



THE ENERGY SECTOR: DEVELOPMENTS AND PROSPECTS*

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I INTRODUCTION

The crisis that hit the Greek economy over the 2008-2016 period made clear that Greece's growth model was characterised by structural weaknesses. The preceding economic boom was almost entirely led by domestic demand, underpinned by low-cost credit. During the current transition period, it is imperative to develop a new growth paradigm that will help the economy to embark on a vigorous and sustainable growth track.

This new growth model must rely on exports of tradable goods and services, import substitution and capital inflows, mainly investment.¹ With regard to investment, the bulk of available resources should be channelled into the tradable sectors to enhance economies of scale, expertise and international competitiveness. Therefore, those sectors with a major comparative advantage for the country need to be fully exploited. Such sectors are tourism, shipping, energy, logistics, and the primary sector (see for instance DiaNEOsis 2016, Karavias and Anastasatos 2018, and McKinsey 2011).

Against this background, the energy sector is a key driver of transition to sustainable and export-led growth. It comprises the generation, transmission, distribution and supply of electricity; the import, refining and trading of petroleum products; and the import, storage and distribution of natural gas.² According to national accounts data published by ELSTAT, the sector's contribution in 2016 was small in terms of Gross Value Added (GVA) (3.6%) and employment (0.8%).³

Nevertheless, the energy sector can greatly improve Greece's economic prospects, as it has

three major comparative advantages (see among others Vettas 2016): (1) Significant sources of energy and natural resources, namely renewable energy sources (RES) such as solar and wind energy. (2) A strategic position that is key to the deployment of trans-European energy interconnection and transmission grids. (3) A fairly clear regulatory framework, actually due to the transposition of EU regulations into Greek law, which creates a relatively stable business environment.

At the current juncture, the Greek energy sector is still marked by considerable weaknesses, such as high energy consumption per unit of GDP, strong dependency on energy imports, limited use of RES, and high energy prices. Consequently, any policy measure addressing those weaknesses is expected to have multiple positive effects on economic activity.

The development of the energy sector is expected to contribute to the improvement of the trade balance, as: (1) The use of domestic resources in energy production, coupled with higher energy efficiency, is expected to lead to a reduction in energy imports. At the same time, in the long run, the use of domestic resources is expected to affect favourably energy exports.

* The views expressed in this article are of the authors and do not necessarily reflect those of the Bank of Greece. The authors are responsible for any errors or omissions.

1 This process is already under way, given that exports as a percentage of GDP have risen over the 2009-2017 period, mainly on account of the strong negative impact of the recession on domestic demand; yet this shift must be further supported and sustained in the long term (see Bank of Greece 2016a and 2018).

2 The broader energy sector also refers to activities related to the construction, installation and maintenance of energy production and distribution equipment, as well as the provision of energy saving and energy efficient products and services.

3 Calculations take into account GVA and employment in sub-sectors that are related to coal and lignite mining, natural gas extraction, manufacture of coke and refined petroleum products, and supply of electricity, gas, steam and air conditioning.

(2) A secondary effect coming from the use of domestic resources and the energy market deregulation is a decrease in energy prices. Given that energy constitutes the main input in all production activities, low energy prices are expected to be reflected in low production costs. This translates into competitiveness gains for the Greek tradable goods and services, which in turn will make exports to increase and imports to decrease. In other words, the development of the energy sector will have an additional positive effect on the trade balance. Low energy prices also have a favourable downward effect on households' cost of living.

In addition, the sector's development based on the country's comparative advantages and under the European regulatory framework is expected to attract investment with positive effects on the production capacity of the Greek economy.

A positive coincidence is that the development of the energy sector is currently being promoted by the European Union (EU), as it is in line with its core objectives. The three main aims of the EU's energy policy are the following: (1) sustainable development, aimed at changing the energy mix to address climate change; (2) security of energy supply; and (3) energy market deregulation in an effort to reduce production costs in the EU and raise its competitiveness. The EU has pursued a number of legislative interventions and operational programmes and has clearly defined these three aims of its energy policy, which are also referred to as sustainability, energy security, and competitiveness, since as early as 2007.

Actually, especially with regard to the first objective of sustainable development, the EU has assumed a leading role in addressing climate change, having set concrete energy and climate targets for 2020, 2030 and 2050. The targets to be met by 2020 are: to cut greenhouse gas (GHG) emissions by at least 20% below 1990 levels; to raise the share of RES in energy consumption to 20%; and to improve energy efficiency by 20%. The targets for 2030

refer to: at least 40% cuts in GHG emissions; a minimum 27% share for RES; 27%-30% improvement in energy efficiency; and electricity interconnection of at least 15% (i.e. 15% of the electricity produced in an EU country should be able to be transmitted across its borders to neighbouring EU countries). Finally, the 2050 target involves reducing GHG emissions by 80%-90% below 1990 levels (see EKKE 2017).

The present article explores the potential of the energy sector to act as a driver of growth and to lead to a new production model for the Greek economy. Section 2 analyses the comparative advantages of the sector, while Section 3 documents the weaknesses of the sector in the recent period. Section 4 discusses the targets to be met for the sector's transformation and growth, and sets forth the recent policy measures towards this direction. The final section summarises and concludes.

2 COMPARATIVE ADVANTAGES OF THE GREEK ENERGY SECTOR

The energy sector in Greece is characterised by: (a) the available natural resources; (b) the country's geographic location; and (c) the regulatory framework. More specifically:

(a) The country has a strong potential for RES (solar and wind energy, in particular), which makes it a privileged place for systematic exploitation and a major pull factor for investment funds that are active in this field. For this reason, financing and investment in the energy sector declined less than in other sectors during the crisis. The country has also untapped hydropower and geothermal energy potential. In addition, hydrocarbon exploration points to possible petroleum prospects that may be exploited in the future.⁴ The possibility to exploit different sources of energy brings

⁴ The country also boasts lignite reserves. However, as the use of lignite for energy production purposes is very harmful to the environment, it tends to be replaced with less polluting sources, in line with the EU's aims.

Greece to the fore as regards the security of energy supply in the EU.

(b) The country's geographic location plays a strategic role in the design of new energy interconnection routes between the EU and natural gas and electricity producing countries, in the context of the EU's energy security objective. The positive outcome from the selected route of the Trans Adriatic Pipeline (TAP) transporting natural gas from Azerbaijan to Western Europe via Greece, Albania, the Adriatic Sea and Italy is expected to have a significant growth impact. Similarly, the project to transport natural gas and electricity from Israel, Cyprus and Greece, via Crete, to the rest of Europe is estimated to play an important role (see also Karavias and Anastasatos 2018). The integration of domestic grids (e.g. of the islands) with international grids will further support energy security and help reduce energy intensity and energy costs in Greece.

(c) With regard to the regulatory framework: (1) As part of the efforts to save energy and address climate change, binding targets have been set to increase the use of RES and reduce GHG emissions. (2) Greece must harmonise its regulatory framework and increase the interconnections of its energy markets in order to ensure energy security. (3) A number of measures aim to the deregulation of the electricity and natural gas markets in an effort to reduce production costs.

