework across Europe.
- Priority for new projects for abundant and affordable low-carbon renewable and nuclear energy.
- Creating a single market for waste and a truly single European energy market.
- Avoidance of linking Green Deal policy objectives to a multitude of detailed implementing regulations, while at the same time assessing the cumulative impact of legislation.

6.3 Next steps

Cooperation to support the transition is particularly important. The publication of the Transition Roadmap is the first key step and should be pursued with a co-implementation process involving all stakeholders, accompanied by structures and participatory processes to promote agreed actions and monitor progress in the transition of the chemical industry. The next steps for a national co-implementation process of the actions included in this Transition Roadmap may include, but are not limited to:

- An annual meeting of stakeholders participating in the co-implementation of the Transition Roadmap.
- An annual report to monitor progress.
- Establishment of dedicated working groups to monitor the high priority issues identified in the National Roadmap.
- Annual survey of stakeholders who have made specific commitments to contribute to the implementation of actions and objectives of the Transition Roadmap.
- Writing of a practical guide for businesses. Companies in the sector should work out their own roadmap to help them understand their own needs and potential requirements, while also aiming at understanding by younger executives, in particular:
    - Definition of a group of specialists covering technology, sustainability, operations and regulatory framework. This group will be able to be enriched, with additional executives depending on corporate specificities.
    - Categorisation by the teams of the topics mentioned in the Transition Roadmap according to the extent of the company's exposure to them, the criticality in financial size or the cost impact, the maturity of the alternatives and any other criterion that suits.
    - Account shall be taken on the impact that each issue may have on the value chain, supplier and customer of the business.
    - The actions are part of a timeline focused on the intermediate and final targets of the transition.
    - Assessment of the existing position of the company. If there are no measurable criteria (metrics), the measurement methodology shall be decided to provide the basis for continuity.
    - An action plan should be drawn up, the corporate Roadmap of Transition. It is important in addition to the obligations (Weaknesses & Threats) to highlight opportunities (Strengths & Opportunities). A SWOT analysis can be a useful communication tool.
    - Identification of the human resources and investments that will be needed.
    - Periodic reviews should be defined, depending on the extent to which the business environment is changing.
    - The company's goals are set, while the organisation's commitment to achieve them is set, so that the challenge becomes a success.

7 ANNEX

Table 7.1: Statistical classification of chemical sub-sectors

20	Manufacture of chemicals and products
20.1	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms
20.11	Manufacture of industrial gases
20.12	Manufacture of dyes and pigments
20.13	Manufacture of other inorganic basic chemicals
20.14	Manufacture of other organic basic chemicals
20.15	Manufacture of fertilisers and nitrogen compounds
20.16	Manufacture of plastics in primary forms
20.17	Manufacture of synthetic rubber in primary forms
20.2	Manufacture of pesticides and other agrochemical products
20.20	Manufacture of pesticides and other agrochemical products
20.3	Manufacture of paints, varnishes and similar coatings, printing inks and mastics
20.30	Manufacture of paints, varnishes and similar coatings, printing inks and mastics
20.4	Manufacture of soaps and detergents, cleaning and polishing products, perfumes and toilet preparations
20.41	Manufacture of soaps and detergents, cleaning and polishing products
20.42	Manufacture of perfumes and toilet preparations
20.5	Manufacture of other chemical products
20.51	Manufacture of explosives
20.52	Manufacture of glues
20.53	Manufacture of essential oils
20.59	Manufacture of other chemicals n.e.c.
20.6	Manufacture of man-made fibres
20.60	Manufacture of man-made fibres

Table 7.2: Mapping of categories of chemicals and subsectors according to NACE rev2 statistical classification

Industry	NACE rev2
Petrochemicals	20.14
Basic inorganic	20.11 – 20.13 – 20.15
Polymers	20.16 – 20.17 – 20.6
Specialty chemicals	20.2 – 20.3 – 20.5 – 20.12
Consumer chemicals	20.4

Table 7.3: Additional actions per building block of the Chemical Industry Roadmap in Greece

