

Energy

Greece

Sectors in focus



April 2020

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- The energy sector comprises products used as inputs or outputs in the energy chain, such as renewable sources, fossil fuels –like oil, natural gas and lignite– and electricity.
- Energy is a pivotal sector for the Greek economy, with substantial progress achieved regarding major infrastructure projects and policies that enhance competition and liberalize the electricity and natural gas markets, but also with several important steps regarding the use of renewable energy.
- The country's strategic geo-economic location as a crossroad between East and West and the crucial transport routes of the Aegean Sea and the South-Eastern Mediterranean, play an important role in energy distribution in the wider region.
- Significant projects such as the Burgas-Alexandroupolis oil pipeline, the Interconnector Turkey-Greece-Italy (ITGI) and the South Stream natural gas pipeline intend to supply South-Eastern and Western Europe, turning Greece into a crucial energy hub in the region.
- During the last decade, the energy sector has experienced reforms which include among others the liberalization of electricity and natural gas wholesale and retail markets. These measures established sustainable, competitive, and secure energy sources and a regulatory framework that transformed the energy and electricity market, breaking Power Public Corporation's (PPC) monopoly in production, transmission and distribution of energy and increasing competition.
- Primary energy consumption of electricity slowed down during the economic crisis. However, electricity demand is expected to rise amid the economic recovery. To this end, Greece's internal electricity interconnections of many non-interconnected islands with the main network and the strengthening of the transmission network are of crucial importance.
- Greece's use of lignite, the primary and most environmentally harmful fuel for electricity generation, has decreased by the largest amount among European lignite-producing countries. Because of this reduction and although still relatively high, Greece's greenhouse gas emissions have decreased significantly over the past decade.
- Since 2008, the energy mix for electricity generation has shifted considerably towards renewable energy sources like solar and wind. Renewable energy penetration, in addition to the achievements of Greece in this field, involves taking more technical measures, in order to further integrate solar and wind power.
- Higher renewable energy penetration can be achieved via hybrid systems and integration of energy storage technologies. To this end, RAE has prepared a new energy storage support framework to foster renewable energy growth.
- Greece achieved its renewable energy target for gross final energy consumption. A large part of renewable energy is consumed by the residential sector but, although it remains low, the share of transport has also increased. Renewable energy in total primary energy supply increased significantly.
- Greece is still highly energy dependent on imports of oil and natural gas, although there was a successful diversification of the relevant import sources. Natural gas supply is almost fully covered by imports, while its consumption more than doubled in the last decade. The natural gas market is fully liberalized, with various investments and projects underway.
- The Greek National Energy and Climate Plan (NECP) has set ambitious targets, in line with the broader European plan targets. Apart from the further reduction of greenhouse gas emissions, other NECP targets include higher shares of renewable energy in energy consumption and electricity generation.



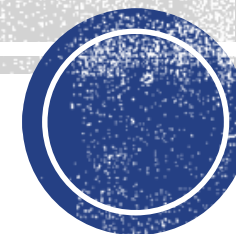
Worldwide effect

- The new coronavirus pandemic (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is turning into an unprecedented crisis, expected to have a deep impact on economies around the world across as an of a yet unforeseeable time span.
- The outbreak of SARS-CoV-2 is expected to decrease supply and demand on a global level and push many economies into recession. This outcome could directly and indirectly affect the energy sector.
- Oil markets are currently declining at their worst rate since the first Gulf war in 1991, amid a price war between Russia and Saudi Arabia. Last month oil prices fell by more than half, with the energy industry contorted. Prices are affected by the new pandemic, as supply chains are stretched, labor shortages are emerging and travel is limited or even forbidden in many parts of the world.
- Lower energy prices are pressing the trade balances of oil export countries and drill companies. A negative impact is also likely to be seen by clean energy companies that could become less competitive as the cost of oil plummets. A rebound is expected but a long-term effect is considered probable amid a continuation of the virus spread and a further depression of prices.
- Demand for oil has fallen faster and further than at any other time. On April 12th the world's largest oil producers reached a new deal to try to support prices. OPEC (The Organization of the Petroleum Exporting Countries) as well as Russia said they would reduce production by 9.7 mn barrels a day from May to the end of June, a record, and restrain output for two years.
- For renewable energy the main COVID-19 concern is whether equipment supply, especially from producer countries like China, will meet demand in products like solar panels, wind turbines and batteries, given the lockdown of factories. However, there could be a shift of concern in demand as well, as Bloomberg New Energy Finance changed its 2020 global solar demand forecast from 108 to 143 gigawatts, lower by 9% at the low end compared to its prior estimate. This would make 2020 the first down year for global solar installations since the 1980s.
- On the other hand, amid the current emerging crisis, investing in renewable energy is anticipated to be more resilient than in other energy forms. According to the Executive Director of the Centre for Climate Finance and Investment at London's Imperial College Business School, this will be the result of the renewable energy's "greenness", but more importantly of the stability of cashflows from the underlying assets.
- Although a fall in CO₂ emissions is anticipated in 2020, resulting from the expected slowdown of economic activity and mainly of transport, the effect will not be permanent unless new policies and strategies towards clean and green energy and renewable resources are adopted.
- The COVID-19 pandemic could further decrease long-term oil demand. Home-working, limited flights and less pollution could also help alter public opinion on the attractiveness of a quick turn from fossil fuels based economies.