3 PERFORMANCE, SHORTCOMINGS AND PROBLEMS OF THE ENERGY SECTOR

Although some of its features have improved markedly, the energy sector continues to exhibit major weaknesses, namely: (a) High energy intensity: high ratio of energy consumption to GDP. (b) High energy dependence: a high share of energy consumption is imported from abroad. (c) Low use of RES, considering the country's resources. (d) High prices: in consumer terms, energy prices are subject to heavy indirect taxes and excise

duties. On top of that, the monopoly structure of the energy markets (of the electricity market in particular) has a substantial cost-increasing effect.

3.1 HIGH ENERGY INTENSITY

High energy intensity is a measure of an economy's energy efficiency. It is defined as energy consumption per unit of GDP. Electricity consumption in Greece steadily increased up until 2008 (56.6 TWh), before starting to fall for five consecutive years from 2009 to 2013 during the economic crisis.⁵ Since 2014, consumption has recovered slightly to reach 53.4 TWh of electricity in 2016.

Energy intensity largely reflects the structure of the economy. Service economies exhibit relatively low energy intensities, whereas industrial economies exhibit higher intensities. In Greece, the bulk of energy is consumed by households and other sectors (78.5%, against an EU average of 61.3%), which is consistent with the production model of a service-based economy (see Charts 1 and 2).

By consequence, on the basis of the economic production model, low energy intensity would have been anticipated for the Greek economy, relative to the EU. This was actually the case for the period up until 2010 (see Chart 3), but not for the years of the crisis (2011-2016), possibly indicating the decline in productivity during the crisis: although production units remained active, they had to reduce their output in response to falling demand. This may also reflect a waste of resources in energy production, distribution and consumption, which might be due to (a) obsolete grids, (b) old and

⁵ It refers to electricity consumption in industry, transport and households/services, and stands for final energy consumption. This means that consumption in industry covers all industrial sectors except the energy sector, e.g. power stations, oil refineries, coke ovens and all other plants converting energy products into another form. Final energy consumption in transport covers mainly the consumption by railways and electrified urban transport systems. Final energy consumption in households/services covers quantities consumed by private households, small-scale industry, crafts, commerce, administrative bodies, and services, with the exception of transportation, agriculture and fishing.

Chart 1 Electricity consumption by sector: Greece

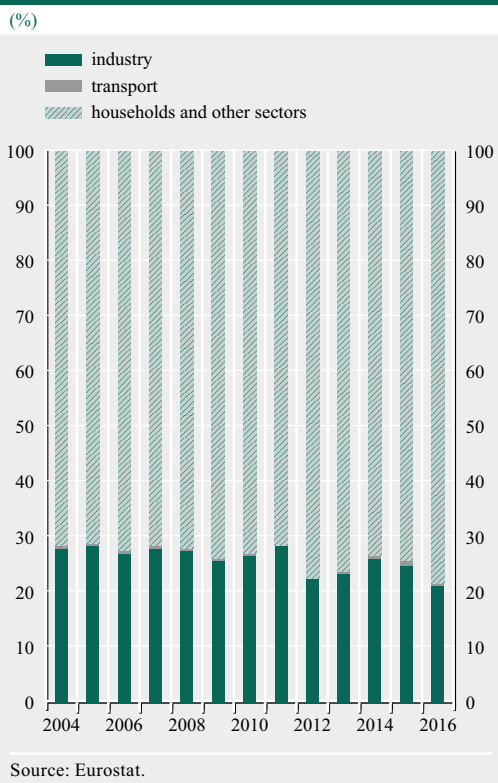
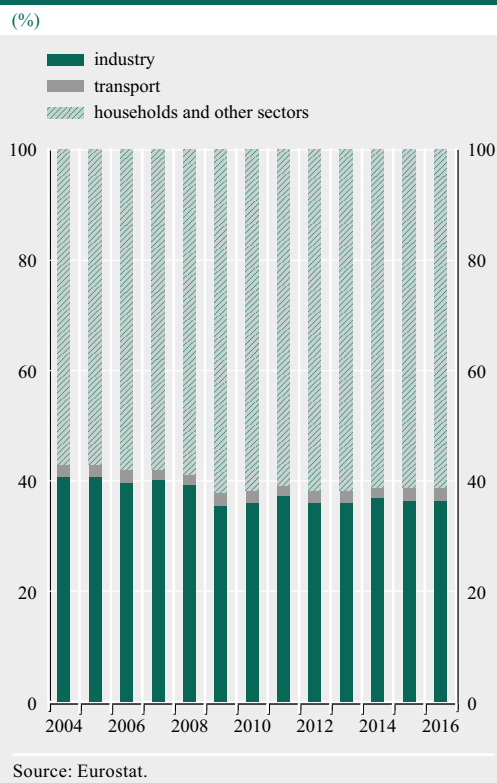


Chart 2 Electricity consumption by sector: EU-28



(non-green) energy consuming buildings, and (c) low use of mass transportation. Besides, it reflects the fact that energy saving was achieved across the EU as a whole over that same period, i.e. the energy intensity of each national economy was lowered.⁶

3.2 HIGH ENERGY DEPENDENCE

The fact that Greece relies on imports to meet its energy needs is mirrored in its energy dependence rate, which is extremely elevated and notably higher than the European average (see Chart 4). Energy dependence was seen to moderate in the early years of the crisis, 2008-2013, possibly reflecting a recession-induced reduction in consumption, but thereafter it embarked on an upward path and reached its pre-crisis levels in 2016.

The recent rise in the energy dependence of the Greek economy is also verified by the pat-

tern of the electricity trade balance: the 2005-2013 period was marked by an improvement in the electricity trade balance; however, a reversal of this trend was observed in 2014-2015 (see Chart 5).⁷

3.3 LOW USE OF RENEWABLE ENERGY

3.3.1 Energy production in Greece and the EU

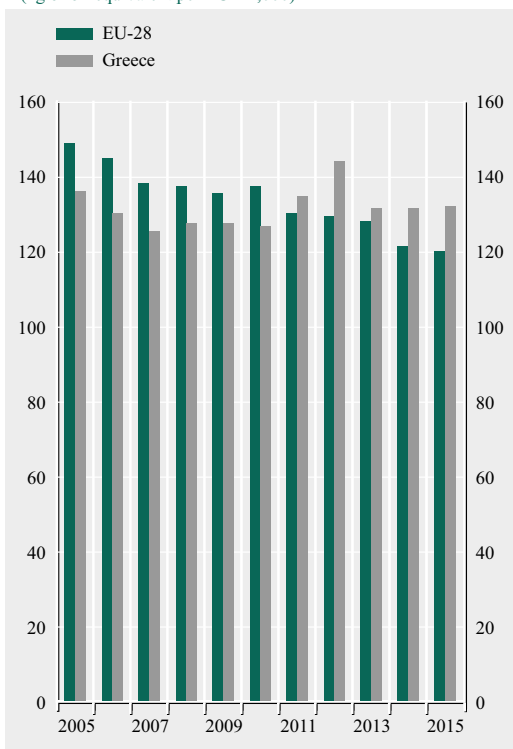
Greek energy production continues to rely on polluting sources, e.g. lignite and oil, with the production share of those two sources being considerably higher than in the EU. Nevertheless, a rise in generation by RES has been observed lately (see Chart 6).

⁶ Between 2005 and 2015, energy savings were delivered in every EU Member State (the energy intensity of each Member State was reduced). Greece, however, posted the smallest decrease (-3.1%) (see Eurostat 2018).

