



Support to REPowerEU

Country Report

Cyprus



This project is funded by the EU via the Technical Support Instrument and implemented by Trinomics and its partner organisations, in collaboration with the European Commission. The views expressed herein can in no way be taken to reflect the official opinion of the European Union.

Authors

Nestor Fylaktos
Theodoros Zachariadis
Anthi Charalambous
Chryso Sotiriou
Afroditi Magou

Contact persons

Ms. Anna Kralli
E: anna.kralli@trinomics.eu

Prof. Theodoros Zachariadis
E: t.zachariadis@cyi.ac.cy

Ms. Anthi Charalambous
E: a.charalambous@ideopsis.com

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In association with:



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Executive Summary

Energy dependence

The essential challenge for Cyprus is not to become energy-independent from Russia but to strongly reduce its dependence from imported fossil fuels in general. Currently, the country does not have any natural gas imports and had been almost independent of direct oil imports from Russia. Russian oil products could indirectly find their way to Cyprus, since Greece - a main oil exporter to Cyprus - imported one quarter of its oil from Russia. These are now being eliminated after the EU ban on oil imports from Russia. Overall, to curb its energy dependence, Cyprus must invest in further energy efficiency improvements in buildings and road transport and accelerate the deployment of renewables.

Key challenges and opportunities in the context of REPowerEU

After describing the underlying trends in the Cypriot energy system and the related dependencies, this report provides an analysis of the gaps in investments and reforms that would allow Cyprus to achieve the REPowerEU objectives. This is conducted through a detailed assessment of both the main policy texts (National Energy and Climate Plan, Recovery and Resilience Plan, Cohesion Policy, Just Transition Plan, Connecting Europe Facility) and the actual budgets foreseen in these strategies which are devoted to interventions relevant for REPowerEU. The list of potential investments and reforms at the end of this Executive Summary is an outcome of this detailed gap analysis.

Energy savings

Both buildings and transport are highly inefficient energy consumers in Cyprus. More than 90% of buildings were built before the introduction of mandatory energy performance requirements. Building renovation rates are currently low and must be accelerated to keep the country on track with its energy efficiency obligations for 2030. In road transport, over 90% of passenger mobility is met by private cars.

Our gap assessment has shown that additional investments in building energy renovations are necessary to meet REPowerEU objectives. Apart from additional funds of at least 200-300 million Euros up to 2030, proper design of support schemes can enable a faster uptake of such investments by households and firms, especially in cases where citizens or enterprises are reluctant to proceed with energy renovations (e.g. in multi-family buildings). For this purpose, authorities can make use of insights from behavioural science; such an investment/reform is included in the recommendations.

With regard to reducing the use of fossil fuels in transport, the gap analysis has revealed a very substantial need for increased investments in sustainable mobility, i.e. on public and non-motorised transport. The currently foreseen investments up to 2030 are about €800 million lower than what would be required to align with the REPowerEU priorities. Additionally, sustainable mobility can be promoted by increasing awareness of the possibilities offered to citizens through the already ongoing investments in public and non-motorised transport through targeted behavioural interventions.

As far as electricity interconnection of Cyprus is concerned, the funds secured for the EuroAsia Interconnector seem to be adequate for the implementation of this very important project, provided that the project promoters will also contribute their share for this investment. If this project is implemented, interconnection aspects are fully aligned with REPowerEU priorities.

Accelerated renewable energy deployment

Although lower than the EU average, the share of renewables in total energy supply can be regarded as satisfactory since Cyprus has overachieved the binding 13% national RES target - it attained a 17.0% share according to official statistics. However, a much higher share of renewables is necessary to keep the country on track to achieve its 2030 decarbonisation targets; a higher penetration of renewable electricity, primarily solar photovoltaics combined with energy storage, has the potential to dramatically reduce the island's energy costs and greatly enhance its energy independence. According to our gap analysis, the investments already foreseen in renewables up to 2030 may be sufficient for meeting the REPowerEU objectives, provided that all of them will indeed be implemented. At the same time, to ensure that the full potential of renewable energy will be exploited, some missing reforms should be adopted to provide regulatory clarity for energy communities, energy storage, and charging of electric vehicles; these are outlined in our recommendations at the end of this Executive Summary.

Diversification of energy supply

Cyprus' total energy supply consists by 85% of fossil fuels, of which petroleum products dominate. Some diversification will happen once the Cyprus LNG import terminal is in operation, so that most of the thermal power plants will run on natural gas. Official sources expect this project to be in operation in 2024, although this date is subject to potential delays. No natural gas interconnections exist, but there are plans for the East Med pipeline that will connect Israel, Cyprus, and Greece; implementation of this project remains subject to its financial sustainability. Cyprus does not use solid fossil fuels in its energy mix apart from small amounts of coal used by the cement factory. In any case, the most essential step towards energy supply diversification is the exploitation of the country's renewable energy potential.

In-depth support on the development of a national hydrogen strategy

The in-depth support (Annex III of the report) involved an extensive review of techno-economic data related to renewable hydrogen in Cyprus, including data provided by E3Modelling in the frame of this project, information available in the international literature, and input from experts with knowledge of actual costs in the market of Cyprus. Our work has also benefited from very extensive interactions with national stakeholders through questionnaires and interviews described in Annexes I and II of this report.

Our main finding is that although the Cypriot economy (with its small, isolated energy system without a robust industrial base) is less favourable for rapid and deep hydrogen deployment than other countries, and direct electrification makes a better case in many cases, hydrogen may be appropriate for specific uses such as in industrial clusters utilizing hydrogen in high-temperature industry and for heavy vehicles, and in the maritime and aviation sectors.

We then defined two scenarios - a 'cautious' and an 'aggressive' one - on the future deployment of hydrogen. The 'cautious' scenario foresees little penetration of hydrogen in 2030. In the 'aggressive' case, which requires large infrastructure investments and fast technical progress, hydrogen use is foreseen in the cement and the ceramics industry, in trucks and buses, and in shipping and aviation. The latter two sectors are projected to be the largest hydrogen users in 2050. To realise these prospects will require active policy interventions and substantial investments in a) renewable energy capacity, b) electrolysers for hydrogen production, c) balance-of-plant projects, and d) equipment and vehicles for the use of hydrogen in different sectors. The report has provided an estimate of the related costs associated with these scenarios and is supplemented by an Appendix with detailed spreadsheets with technoeconomic calculations that can be used by national authorities.

Proposed reforms and investments in the context of the REPowerEU initiative

Based on an extensive analysis and detailed consultation with stakeholders and authorities in Cyprus, the following reforms and investments are suggested:

Title	R/I	Description
Additional funds for energy renovations of residential, commercial and public buildings	I	<ul style="list-style-type: none"> Aims at improving the energy efficiency of the building stock Addresses the identified investment gap in this sector
Establishment of a Behavioural Insights Team to enable and/or accelerate the adoption of energy conservation and sustainable mobility measures by the population	R/I	<ul style="list-style-type: none"> Currently, some energy conservation measures are not well targeted to the most appropriate households/firms to maximise energy savings Aims at improving the effectiveness of the funds devoted to energy renovations and sustainable mobility, leading to higher energy savings Behavioural insights to be used in Cyprus for the first time, in line with best international practices.
Creation of institutional framework for the operation of Energy Communities and the participation of local authorities in such Communities	R	<ul style="list-style-type: none"> Can increase the deployment of decentralised renewable energy generation
Creation of institutional framework for the operation of energy storage facilities	R	<ul style="list-style-type: none"> Can increase the deployment of decentralised renewable energy generation as it will clarify the licensing procedures for all kinds of energy storage that are currently not included in legislation
Creation of institutional framework for the operation of charging points for electric vehicles	R	<ul style="list-style-type: none"> Aims at a higher uptake of electric vehicles within an operating environment that will safeguard electrical grid stability
Clear definition of procedures for licensing of hydrogen projects	R	<ul style="list-style-type: none"> It can accelerate hydrogen deployment to replace fossil fuels by i) providing clear rules for investors and ii) enabling them to verify the use of hydrogen of renewable origin in their installations
Targeted investments to support the launch of production and use of renewable hydrogen	I	<ul style="list-style-type: none"> They can accelerate hydrogen deployment to replace fossil fuels They involve financial support schemes to enable investments in i) production of renewable hydrogen and ii) hydrogen use in industry, heavy vehicle transport, and refuelling stations
Additional financial support for the electricity interconnections of Cyprus (if necessary and appropriate in case of difficulty to ensure adequate private funds)	I	<ul style="list-style-type: none"> Due to the energy isolation of Cyprus, electricity interconnection is key for ensuring the transition to net zero power generation as it can lead to higher penetration of renewables and enhance energy security of the country Strong financial support from the EU has been secured; it is worth exploring whether additional funding is necessary due to the very high investment cost
Additional investments to implement the existing Sustainable Urban Mobility Plans of Cypriot cities	I	<ul style="list-style-type: none"> They address the currently large funding gap for sustainable mobility investments They will reduce the use of fossil fuels in road transport, which is currently responsible for half of non-ETS greenhouse gas emissions

R: Reform, I: Investment

1 Introduction

In May 2022, the European Commission presented the REPowerEU Plan, its response to the hardships and global energy market disruption caused by Russia's invasion of Ukraine. The REPowerEU plan sets out a series of measures to rapidly reduce EU's dependence on Russian fossil fuels and fast-forward the green transition, while increasing the resilience of the EU-wide energy system. It is based on three pillars: diversifying gas supplies; accelerating renewable energy deployment in homes, industry and power generation; and reducing demand for fossil fuels, including through energy efficiency measures.

In the context of the REPowerEU plan, the European Commission is providing support under the Technical Support Instrument (TSI) to 17 Member States in order to help identify the most suitable reforms and investments to phase out their dependency on Russian fossil fuels. The technical support will focus on areas such as diversifying energy supplies, accelerating the transition to renewable energy and increasing energy efficiency.

DG REFORM contracted a consortium led by Trinomics to provide technical support to 15 of those Member States. The work carried out under this technical support project will provide relevant analysis and elements to Member States under the REPowerEU objectives. Member States may consider some of the measures identified in the context of the new REPowerEU initiative. This particular report concerns the technical assistance provided to Cyprus.

The information contained in this report does not represent the views of the European Commission, nor does it constitute an endorsement of the European Commission of its content. The authorities of Cyprus remain fully responsible for any measures they choose to pursue in the context of REPowerEU.

The work performed under this project includes:

1. An analysis of energy-related dependencies (chapter 2);
2. The identification of possible reforms and investments to support REPowerEU objectives (chapter 3);
3. In-depth support on priority areas (chapter 4, with the main content of this provided as a separate Annex III).

The work was delivered between June 2022 and January 2023 by a team of local consultants and international experts. For Cyprus, apart from Trinomics, The Cyprus Institute and ideopsis ltd. were the prime responsible organisations.

2 Energy related dependencies

2.1 Background

Cyprus is among the EU Member States with the highest greenhouse gas (GHG) emissions per capita - 11.2 t CO₂eq/capita in 2019 compared to the EU average of 7.8 t CO₂eq/capita. Its GHG emission intensity (emissions per unit of GDP) is also 73% higher than the EU average. Total GHG emissions have grown by 57% between 1990 and 2019, whereas they declined by 24% in the EU during the same period. This was due to a strong increase in national GDP during the last 30 years (over 140%), but also because of the lack of strong energy efficiency and decarbonisation policies.

Economic activities subject to the EU Emissions Trading System (ETS) are three oil-fired power plants, a cement plant and a small number of brick and tile factories.

2.2 Energy demand

Cyprus' pre-Covid¹ primary energy consumption was approximately 29.5 TWh/year (2019)² and its final energy consumption was around 21.9 TWh/year (2019)³. Its energy consumption increased in the previous 5 years (2014-2019) by 14.2% (primary energy) and 16.5% (final energy), which is considerably higher than both the EU average growth for primary energy (1.8%) and for final energy consumption (5.0%). At the same time, however, the following has to be noted:

- In years 2017, 2018 and 2019, both for final and for primary energy consumption, there is a stabilization of the consumption (with lowering trends), indicating the decoupling of the economic growth from energy consumption, due to the impact of energy efficiency measures⁴.
- The energy intensity index of Cyprus has been decreasing during the last years (especially in 2017-2019), indicating the continuous improvement in the energy efficiency of the Cyprus economy⁵.
- The national 2020 indicative targets (the country's contribution to overall the EU target energy efficiency as in the Energy Efficiency Directive 2012/27/EU), which had been set based on the 2020 projections for Cyprus in the European Commission's EU Reference Scenario of 2007 in order to reflect national specificities, have been achieved.

Both buildings and transport are highly inefficient energy consumers in Cyprus. More than 90% of buildings were built before the introduction of mandatory energy performance requirements, which started after the country's accession to the EU in 2004. Building renovation rates are currently around 0.5% of the total building stock annually, below the EU average of about 1%, and must be accelerated strongly to keep the country on track with its energy efficiency obligations for 2030. As a result, coupled with a growing demand for space cooling, residential energy consumption per capita increased by about 15% between 2005 and 2019, as opposed to an EU-average decrease by 7.8%. The widespread

¹ Note that we limit our analysis on the increase/decrease in energy consumption to the pre-Covid energy consumption figures because the developments during Covid are not representative for the long-term development and it's too early to get a clear view on the post-Covid energy consumption levels.

² Eurostat simplified energy balances (nrg_bal_s, primary energy consumption)

³ Eurostat simplified energy balances (nrg_bal_s, final energy consumption)

⁴ See https://ec.europa.eu/eurostat/databrowser/view/NRG_BAL_C_custom_3358701/default/table?lang=en

⁵ See https://ec.europa.eu/eurostat/databrowser/view/nrg_ind_ei/default/table?lang=en

adoption of solar water heating systems is currently the main technology option contributing to the relatively high renewable energy share in the heating and cooling sector.

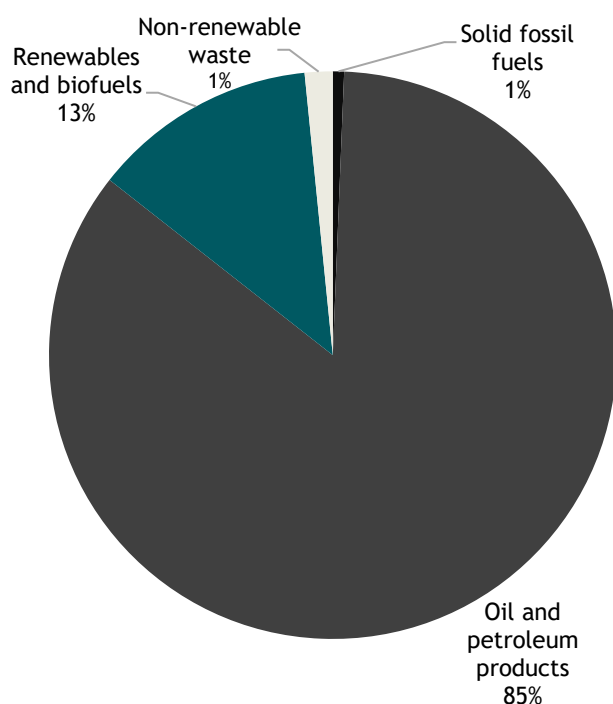
Mobility is largely dependent on motor vehicles for the transport of both passengers and goods; there are no railways, and public transport modes account for about 2% of total passenger mobility. The share of electric vehicles is very low (less than 1% of the current fleet) and there are very few public charging stations. As a result, land transport is responsible for more than half the GHG emissions of the non-ETS sectors - which makes it very difficult for the country to meet its emission abatement obligations stemming from the Effort Sharing Regulation.

Industrial activity in Cyprus has been almost steady in absolute terms in the last decades but its share in total economic output has been declining - from 12% of national GDP in the mid-1990s to less than 8% today. This, in combination with energy efficiency improvements and structural changes across the sector, has led to a drop in final energy consumption of the industrial sector. The non-metallic minerals sector, dominated by the cement industry, is currently the only energy-intensive industrial activity in Cyprus and is responsible for more than half of industrial energy use. First steps to establish industrial copper mining activity in the Troodos Mountain have also been taken, with the companies involved completing the resource base within 2022.

2.3 Energy supply

Cyprus' total energy supply amounted to 26.9 TWh in 2019 and 25.5 TWh in 2020 and consisted by 86% of fossil fuels, of which petroleum products were the heavily dominant fuels (see Figure 1). In fact, the only other notable appearance in the chart below is for renewables and biofuels which collectively contributed 12.8% of energy supply in 2020.