Effect in Greece

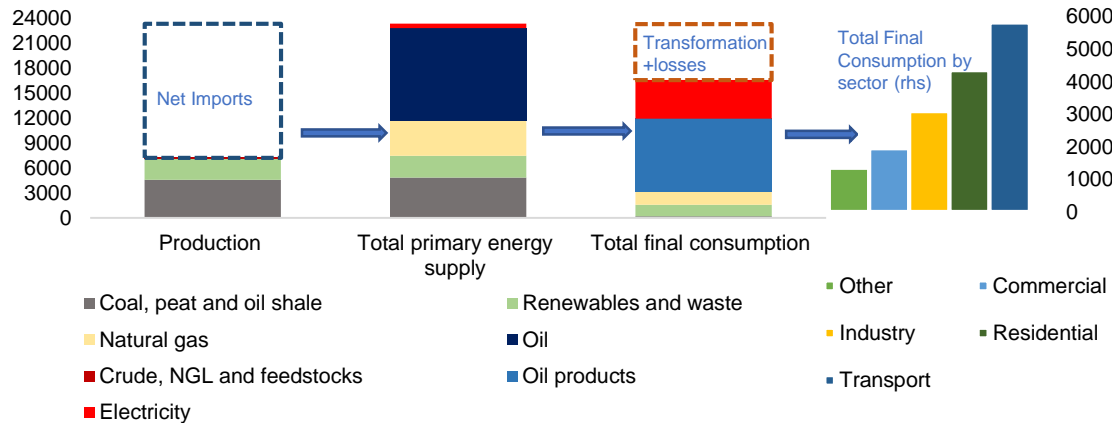
- Given its high dependency on oil and natural gas imports, Greece could be affected by the fall in oil prices and the potential negative impact on global oil and natural gas markets amid the spread of SARS-CoV-2. Initially, Greece can be positively affected by the falling oil import prices and thus the subsequent lower domestic oil prices and production costs, but this positive effect could be offset by lower domestic and external demand.
- According to recent statements by the Minister for the Environment and Energy, Costis Hatzidakis, Greece is not expected to face energy problems, highlighting energy efficiency as a major issue amid the coronavirus pandemic. To this end, potential aid for electricity bills - to be fully funded by the government for businesses affected by the new pandemic and their employees - has been announced. In this context, flexibility and/or support regarding electricity costs is being examined, among other actions that could be taken in the electricity market.
- Along these lines, the Minister for the Environment and Energy said that a framework for the support of electricity supply companies potentially affected by unpaid bills over the coming months is under consideration via the provision of state guarantees on working capital financing facilities, with the support of EBRD and EIB. According to the Minister, a 30% reduction in bill receipts for 3 months would cost the electricity system EUR 650 mn.
- Under the examined framework, electricity suppliers could announce support schemes for consumers affected by the crisis by making use of State aid.
- Governments across the world can make the most of the current crisis to push forward their green energy plans and adopt sustainable solutions backed by clean and green energy technologies. In this respect, the current crisis can be seen as an opportunity for renewable energy transitions in many countries, including Greece.

Energy balance



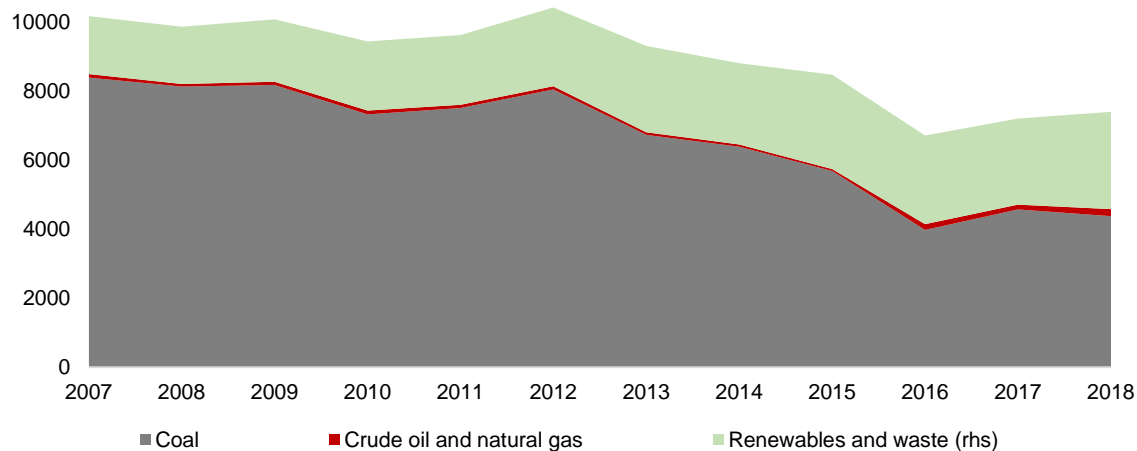
In coal and renewable energy production, Greece is self-sufficient

Energy mix chain (kilotonnes of oil equivalent or ktoe, 2017)



A great amount of coal used in energy production has been substituted by renewable energy

Energy production by input source (kilotonnes of oil equivalent or ktoe)



Source: International Energy Agency database (IEA), Data processing: Alpha Bank

Energy mix production, supply and consumption chain

- The energy sector comprises products used as inputs or outputs in the energy chain, such as renewable energy sources (RES), biofuels and waste, fossil fuels –like oil, natural gas and lignite– and electricity.
- Renewable energy includes RES, i.e. hydro, geothermal, solar, wind and tide/wave/ocean energy, but also solid biofuels, liquid biofuels, biogases, industrial waste and municipal waste, as well as the use of these energy forms for electricity and heat generation (International Energy Agency-IEA definition).
- The energy mix chain comprises a) domestic energy production, b) Total Primary Energy Supply (TPES) and c) Total Final Consumption (TFC)*.