⁷ Net imports of electricity to Greece in 2015 originated mostly from Bulgaria, Turkey, FYROM and Italy. Greece mainly exports to Italy and Turkey.

Chart 3 Energy intensity¹: EU-28 and Greece²

(kg of oil equivalent per EUR 1,000)



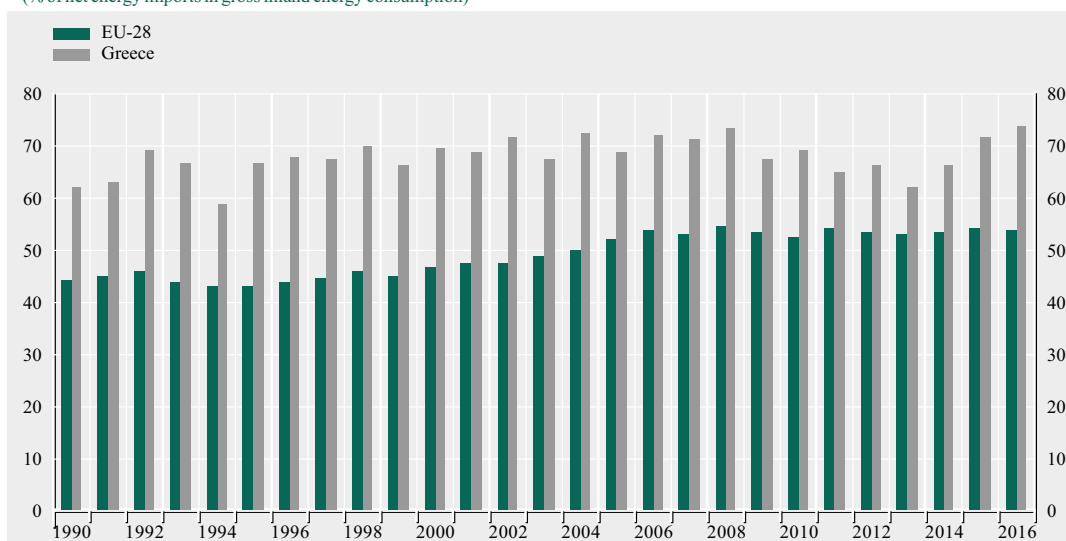
Source: Eurostat.
 1 Gross inland energy consumption per GDP.
 2 From 2011 onwards, data for Greece are provisional.

With regard to the EU, RES were at first seen as unstable and unsuitable sources of energy, too costly to rival the existing coal-fired power stations and nuclear power plants. Resolute political initiatives, coupled with the active involvement of new business agents, supported the growth of RES during the post-1990 period. Against this backdrop, the European electricity system underwent an extensive transformation, which led to a rise in the shares of RES from 2005 onwards (see Chart 7). Notwithstanding, the crisis has dealt a heavy blow to investment in renewables at the European level, with financing conditions and regulatory reforms emerging as key determinants of the development of RES (see among others Midttun and Piccini 2015).

The observed increase in the share of renewable energy was also underpinned by grants provided by several Member States, which are often devised to promote less mature technologies. In Finland, investment grants and subsidies are the only support available at the national level. Tax incentives or exemptions often complement other types of renewable energy incentive programmes. A wide range of tax incentives are present in the EU. Some

Chart 4 Energy dependence: EU-28 and Greece

(% of net energy imports in gross inland energy consumption)



Source: Eurostat.

Chart 5 Electricity trade balance: Greece

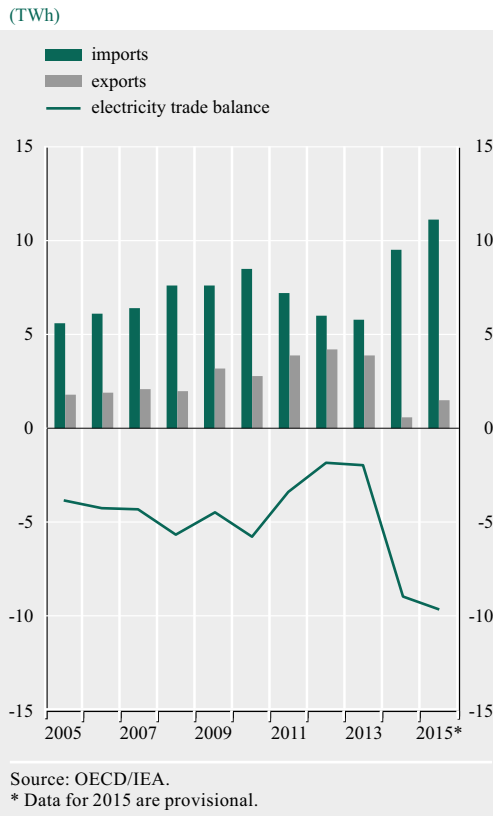


Chart 6 Primary production of energy by source: Greece



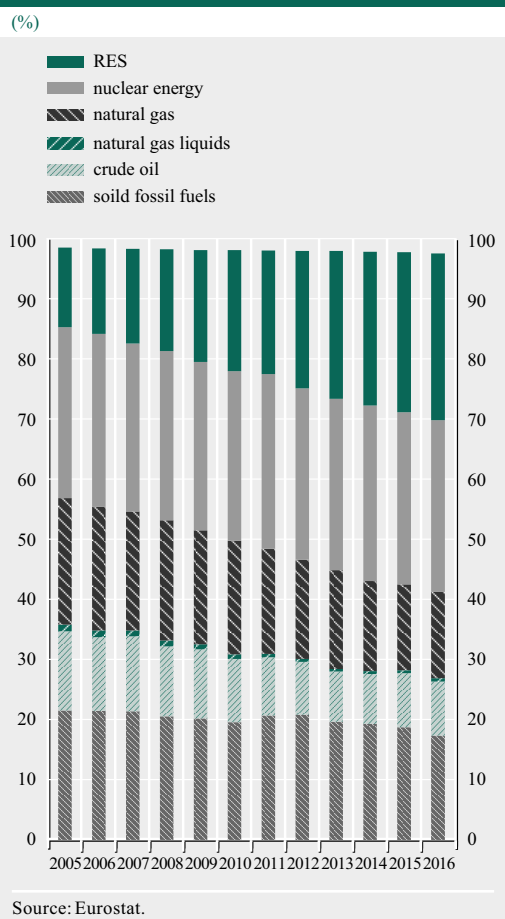
Member States (Spain, the Netherlands, Finland and Greece) provide tax incentives related to investments, while others (Latvia, Poland, Slovakia, Sweden and Hungary) have devised production tax incentives that reduce operational costs (see Kanellakis et al. 2013). With respect to the contribution of nuclear energy to Europe's electricity generation, the observed stabilisation of the share of nuclear power (see Chart 7) is associated with the accident in Fukushima, Japan, in March 2011, as many countries called off the expansion of their nuclear power programmes.

3.3.2 Electricity production in Greece and the EU

With regard to electricity production, Greece succeeded in raising its share of renewable energies markedly, even relative to the EU as a whole (see Charts 8 and 9), with renewables reaching 30% of electricity production in 2016.