Figure 1: Energy supply by fuel for Cyprus (2020)

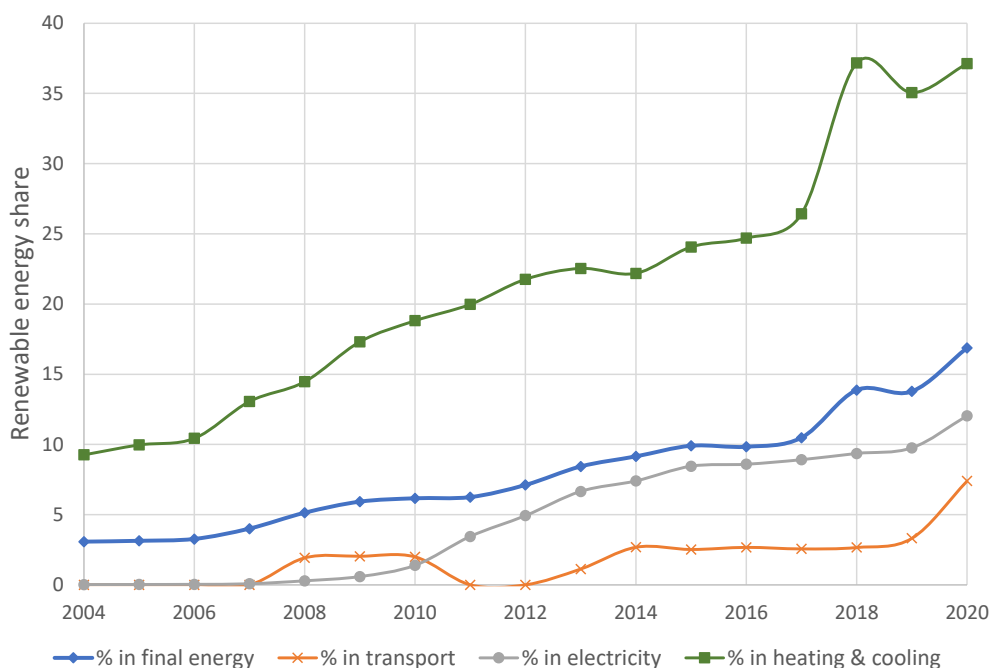


Source: Eurostat simplified energy balances (nrg_bal_s, total energy supply)

2.4 Renewable energy sources

Renewables accounted for 12.8% of Cyprus' energy supply in 2020, which is lower than the EU average of 18.1%⁶. However, considering national specificities and the targets and calculation methods adopted in the Renewable Energy Directive 2009/28/EC (and its recast Directive 2018/2001/EU or RED II), this share can be regarded as satisfactory since Cyprus has overachieved the 13% national RES target foreseen by this Directive - it attained a 17.0% share according to the definition of the RES share in RED II. This share grew considerably from 7.6% in 2015 to its current value, an increase of 5.2%-points which is higher than the average growth across the EU (3.7%-points).⁷

Figure 2: Evolution of the share of renewable energy in Cyprus, 2004-2020



Source: Eurostat⁸. Note that the RES shares in each sector have been calculated in line with the corresponding calculation methods foreseen in RED II Directive. The sharp increase in heating & cooling between 2017 and 2018 is attributed to the contribution of heat pumps for heating that had not been calculated before 2018, rather than a dramatic shift in the installed base.

Overall, Cyprus started harvesting its solar energy potential many years ago through the use of solar water heaters for residential and commercial use. Therefore, the share of renewable energy in heating and cooling has been non-negligible even before 2000 and currently accounts for more than one third of energy used for heating and cooling purposes. It took more years, however, to use renewable energy for power generation: first, the relatively limited wind power potential of the island was exploited to a large extent, and later the strong decline in solar photovoltaic (PV) panel costs led to a gradual increase of PV deployment. As a result, the share of renewables in power generation reached 12.3% in 2020, broken down into 5% for wind energy, 1.3% for 'other renewables and biofuels', and 6.1% for solar PVs. The 5-year growth of the intermittent renewable electricity sources (wind and solar energy) was 4.2%-points and 0.4%-points respectively, while the EU average growth was 4.9%-points for wind and

⁶ Note that this is a different indicator than the official RES shares that are reported within the context of the Renewable Energy Directive, where the renewable energy share is expressed as a share of final consumption.

⁷ Eurostat simplified energy balances (nrg_bal_s, total energy supply)

⁸ Eurostat statistics on the share of energy from renewable sources ([NRG_IND_REN](#))

1.9%-points for solar. The total contribution of renewables to total final energy consumption was 16.9% in the same year. Figure 2 depicts the evolution of these shares since 2004.

A much higher share of renewables is necessary to keep the country on track to achieve its 2030 decarbonisation targets, both in ETS and non-ETS sectors; a higher penetration of renewable energy, primarily solar PV combined with energy storage, has the potential to dramatically reduce the island's electricity costs.

2.5 Natural gas and renewable gases

Cyprus does not currently use natural gas. Once the Cyprus LNG Import terminal is in operation, a large part of the island's thermal power generation capacity is expected to run on natural gas. Official sources expect the construction of the project to be completed by the end of 2023 and to be in operation from 2024 onwards - even though this date is provisional and subject to potential delays. More specifically, there are plans for importing LNG through a Floating Storage and Regasification Unit (FSRU) moored on a jetty to be constructed at the Vassilikos area that will supply natural gas to the electricity sector in a first phase (planned for the end of the year 2023), and potentially to other end users (industrial and domestic) at a later stage, subject to the construction of the necessary infrastructure. The LNG import terminal will have a capacity of 65.7 GWh/day. Although the official information received by the government in autumn 2022 is that the power plant of Vassilikos will indeed use natural gas from 2024 onwards, there are indications that the deadline may not be met; if so, all thermal power plants will continue using fuel oil and diesel oil for some time even after 2023.

There are no natural gas pipeline interconnections to any neighbouring country (Cyprus is an isolated energy system), but there are tentative plans to be interconnected via the East Med pipeline that will connect Israel, Cyprus, and Greece with an initial capacity of up to 10 bcm/y (312 GWh/day), with a plan to expand at a second stage up to 20 bcm/y. This project however, with an estimated budget of €6 billion, is expected, according to the timeline submitted by the project promoter, to be fully commissioned in 2027. In 2020, the Energy Ministers of Cyprus, Greece and Israel signed the intergovernmental agreement for the EastMed pipeline. Preliminary feasibility studies claim that the project is technically and commercially viable; however, the implementation of the project remains subject to its financial sustainability. In April 2022 the European Parliament voted to keep the pipeline in the 6th Project of Common Interest List, so that it remained eligible for EU funding although it involves natural gas. More specifically, a derogation has been introduced for Cyprus and Malta until 2029 in the revised TEN-E Regulation no. (EU) 2022/869. Natural Gas Projects of Malta and Cyprus shall maintain their PCI status until those member states are fully connected to the EU gas network. A prerequisite is the exclusive transport of hydrogen by 2036, with the possibility of projects' funding until the end of 2027. According to the Cypriot government, the project has been designed to support and enable the European energy transition to clean energy sources; through its "Hydrogen readiness", from the start of operation, it is planned to enable the transportation of significant quantities of hydrogen, thereby contributing to EU energy criteria of market integration, security of supply, sustainability, and competition.

The only biogas sites in Cyprus are 11 existing installations producing biogas from anaerobic digestion of animal waste and using it to cogenerate electricity and heat, with a total installed capacity of 9.77MW; according to Eurostat, they accounted for slightly more than 1/10 of renewable power generation in

Cyprus, or about 1% of total power generation, in years 2018-2020. There are no biomethane facilities in the country.

Cyprus does not yet have hydrogen production facilities, except for small-scale experimental units for research purposes. Steps are being taken to develop the regulatory framework for hydrogen production. This framework is projected to be complete during 2023, also in the context of the present study.

2.6 Oil and petroleum products

In 2020 Cyprus consumed 28.3 TWh of oil and petroleum products⁹, all of which was imported.¹⁰ 29.1% of its oil imports originate from non-EU sources with Israel being by far the largest non-EU supplier accounting for 94% of non-EU supply, followed by Russia (4%), and other non-EU countries at 1.7%. The remaining share of oil products are refined imports from Greece (i.e., within the EU). This however means that Russian oil products can indirectly find their way to Cyprus, since Greece is importing 26.3% of its oil products from Russia. These indirect imports will likely converge to zero after the end of 2022 and the eventual ban on liquid hydrocarbon imports from Russia.

With Cyprus being an ‘isolated energy island’, it exhibits a high degree of dependence on imported oil products, while the main fuels currently used in power generation being heavy fuel oil and gas oil. The various oil products imported are used in the transport, households, services, agriculture, and industry sectors.

Currently, imported oil products include liquefied petroleum gas (LPG), unleaded gasoline, jet fuel (ATF - Aviation Turbine Fuel), kerosene, diesel, gasoil, LFO (light fuel oil), HFO (heavy fuel oil, mainly used for power generation purposes by the local utility), bitumen (used in road asphalt) and pet coke (used for cement production by the Vasilikos Cement Company). Apart from these, also biofuel blends, marine bunker fuels and lubricants are imported, which have other own applications.

Imports of oil and petroleum products, except HFO (i.e., LPG, gasoline, kerosene, diesel, heating oil, marine gasoil, LFO) constituted 67% (1.5 million tonnes of oil equivalent - mtoe) of the total oil products imports in 2020, while 33% (0.75 mtoe) concerned imports of HFO, which was mostly used for power generation. The import of pet-coke reached 0.03 mtoe (1.5% of total oil-products imports) and the rest amounted to the import of bitumen (0.03 mtoe) for road construction purposes (non-energy use).

The possibility to diversify the current energy supply is very limited. Firstly, due to the small size of the local market, the imported amounts are small in physical and monetary terms, so that it would not be easy for importers to negotiate lower prices from different markets. Secondly, shipping costs are crucial for deciding which country to import from; it is reasonable to opt for importing oil products from neighbouring countries with relatively lower transport costs. Finally, other markets may not be appropriate for providing petroleum products to Cyprus both because refineries in neighbouring countries other than Greece and Israel may not be able to supply fuels with the specifications required for an EU country, and because the fuel needs of Cyprus need to be suitable for the prevalent hot

⁹ Eurostat simplified energy balances (nrg_bal_s, total energy supply)

¹⁰ Eurostat imports of oil and oil products by partner country (nrg_ti_oil)

climatic conditions of the country. Therefore, the most efficient way to diversify energy supply is through the replacement of fossil fuel use by renewable energy.

2.6.1 Upstream Sector- Domestic Production and Exploration

Currently, there is no domestic production of oil or oil products. However, the energy sector of Cyprus is transforming due to new natural gas discoveries within its Exclusive Economic Zone (EEZ). There are strong signals that Cyprus will soon move from exploration to exploitation and production. The hydrocarbon exploration activities taking place offshore Cyprus do not preclude the possibility of oil finds, while the natural gas reserves already discovered in Block 12 are expected to contain some condensates.

Based on information provided by MECI in September 2022, according to the approved Development and Production Plan for the Aphrodite gas field in Block 12 of the Cyprus EEZ, the expected first year of production is 2027 and the production will be 750 MMscfd (or 277,4 Bcf/y). Production is expected to start declining after production year 12. Chevron, which has the rights for Block 12, is now re-evaluating the approved Development and Production Plan with the aim to optimise it in view of potential synergies with other existing gas facilities in the Eastern Mediterranean area. The main alternatives identified are tie-backs to other processing facilities in the region.

There have also been additional natural gas discoveries in the Glaucus and Calypso fields. According to MECI, for the time being there are no specific plans for the exploitation of these discoveries as they are still under appraisal.

The recent discovery of the Cronos-1 and Zeus-1 in block 6 wells increases the discovered gas reserves in Cyprus to a total of around 14-18tcf (around 396-210 bcm). ExxonMobil and QatarEnergy consortium continued their exploration activities in blocks 5 and 10. Cronos-1 and Zeus-1 have increased the possibility of further discoveries.

2.6.2 Downstream and Midstream Sectors Infrastructure (Refineries, Pipelines, Storage, Terminal, and Domestic Oil Market)

The Cyprus oil market is dominated by eight local petroleum products trading companies which import and supply oil products in Cyprus for retail, industrial and commercial purposes. Three of them have more than 70% of the market share. After the cease of the operation of the Cyprus Petroleum Refinery in Larnaca in April 2004, these trading companies import finished petroleum products from refineries abroad, store them at their facilities and then distribute them out to the local market through their own network of petrol stations. In 2020 the total number of petrol stations operating in Cyprus was 305.

Since the accession of Cyprus to the EU, oil product prices are set freely, while the Minister of Energy, Commerce & Industry (MECI) has the authority to set a price ceiling for specific oil products and for a specific duration in the event of emergency or during times of intense price volatility.

LPG is currently only used only for domestic, industrial, services (hotels and restaurants) and heating purposes and is sold both in bottles and in bulk. LPG bottles delivery has been imposed with reduced VAT equal to 5%.

The Cyprus Organization for the Storage & Management of Oil Stocks (KODAP) purchases its strategic products through tenders. KODAP mainly maintains oil stocks in Cyprus and Greece, at a level equivalent to 90-days daily net import, in line with EU legislation. According to the data provided in its 2022 budget, KODAP maintains about 60,000 million tonnes of oil products in Greece, or less than 10% of the total quantity of stored oil products. Based on information provided by KODAP in September 2022, KODAP had 242,000 million tonnes of own stocks, out of which 24% were kept in Greece and 76% in Cyprus (Vassiliko) during that period.

The Electricity Authority of Cyprus (EAC) procures gasoil and HFO through periodic tenders for its own needs in fuel for power generation. The storage facilities for oil products in Cyprus are presented in Table 1.

Table 1: Oil products storage terminals/capacity

Owner/Operator	Type of Facility	Petroleum Products& Tanks	Storage Capacity
Electricity Authority of Cyprus (EAC)	Storage facilities (and Single Point Mooring system for oil imports) at the three power stations of EAC (Vassiliko, Moni, Dhekelia), for its own fuel needs (operational and strategic stocks) for power generation	Gasoil	95,000 cubic meters
		HFO	112,000 cubic meters
Electricity Authority of Cyprus (EAC) - stocks of KODAP	One Tank at Vassiliko	Gasoil	30,000 cubic meters
Iacovou Brothers Ltd	Tank farm	Bitumen	8,860 metric tonnes
VTTV Ltd (private company wholly owned by VTTI which was created with a 30% share of Vitol Group)	Storage hub and associated infrastructure (including truck loading facilities) and a jetty for oil import/export	Gasoil (12 tanks for import/export)	287,991 cubic meters
		Heating Gasoil (0.1% sulphur content) - 1 tank for imports	11,345 cubic meters
		Automotive Diesel (10ppm sulphur content) - 2 tanks for imports	32,054 cubic meters
		Unleaded gasoline (total of 8 tanks: 5 for import/export and 3 for imports)	138,078 cubic meters
		Gasoline-MTBE (1 tank for import/export)	10,422 cubic meters
		Jet Fuel (total of 3 tanks: 2 for import/export and 1 for imports)	62,698 cubic meters
		FAME (a diesel blending agent) - 1 tank	2,038 cubic meters
Petrolina Group (a local Cypriot private company)	Storage terminal (+ truck loading facilities)	Gasoline, Auto / Heating Gasoil, Kerosene, Bunkering fuels, Jet fuels, bitumen	104,139 cubic meters

Owner/Operator	Type of Facility	Petroleum Products& Tanks	Storage Capacity
EKO LOGISTICS (private company)	Storage and distribution facility	Unleaded 95	26,000 cubic meters
		Unleaded 98	1500 cubic meters
		Unleaded 100	1000 cubic meters
		Automotive Diesel	26,000 cubic meters
		Heating Gasoil	11,500 cubic meters
		Kerosene	2000 cubic meters
		Biodiesel - HVO	1000 cubic meters

Source: [South East Europe Energy Outlook 2021/2022](#) of the Institute of Energy of Southeast Europe; and information obtained through communication with private companies.

2.6.3 Planned New Projects

In line with a decision by the Council of Ministers, the relocation of the existing storage facilities of the local petroleum and LPG trading companies to the area of Vassilikos is completed. Also, a strategic oil stocks depot will be set up and operated by KODAP.

As an interim solution, until the construction of the oil depot of KODAP, the stocks are held in the VTTV terminal, a private oil tank farm (see Table 1). According to information provided by KODAP in September 2022, construction is scheduled to start in December 2022 and is expected to be completed by the end of 2024.

2.7 Solid fossil fuels

Cyprus does not use solid fossil fuels in its energy system apart from small amounts of coal used by the local cement factory that consumed 157.6 GWh in 2020¹¹, all of which was imported from Russia¹². This import will have to cease, or the plant must switch suppliers, in view of the ban on Russian coal imports decided by the EU.