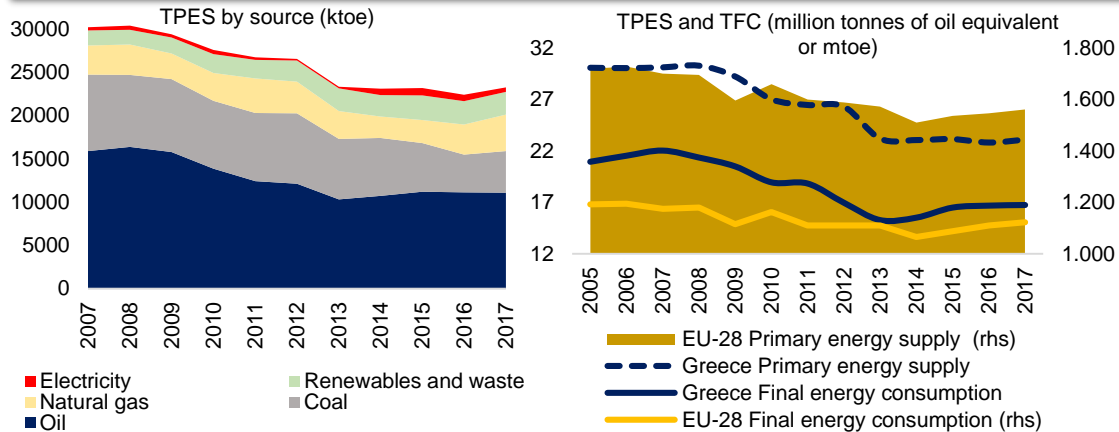
Domestic energy production

- Domestic energy production was cumulatively reduced by 25% from 2008 to 2018, mainly because of the coal reduction.
- The vast majority of domestic energy production in Greece comes from coal (brown coal or lignite), which belongs to the family of fossil fuels, along with petroleum and natural gas, all containing high percentages of carbon.
- Coal (mainly lignite in Greece) accounted for c. 59% of domestic energy production in 2018. The large amount of coal stock covers domestic demand.
- On the contrary, the use of renewable energy increased significantly by 70% in 2018 compared to 2008, accounting for 38% of domestic energy production.
- Crude oil, NGL (Natural Gas Liquids) and feedstocks account for only 2.5% of domestic production, having decreased to these negligible amounts since their production peak in the mid-80s.

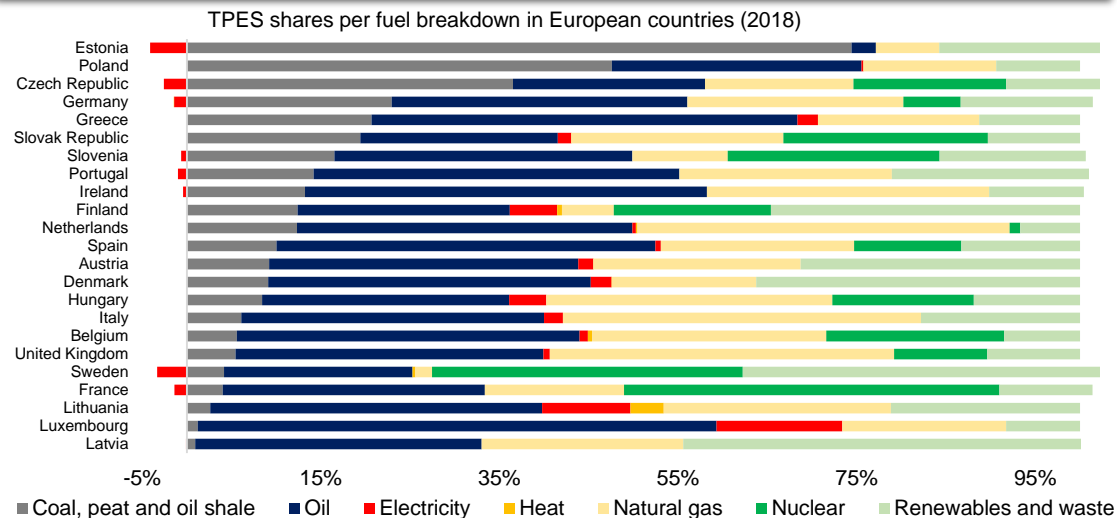
*The latest available data for production and Total Primary Energy Supply refer to 2018 but data for Total Final Consumption refer to 2017. In the diagram all data refer to 2017 in order to match all categories, whereas in the text the latest available data are given.



TPES was cumulatively reduced by ¼ in 2018 compared to 2008, mainly because of the reduction of coal and oil



Greek TPES mix comprises a higher than the EU average use of fossil fuels and does not include nuclear power



Source: IEA database, Eurostat - Energy statistics, Data processing: Alpha Bank

Total Primary Energy Supply (TPES) in Greece

- TPES comprises domestic production, plus net imports (imports minus exports), minus international marine, plus aviation bunkers, plus/minus stock changes (IEA definition).
- Total domestic energy production accounted for 1/3 of TPES in 2018.
- TPES consists of oil, coal, renewable energy, natural gas and electricity (only 2%) and it was cumulatively reduced by 26% in 2018 compared to 2008, mainly because of the reduction of coal and oil products.
- Coal represents 1/5 of TPES (2018), reduced from 27.3% in 2008.
- Oil in TPES is defined as crude oil, NGL and feedstocks minus oil products. Oil accounted for 46% of TPES in 2018 (down from 54% in 2008).
- Greece introduced natural gas into its energy system in the late 1990s, which comprises 18% of total TPES (2018) and is the 3rd mostly used fuel.
- The share of renewable energy in TPES was 13% in 2018, increased from c. 6% in 2008, but still remains low.

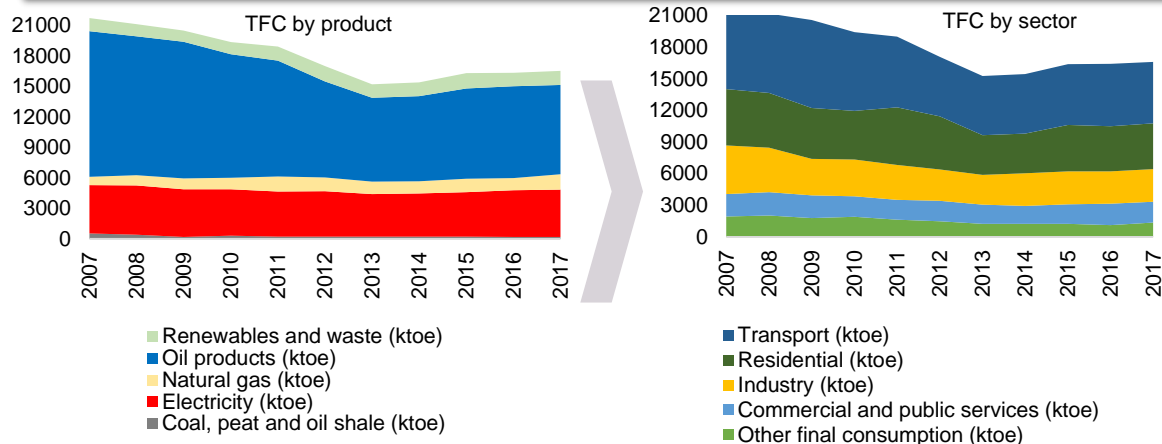
TPES in other European countries*

- The Greek TPES mix comprises higher use of fossil fuels (oil, coal and natural gas), reaching 86% (2018), versus a European average of 72%.
- Greece ranked 5th in 2018 in coal use as a % of TPES, after Estonia (74%), Poland (48%), Czechia (36%) and Germany (23%), implying higher carbon intensity of the power sector, above the 23 European countries average (14%).
- Coal is phasing out but still needs to be further reduced at a European level.
- Natural gas in European countries stood at 25% of total fuels used in TPES, higher than the Greek share (18%).
- Nuclear power is used in the energy supply mix of France (42%), Sweden (35%), Slovenia (24%), Slovak Republic (23%) and Belgium (20%), among others.