Greece enjoys on average 300 days of sunshine a year and boasts high wind potential, especially on its islands. Nevertheless, the renewable energy system is only viable if sufficient energy plants are in place, flexible enough in their generation capacity. Furthermore, the exploitation of the islands' wind potential calls for their connection to the mainland power grid, as well as for economies of scale in order to make such projects competitive. Upon completion of the envisaged main interconnection of the islands, significant potential for exploiting renewable energy will be created (see also Karavias and Anastasatos 2018), while the interconnection is likely to contribute to a further increase in the share of renewables in electricity generation.

Chart 7 Primary production of energy by source: EU-28



3.3.3 Renewable energy sources by category

The evolution of RES by category in Greece over the 2004-2016 period is illustrated in Charts 10 and 11. Installed renewables increased more than tenfold, while renewable energy generation rose eightfold, albeit from a very low starting point (see also EIA 2017). In the 2010-2015 period the cumulative growth rate in wind and solar photovoltaic power generation stood at 300%.

The development of renewables relied heavily on an increase in solar photovoltaic (PV) power plants (see Chart 10). In 2016 Greece boasted the second (after Spain) highest share in solar power plants, relative to total installed electricity generation capacity among member

countries of the International Energy Agency (see IEA 2017). This success story is attributable to generous feed-in tariffs and lower technology costs. Compared with other countries, Greece was quick to adopt the tool of feed-in tariffs (as early as 1994), with a view to boosting investment in this field. Furthermore, a new legal framework to support electricity generation from renewable sources was established. Speeding up and streamlining the complex licensing procedures also made a positive contribution. In 2009, under EU Directive 28/2009, the Greek government, together with the other Member States, announced the launch of the “Helios” project, which promoted the development of solar PV parks by incentivising investors. The objective was for Greece to export electricity generated from renewable sources to the EU. The installed capacity of solar PV plants increased from 11 MW in 2009 to 2,074 MW in 2013, while their share as a percentage of renewables came from 4% in 2009 to 54% in 2014. However, the exceptionally high feed-in tariffs on solar PV plants (higher than in most European countries, see EREF 2009), as well as the declining cost of PV systems caused market distortions in favour of PVs (and against wind turbines) on account of a wide discrepancy in subsidies. Such distortions led to a secondary market for licensing and to a deficit in LAGIE, the Greek electricity market operator (see also Diakoulaki 2014). The institutional framework changed after 2012. Solar PV energy purchase prices on the part of the Public Power Corporation (PPC) were deemed costly. In August 2012 the licencing of new PV installations was suspended, while the law of October 2013 revised renewable energy prices, modified the criteria on energy prices from new PVs and stipulated new provisions regarding the relocation of renewable energy plants. The corrective measures taken by the State since 2012 have basically led to a freezing of investment in solar PVs. Indeed, installed capacity of solar PVs has remained stable at its 2014 level (see Chart 10).

Wind power capacity also increased significantly over the 2010-2015 period, although it

Chart 8 Electricity generation by source: Greece

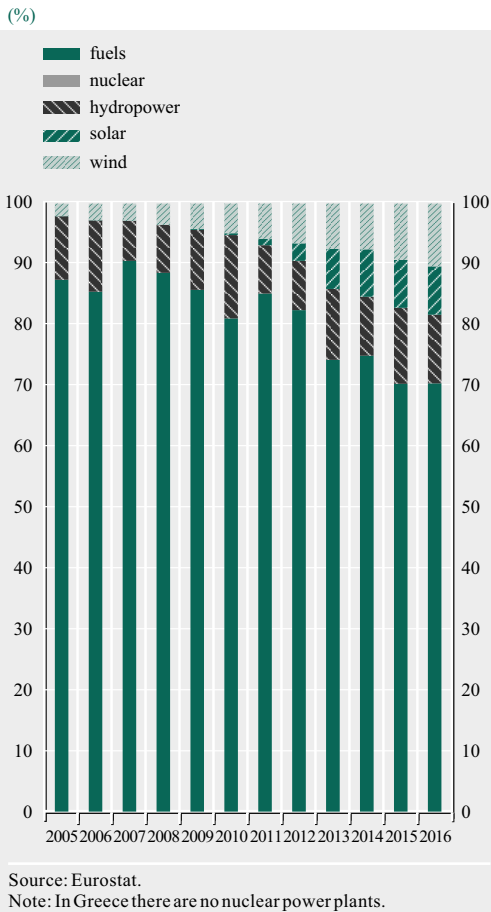
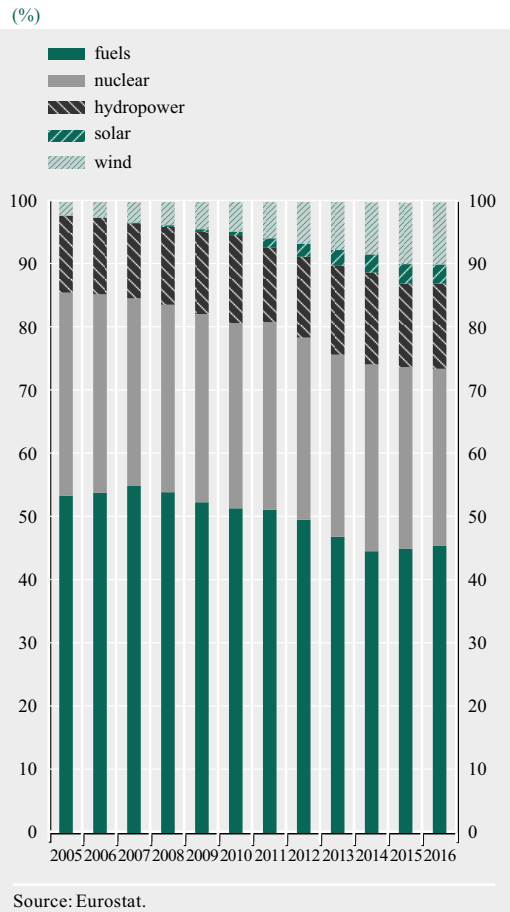


Chart 9 Electricity generation by source: EU-28



stood below the expectations set previously (average annual growth: 12%). Nevertheless, it continues to grow at a relatively higher rate (14%) after 2015 (see Chart 10). In 2017 the share of wind power generation in total renewable energy generation reached 54%, followed by a solar power generation share of 37%.

3.4 HIGH PRICES

Energy is a key input to any productive activity. Against this backdrop, the constant aim of improving productivity and competition conditions in the energy sector, with a view to reducing energy costs, is a prerequisite for competitiveness gains and economic growth. With respect to households, improved competition conditions mean satisfactory living

standards, on the back of uninterrupted, high-quality and affordable energy supply, as well as a vast array of available options for consumers.

Increased energy costs in recent years reflect a considerable rise in both wholesale and retail energy prices. The prices of oil products, electricity and natural gas were elevated, also as a result of sizeable tax hikes and other charges. In particular, electricity prices for households rose by 150% approximately over the 2005-2016 period to reach 0.17 EUR/KWh in 2016, from 0.07 EUR/KWh in 2005 (see Chart 12). Although they are still lower than the EU average, their substantial increase suggests the soaring cost of living in Greece during that period.