¹¹ Eurostat simplified energy balances (nrg_bal_s, total energy supply)

¹² Eurostat imports of solid fossil fuels by partner country (nrg_ti_sff)

3 Identification and selection of reforms and investments for REPowerEU

This chapter starts with an analysis of the gaps in investments and reforms that would allow Cyprus to achieve the REPowerEU objectives. This is conducted through a detailed assessment of both the main policy texts (NECP, RRP, Just Transition Plan) and the budgets foreseen in these strategies (where applicable) which are devoted to interventions relevant for REPowerEU. As a result, a list of potential investments and reforms is provided at the end of Chapter 3.1 for each one of the main REPowerEU areas that are particularly relevant for Cyprus - energy savings, renewable energy deployment, sustainable mobility, and energy interconnections. The two other main areas of REPowerEU - diversifying energy supply and reduction of fossil fuel use in industry - are less pertinent for Cyprus for the reasons explained below, hence the relevant investments and reforms are included under the areas of energy savings and renewable energy.

3.1 Gap analysis

The following analysis was based on an examination of:

- i) The trends in energy efficiency and energy consumption observed in the energy system of Cyprus over the last two decades;
- ii) The future trends foreseen by the government of Cyprus as a result of the policies and measures it has included in its NECP;
- iii) The European Commission's recommendations for Cyprus under the European Semester [Spring Package](#), in particular in its [Country Report \(CR\)](#) and the relevant [Country Specific Recommendations \(CSRs\)](#);
- iv) The energy-related *investments* scheduled by the government of Cyprus, and more specifically:
 - The investments foreseen in the current National Recovery and Resilience Plan (RRP), which were approved by the European Council in the summer of 2021;
 - The investments planned to be funded from the European Structural and Investment funds of the Multiannual Financial Framework (MFF) 2021-2027, (programme "ΘΑΛΕΙΑ"), which were approved by the European Commission in July 2022;
 - The investments planned in the Just Transition Plan of Cyprus, which was also approved in July 2022;
 - Funding from the Connecting Europe Facility for the electricity interconnection of Cyprus, which was approved in January 2022;
 - Additional investments or expenditures foreseen in the national budget specifically for sustainable mobility.
- v) The energy-related *reforms* scheduled by the government of Cyprus which were included in the approved RRP, which have already been partly or fully implemented, and more specifically:
 - The legislation making the Electricity Transmission System Operator of Cyprus an independent authority (which will facilitate the full deployment of the electricity market and the increased deployment of renewables in electricity), which entered into force on 7 October 2021.

- The institutional framework for energy storage, which will also facilitate the fast penetration of renewables, also legally adopted.
- The creation of a “Digital One-Stop-Shop”, which has been launched, with two relevant detailed studies under way. This will enable accelerating the permit procedure for energy renovations and renewable energy investments in all economic sectors.
- The implementation of a green tax reform is currently under study through another Technical Support project requested by the Finance Ministry of Cyprus and funded by DG Reform.

It should be noted that the government of Cyprus listed the following priorities for technical support in this project:

- In support area 3 (Technical support for accelerating the roll-out of renewable hydrogen and other suitable forms of fossil-free hydrogen), Cyprus requested assistance on *developing a national hydrogen strategy*.
- In support area 7 (Technical support for accelerating the deployment of innovative hydrogen-based solutions and cost-competitive renewable electricity in industrial sectors), Cyprus requested assistance on *developing a short-term strategy to encourage innovation and support a fair social transition*.

Evidently, the national priorities cannot be easily aligned with the REPowerEU initiative, because hydrogen-related investments are relevant for the medium and longer term and there is limited potential for specific investments on hydrogen to be ready for completion by the end of RRP, i.e., end of 2026. Still, our study identifies, *inter alia*, gaps in reforms related to the deployment of hydrogen, which could be implemented in the coming years and enable the application of the hydrogen strategy requested by the government; as well as some first investments (support schemes) for the initial deployment of hydrogen projects. Apart from these, as explained in the Inception Report, our study provides an insight into the gaps in investments and reforms in all other aspects related to REPowerEU; these are outlined in Sections 3.1.1 to 3.1.5 below.

Chapter 3.1 is organised as follows: Sections 3.1.1 to 3.1.5 identify trends, outline NECP-based interventions, list the investments and reforms foreseen, and describe the relevant EC recommendations for each one of the five main REPowerEU areas (energy savings, renewable energy, energy supply diversification, reduction of industrial fossil fuel use, and other areas), respectively. Then, section 3.1.6 focuses on investments and provides a detailed assessment of the budget foreseen in all main strategies financed by public (national and EU) funds; this helps identify investment gaps. Based on the review of the current situation of Chapter 2 and the sectoral reviews of Sections 3.1.1 to 3.1.5, Section 3.1.7 identifies reform gaps. Finally, Section 3.1.8 uses the findings of the previous sections to identify the main gaps in each REPowerEU area; this provides input for Chapters 3.2 and 3.3, which include a proposal about additional investments and reforms in line with REPowerEU priorities.

3.1.1 Saving energy

3.1.1.1 Current provisions in the NECP

The NECP that was submitted by the Republic of Cyprus in January 2020 and is currently undergoing revision, includes a large number of measures aiming at the improvement of energy efficiency and enabling energy savings (see pp. 126-142 of the official NECP, as well as Appendix 4 of the NECP that shows all policies and measures). Main elements of the policies foreseen are the following:

- Implementation of an Energy Efficiency Obligation Scheme
- Introduction of a 'fund of funds' providing soft loans for energy efficiency
- Provision of additional floor space "allowance" for new buildings and buildings that are renovated
- Energy efficiency interventions in governmental buildings, with national and EU funds
- Soft measures (information campaigns, trainings, workshops etc)
- Support schemes for promoting energy efficiency renovations in a) dwellings, b) small and medium sized enterprises (SMEs), c) local authorities through European Structural and Investment Funds
- Support schemes for energy audits in SMEs
- Installation of energy efficient street lighting
- Installation of 400,000 smart electricity meters (a measure that is late on schedule but has been included in the RRP with specific targets for 200,000 meters by the end of the 3rd quarter of 2024 and the other 200,000 meters by the end of the 2nd quarter of 2026)
- Promotion of energy efficiency in the water sector through detection of water leakages, replacement of old inefficient pumping equipment etc.

As a result of these measures, according to the NECP, Cyprus intended to meet its declared indicative contributions to primary and final energy target for 2030 (2.5 Mtoe for primary energy and 2.0 Mtoe for final energy). By summer 2022, implementation of many of these measures had started. Some delays have been observed (e.g., in the installation of smart meters), but as essentially all the above measures are included in the national RRP, their eventual implementation is not under any uncertainty.

Obviously, these measures are not sufficient to meet the more ambitious energy saving objectives which are currently under negotiation in the frame of the 'Fit-for-55' policy package aiming to deliver the European Green Deal. This topic will be further dealt with in Sections 3.1.6 and 3.1.7 below.

3.1.1.2 EC recommendations

The European Commission's recommendations for Cyprus under the European Semester [Spring Package](#), in particular in its [Country Report \(CR\)](#) and the relevant [Country Specific Recommendations \(CSRs\)](#), related to energy savings are the following:

- Expand public investment for the green and digital transition and for energy security, including by making use of the RRF, REPowerEU and other EU funds.
- Extend and accelerate economy-wide energy efficiency measures, including in the transport sector.

Moreover, in its assessment of the Cypriot NECP, the European Commission underlined the need for proper implementation of the policies and measures foreseen, in order to actually realise the energy savings scheduled to be achieved through the NECP.

3.1.1.3 Current provisions on investments and reforms from EU and national funds

The main projects related to saving energy in buildings and industry are the following:

- i) From the national RRP:
 - Support for energy efficiency investments in SMEs, broader public sector, and NGOs
 - Support for energy efficiency & RES investments in residential dwellings
 - Support for energy efficiency & RES investments in local authorities

- Reduction of CO₂ emissions in industries, businesses, and organisations
- Energy renovations in public buildings & water pumping stations
- Installation of smart grid at the University of Cyprus
- Installation of smart meters in electricity consumers

ii) From MFF 2021-27:

- Energy efficiency upgrades & RES in schools and public buildings
- Energy efficiency upgrades & RES in private buildings

The amount of these investments is specified in section 3.1.6 below.

3.1.2 Accelerating renewable energy deployment

3.1.2.1 Current provisions in the NECP

The NECP builds on the experience obtained by the Cyprus Government since the early 2000s when it started developing support schemes and soft measures to enable renewable energy penetration, especially in the electricity sector. As a result, the following main policies and measures have been included in the NECP (see also Table 36 of the official NECP document):

- Self-Consumption schemes for households, with special provisions for vulnerable consumers
- Net-metering measures, to be converted to net-billing schemes from 2023 onwards
- Net-metering and net-billing schemes for charging of electric vehicles
- Support for cogeneration plants utilising animal waste
- Replacement of solar thermal water heaters in households and enterprises
- Installation of renewable energy systems in public and private buildings as part of broader energy renovation support schemes
- Promotion of renewable energy in road transport (use of biofuels in motor vehicles, clean vehicle mandates for the new contracts with bus companies)

As a result of the above policies and measures, in combination with the further decline in investment costs of renewable energy technologies (mainly solar PVs) that is expected up to 2030, it seems that both binding RES-related targets of Cyprus (23% share in total final energy demand and 14% share in road transport energy consumption) are feasible with the NECP's foreseen policies and measures. As with the measures related to energy savings, most of the RES-promoting interventions have started being implemented and are largely included in the national RRP. Obviously, these measures are not sufficient to meet the more ambitious objectives which are currently under negotiation in the frame of the 'Fit-for-55' policy package aiming to deliver the European Green Deal.

3.1.2.2 EC recommendations

The European Commission's recommendations for Cyprus under the European Semester [Spring Package](#), in particular in its [Country Report \(CR\)](#) and the relevant [Country Specific Recommendations \(CSRs\)](#), related to renewable energy are the following:

- Expand public investment for the green and digital transition and for energy security, including by making use of the RRF, REPowerEU and other EU funds.
- Reduce overall reliance on fossil fuels and further diversify energy supply by accelerating the deployment of renewables, in particular by further streamlining permitting procedures and expanding photovoltaics.

3.1.2.3 Current provisions on investments and reforms from EU and national funds

The main projects related to renewable energy deployment are the following:

- i) From the national RRP:
 - Support for energy efficiency & RES investments in residential dwellings
 - Support for energy efficiency & RES investments in local authorities
 - Support for installing photovoltaics in electric vehicle charging stations
 - Production of biogas from livestock waste

- ii) From MFF 2021-27:
 - Energy efficiency upgrades & RES in schools and public buildings
 - Energy efficiency upgrades & RES in private buildings
 - Installation of photovoltaics in military camps and at the University of Cyprus

- iii) From the Just Transition Plan (JTP):
 - Support scheme for energy storage investments of 300+300 MWh
 - RES investments in energy-intensive industries
 - Various interventions to improve the electricity transmission and distribution system, which will enable the penetration of renewables - mainly solar electricity. Such measures include the upgrade of electricity substations and transmission lines and several projects to modernise the distribution system.
 - New Technical School of secondary education dedicated to training young people to obtain green skills, with a focus on the installation and maintenance of RES technologies.

A large part of the above-mentioned JTP investments are crucial for upgrading the electricity grid to accommodate much higher shares of intermittent renewable energy capacity, mainly coming from solar energy.

The budget foreseen for each type of the above investments is specified in section 3.1.6 below. Evidently, the above projects focus mainly on the exploitation of the solar energy potential of Cyprus; there seems to be little potential for additional capacity of other renewable energy sources, therefore there are no specific investments foreseen for wind, geothermal or other investments. In fact, exploitation of the significant offshore wind potential, especially west of the island, is currently restricted by the deep waters of the area and make offshore wind investments too costly to be implemented in the current decade¹³.

Whether the above investments are sufficient to meet the REPowerEU objectives is assessed in section 3.1.7.

3.1.3 Diversification of energy sources

As explained in Chapter 2, Cyprus currently does not have natural gas supplies through LNG nor through pipelines. Moreover, it does not avail of hydrogen infrastructure. As regards oil imports, the country is almost independent of direct imports from Russia. The only dependence is on the limited amount of

¹³ Nikolaidis G, Karaolia A, Matsikaris A, Nikolaidis A, Nicolaidis M and Georgiou GC (2019) Blue Energy Potential Analysis in the Mediterranean. *Front. Energy Res.* 7:62.[doi: 10.3389/fenrg.2019.00062](https://doi.org/10.3389/fenrg.2019.00062)

coal imports used in the country's cement plant. This coal comes from Russia and will obviously have to be eliminated (through fuel substitution by the cement plant) or the supplier must change, in view of the ban on Russian coal imports decided by the EU.

The relevant EC Country-Specific Recommendation, to “Reduce overall reliance on fossil fuels and further diversify energy supply by accelerating the deployment of renewables” reflects this reality that Cyprus is independent of Russian imports; therefore, diversification of energy sources comes from the higher use of renewables, which is addressed in Section 3.1.2 above.

3.1.4 Reducing fossil fuel consumption in industry

3.1.4.1 Energy efficiency and consumption trends in industry since 2000

Industrial activity in Cyprus has been steadily declining over the last decades. This has led to a drop in final energy consumption of the industrial sector. The fall in energy use has been accelerated by substantial energy efficiency improvements across the sector and mainly in the cement industry.

3.1.4.2 Current provisions in the NECP

The NECP of Cyprus foresees several financial support schemes for Cypriot industries regarding energy renovations in their buildings, replacement of the old capital stock with modern, more efficient industrial equipment and machinery, promotion of cogeneration, and deployment of renewable energy to promote clean electrification of the industrial sector. These schemes are largely part of the broader energy efficiency and RES promotion schemes for all economic sectors, which were outlined in Sections 3.1.1 and 3.1.2 above. Apart from those, a specific scheme for the reduction of greenhouse gas emissions in businesses was included in the NECP, which has been included in the green investments foreseen in the national RRP. As a result, according to the NECP's Planned Policies and Measures scenario, the industrial sector of Cyprus is projected to contribute its proportional share to the economy-wide reduction of fossil fuel use of the country. Obviously, this ambition must increase in the frame of the stronger targets on energy savings and decarbonisation that are part of the 'Fit-for-55' policy package to deliver the European Green Deal.

3.1.4.3 EC recommendations

The European Commission's recommendations for Cyprus under the European Semester [Spring Package](#), in particular in its [Country Report \(CR\)](#) and the relevant [Country Specific Recommendations \(CSRs\)](#), related to reducing industrial fossil fuel consumption, are the following:

- Expand public investment for the green and digital transition and for energy security, including by making use of the RRF, REPowerEU and other EU funds.
- Extend and accelerate economy-wide energy efficiency measures.

Moreover, in its assessment of the Cypriot NECP, the European Commission underlined the need for proper implementation of the measures foreseen in that Plan, in order to actually realise the scheduled energy savings.

3.1.4.4 Current provisions on investments and reforms from EU and national funds

The industrial sector is expected to benefit from funds of the RRP, the MFF and the JTP described in Sections 3.1.1 and 3.1.2 above, for improving industrial energy efficiency, promoting renewable heat based on solar energy, and electrifying industrial processes where possible.

3.1.5 Other

Two additional areas that receive attention in the RePowerEU priorities and are relevant for Cyprus are the electricity interconnection of the country and the promotion of sustainable and electric mobility. The first sub-section below focuses on trends in transport energy consumption, while the next sub-sections report on both topics of interconnections and mobility.

3.1.5.1 Energy efficiency and fuel consumption trends in transport

Transport accounts for half of final energy consumption in Cyprus. This is due to the very low use of public transport, despite recent investments in public buses which have not been adequate to induce a significant modal shift in passenger transport - which is still dominated by cars. Attempts to strengthen the public transport system, which consists of urban and interurban buses, have not been effective up to now. Therefore, the share of cars in total passenger traffic has remained very high in Cyprus; in fact it has slightly risen further between 2000 and 2018. Inland freight transport is conducted only with trucks. Despite some energy efficiency improvements because of the gradual renewal of the stock of motor vehicles, increases in total passenger kilometres and tonne kilometres travelled have been stronger; therefore, total energy consumption of transport has risen by more than 25% between 2000 and 2018.

Currently, the transport sector is almost entirely dependent on imported fossil fuels. The fraction of battery electric vehicles is very low although their sales are expected to increase to sizable proportions in the next years, partly because of the increased availability and falling costs of EVs and partly due to the financial support and infrastructure measures foreseen in the RRF to be explained below.

Transport fuels are taxed above the minimum levels foreseen by the current Energy Taxation Directive, and automotive diesel fuel is taxed slightly less than petrol; this has temporarily changed since spring 2022: in response to the surge in international oil prices, the government reduced excise taxes on petrol and diesel to the minimum rates allowed by the ETD. Fossil fuel subsidies exist but compared to other EU Member States, they are not very pronounced: fuels used for power generation and are exempted from excise taxation, plus fuel used in shipping and aviation - a situation that is likely to change after the revision of the EU Energy Taxation Directive that is currently under negotiation. Moreover, excise duties for agricultural gas oil are very low, much lower than that for other gas oil types.