*From the sample of IEA, five countries are missing: Bulgaria, Croatia, Cyprus, Malta and Romania

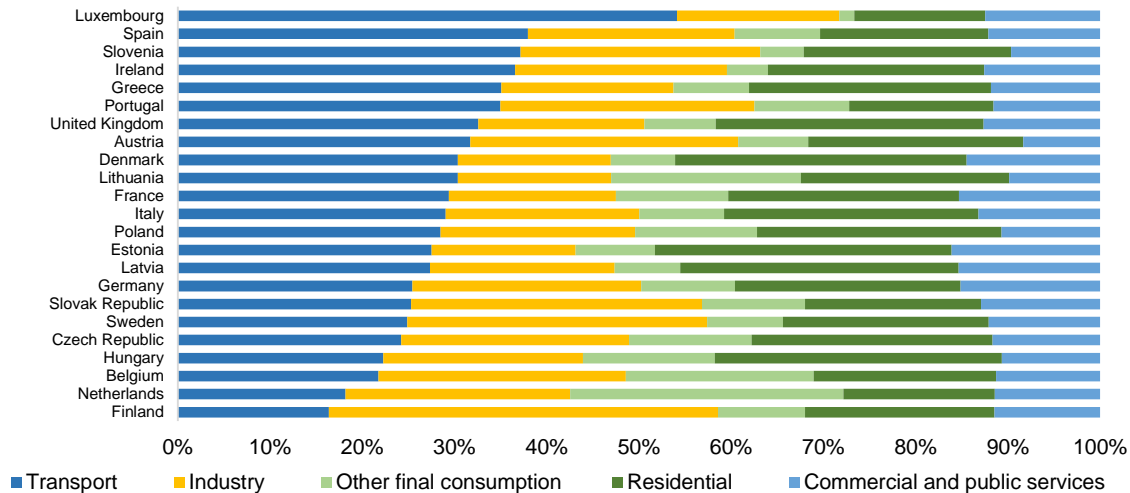
Total final consumption by product

TFC was reduced by ¼ in a decade (2007-2017), mainly because of the reduction of oil products as a result of the prolonged economic crisis



Transport sector in Greece is among the most energy consuming compared to European countries

TFC breakdown by sector in European countries (2017)



Source: IEA database, Data processing: Alpha Bank

Total Final Consumption (TFC) in Greece

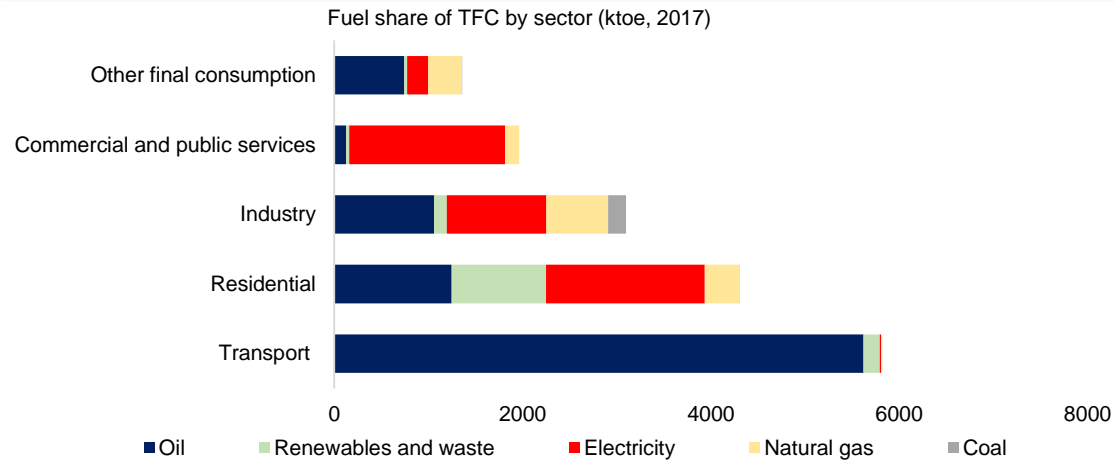
- TFC or secondary energy supply is the final consumption of fuels (e.g. electricity, natural gas, oil products) by end users, without the transformation sector (e.g. power generation and refining) (IEA definition).
- Due to transformation and losses, TFC accounted for c. 72% of TPES in 2017.
- TFC was reduced by 24% in a decade (2007-2017), slightly higher than TPES, mainly because of the reduction of oil products over the same period, as a result of the prolonged Greek economic crisis.
- Oil (oil products and refined petroleum) was substantially reduced by 39% over 2007-2017, accounting for 53% of TFC in 2017, from over 2/3 of TFC in 2007.
- Electricity in TFC was only slightly (-2%) decreased in 2017 compared to 2007, but its share in TFC increased to 28% from 22%.
- Natural gas use represented 9% of TFC in 2017, up by 82% since 2007.
- Renewable energy (RES, biofuels and waste) accounted for 8% of total final consumption in 2017, up from 6% in 2007.