Chart 10 Installed capacity by RES category in Greece

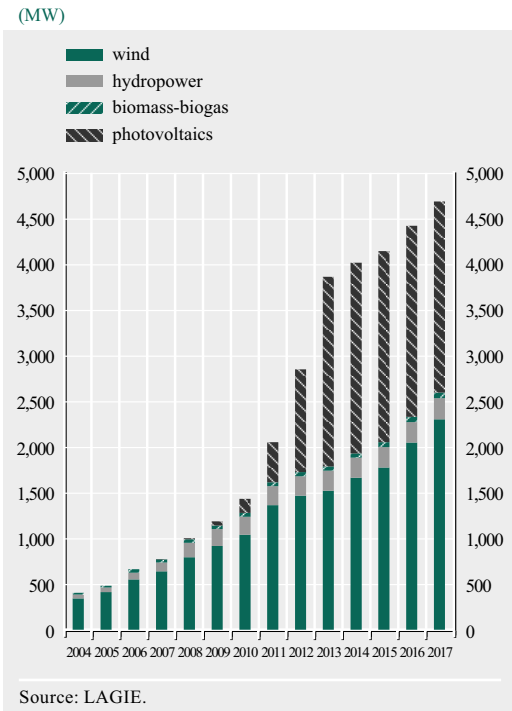
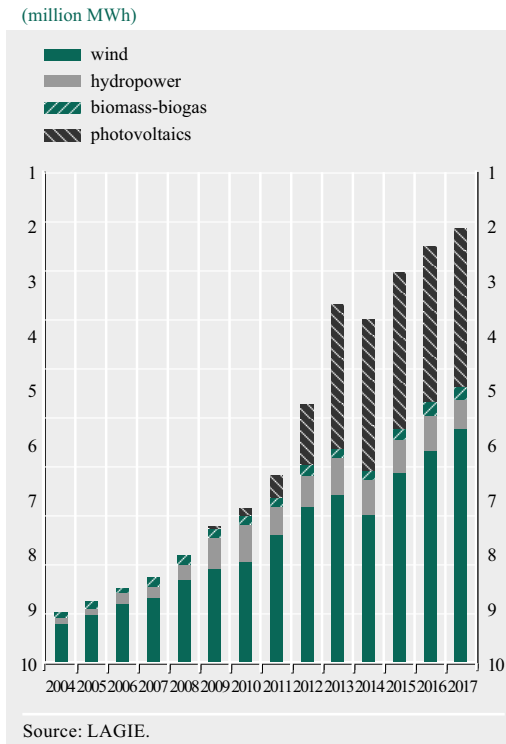


Chart 11 Energy output by RES category in Greece

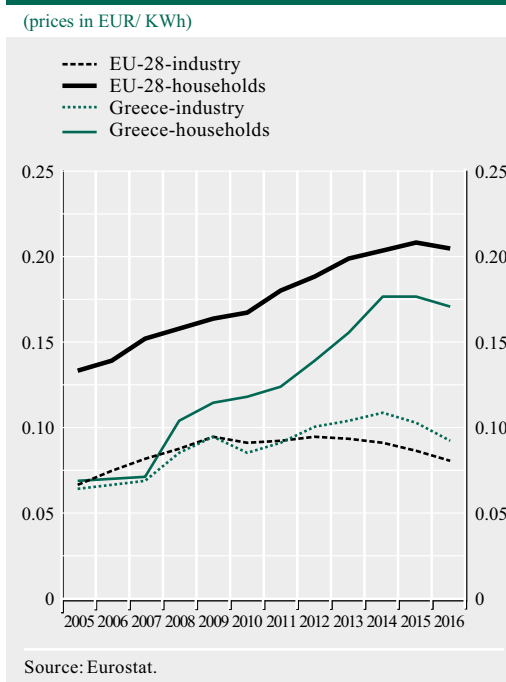


Electricity prices in industry also surged (by 44%) to 0.09 EUR/KWh in 2016 from 0.06 EUR/KWh in 2005, outgrowing the EU average (see Chart 12). As a result, in 2016 electricity prices for the Greek industrial sector (0.093 EUR/KWh) turned out to be higher than the European average (0.081 EUR/KWh), and thus acted as a counterincentive to productive investment in Greece compared with the EU and as a drag to the competitiveness of domestically produced goods.

3.4.1 High prices – the role of the market structure

An important factor behind high prices is the structure of the domestic electricity market. The market was characterised by monopoly structures, which led to competition distortion and posed barriers to new entrants. The vertically integrated State-controlled electricity company “Public Power Corporation S.A.” (PPC) had the exclusive right to produce electricity from lignite and hydro units, as well as to operate the electricity transmission and dis-

Chart 12 Electricity prices: EU-28 and Greece



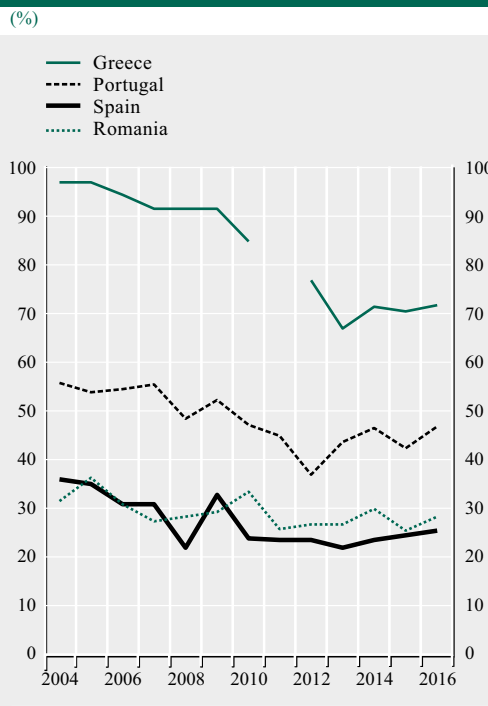
tribution grids. Lack of competition in electricity production and supply has heavily weighed on the domestic market, limiting the available choices for lower prices and better services (see Bank of Greece 2016b).

PPC continues to dominate electricity production. It accounts for 79% of the installed thermal generation capacity and about 75% of thermal electricity generation. PPC's share in the retail market also remains fairly elevated, despite the decline that was observed following the 2013 measures. Specifically, its share reached 88% in 2016. Furthermore, 17 suppliers were active in the retail market, with the second-largest supplier market share coming to a mere 2.9% in 2016 (see also IEA 2017). PPC's share is the highest across the EU, even relative to EU countries with less deregulated markets such as Spain, Portugal and Romania (see Chart 13).

It should be noted that for a significant part of PPC customers it would not be easy to switch to an alternative supplier. Such customers include farmers, who are offered low tariffs by PPC, large industrial customers, who enjoy discounts, and organisations that are housed in public buildings (see also Bank of Greece 2016b). Besides, the remaining customers have hardly used the possibility to switch supplier. A reason for this consumer behaviour may be the misconception about possible financial gains and the complexity of the switching process. Difficulty in understanding the electricity bill, which includes several non-electricity related items like municipal tax and television charges, has also been identified as a possible barrier to change suppliers.