3.1.5.2 Current provisions in the NECP

Considering the very low share of public and non-motorised transport in Cyprus and the high contribution of motor vehicles to the total fossil fuel consumption and greenhouse gas emissions, the NECP assumed the implementation of strong policies and measures to reverse these trends and set the country on a path to decarbonisation. The NECP's Planned Policies and Measures scenario includes measures that could lead to a substantial modal shift from passenger cars to sustainable transport modes, including a larger bus network, an additional number of buses servicing the cities, advanced IT application and bus station infrastructure to make bus travel more attractive, and the construction of a tram in the city of Nicosia. This in turn would lead to a much lower forecast of the stock of passenger cars in 2030 compared to the baseline scenario and a drastic reduction in overall energy demand of the transport sector. The biggest change is projected in the consumption of gasoline, which is calculated to be 27% lower in 2030 compared to the baseline scenario. Battery electric vehicles were projected to reach 58,000 passenger cars and about 2,000 trucks and buses by 2030, accounting for 8.6% of the total

vehicle stock¹⁴. The latest published (in 2020) Eurostat statistics report a total of 240 registrations of BEVs (fully electric) and 9,992 mild hybrids (i.e., not plug-in hybrids, which were zero), in a total of 578,158 passenger cars in Cyprus.

Such a drastic change needs substantial investments. According to the NECP, additional cumulative investments in public transport amount to €800-900 million (at 2016 prices) to develop a tram line in Nicosia and increase the fleet of urban and interurban buses, and an additional €500 million for creating the necessary infrastructure for sustainable mobility (public and non-motorised transport modes) until 2030. These levels of investment are very large compared to what's foreseen in other sectors, but they also lead to lower private investments in passenger vehicles of approximately €2 billion during the same period. The NECP notes that the materialisation of these projections will necessitate both infrastructure investments and public acceptance and adoption of these modes of transport to make the investments successful. In fact, the timetable for the completion of these measures is unclear, especially as regards the construction of the tram; the Sustainable Urban Mobility Plan of the city of Nicosia, which is currently under revision, is likely to provide a relevant timetable. Section 3.1.6 below includes a calculation of the relevant investment gap for sustainable mobility, which in fact highlights a more general case of a gap between commitments and actual implementation.

As regards electricity interconnections, these had not been included in the NECP because of the uncertainty surrounding the implementation of the EuroAsia Interconnector by the time of NECP submission. The interconnection had only been included as a sensitivity case that had been preliminarily prepared but was not included in the official NECP.

3.1.5.3 EC recommendations

The European Commission's recommendations for Cyprus under the European Semester [Spring Package](#), in particular in its [Country Report \(CR\)](#) and the relevant [Country Specific Recommendations \(CSRs\)](#), related to energy interconnections and transport, are the following:

- Develop energy interconnections with neighbours.
- Extend and accelerate energy efficiency measures, including in the transport sector.

3.1.5.4 Current provisions on investments and reforms from EU and national funds

In the areas of electricity interconnection and promotion of sustainable and electric mobility, the following are foreseen:

- Regarding the EuroAsia interconnector (a project to construct a subsea cable connecting the grids of Israel, Cyprus, and Greece), the European Commission approved in January 2022 funding of €657 million from the Connecting Europe Facility (CEF) for this project, to support the construction of the Cyprus - Crete link. The Grant Agreement between the Project Promoter and CINEA was signed in September 2022. Also, in July 2021 the project was approved to receive €100 million from the RRP¹⁵. The total budget of the project is expected to be €2.5 billion (out of which €1.5 billion for the Cyprus - Crete link). When this project is completed, the share of renewable energy in power generation in Cyprus can increase

¹⁴ Recent policy developments that promote electric mobility in the frame of the 'Fit-for-55' policy package will certainly lead to a strong increase in the number of electric vehicles in the updated NECP due in 2023.

¹⁵ The funding amounts mentioned here refer to the intra-EU part of the project, i.e. the connection between Cyprus and Greece.

substantially. The latest information on the project is that the first phase of 1,000MW will move into the project implementation stage in 2028. The EuroAsia Interconnector's (Cyprus-Crete link) Inauguration Ceremony was held in October 2022 in Nicosia, in the presence of Ms Kadri Simson, the European Commissioner for Energy.

- On sustainable mobility (promotion of public transport, walking and cycling), investments are foreseen of the order of €30 million in the RRP, €90 million from the MFF, and another €400 million from the budget of the Ministry of Transport of Cyprus. Additional measures of the order of €50 million are foreseen in the RRP for encouraging the purchase and use of electric vehicles.

The above amounts are explained in more detail in Section 3.1.6 below.

3.1.6 Detailed assessment of the investment gap¹⁶

This section focuses on investments (reforms are dealt with in Section 3.1.8 below) and provides an in-depth assessment of whether the public and private investments that are currently planned in Cyprus until 2030 are sufficient to meet:

- The investment needs foreseen in the NECP, especially in its Chapter 5 (Impact Assessment)
- The additional investments required - beyond the NECP - to deliver the European Green Deal and specifically the REPowerEU priorities.

For this purpose, as mentioned in the introduction of Chapter 3.1, we explored all investments primarily related to the energy system of Cyprus which are foreseen in the following plans:

- The National Recovery and Resilience Plan (RRP) in its current version
- The planned projects of the European Structural and Investment Funds (MFF 2021-27)
- The Just Transition Plan
- The Connecting Europe Facility
- Additional sustainable mobility investments or expenditures foreseen in the national budget of the Ministry of Transport, Communications and Works.

It has to be noted that the Partnership Agreement between the European Commission and the Republic of Cyprus, which includes funding from the European Regional Development Fund, the Cohesion Fund and the Just Transition Fund, was adopted very recently (on 8 July 2022); in contrast to the RRP, these plans include categories of investments and not specific projects. Therefore, investments of the Structural Funds and the Just Transition Plan are listed as broader categories of interventions, and the budget is indicative because budget shifts are allowed during the execution of these Plans. Still, they provide a reasonably accurate picture of the public investments foreseen as part of the broader national strategy for the green energy transition.

Table 2 presents the list of investments foreseen in EU and national funds. To understand the contents of this table, it is important to note the following:

- i) The list of projects of the RRP is the most detailed, firstly because it is publicly available and secondly because the RRP's investments and reforms are specific and have clear implementation timelines. Investments foreseen in the Structural Funds and Just Transition Fund are listed in an

¹⁶ This section is an update of earlier analysis carried out by The Cyprus Institute for the Cypriot Ministry of Finance in the frame of a Memorandum of Understanding signed by the two organisations for the long-term scientific support of the Cypriot government towards the implementation of the European Green Deal in Cyprus.

aggregate manner but have been assessed in a more disaggregated and detailed form, according to provisional information that was made available to the study team in summer 2022.

- ii) The second column of Table 2 displays the public budget of these funding schemes, i.e. the amount coming from public (national + EU) funds, whereas the third column shows the estimated total costs, which include both public and private investments. Some of the projects shown in Table 2 are direct investments of the public sector, so that the amounts foreseen in the public budget (second column of the table) are equal to the total investment costs (third column). Other projects in that list constitute support schemes to the private sector, in which the public budget grants an amount ranging between 50% and 80% of the total investment; for these projects we estimate their total (public + private) investment cost of these projects, hence the third column of the table contains amounts that are higher than those shown in the second column. The exact intensity of the public grants in each support scheme is different and has been determined after discussions with officers from MECI during the period of May-June 2022.
- iii) Many of the investments in energy renovations provide funding both for energy saving interventions (e.g. roof insulation, installation of double-glazed windows, conversion of buildings to near-zero energy buildings etc.) and for the installation of solar PV panels in buildings. Therefore, a portion of the funds has to be attributed to energy efficiency investments and another portion to renewable energy investments. This is presented in the last two columns of Table 2. The allocation of the funds is different for each investment because it depends on the kind of interventions supported by each project. For example, building renovations supported by the RRP have different requirements from the corresponding renovations supported by the Cohesion Funds. The allocation of investment amounts between energy saving and renewable energy measures has been conducted on the basis of recent information obtained by MECI officers.

Table 3 shows the corresponding funds foreseen in the NECP of Cyprus in order to achieve the individual targets on primary energy consumption, final energy consumption, and renewable energy shares that have been explained in the previous sections 3.1.1 to 3.1.5. It comes from Table 5.34 of the official NECP document but is adapted in comparison to the NECP table in order: i) to account for minor re-classifications of expenditures based on more recent information; and ii) to exclude the entirely private expenditures for purchasing conventional private cars, which were included in the NECP assessment but are out of the scope of this study.

Table 2: List of main investments or investment categories related to the energy transition foreseen in EU and national funds of Cyprus

Recovery and Resilience Plan				
Measure	Public Budget	Total Budget	Portion of the budget for energy efficiency	Portion of the budget for renewables
	(MEuros)	(MEuros)	(MEuros)	(MEuros)
Support for energy efficiency investments in SMEs, broader public sector, NGOs	40.0	80.0	32.0	48.0
Support for energy efficiency & RES investments in residential dwellings	30.0	60.0	12.0	48.0
<u>Extra</u> support for energy efficiency & RES investments in residential dwellings	40.0	80.0	16.0	64.0
Support for energy efficiency & RES investments in local authorities	9.0	9.0	3.6	5.4
Reduction of CO2 emissions in industries, businesses and organisations	20.0	33.3	26.7	6.7
Energy renovations in public buildings & water pumping stations	11.5	11.5	8.0	3.4
Res upgrade & smart grid at Univ. of Cyprus	1.6	1.6	0.0	1.6
Smart metering infrastructure	35.0	35.0	35.0	0.0
EuroAsia Interconnector	100.0	200.0	0.0	200.0
Sustainable mobility	31.5	31.5	31.5	0.0
Electric Vehicles - Grants for Chargers with PV	2.0	3.4	0.0	3.4
Electric Vehicles - Promotion of purchase of electric cars	48.8	231.6	231.6	0.0
Electric Vehicles - Installation of charging stations	4.8	7.5	7.5	0.0
TOTAL	374	784	404	381

European Structural and Investment Funds (MFF 2021-27) (ΘΑΛΕΙΑ)

Measure	Public Budget	Total Budget	Portion of the budget for energy efficiency	Portion of the budget for renewables
	(MEuros)	(MEuros)	(MEuros)	(MEuros)
Energy efficiency upgrades in schools, public buildings & InvestEU programme	75.0	75.0	60.0	15.0
Energy efficiency upgrades in private buildings	75.0	125.0	100.0	25.0
Installation of PVs in buildings of broader public sector	27.5	27.5	0.0	27.5
Sustainable mobility	79.9	89.9	89.9	0.0
TOTAL	257	317	250	68

Just Transition Plan

Measure	Public Budget	Total Budget	Portion of the budget for energy efficiency	Portion of the budget for renewables
	(MEuros)	(MEuros)	(MEuros)	(MEuros)
Support scheme for energy storage investments	80.0	300.0	0.0	300.0
RES investments in energy-intensive industries	20.0	66.7	0.0	66.7
Upgrades of electricity transmission and distribution system to accommodate high shares of renewable electricity	175	200	0.0	199.7
TOTAL	275	566	0	566

Table 2 (continued)

Connecting Europe Facility		
Measure	Public Budget (MEuros)	Total Budget* (estimated) (MEuros)
EuroAsia Interconnector	657.0	1000.0

* Rough assumption about the private investors' contribution

Funds from National Budget for Sustainable Mobility		
Measure	Public Budget (MEuros)	Total Budget (MEuros)
Sustainable Mobility Investments	400.0	400.0

All Funds from EU & National Budget				
Measure	Public Budget (MEuros)	Total Budget (MEuros)	Portion of the budget for energy efficiency (MEuros)	Portion of the budget for renewables (MEuros)
Investments for Energy Efficiency only	35.0	35.0	35.0	0.0
Investments for Promotion of Renewable Energy Sources only	1061.7	1797.3	0.0	1797.3
Investments Promoting Energy Efficiency + RES	302.0	475.4	258.3	217.1
Sustainable Mobility Investments	511.4	521.4	521.4	0
Investments Promoting Electric Mobility	53.6	239.0	239.0	0.0
TOTAL	1964	3068	1054	2014

Table 3: Investments foreseen in the Cyprus NECP (Planned Policies and Measures Scenario compared to the Existing Measures Scenario)

Project Category	Public Cost (mio €)	Total Cost (mio €)
Energy Efficiency in Buildings + Industry	523	792
Renewable Energy	0	35
Smart Electricity Meters	35	35
Energy Storage	0	0
Reduction of CO2 in businesses	5	8
Sustainable Mobility Investments	1378	1378
Electric vehicles & Charging Infrastructure	2	10
Total EU Funds	1942	2258

Source: Adapted version of Table 5.34 of the official NECP document.

Based on the above estimates, Table 4 provides a comparison between the amount of investments foreseen in the NECP and what is planned to be funded for the green energy transition under the different EU and national funding mechanisms. In line with the contents of this table, the main findings of our assessment are the following:

- The planned investments for energy efficiency and renewables reach €2.3 billion and are more than 150% higher than the €870 million foreseen in the NECP. This difference is largely due to the funding for the electricity interconnection, which had not been considered in the NECP scenarios due to the uncertainty about its implementation by the time of the submission of the NECP. Another part of the additional funds is due to investments for energy storage (up to €300 million) foreseen in the JTP, whereas the NECP did not include specific storage investments up to 2030, because the less ambitious renewable energy targets that were in

place in 2019 could be met without much additional renewable energy capacity, so that no energy storage projects were necessary up to 2030.

- Despite the above encouraging finding, it is clear from Table 4 that most of the budget of €2.3 billion is expected to fund projects in renewable energy, whereas energy efficiency investments lag behind what was foreseen in the NECP. As is evident from the last rows of Table 2, the budget dedicated to energy efficiency projects is less than €300 million ($35.0 + 258.3 = 293.5$). Since the NECP did not explicitly differentiate between investments for energy efficiency and those for renewables, it is difficult to make direct comparisons. Still, combining the above figure with the amount of $(43 + 792 =)$ €835 million shown in the NECP column of Table 4 for measures that include (but are not entirely dedicated to) energy efficiency, it is evident that the currently planned investments in EU funds which will enable energy savings are lower than what is required to meet the NECP targets. The difference between the planned investments for energy savings up to 2030 and those included in the NECP, i.e., the investment gap, can be estimated between €100 million and 200 million, and this is mainly a gap in funding for energy renovations in buildings. This gap may be more pronounced if one considers the increase in the cost of construction materials during late 2021 and early 2022, which makes all construction-related projects more difficult even after accounting for reductions of energy use due to energy saving. Evidently, this gap is larger if the country must meet the objectives of REPowerEU, which are clearly more ambitious than those of the NECP; for these reasons, **the gap in funding for energy renovations in buildings can be estimated between €200 and €300 million.**
- As far as the transport sector is concerned, there is a large gap in sustainable mobility investments, estimated at €856 million. Obviously, the NECP has been optimistic regarding the possibility to invest in infrastructure for public and non-motorised transport, and the currently planned projects are insufficient to achieve these targets. On the other hand, investments in electric mobility - in the form of public purchases of electric cars and motorcycles, financial support schemes for citizens and private firms to obtain electric vehicles and to install charging stations etc. - are considerably higher than what was planned in the NECP. Overall, **there is a gap of €627 million in investments that would enable the reduction of fossil fuel use in transport**, assuming a concurrent shift to less carbon intensive electricity generation profile, as envisaged in the NECP. It must be noted, however, that since many of the necessary investments take time to implement, it is not straightforward to include further funding for sustainable mobility in the revised RRP, which must include projects that have to be completed by the end of 2026. This assessment is based on prior experience of national authorities with infrastructure projects related to public transport and the necessary planning/permitting/procuring/construction procedures associated with such investments. Therefore, **the identification of this gap cannot lead to immediate conclusions about the feasible additional investments to be considered in the context of the REPowerEU initiative; however, it underlines the need to accelerate those sustainable mobility investments that are feasible until 2026, and provides a clear outline of the investment needs up to 2030.**

Table 4: Difference in green energy investments from EU + national funds compared to the main scenario (PPM) of the Cyprus NECP for the period 2021-2030

Project Category	(mio €)		
	NECP PPM Scenario	EU + national funds foreseen	Difference
Investments for Energy Efficiency only	43	35	-8
Investments for Promotion of RES only (except storage+interconnection)	35	297	262
Investments Promoting both Efficiency + RES	792	475	-317
Energy Storage	0	300	300
Electricity Interconnection	0	1200	1200
<i>Total Energy Efficiency + Renewables</i>	<i>870</i>	<i>2308</i>	<i>1437</i>
Sustainable Mobility Investments	1378	521	-856
Electric vehicles & Charging Infrastructure	10	239	229
<i>Total Green Transport</i>	<i>1388</i>	<i>760</i>	<i>-627</i>
Total	2258	3068	810

Source: Own calculations based on data or estimates from Table 2 and Table 3 above.