TFC in other European countries*

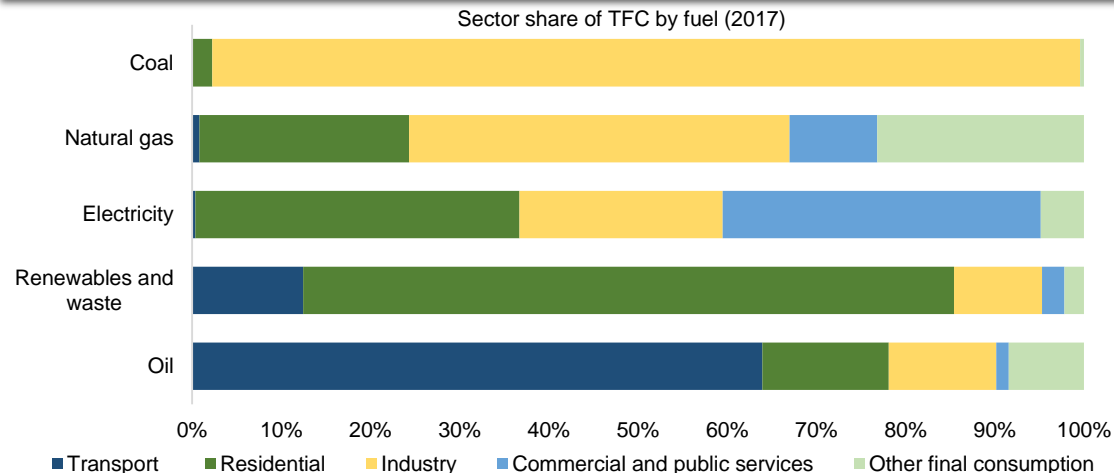
- TFC as an average of 23 European countries was cumulatively reduced by 5% in 2017 compared to 2007, gaining pace after 2014, although standing at a lower level compared to that of 2010.
- Greece ranks 5th in transport consumption (35%) among European countries, following Luxembourg (54%), Spain (38%), Slovenia and Ireland (37%).
- In the residential sector, Greece's share of TFC stood at 26% in 2017, with the country ranking 8th among other European countries.

*From the sample of IEA, five countries are missing: Bulgaria, Croatia, Cyprus, Malta and Romania.

The residential sector consumes mainly electricity (39%) and refined oil (29%), but also renewable energy (23%) and natural gas (8%)



Renewable energy is used for residential purposes (73%) and a small share for transport (12%)



TFC by sector

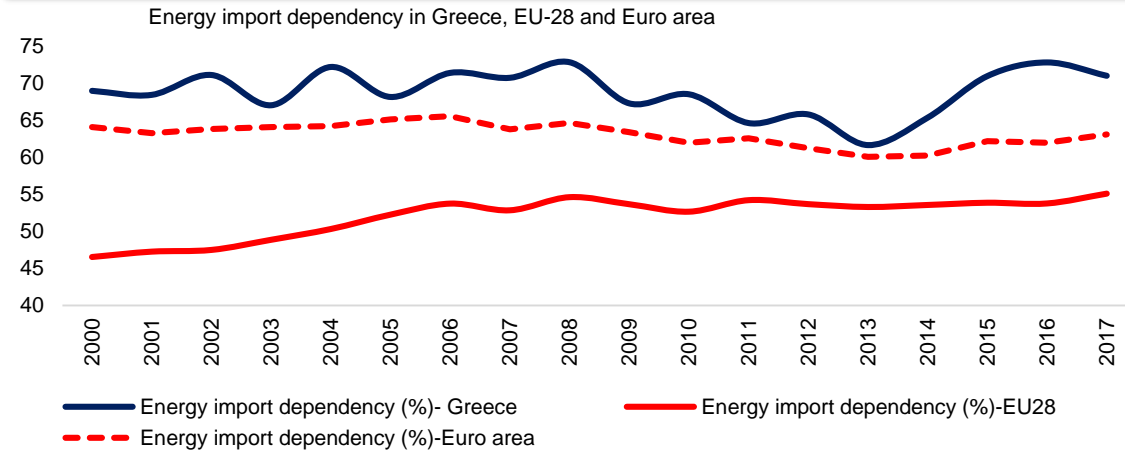
- Consumption by sector includes transport, the largest energy consumer, absorbing 35% of TFC, the residential sector (26%), industry (19%) -which includes non-energy use-commercial and public services (12%) and other final consumption (8%), which includes agriculture, fishing and forestry.
- In transport, 97% of consumption in 2017 was oil (mostly refined petroleum) and 3% renewable energy, mostly biofuels.
- The residential sector consumes electricity (39%), refined oil (29%), renewable energy (23%) and natural gas (8%).
- Industry consumes oil and electricity (34% each), natural gas (21%), coal (6%) and renewable energy (4%).
- Commercial and public services use electricity as their main fuel (85%) and to a lesser extent natural gas (8%), oil (6%) and renewable energy (2%).
- Other final consumption includes oil (55%), natural gas (26%), electricity (17%) and renewable energy (2%).

TFC distribution of fuels

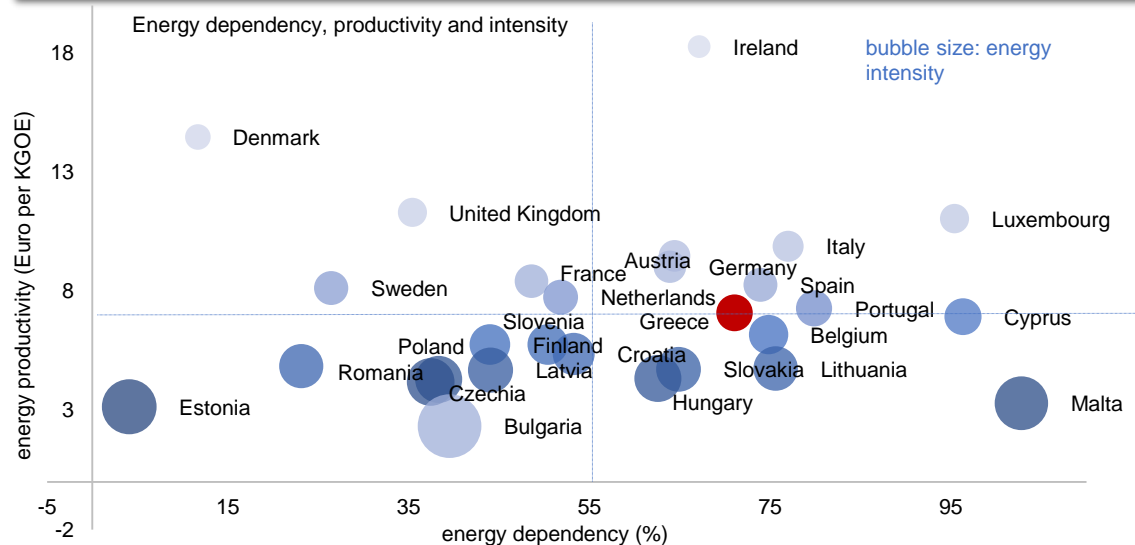
- Conversely, by fuel, oil is mostly used in transport (64%), residential sector (14%) and industry (12%) (2017).
- Electricity is used by residences and commercial and public services, each consuming 36%, followed by industry (23%) and other final consumption (5%).
- Renewable energy is primarily used for residential purposes (73%), with smaller shares consumed by transport (12%), industry (10%), commercial and public services (3%) and other final consumption (2%).
- Natural gas is a basic fuel for industry (43%), residential sector (23%), other final consumption (23%) and commercial and public services (10%).
- Coal is used almost exclusively in industry (97%) and 2% in the residential sector.