Actions	Actors	Timeframe	Link to action
1. Sustainable competitiveness			
Analyse medium to long-term impacts of energy crisis on sustainable competitiveness and ability to develop	Industry and EU/EL	S	1.1
Global industry initiatives (new and existing) to further promote EU environmental and safety standards globally	Industry and EU/EL	S/M	1.1
Ensure that hazardous chemicals banned in the European Union are not produced for export including by amending relevant legislation if and as needed	EU	S	1.2
Develop 'market pull' measures and incentives to purchase sustainable products with higher costs	EU/EL	M	1.2
Undertake a strategic foresight exercise focusing on the EU open strategic autonomy (link with critical raw materials)	Industry and EU/EL	S	2.1
Assess the need to build up and maintain strategic stocks of critical raw materials within the EU	Industry and EL	S/M	2.1
Secure long-term supply contracts for critical raw minerals/metals, while assessing and accounting for any environmental and socioeconomic implications of the critical raw materials and their long-term sourcing plans	Industry and EU/EL	M	2.2
Start or strengthen international (regulatory) economic cooperation (e.g. making use of OECD and WTO mechanisms), especially with the EU's most important trading partners. Prevent potential barriers to market access (e.g. related to the use of waste as feedstock)	Industry and EU/EL	M	2.3
Maintain an EU-wide SSbD support network to promote cooperation and the sharing of information across sectors and the value chain, and provide technical expertise on alternatives	EU/EL	S/M	3.1
Explore the potential role of digital innovation hubs in the chemical industry	Industry and EU	S	3.2
Promote interregional collaboration along sustainable value chains in the chemical industry through smart specialisation to accelerate the development of joint investment projects	EU	M	3.2
Proposals to extend the generic approach to risk management to ensure that consumer products do not contain chemicals that cause cancers, gene mutations, affect the reproductive or the endocrine system, or are persistent and bioaccumulative and toxic; assess the modalities and timing to extend the same approach to further chemicals including those affecting the immune, neurological or respiratory systems and chemicals toxic to a specific organ; proposal to restrict PFAS under REACH for all non-essential uses including in consumer products	EU	S	3.3
Support the uptake of new business models (e.g. facilitate the chemical 'leasing' concept within public tendering; engage and/or support projects on digital product passports that aim at passing along information on chemicals and other sustainability assets within the value chain)	Industry	S/M	3.3
Develop digital infrastructure for data spaces to share high quality data on products' environmental footprint, including the GHG footprint of products and applications (up to 'scope 3' emissions) and chemical-hazard profiles	Industry and EU/EL	S/M	3.3
Develop tools and policies to promote cooperative buying in compliance with competition rules	Industry and EU/EL	S	4.1
Strengthen the Enterprise Europe Network	EU/EL	S	4.1
Develop modular production processes to enable local and regional chemical economies	Industry	M	4.1
Ensure the EDIH are appropriately funded	EU/EL	S/M	4.2
Assess the need for – and develop, if needed – regulatory sandboxes for regulatory testing and learning	Industry and EL	S	4.4
Develop and promote 'plug-and-play' technologies with an appropriate regulatory framework and standards, and support from Member States	Industry and EU/EL	M	4.4
2. Investments and funding			
Consider drawing up delegated acts and FAQs to support the Taxonomy Regulation implementation ensuring the consistent interpretation of the relevant economic activities	EU	S	6.1
Continue fostering global dialogue and coordination on sustainability taxonomies through the International Platform on Sustainable Finance	EU	M	6.1
Develop hub structures to increase investment in the development and uptake of cross-sectoral low-carbon industrial technologies	Industry and EU/EL	M	6.2
Consider drawing up meaningful, harmonised and applicable sustainability-assessment methodologies and tools to stimulate collaborative innovation, with hubs as the entity charged with promoting these methodologies and tools (e.g. Hubs4Circularity [Horizon Europe], Circular Cities and Regions Initiative)	EU/EL	M	6.2
Adopt a transition plan on the conversion or replacement of existing assets, while taking investment cycles into account	Industry	M	6.3
3. Support to R&I, new techniques and technological solutions			
Innovate safety testing and chemical-risk assessment	Industry and EU/EL	S/M	8.1
Publish additional technology roadmaps on circular economy	Industry and EU/EL	S	8.3
Consider developing national roadmaps for a low-carbon or circular chemical sector, where not existing	Industry and EL	S	8.3