3.1.7 Findings of the gap analysis by REPowerEU area

a. Energy savings

As shown in detail in the tables of Section 3.1.6, there are substantial funds dedicated to energy renovations in buildings and other energy saving measures, but a large part of these funds are dedicated to a combination of energy efficiency and renewable energy deployment interventions. We estimate that the total (public + private) investment cost of these projects that will be indeed devoted to energy efficiency improvements is about €290 million. This amount does not include investments in sustainable mobility, which are addressed later in this section.

Considering also the recent increase in the cost of construction materials, there is a gap of €200-300 million between the planned investments up to 2030 and those included in the NECP, especially related to building renovations.

The above indicate that **additional investments are necessary to meet not only the NECP objectives but particularly the more ambitious objectives of REPowerEU**. At the same time, according to the authors' assessment, it seems that few additional investments and reforms related to energy savings can realistically be considered in the context of the REPowerEU initiative.

Apart from additional funds, proper design of support schemes for energy renovations can enable a faster uptake of such investments by households and firms, especially in cases where it has been shown that citizens or enterprises are more reluctant to proceed with energy renovations (e.g. in multi-family buildings). For this purpose, authorities could make use of insights from behavioural science; such an investment/reform is included in the next sections.

b. Accelerating renewable energy deployment

Considering that a) some of the RES-related projects listed in Section 3.1.6 comprise support schemes to the private sector where the public budget grants an amount ranging between 50% and 80% of the total investment; and b) some of these projects are not entirely dedicated to renewables but also to energy efficiency as explained above, we estimate that the total investment cost of those interventions which will be devoted to renewables is more than €1 billion. Compared to the renewables-related policies and measures of the NECP, the planned investments up to 2030 seem to be considerably higher.

The above indicate that **investments in renewables may be sufficient for meeting both the NECP targets and the more ambitious objectives of REPowerEU, provided that all of them will indeed be implemented.**

At the same time, to ensure that the full potential of renewable (mainly solar) energy will be exploited, some missing reforms should be implemented to provide regulatory clarity for energy communities, energy storage, and charging of electric vehicles; these reforms are outlined in Section 3.1.8 below.

As regards renewable hydrogen, the relevant needs have been identified by the in-depth support provided during this project - see Chapter 4 below, and Annex III for more details.

c. Diversification of energy supply

As explained in Section 3.1.3, in the absence of natural gas supplies and hydrogen infrastructure, diversification of energy supply for Cyprus is equivalent to accelerating the use of renewable energy, and the relevant gaps have been addressed in the previous paragraphs.

d. Reducing fossil fuel consumption in industry

Since industry represents a small part of economy-wide energy consumption, the gap analysis regarding this sector is part of the broader gap analysis for energy savings and renewable energy deployment that addresses all sectors of the Cypriot economy, which was presented in Section 3.1.6.

As regards specifically the possibilities for development of industrial hydrogen-based solutions, these have been identified during the in-depth support of this study - see Chapter 4.

e. Other areas (mobility and interconnections)

With regard to reducing the use of fossil fuels in transport, the gap analysis has led to the following findings:

- Compared to electromobility-related measures of the NECP, the currently foreseen projects are sufficient to satisfy the NECP targets - and perhaps also the more ambitious GHG emission reduction targets of the recent 'Fit-for-55' proposals. Consequently, **these measures may be adequate for REPowerEU** because further electrification of transport will not lead to further independence from fossil fuels if power generation is not decarbonised faster.
- However, as far as sustainable mobility investments are concerned, i.e. those related to public and non-motorised transport, the NECP included a substantially higher budget; compared to the NECP, the detailed assessment of Section 3.1.6 shows that there is a large gap in the currently foreseen investments, of the order of €800 million up to 2030. **This gap applies also to the REPowerEU priorities.** Apart from this investment gap, sustainable mobility can be promoted by increasing awareness of the possibilities offered to citizens through the already ongoing investments in public and non-motorised transport. This can be a topic of targeted behavioural interventions if a specialised Behavioural Insights Team is recruited; a relevant investment/reform is included below.

With regard to electricity interconnection of Cyprus with the rest of Europe, the funds secured for the EuroAsia Interconnector seem to be adequate for the implementation of this very important project, provided that the private investors will also contribute their share for this investment. **If this project is implemented, interconnection aspects are aligned with (and sufficient to meet) REPowerEU priorities.**

3.1.8 Gaps in reforms to meet REPowerEU objectives

Based on:

- The review of the current energy dependencies of Chapter 2
- The current and foreseen national measures outlined in Sections 3.1.1 to 3.1.5; and
- The EC Country-Specific Recommendations that were also described in these sections,

it becomes evident that the fast deployment of renewable energy, electric mobility, and renewable hydrogen does not only require additional funds but regulatory changes that will enable these investments. Therefore, this section outlines the reforms that are deemed necessary to complement the investments identified above for Cyprus to meet the REPowerEU objectives. The following is proposed:

- Reform on i) the operation of Energy Communities and ii) the participation of Local Authorities in such energy communities and the concept of energy cooperatives, which allow communities to use the revenue generated from their RES for other projects and programmes. This will enable the uptake of renewable energy projects in society, thereby allowing a faster penetration of renewable energy in the economy.
- Reform on the operation of energy storage facilities. Currently, the adopted legislation that was mentioned in the introductory part of Chapter 3.1 and was included in the existing RRP addresses electricity storage only. The proposed reform should aim to address other forms of storage as well, which are currently not covered by legislation: thermal storage, hydrogen storage¹⁷, storage of biogas generated from waste, etc. It should lay out the necessary institutional framework (permitting processes, definition of sites where such investments are allowed, guide of procedures which an investor must follow in order to obtain licenses for a specific energy storage facility, etc). This will enable a variety of energy storage investments, which, as explained in section 3.1.7.b, are essential for a faster RES deployment.
- Reform on the operation of charging points for electric vehicles, in addition to legislation that has already been adopted. This will enable the faster penetration of personal and commercial electric vehicles.
- Clear definition of procedures for licensing of hydrogen projects, which can play a decisive role for the gradual deployment of hydrogen in the Cypriot energy system.
- Establishment of a verification regime for Guarantees of Origin for renewable hydrogen.

The latter two reforms are intended to enable the deployment of hydrogen and implement the hydrogen strategy that is part of the in-depth support of this study (Chapter 4). **Therefore, these two reforms are further elaborated in Section 3.3 below.**

As far as non-hydrogen-related reforms are concerned, it must be emphasised that **the need for additional reforms on renewable energy deployment depends crucially on the success two important and closely related projects under way:**

- The reform on “Digital One-Stop Shops to streamline RES projects permitting and to facilitate Energy Renovation in Buildings” (Reform 3 of Component 2.1 of Policy Axis 2 of the RRP).
- The study “Technical Support for Setting Up One-Stop Shops to Facilitate Building Renovation and Renewable Energy Sources Project Permitting in Cyprus”, which has been approved to be

¹⁷ Especially for hydrogen storage, see e.g. various options on <https://www.enerdata.net/publications/executive-briefing/hydrogen-storage.html>; and Annex III of this Country Report.

funded by DG Reform and whose Request for Service is expected to be published in autumn 2022.





The former project is intended to establish a digital platform that will enable streamlining the permitting process for investments in building energy renovations and RES, while the latter will contribute towards implementation of the former project by defining the methodology that will be incorporated in the digital platform.

These two projects will not be completed before 2023. As this RRP reform may turn out to be successful, **further reforms on accelerating the permitting procedures may not be necessary and have therefore *not* been included in this section.**

3.2 Impact analysis

Based on the findings of Chapters 2 and 3.1, this section and the next one propose specific interventions in order to align the Cypriot energy system with the priorities of REPowerEU. The recommendations that follow are the result of the intervention logic which is outlined in Table 5 below.

Table 5: Linkages between chapters of this report, which lead to recommendation of Chapters 3.2 and 3.3.

Chapter of the Country Report	Content	Findings
2	Energy related dependencies	Cyprus is almost independent of Russian fuel direct imports. However, significant challenges remain for the implementation of REPowerEU priorities: Energy savings are still modest, renewable energy penetration has accelerated significantly but stronger RES deployment is clearly needed, and the transport sector is still very inefficient and heavily dependent on fossil fuels.
		
3.1.1 - 3.1.5	Current policies and measures of national plans (NECP and RRP) and EC's Country-Specific Recommendations about each REPowerEU objective	<ul style="list-style-type: none"> • NECP targets in energy efficiency can be attained, but measures are insufficient for the more ambitious Fit-for-55 and REPowerEU objectives. • RES deployment is in line with NECP, and more ambitious RES targets are addressed from RRP and JTP - but implementation is key for the success of RREP and JTP measures • Electricity interconnections are essential • Very little progress in sustainable mobility <p>The above are confirmed by EC's Country-Specific Recommendations.</p>
		
3.1.6 - 3.1.7	Detailed assessment of the investment gap (REPowerEU targets vs, investments foreseen in RRP, Structural Funds, JTP, national budget)	<ul style="list-style-type: none"> • Investments foreseen for RES are sufficient to meet REPowerEU objectives, as long as they can be implemented on time • Important investment gap in energy renovations • Very serious investment gap in sustainable mobility • Adoption of energy efficiency grants and effectiveness of sustainable mobility investments are partly hindered by behavioural issue in the population.
		
3.1.8	Assessment of gap in reforms, based on findings of sections 3.1.1 - 3.1.7	<p>Additional reforms needed to clarify the regulatory environment in:</p> <ul style="list-style-type: none"> • energy communities (to enable RES deployment), • energy storage (to enable RES deployment), • electric mobility • hydrogen
		
3.2	Summary of proposed additional investments / reforms, timeline for their implementation, and potential impacts	
3.3	Proposal for reforms and investments to be added in the updated RRP, with emphasis on those related to renewable hydrogen deployment	

3.2.1 *Summary of potential investments and reforms in the context of the REPowerEU Initiative*

As a summary of the gap analysis and the proposed investments and reforms outlined in the previous sections, the following investments and reforms could be considered in the context of the REPowerEU initiative:

- Additional funds for energy renovations of buildings and sustainable mobility
- Creation of a behavioural insights team which will enable behavioural change of the population towards energy conservation and adoption of sustainable mobility habits; this is an investment of comparatively very low cost, which can also be considered as a reform because no such team operates in the Cypriot government up to now, in contrast to most EU and OECD countries.
- Institutional reforms related to the establishment of energy communities and the development of the institutional framework for energy storage and electric vehicle charging as outlined in Section 3.1.8 above.
- Institutional reforms to enable the deployment of hydrogen, combined with targeted investments on the production and use of renewable hydrogen; these have resulted from the in-depth support of this study and are described in more detail in Section 3.3 below.

Table 6 summarises the linkage between gaps and suggested reforms and investments.

Table 6: Summary of links between identified gaps in REPowerEU topic areas and suggested reforms and investments for Cyprus. The topic area of reduction of fossil fuel use in industry is covered by the first two topic areas of saving energy and accelerating renewables deployment, as explained in Section 3.1.

REPowerEU Priority	Gap	Suggested reform/investment to address the gap
Save energy	Funding gap for energy renovations in buildings	Additional funds for energy renovations of residential, commercial and public buildings
	Uncertainty about the possibility to implement all planned energy renovations on schedule in order to absorb all available EU funds. Apart from potential labour shortages, the uncertainty is also caused by the reluctance of many building owners to proceed with energy renovations.	Establishment of a Behavioural Insights Team to enable and/or accelerate the adoption of energy conservation and sustainable mobility measures by the population; this will address a part of the uncertainty causing the investment gap and can increase the uptake of energy efficiency investments
Diversify energy supply & Accelerate renewable energy deployment	Uncertainty about the possibility to implement all planned renewable energy projects according to schedule and to fully exploit the renewable energy potential, avoiding curtailment or other restrictions	Creation of institutional framework for the operation of Energy Communities and the participation of local authorities in such Communities
		Creation of institutional framework for the operation of all types of energy storage facilities, in addition to electricity storage that has been addressed by the adopted reform in the existing RRP
		Creation of institutional framework for the operation of charging points for electric vehicles
	Lack of complete regulatory framework for the deployment of hydrogen	Institutional reforms to enable the deployment of hydrogen in various economic sectors (part of the in-depth study of Chapter 4)
	Lack of cost-competitiveness of renewable hydrogen projects	Targeted investments to support the launch of production of renewable hydrogen and its use in industry and transport
	Uncertainty about the possibility to mobilise adequate private funds for electricity interconnection	Additional financial support for the electricity interconnections of Cyprus (if necessary)
Other (reducing fossil fuel use in road transport)	Funding gap for sustainable mobility investments	Additional investments to implement the existing Sustainable Urban Mobility Plans of Cypriot cities

3.2.2 *Impact assessment*

As already mentioned, Cyprus does not directly depend on oil or gas imports from Russia. Consequently, the potential additional investments and reforms to be considered in the context of the REPowerEU initiative as listed in the previous section will not improve the (non-existent) dependence of Cyprus on Russian energy; however, they can be very beneficial for reducing the broader dependency of the country on fossil fuel imports and accelerating the green transition of its economy. Table 7 below provides a first qualitative assessment of the potential impact of these additional investments and reforms, grouped according to the EU's REPowerEU Plan.

Table 7: Preliminary impact analysis of the identified reforms and investments. The topic area of reduction of fossil fuel use in industry is covered by the first two topic areas of saving energy and accelerating renewables deployment, as explained in Section 3.1.

REPowerEU Priority	Type	Name	Impact on REPowerEU objectives*	Timeline for main impact to materialise	Aim
Save energy	Investment	Additional funds for energy renovations of residential, commercial and public buildings	Medium	2023-2026	Improvement of energy efficiency of the building stock
	Investment / Reform	Establishment of a Behavioural Insights Team to enable and/or accelerate the adoption of energy conservation and sustainable mobility measures by the population	Medium in the short term; High in the long term	2023-2030	Improved effectiveness of the funds devoted to energy renovations and sustainable mobility, leading to higher energy savings
Diversify energy supply & Accelerate renewable energy deployment	Reform	Creation of institutional framework for the operation of Energy Communities and the participation of local authorities in such Communities	High	2023-2026	Increased deployment of decentralised renewable energy generation
	Reform	Creation of institutional framework for the operation of energy storage facilities	High	2023-2026	
	Reform	Creation of institutional framework for the operation of charging points for electric vehicles	High	2023-2026	Increased uptake of electric vehicles
	Reform	Clear definition of procedures for licensing of hydrogen projects	High	2023-2030	Acceleration of hydrogen deployment to replace fossil fuels
	Investment	Targeted investments to support the launch of production of renewable hydrogen and its use in industry and transport	High	2023-2030	
Investment	Additional financial support for the electricity interconnections of Cyprus (if necessary and appropriate in case of difficulty to ensure adequate private funds)	High	2023-2026	Higher penetration of renewables and enhanced energy security	
Other (reducing fossil fuel use in road transport)	Investment	Additional investments to implement the existing Sustainable Urban Mobility Plans of Cypriot cities	Small in the short term; High in the long term	2027-2030; post-2030	Reduction in the use of fossil fuels in road transport

* The qualitative impact assessment of investments is based on information from the broader impact assessment of the Cyprus RRP - see Table A4.6 on p. 588 of the [officially submitted national RRP](#). More specifically, the RRP report included an assessment of the effectiveness of green energy and sustainable mobility investments in terms of *energy savings per million Euros invested*. Combining that assessment with an estimation of the magnitude of the potential energy savings of each measure in the table provides an indication of the potential impact of additional investments that may be included in the revised RRP.

3.3 Proposal for reforms and investments in the context of REPowerEU

3.3.1 Overview

On the basis of all considerations and assessments provided in Chapter 3.1, the following additional investments and reforms could be considered in line with REPowerEU priorities, having a timeline until the end of the Recovery and Resilience Facility (August 2026). It must be underlined that the measures outlined below do not necessarily lead to compliance of Cyprus with the 'Fit-for-55' policy targets agreed at EU level, as the latter are valid for the year 2030, whereas the interventions mentioned in this section are meant to be those which can be implemented up to 2026.

a. Reforms

- Reform on the operation of Energy Communities and the participation of Local Authorities in such energy communities, and on energy cooperatives. This will allow municipalities and communities to be actively engaged in decentralised renewable electricity generation and will help maximise the exploitation of the country's renewable energy potential.
- Reform on the operation of energy storage facilities (not only for electricity storage that has already been addressed by legislation). This will ensure investments in various forms of energy storage, which will in turn promote the installation and full use (without curtailment) of intermittent renewable energy sources.
- Reform on the operation of charging points for electric vehicles. Clarifying the regulatory framework for charging points will encourage the penetration of electric vehicles in the market as it will facilitate their everyday use by both individual and commercial consumers.
- Clear definition of procedures for licensing of hydrogen projects. This is essential for the deployment of hydrogen in the Cypriot energy system and is further elaborated below as a result of the in-depth support of this study.
- Establishment of a verification regime for Guarantees of Origin for renewable hydrogen. This is also important for enabling the deployment of hydrogen and implementing the hydrogen strategy. Again, this has been one of the outcomes of the in-depth support of this study and is described in more detail below.