Supply security remains a high priority, since Greece imports almost 100% of its crude oil and natural gas, accounting for 2/3 of TPES



Energy productivity in Greece is equal to the EU-28 average, despite higher energy dependency



Source: Eurostat – Energy Statistics, Data processing: Alpha Bank

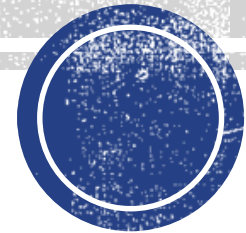
Energy import dependency

- Energy import dependency is defined as net energy imports (imports minus exports), over gross available energy, whereas energy security is a country's ability to continue its operations covering its energy needs.
- Energy import dependency and security are interconnected since higher dependency from sources outside a country's control means lower security, increasing the possibility of a disruption in energy flows.
- Greece imports almost 100% of its crude oil and natural gas, which account for c. 2/3 of its TPES. Consequently, supply security remains a high priority policy.
- Overall energy import dependency of Greece stood at 71% in 2017, above the Euro area average (63%), implying relatively high dependency on imports.
- Cyprus and Malta are the most energy dependent European countries (96% and 103% respectively) and Estonia the least (4%).

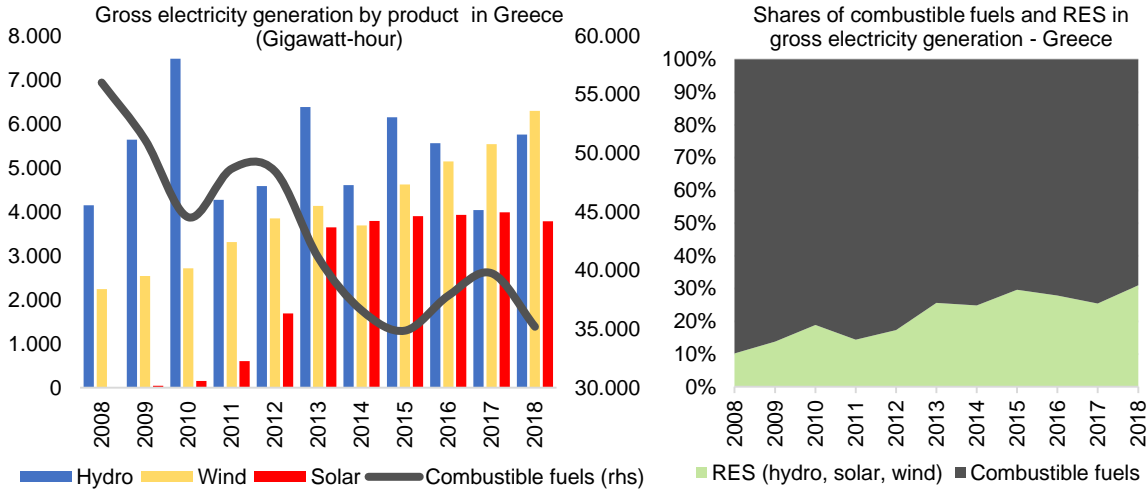
Energy import dependency and productivity/ intensity

- Both energy productivity and energy intensity measures are used as energy efficiency indicators, but with a reverse effect: the least energy productive countries are also the most energy intense.
- Energy productivity measures the productivity of energy consumption and provides a picture of the degree of decoupling of energy use from growth in GDP. Higher energy productivity implies higher energy efficiency.
- Energy intensity is one of the indicators to measure the energy needs of an economy. Higher energy intensity implies higher cost to convert energy into GDP and lower efficiency.
- In terms of energy productivity, Greece stood at the European average in 2017 (at 7.1 EUR per kilogram(s) of oil equivalent or kgoe). In energy intensity, Greece stood at a lower than the European average level (140.8 EUR per kgoe vs 171.9 EUR per kgoe).
- Energy dependency does not seem to be correlated with energy productivity or energy intensity.

Electricity



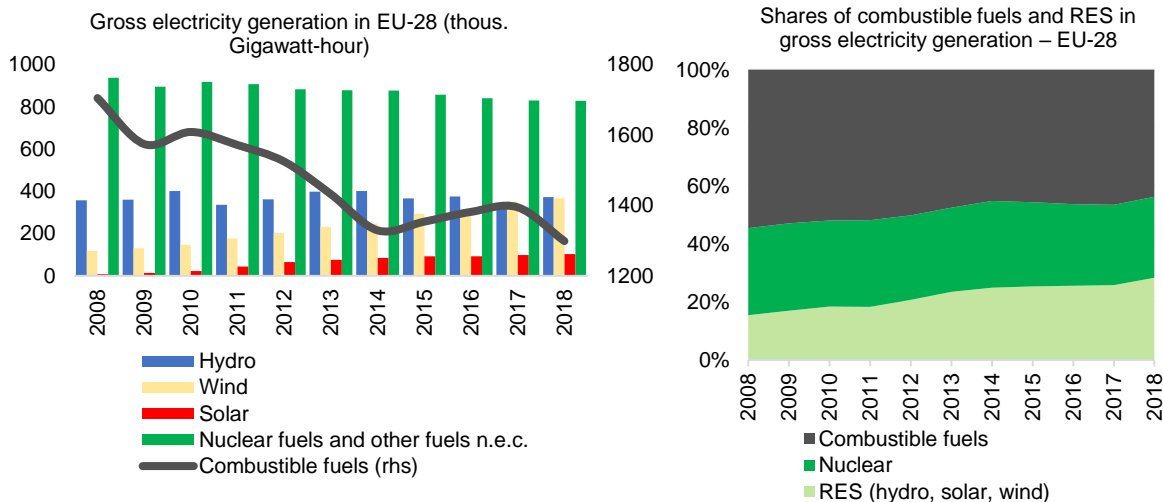
Electricity generation uses fewer combustible fuels in 2018 and more RES, mainly solar and wind