Develop Chemical Data Spaces with the support of the Data Spaces Support Centre to leverage the potential of data exchange for more transparency and manageability	Industry	S	9.1
Appropriate financial and regulatory support between different levels of technology readiness, including by establishing a community of practice to facilitate the authorisation for first-of-a-kind installations for low-carbon industrial technologies	EU/EL	S	9.2
4. Regulation and public governance			
Continuously update the EUCLEF portal with information on chemicals legislation	EU	M/L	11.1
Define and explain new concepts introduced by recent EU legislation and policy documents	EU/EL	S	11.1
Develop a sectoral roadmap towards achieving the climate-neutrality objective	Industry and EU	S	11.1
Take note of the proposals suggested by stakeholders on future chemicals legislation	EU	M/L	11.1
Propose drawing up a comprehensive and integrated overview of the regulatory framework applied to the EU chemical industry at EU and national level. This overview should include a comparison with key competing regions to suggest to policymakers' options to harmonise regulations and remove obstacles to circularity	Industry	S	12.1
Consider revisiting legislation on occupational safety and health to ensure it is future-proof and promotes the safe use of chemicals in professional and industrial settings [COM(2021) 323 final]	EU/EL	S	12.1
Lay down – under the Market Surveillance Regulation – uniform conditions and frequencies of checks for certain products where specific risks or serious breaches of applicable EU harmonisation legislation have been continuously identified	EU	S	13
Explore the use of digital tools to support market-surveillance and customs authorities and to improve the compliance of products containing chemicals that are sold online to European consumers	EU	S/M	13
Extend the scope of action of the European Anti-Fraud Office in coordination and investigation, so it can help to tackle the circulation of illicit chemical products in the EU	EU	S/M	13
5. Access to Energy and Feedstock			
Evaluate the impact of increases in energy prices	Industry and EU/EL	S	14
Consider developing a strategy for the competitive supply of clean energy and strategic raw materials to the EU that takes geopolitical factors into consideration (REPowerEU). Consider evaluating the potential role of eliminating tariffs for supplies of key resources	EU/EL	S	14
Publish guidance to Member States on PPAs EU/MS	EU/EL	S	15.3
Ensure diversification of sources and the strategic autonomy of the EU for essential power supply while safeguarding competitive supply	EU	M/L	15.3
Consider setting targets for renewable/non-fossil content to stimulate demand	EU/EL	S	16.1
Consider harmonising EU and international certification systems for the sustainable sourcing of biomass feedstock (including secondary biomass) and standards irrespective of the feedstock's end-use	EU/EL	S	16.1
Assess further the economic and technical potential of aquatic biomass (third-generation biomass)	Industry	S	16.1
Provide a detailed definition of 'non-fossil sources' and a methodology to calculate the share of total feedstock in carbon sources. Make statistical data more detailed to support the calculation of this share	Industry and EU/EL	S	
Harmonise criteria and methodologies – and make sure they also apply to SMEs – to assess the environmental and socioeconomic performance of bio-based systems (integrating biodiversity for example). Ensure that these criteria and methodologies are aligned with the future SSbD framework	Industry and EU/EL	S/M	16.1
Promote setting targets for recycled and bio-based content in order to stimulate demand	Industry	S	16.3
Consider developing an impact assessment on the CO2 footprint of the increased demand for strategic metals	Industry and EU/EL	S/M	16.4
Consider harmonising the EU regulatory framework for cross-border CO2 transport	EU/EL	M	16.4
Re-think business models and identify potential enablers for these new business models	Industry and EU/EL	S	17
Support the development of advanced and alternative separation technologies	Industry and EU/EL	S/M	17
Invest in the development of novel catalysts	Industry	M/L	17
6. Infrastructure			
Set up a dedicated workstream on joint, renewable hydrogen purchasing under the EU Energy Platform	EU/EL	S	18.1
Develop an infrastructure outreach programme to non-EU countries via the EU global gateway strategy	EU/EL	S/M	18.1
Consider participating in infrastructure projects	EU/EL	S	22.2
7. Skills			
Raising awareness of the European Digital Innovation Hubs in the field and the digital training they offer	EU	S	23.1
8. Social dimension			
Conduct a detailed investigation of employment in industries at NUTS 2 and 3 levels to identify where jobs are being created, transformed and lost in order to target support and cohesion policies	EU/EL	M	25.1
Ensure social dialogue at company, sectoral and regional/national levels through an appropriate legal framework (EMPL Committee 2013 Cercas report) and make public funding for transition projects dependent on the involvement of workers and their representatives in these projects	EU/EL	M	25.2

Note: [Industry]: Actions initiated by or with the participation of the chemical industry and its sectoral entities. [EU]: Actions initiated by or with the participation of the European Union/Commission. [EL]: Actions initiated by or with the participation of the Greek government. [S]: Short term (actions that need to start as soon as possible). [M]: Medium term (actions to start by 2030). [L]: Long term (actions to start and be completed by 2050).

Table 7.4: Indicative short-term actions in the context of the needs of the Greek Chemical Industry