As mentioned in Section 3.1.8, the need for further reforms for the facilitation of renewable energy and energy savings investments depends on the completion of other ongoing projects and the experience to be gained through the real-world implementation of the digital one-stop shops. Therefore, further reforms on accelerating the permitting procedures are not included in this list and may not be necessary if the ongoing projects are implemented successfully. After the operation of these projects, if specific problems are identified that require a regulatory change, further reforms could be deployed to remedy such issues.

b. Investments

- Additional investments for energy renovations of buildings that can reduce the consumption of fossil fuels and boost the deployment of solar energy in the residential, commercial, and industrial sectors. These will comprise additional funds for energy renovations of residential and commercial buildings, i.e. an extension of the currently ongoing schemes listed in Table 2, to close the identified funding gap of €250-300 million. Such an extension can take the form of:

- Expanding the number of households/firms that can benefit from energy renovation grants or loans,
 - Increasing the number of households identified as ‘vulnerable’ in order to allow a larger part of the population to have access to the higher amount of subsidy available for vulnerable citizens¹⁸, and/or
 - Expanding the kind of interventions that can be supported, e.g. by including in the current schemes the installation of heat pumps or the replacement of white appliances as eligible expenses.
- Additional investments for energy efficiency in the industrial and agricultural sector. Expanding the support schemes that are directed to the agricultural and industrial sector can further exploit the energy saving potential in those sectors; for an effective implementation of such schemes, however, the realistic potential of these sectors has to be assessed in order to avoid underutilisation of the funds to be devoted.
 - Additional investments for sustainable mobility. These will involve providing additional funds for the implementation of the existing Sustainable Urban Mobility Plans (SUMPs), which can reduce the consumption of fossil fuels in road transport. SUMPs of the cities of Larnaca and Limassol have started being implemented, and some investments are already included in the current RRP. Further projects from the SUMP workplans can be considered in the context of the REPowerEU initiative; for this purpose, the most suitable and mature projects of the SUMP have to be selected by transport authorities. Although the funding gap identified in Chapter 3.1 for sustainable mobility investments is over €850 million, it is likely that projects of a much lower amount will be able to be implemented in the timeline of the RRP.
 - Additional financial support for the electricity interconnections of Cyprus (only if needed in case of difficulty to ensure adequate funds from the project promoters).
 - Establishment of a team to apply behavioural insights for the green transition in the fields of i) residential energy conservation and ii) sustainable mobility. In some cases, international experience has shown that additional funds for green investments may not be effective unless a proper communication campaign is implemented, and citizens’ behaviour is analysed in order to target green energy interventions to specific parts of the population. This Behavioural Insights Team, dedicated to energy and mobility topics, can help design new investments or adjust the existing RRP investments to increase the uptake of important energy renovations by the population, clearly highlight the economic benefits of such projects, and nudge citizens to use public transportation, as well as switching to micromobility and non-motorised transport modes more widely than today. Overall, this is a small investment (of the order of less than €1 million for the period of the RRP) that can induce large benefits in the medium and long term¹⁹.
 - Investments for financial support to renewable hydrogen projects. These can enable an early launch of hydrogen-related investments in the private sector, and are elaborated below.

¹⁸ This is in line with the decision announced by MECI on 22 August 2022 to expand the definition of vulnerable households to include about 30,000 additional people eligible for special support schemes for energy renovations.

¹⁹ For reasons of transparency, it has to be noted that the Cyprus Institute - a member of the country team of this project - has already proposed to the Finance Ministry of Cyprus to receive funding from the revised RRP to include a small Behavioural Insights Team in the Institute’s workforce, for the duration of the RRP. Currently there is no such team supporting policymakers in Cyprus, in contrast to [over 200](#) behavioural insights teams operating worldwide. We adopt this proposal in this report irrespective of whether the government will accept it and which entity may implement it, because the whole project team considers this to be a very useful and long-lasting investment for the Cypriot government, which - if successful - could later be expanded to support other governmental policies as well.

Note that the above recommendations do not include additional investments in large-scale renewable projects, because there is a very substantial number of such projects that have been already licensed and are about to be operational (e.g. about 300 MW of additional solar PV parks have paid grid connection fees and are expected to enter operation in 2023-2024). Further public support for large-scale renewables may not be needed and may not be effective if the already foreseen investments in energy storage and grid modernisation are not realised.

It should be noted that the feasibility of implementation of the above investments and reforms - especially the investments - in the time frame of the RRP should not be taken for granted. This may be the case, for example, if the amount of additional RRP funds to be claimed by Cyprus will be limited (e.g. if the country will only request additional grants and not additional loans), and/or if implementation turns out to be difficult in some cases, e.g. because of shortages in technical human resources or in administrative capacity of the country. Based on the relevant information provided by Cypriot authorities in the frame of this project, it is indeed very challenging to implement further investments in sustainable mobility and energy renovations by 2026. Even so, **since the above-mentioned measures are considered by our team to be important and realistic to deploy up to 2030, it might be possible to include some of them in the revised national RRP, and the rest could be included in other national or EU funding instruments that can be utilised within the decade (e.g. from Structural Funds from MFF 2021-2027, which can be spent up to 2029).** This does not apply to the above-mentioned proposals for reforms, because these reforms are possible to be implemented in the timeframe of the RRP.

3.3.2 Targeted reforms and investments to accelerate the deployment of renewable hydrogen in the energy system of Cyprus in line with the REPowerEU Initiative

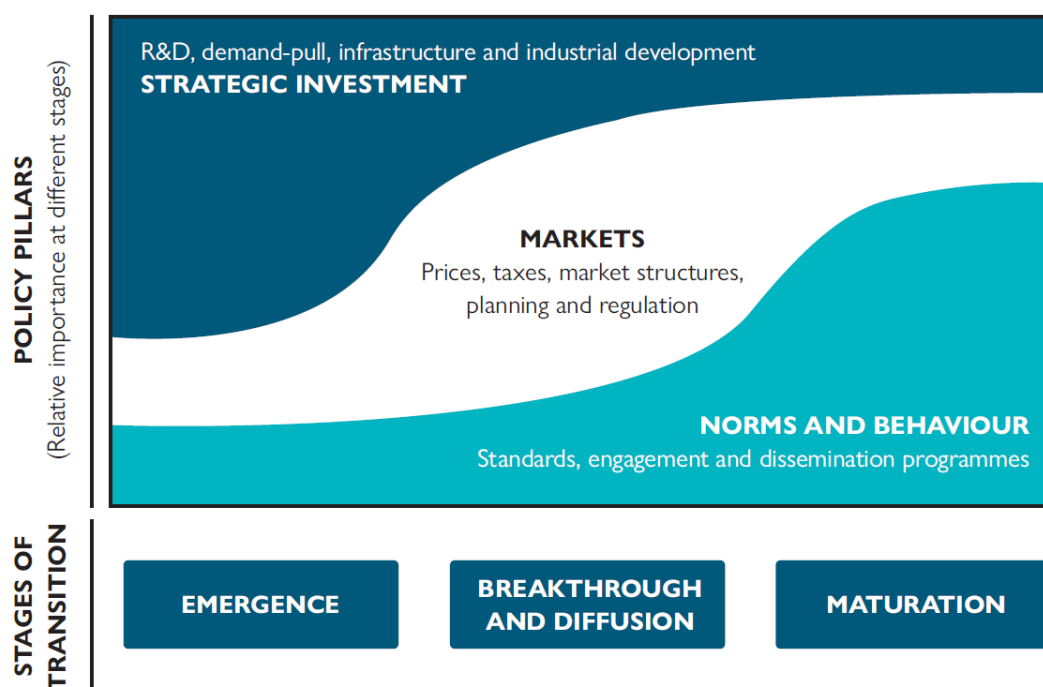
In line with the specific scope of the REPowerEU study for Cyprus, the following paragraphs describe **two proposed reforms and three proposed investments** that we find necessary to enable the timely deployment of hydrogen in the Cypriot economy. It must be clarified that the proposed investments and reforms outlined below focus on hydrogen-related measures, not necessarily because they are the most urgent ones for Cyprus to align with the priorities of the REPowerEU initiative, but because of the agreement between the European Commission and MECI that the technical support in this project should focus primarily on measures related to the national hydrogen strategy.

The rationale of these hydrogen-related interventions is the following:

- As far as regulatory reforms are concerned, there is an obvious need to provide clear guidelines for investors and the broader public on the rules governing the installation of hydrogen-related infrastructure, and to ensure that the hydrogen to be used in the economy will entirely originate from renewable energy sources.
- As regards the proposed investments, they aim at providing the launchpad for hydrogen deployment in Cyprus. Currently, neither the production of renewable hydrogen nor its use in different economic sectors is cost-competitive. However, it has been shown that several green energy technologies which are now mature and cheap have benefited from initial economic support from governments as part of their industrial policies, although they did not pass any cost-effectiveness or cost-benefit test. Prominent examples are the support to solar photovoltaics in Germany and the support to offshore wind power in the UK. Figure 3 illustrates the appropriate policy mix depending on the stage of development of a technology, which shows the importance of strategic investments for an emerging technology to mature²⁰. Therefore, keeping in mind the strong push of the entire EU towards renewable hydrogen, it would be advisable for the government of Cyprus to support the first applications of hydrogen production and use in order to kick-start the penetration of this energy carrier in the Cypriot economy, at the same time with similar pushes of other European governments.

²⁰ *The New Economics of Innovation and Transition: Evaluating Opportunities and Risks*. A Report by the Economics of Energy Innovation and System Transition (EEIST) Consortium, UK, 2022. <https://eeist.co.uk/download/557/>

Figure 3: Indicative evolution of policy mix over the course of a transition to a new technology. Source: Figure 9 in [The New Economics of Innovation and Transition](#).



In line with this argumentation, we propose the following reforms and investments:

Reform 1 - Facilitation of licencing procedure for projects of renewable hydrogen and refuelling stations

Challenges

The long-term sustainability of the economic growth model of Cyprus is facing challenges by rising external uncertainties and pending structural reforms. The European Commission's recommendations for Cyprus under the European Semester [Spring 2022 Package](#), in particular in its [Country Report \(CR\)](#) and the relevant [Country Specific Recommendations \(CSRs\)](#), include the need to expand public investment for the green and digital transition and for energy security, including by making use of the Recovery and Resilience Facility, REPowerEU and other EU funds; and to reduce overall reliance on fossil fuels and further diversify energy supply in order to reduce the country's energy import dependence. To address these challenges, Cyprus can greatly benefit from promoting the development of renewable hydrogen for several users (electricity production, transport and industry). Hydrogen could thus play a key role in decarbonizing the Cypriot economy in industries such as cement, heavy duty vehicle transport, and shipping. Hydrogen is a chemical energy carrier that addresses the storage and flexibility needs of a renewable energy source and can be complementary to renewable power generation in the path to decarbonisation, but only if produced via electrolysis based on renewable electricity.

Objectives

The proposed reform entails shifting towards a more efficient use of the economy's resources for sustainable development and enabling the use of renewable hydrogen by different end users. The reform involves clarifying the process of determining licenses, assigning the responsible authorities, as

well as modifying the legal framework and procedures of the digital One-Stop Shop under development so as to also include renewable hydrogen in its mandate.

The objective of the reform is to promote hydrogen technologies in general, and more specifically:

- To promote and facilitate the inland production and use of renewable hydrogen.
- To facilitate the transport and storage of hydrogen.

To facilitate attainment of these objectives, the reform also involves the appointment of a National Hydrogen Task Force, with the participation not only of governmental officials, but also of experts from various fields and domains (through an expression of interest), that will advise and support the Cypriot government in the formulation of legislative proposals. This is in line with the participation of stakeholders e.g. in the EU's Projects of Common Interest (PCI). The PCI identification process involves stakeholders active in the field of energy, such as consumer and environmental protection organisations. These stakeholder groups, along with business associations and academic researchers, can provide views on the pertinence and added value of the proposed projects. The National Hydrogen Task Force can follow this example and can be complementary and supportive to the role of the Technical Committee on Hydrogen, which mainly consists of administrative officials. This Task Force can meet *ad hoc*, whenever the Technical Committee on Hydrogen requests its support, and will only be able to provide opinions and recommendations, which will not be binding for governmental authorities.

Implementation

- i. Appointment of a National Hydrogen Task Force, through an open expression of interest.
- ii. Following recommendations from interviews that have been held with MECI officers in the frame of this project, the existing Technical Committee on Hydrogen, operating under the European Green Deal governance scheme in Cyprus, should be formally institutionalised through an Executive Decision (e.g. a decision of the Council of Ministers), so that it can operate under the One-Stop Shop that is under development for licensing renewable energy and energy efficiency projects. This will allow the Committee to have a decisive role in the facilitation of renewable hydrogen investments.
- iii. Under the current legal framework, the One-Stop Shop could facilitate production of renewable hydrogen but not other kinds of hydrogen-related projects such as hydrogen transport, storage and distribution activities. If necessary, a revision of this framework could be foreseen so that the One-Stop Shop will be able to facilitate investments in the entire value chain of hydrogen.
- iv. Preparation by the Technical Committee on Hydrogen of a short study that will address the following aspects:
 - Precise definition of the number and kind of licenses and procedures needed for a) renewable hydrogen production and b) hydrogen refuelling infrastructure projects.
 - Preparation of an investment guide for interested parties, including a list of the requirements for permits and the licensing process to be followed.
 - Clear definition of the limiting factors that will apply for the location of a) hydrogen production facilities and b) hydrogen refuelling stations. These limiting factors will ensure full compliance with the 'Do No Significant Harm' Principle.

If authorities that participate in the Technical Committee on Hydrogen do not have the necessary expertise, the government could procure a short study to address the above topics and thereby provide external assistance to the Committee.

- v. The results of this study will enable the Technical Committee on Hydrogen to prepare the licensing process for renewable hydrogen projects, to be approved by the Council of Ministers. The relevant legislation should also include mandatory licensing time schedules.
- vi. Moreover, based on the above-mentioned study, a clear policy should be established for the eligible locations of hydrogen production facilities and refuelling stations.
- vii. As soon as the licensing procedure is finalised, a specific module should be prepared to be added to the digital One-Stop Shop (through procurement of a short study for this purpose).
- viii. All concerned governmental services/departments will prepare modifications of the legislation they are responsible for, to include clear licensing procedures of hydrogen projects.
- ix. Training of governmental officials on clean hydrogen technologies.

Budget

If the study mentioned in point iii) above is to be assigned to external consultants, a limited budget of the order of €100,000 should be foreseen.

Time plan

Until mid-2024. More specifically:

- Steps i), ii) and iii) can be completed by Q2 2023
- The short study (step iv) can be completed by Q4 2023
- Regulatory steps following the study (steps v - viii) and training of officials (step ix) can be completed by Q2 2024.

Compliance with the 'do no significant harm principle'

Since this is a reform, compliance with DNSH is not an issue. The measure has no or an insignificant foreseeable impact on any one of the six environmental objectives related to the direct and primary indirect effects of the measure across its life cycle. The measure includes no infrastructure investments or purchase of equipment. Cross-cutting requirements for all RRP measures listed in Table 1 of the DNSH assessment of the current RRP of Cyprus²¹ will be implemented and are considered to be sufficient for ensuring that the reform complies with the DNSH principle and no further substantive assessment is needed.

Complementarity and/or substitution with other measures

This reform is complementary with reform 2 below; it does not substitute any previous measure because it involves the establishment of new regulatory framework.

Expected results and contribution to REPowerEU objectives

This reform is crucial for enabling a smooth introduction of hydrogen investments in the economy of Cyprus. It is fully compliant with the REPowerEU objectives of reducing fossil fuel imports and diversifying energy supply.

²¹ See Table 1 in Annex 3 of the [official RRP](#) of Cyprus.

Reform 2 - Establishment of a verification regime for Guarantees of Origin

Note: The Cyprus Energy Regulatory Authority is the legally competent authority for this reform and will need, in cooperation with MECI, to design and implement this reform. These authorities can clarify the regulatory regime and the actual reform needs, also in view of the relevant upcoming Delegated Act of the European Commission.