The market share of PPC should be reduced under the Economic Adjustment Programme. In consultation with the European Commission, the Greek government resorted to an alternative mechanism to reduce PPC's market share: the NOME⁸ auctions, under the electricity market law of 2016 (Law 4389/2016), allow for bilateral agreements between electricity producers and distributors (actually, new entrants into the retail market can buy elec-

Chart 13 Market share of the leading electricity supplier: Greece and selected EU-28 countries



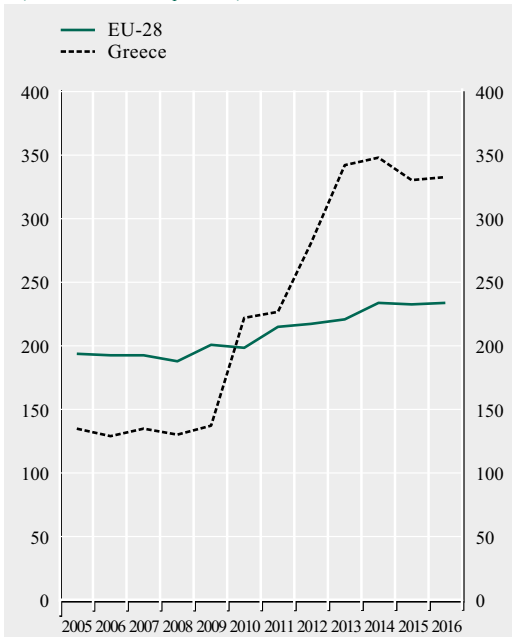
Source: Eurostat.
Note: For 2011 there are no available data on Greece.

tricity from PPC). The Regulatory Authority for Energy (RAE) determines the annual quantity of electricity that will be made available through auction sales of forward electricity products, while the electricity market operator (LAGIE) conducts the auctions. In the auctions, PPC is expected to sell around 40% of its production from lignite-fired and hydro plants (over which it has a monopoly). The NOME auctions and the increasing number of market participants are the first positive signs of a liberalised and competitive energy market, which offers better services and lower prices to consumers (see IEA 2017).

⁸ The NOME auctions (Nouvelle Organisation du Marché de l'Électricité) ensure a level playing field for alternative suppliers to access PPC's electricity production from lignite and hydro units. With the NOME auctions, private suppliers relying on power generation from natural gas may purchase energy at competitive prices, which will then be resold to industrial customers, firms and households. The quantities of electricity produced from PPC lignite and hydro units to be auctioned and the starting price of the auctions are determined on the basis of LAGIE data and following a recommendation by RAE to the relevant ministry.

Chart 14 Excise duty on energy: EU-28 and Greece

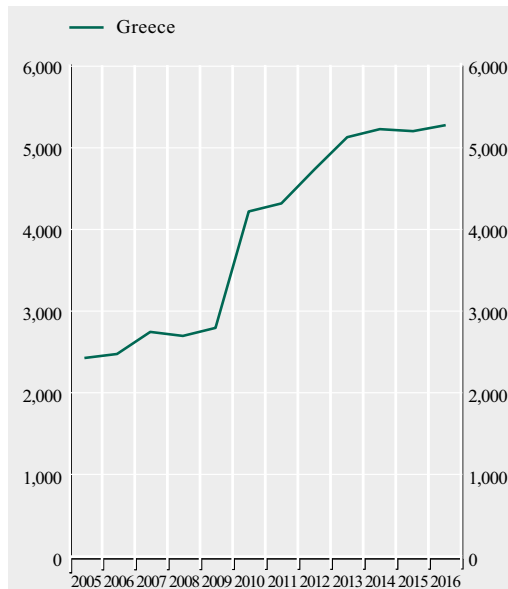
(EUR/tonne of oil equivalent)



Source: Eurostat.

Chart 15 Energy tax revenue: Greece

(EUR millions)



Source: Eurostat.

3.4.2 High prices – the role of taxation

The sizeable hikes in electricity prices are, to a large extent, the result of high taxation. The excise duty on energy was significantly raised in 2010 and actually ended up to be higher than the EU average, reversing the situation that prevailed until then (see Chart 14).

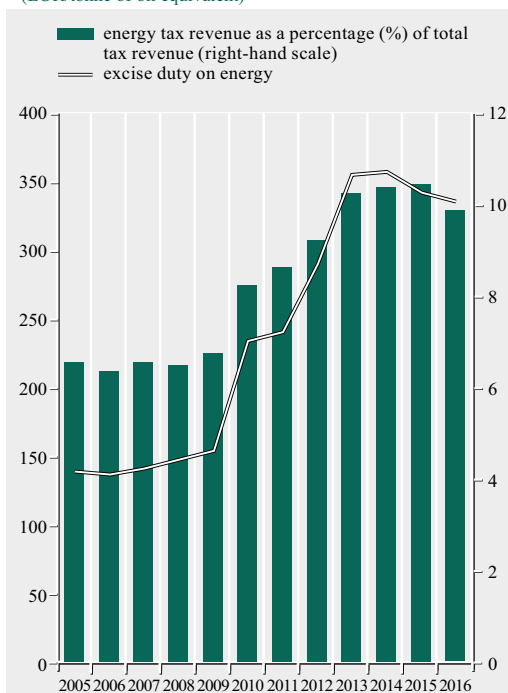
The tax hike in 2010 raised energy tax revenue, as well as its share in total tax revenue (see Charts 15 and 16). For the time being and on the basis of the targets for fiscal adjustment and fiscal revenues, excise duties on energy are not expected to decrease.

4 ENERGY POLICIES IN GREECE

The recent measures as well as the suggested policies are aimed at addressing deficiencies in the energy sector, as described in the previous section. They can be grouped into four main pillars: policies to (1) reduce the energy inten-

Chart 16 Excise duty on energy and energy tax revenue

(EUR/tonne of oil equivalent)



Source: Eurostat.

Chart 17 Share of RES in gross final energy consumption

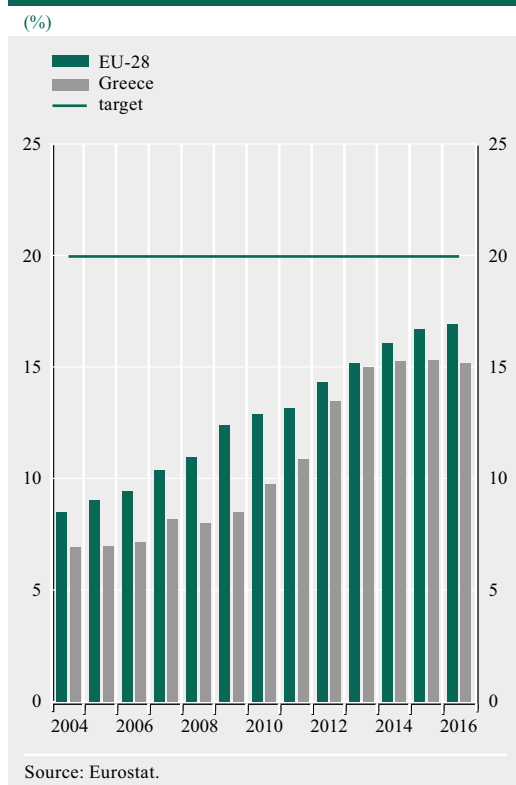
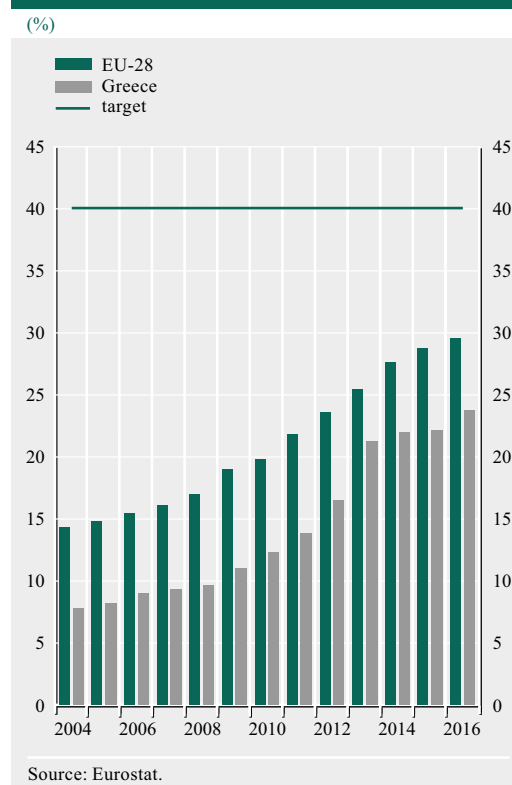