Proposal	Reference to the Transition Roadmap for the Chemical Industry in Greece	National Industrial Strategy and general development policy objectives
1. Call for the "Extrovert Transition" project by the General Secretariat of Industry	2.2.6 Foreign Trade 2.2.7 Investments and Productivity 4.2. Sustainable competitiveness 4.3. Investments and funding	3.2 Target indicators, e.g. % of exports to GDP, covering investment gap 4.2 Flagship Projects by analogy of Smart Manufacturing 4.3. Internationalization Support Program for industrial enterprises
2. Call for the "Circular economy" project by General Secretariat of Industry and inclusion of chemical recycling	2.2.7 Investments and Productivity 3.13 Circular Economy Action Plan 3.14 National Planning for Waste Management, e.g. with reference to agricultural/plant protection plastic packaging 3.15.6 RRF see axis 4.6 4.3. Investments and funding 4.6 Access to energy and feedstock	2.1.5 Ecosystem "Green Technologies/Circular Economy" 3.2. Target indicators, e.g. % of industry in GDP, covering investment gap 3.3.7 SD7 Resilience 4.2 Flagship Projects by analogy of Smart Manufacturing
3. Improvements to the new Manufacturing Development Law regime, e.g. Ceiling increase in buildings from 45% to 60%	2.2.1 Number and size of enterprises 3.11 National Climate Law 3.15.8 Development Law (Law 4887/2022) 4.4. Support to Research and Innovation, techniques and technological solutions	3.3.4 SD4 Green Transformation Filling the investment gap Achieving climate goals
4. Call for the "Extrovert Manufacturing " project by the Ministry of Finance	2.2.1 Number and size of enterprises 2.2.6 Foreign Trade 2.2.7 Investments and Productivity 3.15.5 RDPA 2021-2027 3.18 Promoting factors and obstacles in the transition process (see reference to SMEs) 4.2. Sustainable competitiveness 4.3. Investments and funding	3.2 Target indicators, e.g. % of exports to GDP 3.3.1 SD1 Increasing Competitiveness 3.3.4 SD4 Green Transformation 3.3.7 SD7 Endurance 4.3. Internationalization Support Program for industrial enterprises
5. Over-depreciation of 200% in costs of education - training human resources of industries. In the "Building Materials" Ecosystem pilot extension of the measure and in seminars they organize for their customers	3.18 Promoting factors and obstacles in the transition process 4.2. Sustainable competitiveness 4.8. Human resource skills - Chemskills Project	3.3. Strategic Directions (all) 4.3. P9 Intra-company training/human resources certification support program 4.3 P10 Program for green development, resilience and adaptation of Greek industry to climate change 4.4. P23 Reform of Depreciation Framework
6. Extension of validity of 200% over-depreciation of green - digital expenditure beyond 2025	4.2. Sustainable competitiveness 4.4 Support to Research and Innovation, techniques and technological solutions	3.3.3.SD3 Digital Transformation 3.3.4 SD4 Green Transformation 4.4. P23 Reform of Depreciation Framework
7. Market control for unfair competition	4.5 Regulation and public governance (Legislation) Market control - illegal imports	4.4 P30 Reform of the institutional framework regarding the labeling of products in terms of their environmental characteristics
8. Study of a flagship project of the Elefsina-Ylikis green highway with the aim of EU funding	3.11 National Climate Law 3.13 Circular Economy Action Plan 3.14 National Planning for Waste Management, 3.17.2 “Ifestos” Carbon Capture Unit 3.17.5 Prinos Storage Project 4.7. Infrastructure 4.9. Social dimension	2.4. Society - Support Structures and Services 4.1. P1 Preparation of a National Industrial Symbiosis Action Plan 4.2. Flagship Projects
9. Adaptation of the legislative framework for hydrogen and ammonia	4.6. Access to energy and feedstock (and for ammonia production)	4.4 P42 Promotion of investments in the hydrogen value chain
10. Enhancement of the infrastructure for ammonia as an "energy carrier"	4.7 Infrastructure 2.3. Energy consumption 3.6 Green Deal Industrial Plan 3.10 National Energy and Climate Plan	3.3.4 SD4 Green Transformation Achieving climate goals 4.4 P42 Promotion of investments in the hydrogen value chain 4.3 P10 Program for green development, resilience and adaptation of Greek industry to climate change

11. Reduction of bureaucracy and simplification of procedures especially in areas where chemical companies have significant interaction with Public Administration due to the national and European framework	4.5 Regulation and public governance 5.4 Regulatory framework roadmap 6.2 Antwerp Declaration	3.3.6 SD 6 Business environment
12. Waste management de-characterization and features that prevent circularity. Chemical recycling where circularity is exhausted	4.4 Support of Research & Innovation and new technical and technological solutions	2.1.5 Ecosystem "Green Technologies / Circular Economy P10. Program for green development, resilience and adaptation of Greek industry to climate change
13. Boosting demand for clean zero carbon, low carbon, and circular products	4.2. Sustainable competitiveness 6.2 Antwerp Declaration	3.3.4 SD4 Green Transformation - Implementation of circular economy models, as well as development of green entrepreneurship with the production of environmentally sustainable products
14. Ensuring an effective industrial policy - Designation of an independent Ministry of Industry	6.2 Declaration of Antwerp - calls for the establishment of a Vice-President for the competitiveness of Industry	