Challenges

Apart from the production of renewable hydrogen, the regulatory and financial environment must enable its use by potential end-users. Hydrogen consumers from industry and transport can reduce their carbon footprint by purchasing Renewable Hydrogen Guarantees of Origin, which will allow them to consume renewable hydrogen and count it as a zero-carbon energy source. The Guarantee of Origin (GO) scheme is essential for labelling the origin of the product, thus providing transparency to consumers and creating the necessary market-pull for renewable hydrogen.

Objectives

The aim of the proposed reform is:

- To enhance the process of issuing the Guarantees of Origin of green electricity that supply the production of renewable hydrogen.
- To enable the proper labelling of renewable hydrogen that a hydrogen-consuming installation will use. The Guarantees of Origin and the verification regime for renewable hydrogen should be in line with the Renewable Energy Directive 2018/2001/EU or any revision of it to be adopted in the frame of the 'Fit for 55' package, and with the upcoming European Commission's Delegated Act clarifying EU rules applicable to renewable hydrogen.

Implementation

Procurement of a study on the possible implementation of a GO verification scheme for renewable hydrogen in Cyprus. The study should recommend:

- The possible ways in which the GOs verification can enter the Cyprus market
- Who will be the issuing body(ies),
- The procedure and the legal amendments to be needed.

Based on the results of the study, legislative amendments will be put in place, after a recommendation of the National Technical Committee on Hydrogen, to be adopted by governmental authorities.

Budget

A limited budget of the order of €100,000 should be foreseen, for the external study mentioned above.

Time plan

- The study to be completed by Q4 2023
- Change in regulations and legislation to be completed by Q4 2024

Compliance with the 'do no significant harm principle'

Since this is a reform, compliance with DNSH is not an issue. The measure has no or an insignificant foreseeable impact on any one of the six environmental objectives related to the direct and primary indirect effects of the measure across its life cycle. The measure includes no infrastructure investments

or purchase of equipment. Cross-cutting requirements for all RRP measures listed in Table 1 of the DNSH assessment of the current RRP of Cyprus²² will be implemented and are considered to be sufficient for ensuring that the reform complies with the DNSH principle and no further substantive assessment is needed.

Complementarity and/or substitution with other measures

This reform is complementary with reform 1 above; it does not substitute any previous measure because it involves the establishment of new regulatory framework.

Expected results and contribution to REPowerEU objectives

This reform is crucial for enabling a smooth introduction of hydrogen investments in the economy of Cyprus. It is fully compliant with the REPowerEU objectives of accelerating renewable energy deployment, reducing fossil fuel imports and diversifying energy supply.

Investment 1 - Promotion of Hydrogen use in Transport

Note: The Ministry of Transport, Communications and Works will be responsible about the content and actual implementation of this investment.

Challenges

Based on the data by the Ministry of Energy, Commerce, and Industry of Cyprus, the country has reached a 17% share of RES in the final consumption, overachieving the binding target of 13% for the year 2020. Nevertheless, the transport sector is not performing at the same level. The 7.4% share of RES in the final consumption of the transport sector for the year 2020 (2.6% lower than the national target for that year) has been mainly attained by using biodiesel (consumption equal to 26,948 tonnes of oil equivalent).

Currently, there are support schemes for electrification of transport although the renewable energy share in electricity has not reached a level that would be sufficient to reduce the overall carbon footprint of transport. Therefore, an additional push to decarbonisation through the use of renewable hydrogen can be beneficial for reducing carbon emissions in the Cypriot economy.

Objectives

The investment involves governmental support schemes for:

- a) Hydrogen-fuelled heavy-duty vehicles (through modification of conventional heavy-duty vehicles or purchase of new vehicles); it will be applicable for businesses and local authorities that possess heavy-duty vehicle fleets (freight trucks, buses, garbage collection vehicles, etc).
- b) Hydrogen refuelling stations.

Implementation

- Mobilising funds for the scheme. The Support Scheme can be financed through either the RRP or the European Structural and Investment Funds or through revenues from ETS auctions.
- Drafting the Support Scheme by the Ministry of Transport, Communications and Works
- Public consultation on the draft support scheme

²² See previous footnote.

- Opinion from the National Hydrogen Task Force and recommendations
- Preparation of the application forms and mobilising resources for managing the scheme

Budget

Total cost of the measure could be €25 million - €15 million for 50-70 heavy-duty vehicles²³ and €10 million for 15 hydrogen refuelling stations²⁴. The amount of grants to be provided through the support scheme (i.e. the percentage of this total cost) would vary depending on the funding source (RRF, EU Structural Funds, or national funds) and its specific provisions.

Time plan

- Draft support scheme to be ready by Q2 2024
- Scheme to be announced before the end of Q4 2024

Compliance with the 'do no significant harm principle'

This investment will be fully compliant with the DNSH principle across all six environmental objectives related to the direct and primary indirect effects of the measure across its life cycle, in line with the guidance provided in Commission Notice C(2021) 1054 final, similarly to other related investments and support schemes that are included in the current national RRP of Cyprus.

Complementarity and/or substitution with other measures

This investment is complementary with investment 3 below and requires the completion of reforms 1 and 2 above; it does not substitute any previous measure because it involves the purchase of new technology vehicles and installation of hydrogen refuelling stations that did not previously exist.

Expected results and contribution to REPowerEU objectives

This reform is crucial for enabling the use of renewable hydrogen in some end-use sectors. It is fully compliant with the REPowerEU objectives of reducing fossil fuel imports, especially in road transport, and diversifying energy supply. It is expected to lead to the consumption of hydrogen quantities in transport by 2030 that are in line with the outlook provided in the in-depth support study of this project, outlined in Chapter 4 and described in more detail in Annex III.

Investment 2 - Promotion of Hydrogen use in Industry

Challenges

The Cyprus industrial sector has a relatively low contribution to GDP. However, on the road to net zero carbon emissions, decarbonisation of Cyprus industries is essential but also a difficult task. The carbon intensity of the Cypriot economy decreased by close to 25 % between 2005 and 2019, at a slower rate than the EU average.

Objectives

²³ Cost of modification of an existing conventional heavy-duty vehicle: €170.000 (actual cost). Cost of purchase of a new hydrogen (fuel cell) heavy-duty vehicle: €300.000. It is more likely that new vehicles will be purchased because of limited knowledge on the modification of conventional vehicles to hydrogen powered ones.

²⁴ Cost of a hydrogen refuelling station: €700.000.

The objective of this investment is to foster the transition to hydrogen in the industrial sector. This will be done primarily by providing financial support for electrolysers and launching hydrogen pilot projects in industry.

Implementation

- Mobilising funds for the scheme. The Support Scheme can be financed through the RRP, the European Structural and Investment Funds, the Just Transition Fund, the national Renewable Energy and Energy Efficiency Fund, or through revenues from ETS auctions.
- Drafting the Support Scheme by the Industry Service of the Ministry of Energy, Commerce and Industry
- Public consultation on the draft support scheme
- Opinion from the National Hydrogen Task Force and recommendations
- Preparation of the application forms and mobilising resources for managing the scheme.

Budget

The total cost of the measure could be €10 million for the purchase of electrolysers of a total capacity of 10 MW. The amount of grants to be provided through the support scheme (i.e. the percentage of this total cost) would vary depending on the funding source (RRF, EU Structural Funds, or national funds) and its specific provisions.

Time plan

- Draft support scheme to be ready by Q2 2024
- Scheme to be announced before the end of Q4 2024

Compliance with the ‘do no significant harm principle’

This investment will be fully compliant with the DNSH principle across all six environmental objectives related to the direct and primary indirect effects of the measure across its life cycle, in line with the guidance provided in Commission Notice C(2021) 1054 final, similarly to other related investments and support schemes that are included in the current national RRP of Cyprus.

Complementarity and/or substitution with other measures

This investment is complementary with investment 3 below and requires the completion of reforms 1 and 2 above; it does not substitute any previous measure because it involves the purchase of new industrial equipment that did not previously exist.

Expected results and contribution to REPowerEU objectives

This reform is crucial for enabling the use of renewable hydrogen in some end-use sectors. It is fully compliant with the REPowerEU objectives of reducing fossil fuel imports, especially in industry, and diversifying energy supply. It is expected to lead to the consumption of hydrogen quantities in the industrial sector that are in line with the outlook provided in the in-depth support study of this project, outlined in Chapter 4 and described in more detail in Annex III.

Investment 3 - Scaling Up of renewable hydrogen production

Challenges

Currently, there is a very large investment gap for the production of renewable hydrogen, which makes this activity unattractive to public or private investors in monetary terms. The cost of electrolyzers is expected to decline in the near future, especially in active hydrogen markets where early incentives such as tax exemptions, contracts for difference, and carbon pricing have been adopted. The existence of such early incentives is important as investments could be mobilised at an early stage instead of waiting for a more mature market to be developed with some years' delay.

In view of the large investment gap, and in order to offset the early risk of adoption of electrolyzers, companies and investors should seek out subsidies for their operation costs as well as capital grants. For hydrogen innovators seeking growth funding, dedicated support could also be introduced to reduce their risks as renewable hydrogen production is less cost-competitive compared to that of natural gas-based (grey) hydrogen.

Government support will be essential to get the renewable hydrogen market off the ground. Support for electrolyser deployment will be necessary but likely insufficient by itself for the development of a hydrogen market, therefore it should be combined with the two other investments proposed above, for hydrogen end-users (transport and industry).

Objectives

The objective of this investment is to develop a support scheme for commercially scaling up projects aiming at CO₂ reductions through renewable hydrogen. This could be adopted as a temporary scheme for scaling up renewable hydrogen production and reducing the cost of final product in order to make it competitive during the first years of its introduction in the Cypriot energy system.

Such a scheme should only apply for projects that exceed the level of experimental pilots and demonstration projects and have been scaled up to commercial scale.

At the same time, this support scheme cannot be developed individually, as the end users are necessary for the proper functioning of the hydrogen value chain. Therefore, it should be combined with Investments 1 and 2 mentioned above.

Implementation

- Mobilising funds for the scheme. The Support Scheme can be financed through the RRP, or by revenues from ETS auctions, or the national Renewable Energy and Energy Efficiency Fund. It can include grants for investment support and/or subsidisation of operational costs, depending on the project.
- Drafting the Support Scheme by the Energy Service of the Ministry of Energy, Commerce and Industry
- Public consultation on the draft support scheme
- Opinion from the National Hydrogen Task Force and recommendations
- Preparation of the application forms and mobilising resources for managing the scheme.

Budget

Based on actual and up-to-date market data, the total cost of the measure could amount to €21 million for three hydrogen production projects (€7 million per project that could include an electrolyser of up to 3 MW capacity, a capacity that is appropriate for the size of industrial units in Cyprus; water purification equipment; and hydrogen storage equipment). The amount of grants to be provided through the support scheme (i.e. the percentage of this total cost) would vary depending on the funding source (RRF, EU Structural Funds, or national funds) and its specific provisions.

Time plan

- Draft support scheme to be ready by Q2 2025
- Scheme to be announced before the end of Q4 2025

Compliance with the ‘do no significant harm principle’

This investment will be fully compliant with the DNSH principle across all six environmental objectives related to the direct and primary indirect effects of the measure across its life cycle, in line with the guidance provided in Commission Notice C(2021) 1054 final, similarly to other related investments and support schemes that are included in the current national RRP of Cyprus.

Complementarity and/or substitution with other measures

This investment is complementary with investments 1 and 2 and requires the completion of reforms 1 and 2 above; it does not substitute any previous measure because it involves the installation of new equipment for the production of renewable hydrogen that did not previously exist.

Expected results and contribution to REPowerEU objectives

This reform is crucial for enabling the existence of renewable hydrogen, which will then be available for use in the industry and transport sectors (in line with investments 1 and 2 above). It is fully compliant with the REPowerEU objectives of accelerating renewable energy deployment, reducing fossil fuel imports and diversifying energy supply. It is expected to lead to the production of quantities of hydrogen that are in line with the outlook provided in the in-depth support study of this project, outlined in Chapter 4 and described in more detail in Annex III.

3.3.3 Assessment of the quantitative impact of the hydrogen-related investments

Based on detailed technoeconomic calculations available in the form of spreadsheets, which have been delivered as an annex to this report), the three investments mentioned in the previous section can lead to the following substitution of fossil fuels in the Cypriot energy system:

Investment 1: Retrofitting or replacement of 70 heavy duty vehicles burning diesel oil with ones using renewable hydrogen can save 380 tonnes of oil equivalent (toe) of diesel oil per year, or less than 0.1% of annual fuel consumption in road transport.

Investment 2: The use of electrolyzers of 10 MW capacity in high-temperature industrial processes could lead to annual savings of about 370 toe of heavy fuel oil²⁵, or 4-6% of the final consumption of heavy fuel oil in the industrial sector of the country.

Investment 3: Supporting renewable hydrogen production units of 9 MW capacity in total could produce about 1120 tonnes of hydrogen, which could replace:

- about 4.5 ktoe of automotive diesel if this hydrogen is used for heavy vehicles (1-1.5% of annual automotive diesel use in Cyprus),

²⁵ Based on available industrial data, the calculation assumes for the electrolysis and the maximum hydrogen production the following: (i) electrolyser load of 2000 hours, and (ii) hydrogen flow rate of 8.9 kg/h. An efficiency of 85% is assumed for a fuel oil industrial boiler, and a corresponding efficiency of 60% for a hydrogen boiler. assumptions can be found in Annex III of the Country Report and the corresponding calculation spreadsheets provided.

- or about 0.15 ktoe of marine fuel oil if this hydrogen is converted to ammonia²⁶ and used in shipping (0.1% of annual marine fuel oil sales).

The above indicate that the proposed investments will only have a very small impact on the reduction of the dependence of the country on imported fossil fuels; however, as mentioned above, they are meant to kick-start the deployment of hydrogen in Cyprus, in line with the intervention logic illustrated in Figure 3, without providing too many grants that risk failing in the absence of maturity in the market.

²⁶ Based on available market data and specifications, the calculation assumes for the electrolysis and the maximum hydrogen production the following: (i) a maximum possible electrolyser load of 7000 hours, and (ii) maximum hydrogen flow rate of 17.8 kg/h. The conversion of hydrogen into ammonia is based on the following conversion factor: 3.14 kg of H₂ to kg NH₃. The energy content of ammonia is taken equal to 18.8 MJ/kg (lower heating value) and an efficiency of 50% for oil-based internal combustion engines in shipping is assumed. These assumptions can be found in Annex III of the Country Report and the corresponding calculation spreadsheets provided.

4 In-depth support on priority areas

4.1 Overview

Overall, this chapter analyses the areas of in-depth support identified by the Member States as confirmed in the inception phase, to the extent they are considered as valid, cost-effective options. It also indicates the work needed to develop detailed action plans, assessments, or other types of supporting documents for the identified areas.

In the frame of this project, Cyprus has requested for in-depth support in the following topics:

- Accelerating the roll-out of renewable hydrogen and other suitable forms of fossil-free hydrogen (Priority area nr 3), and
- Hydrogen solutions for the industrial sector and measures to enable the roll-out of these solutions in a socially fair manner (Priority area nr 7).

Due to the close topical proximity between the two priorities, the analysis on the industrial sector (point 2 above) is embedded in the same chapter as a sub-heading. The rest of chapter 4 of this country report provides a summary of the in-depth support provided with regard to the prospects of the use of hydrogen in Cyprus. The full report is provided as Annex III to this country report.

4.2 Summary of views of national stakeholders

Two questionnaires have been prepared - one online questionnaire for stakeholders from the public and private sector and from NGOs; and a more specific questionnaire to be addressed to representatives of public authorities which are responsible for providing licenses to hydrogen projects, in the frame of dedicated interviews. The questionnaires are provided in Annex I and Annex II, respectively. The former questionnaire, which was sent out to all the stakeholders listed in the Inception Report on 1 August 2022, includes sections on the broader investments and reforms that could be considered in the context of the REPowerEU initiative. These have also been informed by an open discussion that took place on 5 July 2022 in the frame of an online [event](#) ('energy stakeholder dialogue') which was organised by the European Commission and its Representation in Cyprus.

4.2.1 *Political, Economic, Social, Technological, Legal, and Environmental (PESTLE) Analysis*

The content of the online questionnaire was discussed and agreed with MECI and is provided in Annex I of this country report. As PESTLE stands for "Political, Economic, Social, Technological, Legal and Environmental" factors, the questionnaire created by the country team (Cyl, ideopsis Ltd) was divided into these sections including questions related to each one of them. Yet, to obtain more information to the related topic as possible, there were three more sections (Parts C, D and E) added to the questionnaire other than the PESTLE factors, which were related to the already existing policies and instruments of Cyprus (referred to them by name in the questionnaire) and the ways these can be improved to assist the Hydrogen Strategy in Cyprus but also to assist Cyprus in achieving all priorities of REPowerEU.