Chart 18 Share of RES in gross electricity consumption



sity of the Greek economy; (2) reduce energy dependence through higher penetration of renewables into energy generation; (3) cut energy costs; and (4) boost investment in the energy sector⁹.

4.1 RECENT MEASURES

(1) To reduce energy intensity

In 2015 a national indicative target was set for total final energy consumption in 2020 not to be higher than 18.4 million tonnes of oil equivalent (Mtoe).¹⁰ In 2017 the Greek Regulation on the Energy Performance of Buildings¹¹ was revised, laying down the cost-optimal minimum requirements on energy efficiency and endorsing the specifications regarding Nearly Zero-Energy Buildings.

(2) To reduce energy dependence – increase the penetration of renewables

Concrete targets for the penetration of renew-

ables into final energy consumption were determined. However, amid the economic crisis the penetration of renewables into the energy mix has slowed to 15.2% in 2016 (Eurostat data), against a target of 20% in 2020¹² (see Charts 17 and 18). The targets for electricity consumption and transport energy consumption are difficult to be met by the deadline (see Chart 19).

(3) To cut energy costs

With regard to the electricity market

With a view to enhancing competition, the unbundling of the transmission and distribution grid from production was introduced. In

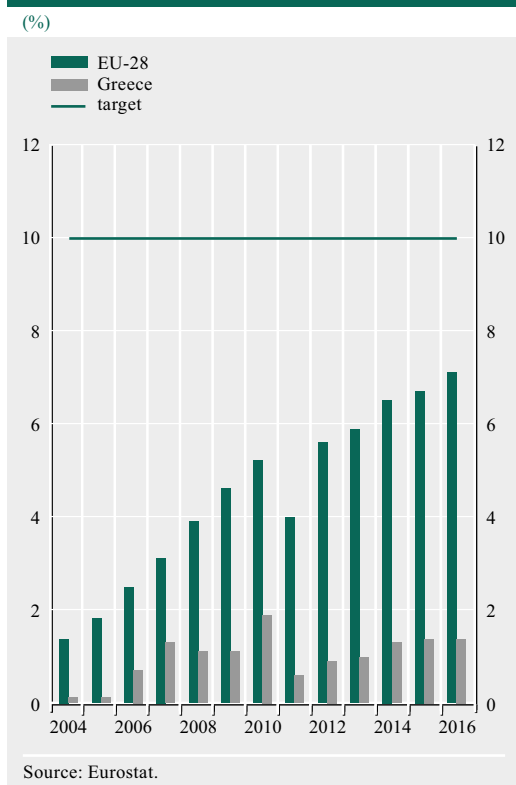
⁹ On the basis of the measures adopted and the agreements signed to bring the sector in line with the EU targets, several investment opportunities have emerged on a small and/or large scale.

¹⁰ Under Law 4342/2015, transposing Directive 2012/27/EU on energy efficiency into Greek law.

¹¹ In line with the requirements of the Directive 2010/31/EU on the energy performance of buildings.

¹² Under Law 3851/2010.

Chart 19 Share of RES in transport fuel consumption



2011¹³ the Independent Power Transmission Operator (ADMIE) and the Hellenic Electricity Distribution Network Operator (HEDNO) were established as PPC subsidiaries. In 2017 the ownership unbundling of ADMIE was completed.¹⁴ In 2016 the NOME auctions were introduced to help reduce the retail and wholesale market share of PPC below 50% by 2020. In April 2018, 40% of PPC's lignite capacity was decommissioned through the sale of two lignite units in Megalopoli as well as through the sale of one lignite unit and the construction permit for a second one in Meliti, Florina.¹⁵

With regard to the natural gas market

By the end of 2016 the unbundling of supply and distribution activities of Gas Supply Companies (EPA) was completed. The natural gas market was fully liberalised on 1 January 2018 and ever since consumers can freely choose their supplier. In April 2018 the tender for the

sale of a 66% stake in the National Natural Gas System Operator (DESFA) was completed.¹⁶ The expansion of the domestic natural gas distribution network, namely the existing networks in Attica, Thessaly and Thessaloniki, as well as the construction of distribution networks in new regions (Central Greece, Central Macedonia and East Macedonia-Thrace) are scheduled to be completed by 2021. Besides, the deployment of compressed natural gas (CNG) distribution infrastructure across selected areas is envisaged for the supply of remote consumers and natural gas fuelling stations.

Growth in natural gas usage is also underpinned by reforms in the retail market, such as the unbundling of the integrated distribution and supply companies. The deregulation of the gas retail market is expected to allow more participants in the supply chain and create a more competitive environment to the benefit of consumers.

(4) To boost investment

As regards consumption, two co-financed programmes have been implemented (Save Energy at Home I and II), which provide incentives for an energy upgrade of houses. Around 50 thousand households benefited from the first programme. The second one was implemented in March 2018 and the funds that were made available for Greece have already been absorbed. Measures are envisaged to upgrade the energy performance of public buildings, improve the energy efficiency of SMEs, support and develop teleheating projects. A mandatory quota in the procurement of energy-efficient vehicles in the public sector has also been determined (see Ministry of Finance 2018).

In the field of interconnection and transmission, a large part of cross-border pipelines is planned to pass through the Greek territory. Greece is expected to benefit from large-scale

¹³ Under Law 4001/2011, in compliance with Directive 2009/72/EC.

¹⁴ A 24% stake of ADMIE was sold to State Grid Europe Limited, while 51% was transferred to ADMIE Holding and 25% to DES ADMIE.

¹⁵ Under Law 4533/2018.

¹⁶ To the Snam-Enagàs-Fluxys consortium for an amount of EUR 535 million.

investment projects that are co-financed by foreign funds and European resources (see Karavias and Anastasatos 2018). Such investment projects include:

(I) Projects with a short timeline for completion (by 2020), such as: (1) The Trans Adriatic Pipeline (TAP), which will cross Northern Greece, Albania and the Adriatic Sea to connect to the Italian natural gas network (investment worth EUR 2 billion for the Greek segment). (2) The Interconnector Greece-Bulgaria (IGB), which will connect the Greek and the Bulgarian natural gas networks (investment worth around EUR 80 million for Greece). (3) The upgrade of the LNG terminal station in Revithoussa (EUR 40 million is remaining to be invested). (4) The floating LNG reception, storage and regasification unit in Alexandroupoli (amounting to EUR 300 million).