Electricity generation in Greece

- Gross electricity generation by main activity producers (including CHP -Combined Heat and Power- generation) amounted to c. 51 thous. Gigawatt-hour (GWh) in 2018, cumulatively reduced by 18% in 2018 compared to 2008, mainly as a result of the economic crisis.
- Electricity generation has substantially shifted its energy mix since 2008 towards RES (hydro, wind, solar) and in particular solar and wind.
- Combustible fuels (coal, natural gas, liquid and other fuels combustion, such as biomass of wood and waste) comprised 69% of gross electricity generation in 2018, reduced by 37% since 2008.
- Biofuels produce a negligible amount of electricity (less than 1%).
- Coal is still the dominant fuel in electricity generation, followed by RES and natural gas.
- RES in gross electricity generation over doubled in 2018 compared to 2008, standing at 31% of production, up from 10% in 2008.
- Solar energy share stood at 7% of gross electricity generation in 2018, up from c. 0% in 2008.
- Wind energy accounted for 12% of renewable electricity generation in 2018, being almost tripled since 2008.
- Hydro power's share increased to 11% in 2018, from 8% in 2008. Hydro power accounted for the largest share of renewable electricity before 2016, although with significant variance per year.

Combustible fuels in electricity generation are reduced less in the EU-28 than in Greece

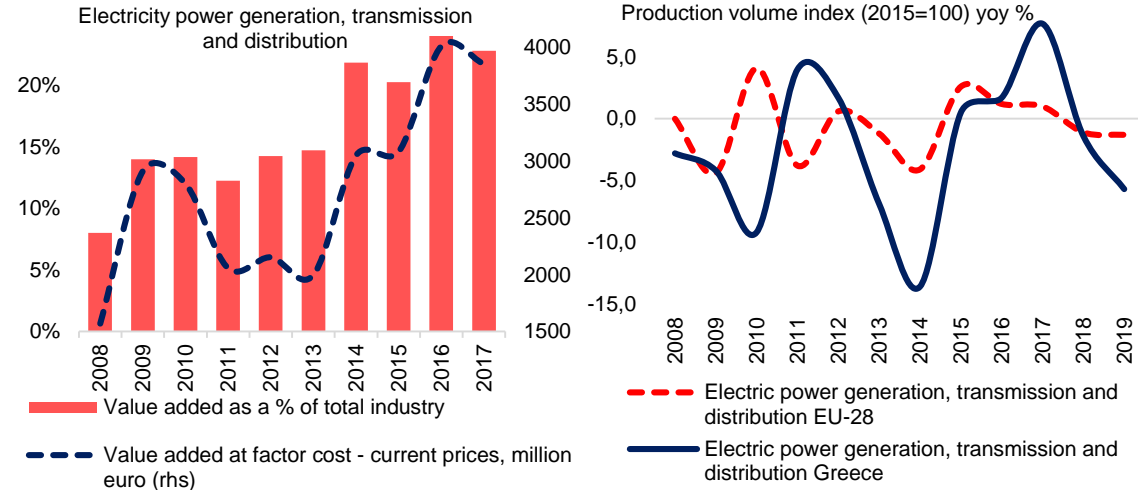


Electricity generation in EU-28

- In the EU-28, combustible fuels accounted for 44% of gross electricity generation, reduced by 24% in 2018 compared to 2008, less than the relative decrease in Greece.
- RES and nuclear power each comprised 28% of gross electricity generation.
- The share of other forms of energy (geothermal, tide, wave, ocean and others, such as heat from chemical sources) was negligible.



Electricity generation, transmission and distribution produce 23% of industry GVA or c. 1.9% of GDP



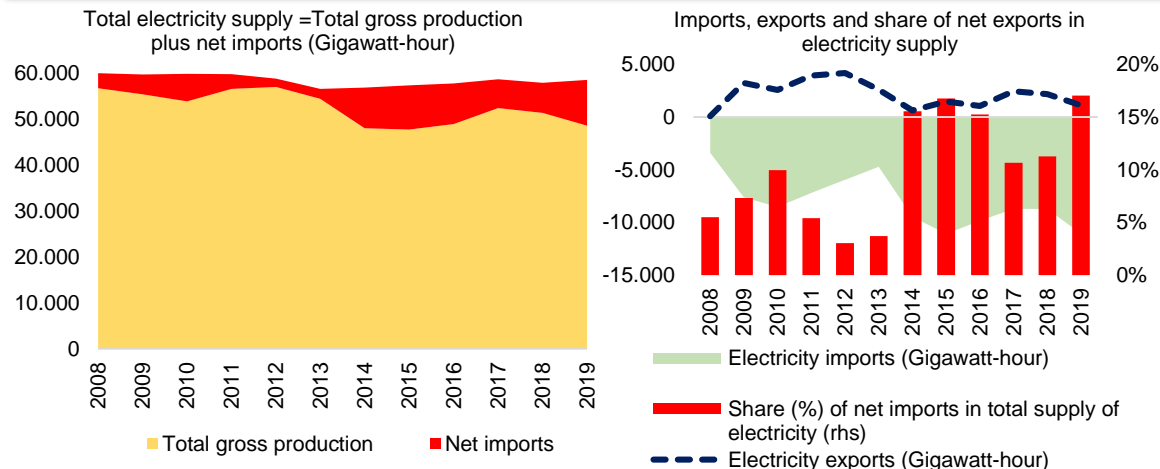
Production, GVA and investment

- Electricity power generation, transmission and distribution produced a GVA (value added at factor costs) of 23% of industry or c. 1.9% of GDP in 2017.
- Production volume index of electricity power generation, transmission and distribution dropped significantly during the crisis.
- From 2015 onwards, production gained pace, albeit a decrease in 2018 and 2019, following the European trend.
- Half of the sector's investment is in tangible goods and 42% in machinery and equipment. The share of the sector's investment in total industry stood at 24% in machinery and equipment, 20% in tangible goods, 28% in land and 9% in buildings construction and alteration (2017).