The questionnaire was sent to 41 stakeholders and was answered by 31 out of them - see the detailed report of the PESTLE analysis in Annex I. The questionnaire was open for the period of August-

September 2022 and the stakeholders were informed through email and contacted by phone. Participants encompassed stakeholders working in different sectors: representatives of governmental/semi-governmental organisations, the potential hydrogen distributors, businesses with potential to produce hydrogen, potential hydrogen users, business associations and people from the academic community.

After the collection of 31 PESTLE questionnaires filled by participants, the analysis was separated into different sections. Firstly, questionnaires were analysed for each stakeholder group, identifying the weighted score for the importance of each factor. This way results were obtained for each of the group of stakeholders individually to identify the most important factors for them. A second analysis was performed to identify the most and least important factors identified by all of the participants for each of the PESTLE factors. As each stakeholder group has identified different factors as the most and least important, the average weighted score for the PESTLE factors can differ from what has been chosen by the groups individually.

The results for *Political* factors from all the stakeholders' groups for this section showed that the factor "Understanding by the government and government policy on the necessity of promoting Hydrogen" is the most important sub-factor within the political factors and the "Ease of decision-making and facilities for the development of Hydrogen infrastructure" factors is the least important one. According to the results obtained from the second step of the analysis about the *Economic* factors, the most important ones identified by the average weighted score from all the stakeholder groups is the "Availability of financial instruments and lending facilities". In the economic factors category, the "Freedom of the press" has been selected as the least important. However, the results differ for some of the stakeholders' groups, as explained in more detail in the full report in Annex I.

For the *Social* Factors, the "Acceptance of Hydrogen technologies by local government and central government" was voted the most important, whereas the least important factor has been scored as the "Attitude towards the labour market or Market potential in the development of new skilled jobs". On *Technological* factors, the most important one turned out to be the "Existence of energy storage systems", although governmental services were found to believe that the most important technological factor is the "Maturity of technology versus other competing technologies"

As regards the *Legal* Factors, seems to be one of the most important for the questionnaire participants as most of the factors included within the category have been rated as important. Calculating the average weighted score of the factors, the most important factor is found to be the "The absence of urban planning or other regulations". Finally, regarding *Environmental* factors, "Implementation of stricter European energy and climate legislation" was identified as the most important factor for all stakeholder groups except potential hydrogen distributors. Business associations have additionally voted the "Environmental values of customers" as one of the most important, yet no other group has voted for this factor.

Other than the PESTLE analysis as such, the questionnaire included further questions (Parts C, D & E) to identify the important investments and actions to be included during the development of the Hydrogen Strategy of Cyprus. In Part C, factors related to additional investments and priority reforms for Cyprus government to promote Hydrogen were identified as the most important ones. Part D of the questionnaire, related to the utilization of the Revised Recovery and Resilience Plan of Cyprus to

accelerate the green energy transition in Cyprus and minimise the use of fossil fuels in the country, led to the finding that “Additional resources to the Recovery and Resilience Plan to promote energy storage” was found to be considered as one of the most important factors. Potential hydrogen users considered the factor “Additional resources to the RRP for energy modernisation and reduction of greenhouse gas emissions in industry” as one of the most important ones, whereas potential hydrogen distributors have considered “Additional resources to promote sustainable mobility” as an important factor. Finally, Part E included factors related to the obstacles that pose risk for the implementation of the RRP related to the green energy transition of Cyprus. The factor “Lack of an appropriate regulatory framework to facilitate faster RES penetration” was identified as the most important factor of the category by half of the stakeholders, whereas others considered “Lack of a simplified procedure (fast track) for the licensing of RES projects” as a very important one.

In summary, responses from Parts C, D and E of the online questionnaire show that most stakeholders:

- *Recommend including additional resources in the RRP for energy storage, building renovations, and promotion of renewable energy sources and sustainable mobility in order to accelerate the green energy transition of the Cypriot economy.*
- *Find it important to foresee additional resources for hydrogen production, hydrogen use in transport, and broader energy storage support schemes in order to facilitate the deployment of hydrogen in the Cypriot energy system.*
- *Consider as the main obstacle to the green transition the lack of an appropriate regulatory framework to facilitate faster RES penetration and the lack of a simplified procedure (fast track) for the licensing of RES projects.*

A detailed presentation of all results of the online questionnaire is provided in Annex I.

4.2.2 In-depth interviews

Following the online questionnaire and the analysis outlined in the previous section, the country team asked stakeholders who responded to that questionnaire to participate in personal interviews related to specific technical, regulatory and financial aspects on the deployment of hydrogen in Cyprus. The questions of the interviews were discussed and agreed with MECI and are provided in Annex II of this country report. 22 of the 31 stakeholders agreed to be interviewed. The interviews were held online between August and October 2022 and were recorded, with the consent of the interviewees. A summary report of the answers of all interviewees is provided (in Greek) in Annex II of this report. In the following paragraphs we summarise the main findings of this procedure focussing on the views that were shared among the majority of interviewees.

Almost unanimously, the interview participants agreed that the overall licensing supervision for the plants producing hydrogen, should be under the Ministry of Energy, Commerce, and Industry (MECI) and more specifically under the Ministry’s Energy Service. However, there were also some different answers referring to the Department of Electromechanical services of the Ministry of Transport, Communications and Works as the potential supervising authority as well as to the Cyprus Energy Regulatory Authority (CERA). Some also answered that there might not be any need for the identification of any supervising authority.

The participants have identified an extended list of governmental services and departments which are important for the licensing of the hydrogen production plants (HPP). These include the following: Energy Service (MECI), Department of Electromechanical Services, Department of Labour Inspection, Department of Town Planning and Housing, Department of Environment, Department of Road Transport, Department of Public Works, District administration offices, Cyprus Energy Regulatory Authority, Cyprus Transmission System Operator, Cyprus Distribution System Operator. The following authorities were mentioned to a lesser extent, but they have still been mentioned as important for the procedures: Shipping Deputy Ministry, Water Development Department, Cyprus Ports Authority, Cyprus Fire Service, and other Departments of the Ministry of Agriculture, Rural Development and the Environment.

The incorporation of hydrogen within the One-Stop Shop procedures (which is currently being set up for licensing of energy efficiency and renewable energy projects) was mentioned by all the participants as a great way to develop a national contact point for hydrogen. In addition, the proper operation of the One-Stop Shop will also solve the scheduling issues and can happen under the supervision of MECI and the appointed person in charge for the resolution of any issues related to licensing. Moreover, a licensing guide from each Department and Ministry mentioned above - individually or jointly - should be developed to provide the applicants with the clear information needed in terms of the stages to be followed to obtain all necessary licenses as well as a licensing timeline.

Furthermore, some stakeholders mentioned that the hydrogen production license application form to be developed should be part of the One-Stop Shop. In general, the development of a specific Hydrogen production license form seems important to the participants. A specific license for the connection of the production plant to the electricity grid is not necessary.

Guarantees of origin were mentioned as one of the procedures that could assist in ensuring that the electricity used for the production of renewable hydrogen is sourced from Renewable Energy Sources (RES). However, it is important to mention that potentially, this will only be regulated by the forthcoming *Commission Delegated Regulation supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin*. Moreover, the energy used from RES will require a combination of the excess electricity of the grid and production of electricity from RES.

The determination of specific geographical locations is believed to make the licensing process simpler and easier. Some interviewees said that the use of the existing locational policy for RES projects could assist in this process. Some participants believe that this might not be necessary as big hydrogen production plants will be in industrial zones. However, it was mentioned that it is important to review those areas which might not fall under the specific locations mentioned above.

As water resources are crucial for the production of hydrogen, the participants specified that the water should be from a source with a low energy and carbon footprint. Whether it must be mandatory or not to use water from such sources was not agreed between the participants, as some believe that making the water source specifications mandatory will unnecessarily influence the hydrogen market of Cyprus.

Awareness campaigns on the importance of hydrogen, its uses and its production, are important so that the public can accept the new technologies that will eventually emerge in the economy of Cyprus.

Training of competent people within governmental Departments is crucial as they will be the ones promoting and supporting the production of hydrogen in the end.

It is believed that renewable hydrogen production needs support for reducing its costs (including the network usage costs), tax exemptions, and in general subsidy schemes. Support of hydrogen users and companies with heavy vehicles is also important in order to launch a hydrogen market in Cyprus for end users. In the case policymakers aim at more ambitious goals, it is believed that the goals to be defined in the National Energy and Climate Plan of Cyprus (NECP) that is currently under revision, satisfies this need.

When it comes to hydrogen refuelling stations, the provision of a manual with the licensing guidelines is considered important to inform the relevant stakeholders on the authorities involved and the documents required to obtain license for the station. The licensing guidelines can also include provisions related to the sites where hydrogen refuelling stations can be located. Whether or not they should be allowed in places where conventional fuel is currently filled (e.g. gas stations) is not clear; both positive and negative views of stakeholders have been recorded on this question, thus this aspect should be further examined.

Moreover, the development of special rules by the authorities, possible in the form of a Code of Practice, is necessary. It is advisable to give a legal status to those special rules (i.e. regulation, decree, regulatory decision).

Objectives developed by the NECP seem to be sufficient by the participants when it comes to the development of more ambitious national targets for Hydrogen supply infrastructure. Those targets should have a 2030-2035 horizon.

In the case of hydrogen storage, special regulatory decisions already exist in other countries, thus they could be adapted to the Cypriot legislative context, taking into account the relevant European and International Standards, as well as the Seveso Directive specifications. Yet, it is believed that when it comes to special support programmes for storage it is too early to provide views about them. This can be the reason why participants believe that no one should be obliged to store excess electricity yet in the form of hydrogen, as it is too early and no hydrogen technologies are used in Cyprus yet; therefore, establishing obligations before the hydrogen market starts operating in Cyprus will complicate procedures and might have a negative impact on the hydrogen market.

It is important to create hydrogen clusters in the industrial sector, where multiple users can use renewable hydrogen for their needs. Potential locations of such clusters must be identified early enough. For this purpose, it is crucial to engage industrial actors in this process through consultations. This will enable providing specific incentives that will be targeted to the needs of the industry to incorporate hydrogen use.

The potential for hydrogen use in residential buildings is much more limited in view of the absence of a gas distribution network and the cost-competitiveness of heat pumps, photovoltaics and solar water heaters.

Creating hydrogen communities is an interesting idea, e.g. in tourist areas where several hotels could use it for heat generation - but not for the immediate future. This, however, requires the construction of a district heating network in these areas - which currently does not exist. At a first stage, a pilot district for heating/cooling network could be developed, powered by renewable hydrogen.

Hydrogen should be promoted for use in heavy duty vehicles and buses. Therefore, it was agreed that a special strategy for the promotion of hydrogen in transport could be initially supporting those vehicles. However, some interviewees clarified that the strategy to be developed should take into account the ongoing electrification of the transport sector. When it comes to the implementation of immediate plans for vehicle replacement to hydrogen vehicles, participants believe that there is no infrastructure to do this yet, but in the long term this idea will be more useful for the replacement of large vehicles.

In the case of hydrogen and its relationship with the maritime sector in Cyprus, some of the participants believe that this might not be necessary for Cyprus as there are no construction plants or anyone designing zero-emission ships in the country. Yet, others believe that small demonstration projects might be important to raise awareness. Also, it was suggested that in the development of new Marinas in Cyprus the provisions of hydrogen infrastructure should be included. On the other hand, the use of hydrogen in aviation (directly or through the production of synthetic fuels) is less attractive; the participants believe it is not a priority for Cyprus and that the European Union will deal with it through its programmes as well as the ETS.

In general, the involvement of stakeholders in the development of the hydrogen economy in Cyprus should be enabled through workshops, consultations and in general bringing everyone in contact to co-develop the new hydrogen market. When it comes to the development of a business model which will provide revenue support to low-carbon hydrogen producers, the participants believe that it will indeed be necessary, and the funds can be obtained from the ETS. However, some stakeholders expressed views against mandatory caps and commitments these might be distorting the market.

CERA was identified by most of the participants as the potential regulatory body to be responsible for the regulation of hydrogen projects, yet some have expressed preference for MECI to be the supervisory authority. The regulatory changes across the hydrogen value chain will be the decision of the potential regulatory body.

The participants believe that there is no need for a specific reference to hydrogen in the texts of international cooperation agreements signed by the Republic of Cyprus; but when referring to RES in any of international agreements, hydrogen should also be mentioned. When it comes to the exporting capacity of Cyprus, participants believe that it is necessary to create the appropriate infrastructures first, and explore export options at a later stage.

Research and innovation for Hydrogen technologies should be supported according to the interviewees, but in a broader context, under the umbrella of green technologies to be consistent with national energy and climate goals. Industrial funding for hydrogen-related research and innovation is crucial. Moreover, a National Research & Innovation Working Group for Hydrogen could be created by the Research & Innovation Foundation (RIF) with a consultative role.

Finally, the participants unanimously believe that there is a lack of know-how in Cyprus and the development of training programs is necessary for the development of the hydrogen market, along with appropriate information and awareness campaigns.

Many of the above points have been taken into account when preparing the new investments and reforms related to hydrogen deployment that have been suggested in Chapter 3.3. above.

4.3 Summary of the in-depth support on the national hydrogen strategy of Cyprus

Annex III of this report provides an analysis of the prospects for deployment of hydrogen in the Cypriot energy system, reflecting the strong support envisioned in the EU Hydrogen Strategy and the REPowerEU initiative, and in light of the large uncertainties surrounding the technological and infrastructure development of this energy carrier.

In summary, after an extensive review of techno-economic data (those provided by E3Modelling in the frame of this project as well as those more broadly available in the international literature), input from experts in the field, and interactions with national stakeholders, the following conclusions have been drawn:

- Small, isolated energy systems without a robust industrial base are a less favourable case for rapid and deep hydrogen deployment.
- Because of the renewable energy (mainly solar) potential of Cyprus, direct electrification may make a better case than hydrogen in low- and medium-temperature industrial processes as well as for satisfying heat demand in most residential and commercial sectors.
- Some end uses of hydrogen may not be suitable for smaller, isolated systems - e.g. for road passenger vehicles.
- However, hydrogen may be appropriate for other uses (such as in industrial clusters utilizing hydrogen in high-temperature industry and for heavy vehicles, and in the maritime sector).

These findings have led to the definition of two preliminary scenarios - a 'cautious' and an 'aggressive' one - on the deployment of hydrogen by 2030 and 2050. The cautious scenario foresees almost no penetration of hydrogen in 2030. According to the 'aggressive' scenario, which has as a pre-requisite both strong infrastructure investments and fast technological progress, hydrogen use could evolve:

- In the cement industry, covering up to 10% of its energy needs if the infrastructure is available by 2030, and up to half of its energy needs by 2050;
- In the bricks and tiles industry after 2030;
- In trucks and buses, accounting for about 4% of total energy consumption in road transport and up to over 15% in 2050;
- In shipping and aviation, covering a very small fraction of fuel demand by 2030 and most of the fuel demand by 2050, in the form of hydrogen derivatives (most likely ammonia for shipping and e-kerosene for aviation).

The above will require active policy interventions and substantial investments in a) renewable energy capacity, b) electrolysers for hydrogen production, and c) equipment and vehicles for the use of hydrogen in different sectors. The report has provided an estimate of the different costs associated with the two scenarios mentioned above; these costs, especially the long-term ones for 2050, have to be treated with caution as many of the technologies are at a low level of development and there is

large uncertainty about the rate of technical progress (and the resulting potential future cost reductions) as well as the actual costs of building all the infrastructure needed for the entire supply chain of hydrogen.

The outcome of this report and the data that have been collected and used for the technoeconomic calculations shown here will provide input for the revision of the country's National Energy and Climate Plan, which is due in a draft form in June 2023.

It must be clarified that the proposed investments and reforms that were included in Section 3.3 have focused on hydrogen-related measures, not necessarily because they are the most urgent ones for Cyprus to align with the priorities of the REPowerEU initiative, but because of the agreement between the European Commission and MECI that the technical support in this project should focus primarily on measures related to the national hydrogen strategy.

5 Summary of hands-on support

The national authorities of Cyprus have not requested hands-on support.

Annexes to the Country Report

- I) Detailed report of the PESTLE analysis, including the online questionnaire sent to stakeholders from public authorities, private sector and non-governmental organisations
- II) Detailed report of the follow-up personal interviews with selected stakeholders, including the relevant questionnaire (in Greek)
- III) In-depth support to the government of Cyprus on its National Hydrogen Strategy

Trinomics B.V.
Westersingel 34
3014 GS Rotterdam
The Netherlands

T +31 (0) 10 3414 592
www.trinomics.eu

KvK n° : 56028016
VAT n° : NL8519.48.662.B01



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