(II) Projects with a longer timeline for completion (by around 2025): (1) The East Mediterranean pipeline (East Med), which will connect Israel to Cyprus, Greece, Italy and the rest of Europe (investment worth around EUR 3 billion for the Greek segment). (2) The Interconnector Greece-Italy (IGI) (amounting to EUR 500 million). (3) The interconnection of Greek islands (Cyclades and Crete) to the mainland power grid (amounting to about EUR 420 million). (4) The EuroAsia Interconnector, which will connect Israel to Attica via Cyprus and Crete (amounting to about EUR 1 billion for the Greek segment).

In the field of production, the authorised auctions for new wind and solar power stations will translate into new wind and photovoltaic parks installed in mainland Greece, Crete and the Aegean islands (a private investment of around EUR 1.2-3 billion is expected) (see Karavias and Anastasatos 2018).

4.2 MEASURES IN THE CONTEXT OF THE FOURTH REVIEW

The aforementioned pillars also include the measures provided for in the fourth review

(Supplemental Memorandum of Understanding – Fourth Review of the ESM Programme, DRAFT – 23.5.2018). These measures aim to:

(1) Improve energy efficiency

In line with the EU's aim of a fully integrated European energy market to ensure energy sufficiency and energy security, the Greek authorities will launch the Target Model, which will harmonise the regulatory framework of the Greek energy market with that of the European market.

(2) Reduce energy dependence – increase the penetration of renewables

As a prior action, the renewable energy supporting supplier surcharge will be reduced.

(3) Cut energy costs

Measures aimed at the deregulation of the electricity market:

The decision to sell PPC's lignite-fired plants in Florina and Megalopoli to private investors was confirmed (Law 4533/2018) and the divestment will be completed by end-2018. In June 2018 the authorities will revise the reserve price of the NOME auctions to incorporate updated data on PPC production costs.

Measures aimed at the deregulation of the natural gas market:

The authorities will move forward with the overall corporate restructuring of Public Gas Corporation (DEPA), while the quantities to be auctioned in 2018 will amount to 17% of DEPA's annual natural gas supply.

4.3 SUGGESTED POLICIES

(1) To reduce energy intensity

Policy measures regarding the production, transmission and final consumption of energy. In energy production, the main suggested policies involve the divestment of obsolete plants. With regard to the electricity transmission and distribution network, projects to upgrade networks and expand interconnections nationwide are warranted in order to connect the

islands' separate systems to the mainland grid. In the area of final consumption, the potential to save energy in buildings and transport, which together account for 80% of final energy consumption, is very high. Buildings are a top priority, given that almost 70% of Greece's building stock was constructed prior to 1980, i.e. before the first Thermal Insulation Rules were issued. Furthermore, the promotion of energy saving interventions in buildings could help the construction industry to get back on a growth track.

(2) To reduce energy intensity

Policies that encourage the utilisation of the country's resources, including RES. The large-scale penetration of RES also requires the development of energy saving technologies, as well as flexible power plants which would offset fluctuations in power generation at a low cost.

(3) To cut energy costs

Measures aimed at the deregulation of the electricity and natural gas markets, the reduction of excise duties on energy and the expansion of the natural gas network.

(4) To boost investment

Long-term planning regarding: (a) renewable energy production with the establishment of business incentives; (b) energy transmission via the expansion of networks (integration with cross-border natural gas pipelines and electricity interconnectors) and the islands' interconnection to the main grid; (c) the expansion of a less energy-consuming transport system; and (d) the reduction in consumption through the upgrading of buildings.

In general, the aforementioned obstacles can be overcome by promoting effective actions in three main directions: (1) A comprehensive energy plan, which outlines the desired future structure of the energy system and designs the roadmap to meet the targets. (2) Institutional arrangements, which guarantee market stability and ensure the removal of distortions and a level playing field for all energy producers

and technologies. (3) Actions to encourage entrepreneurship, with a view to consolidating investors' confidence on the back of energy planning and stable market rules. (4) To raise public awareness – especially in small communities, which often oppose the implementation of certain environmental policies.

However, persistent red tape rigidities, lacking coordination among stakeholders and reduced incentives to invest in renewables may weigh on the investment environment. Other major barriers to investment in the energy sector are the lack of funds, the high cost of financing and the reduced availability of domestic private capital.

5 CONCLUSIONS

The energy sector can emerge as a key sector to the new, export-based growth model of the Greek economy. In the field of energy, Greece has significant comparative advantages: (1) noteworthy renewable energy sources, which are also in line with the aim of sustainable development; (2) a strategic position that is key to the deployment of trans-European energy transmission grids; and (3) a well-defined regulatory framework.

The development of energy production relying on domestic resources leads by default to lower import dependency, with direct positive results for the trade balance. Greece's geographic location makes the country a major energy hub for electrical interconnectors and natural gas pipelines that are essential to the connection of the EU to other energy producing countries, in the context of the EU's energy security strategy. The EU's sought interconnection is expected to have positive secondary effects, as it is expected to lead to the interconnection of the Greek energy market per se and to a less wasteful energy sector. The interconnection of the Greek energy market (actually the islands' interconnection) is estimated to create a multiplier effect for the sector, as it will allow the full exploitation of the islands' solar and

wind potential. Further cuts in energy costs thanks to the use of cheap and environment-friendly resources as well as the opening of the electricity and natural gas markets are expected to have secondary effects on the cost of production and the competitiveness of Greek products, which in turn is expected to affect positively Greek exports.

The conjuncture is all the more favourable, given that the sector's development based on the country's comparative advantages is consistent with the aims of the EU. The three main aims of the EU's energy policy are: (1) sustainable development, aimed at changing the energy mix in an effort to tackle climate change; (2) security of energy supply; and (3) the opening of the energy market in an effort to reduce production costs in the EU.

Against this backdrop, all policy measures taken in the context of bringing Greece's regulatory framework in line with the aims of the EU positively affected the Greek economy. (1) Improvements were observed in the energy mix in favour of RES. (2) Investment in RES increased despite the overall decline in investment in Greece during the crisis. Notwithstanding, the Greek economy is still far from meeting the EU's targets for the penetration of RES in energy production. (3) The energy

(electricity and natural gas) market has to a great extent opened up (see also IEA 2017), although energy prices have not yet dropped considerably, given that they incorporate high tax rates.

The recent policy measures continue to be geared towards the targets of changing the energy mix, ensuring energy supply security and the opening of the energy markets. To this end, further opportunities are created for small and large-scale investment projects in Greece. Large-scale investment refers to participation in the construction of cross-border energy interconnectors, under projects that have already been initiated or are bound to start in the coming years. Small-scale investment mainly refers to participation in power generation and upgrading the energy performance of buildings. The regulatory framework also provides for and recommends the option of co-financing by European investment organisations. The present juncture is favourable. What is warranted on the Greek part is to make the most out of these policies: (a) by creating a tendering system that is characterised by transparency and less red tape, so as to attract investors, and (b) by raising public awareness about the aims and the benefits of the policies, so that the Greek society takes full ownership of the policies.

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