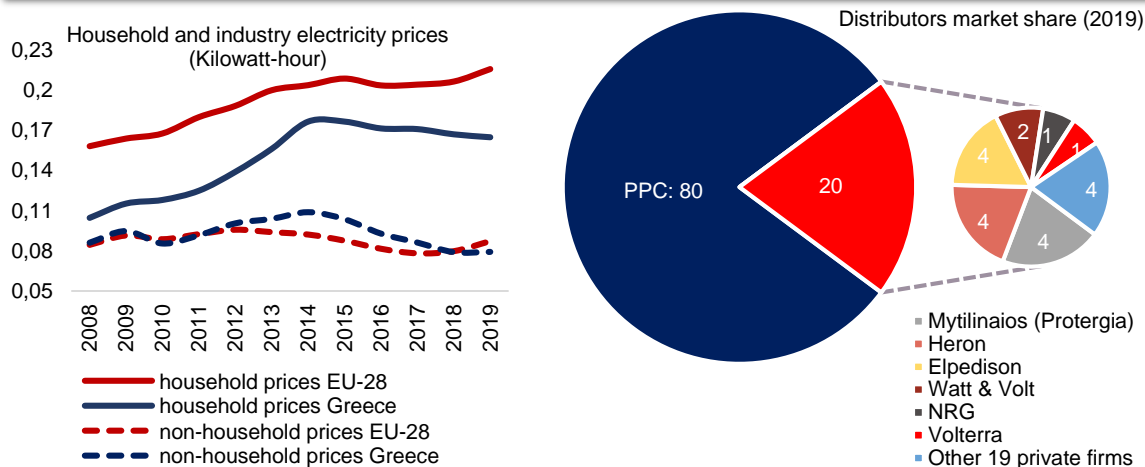
Electricity secondary supply and trade

- Electricity secondary supply is equal to total gross domestic production plus net imports (Eurostat definition).
- Total gross domestic production covered 83% of supply in 2019, reduced from 93% in 2009.
- Electricity imports contributed 19% of electricity supply in 2019 and come mainly from Bulgaria, Turkey, North Macedonia and Italy.
- Although Greece has been a net importer of electricity for years, it also exports electricity, primarily to Italy, North Macedonia, Albania, Bulgaria and Turkey.
- The share of electricity exports stood at 2% (2019) and of net imports at 17%.
- Electricity imports in Greece are anticipated to rise in the coming years, as a result of increasing electricity demand, in line with the country's economic recovery.

Greece is a net importer of electricity, with net imports covering a low share (16%) of total supply



PPC's share in the retail market, as a distributor of electricity, remains relatively high



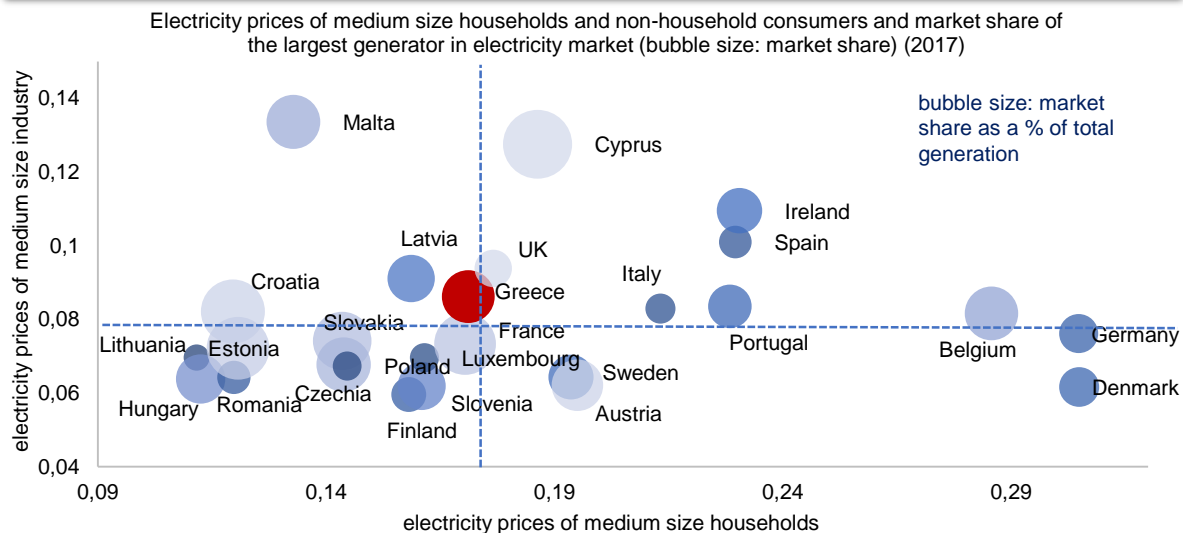
Market shares

- Although electricity competition in Greece has increased, it remains weak.
- The Public Power Corporation (PPC) is still the largest generator, with a total generation share of 58.7% (2017), higher than the EU average (47.5%), significantly reduced compared to 2008 (92%).
- The highest market share of the largest generator belongs to Cyprus (100%) and the lowest to Lithuania (14.2%).
- The PPC's share in the retail market -as a distributor of total electrical energy supply- also remains high, at 79.8% in 2019 (from 94.4% in 2016).
- Other distributors with a market share above 1% (2019) in electricity distribution are Heron (4.1%), Protergia-Mitilinaios (4.2%), Elpedison (3.4%), NRG (1.4%), Watt & Volt (2%), Volterra (1.3%). Other companies (in total 25) include ELTA, KEN, Volton, Zenith, Attica Gas and others.

Electricity prices

- High market shares of largest electricity generators imply high market concentration and are likely to be positively correlated with medium size industry prices.
- Greece stood below the EU average in electricity prices for medium size households (at 0.1711 EUR per kilowatt-hour or kWh vs a European average of 0.1799 in 2017)*.
- In electricity prices for households, Greece ranked 12th among the other European countries in 2017, much below Germany (0.3048 EUR per kWh), which had the highest price, together with Denmark.
- On the other hand, Greece stood at 0.0862 EUR per kWh in electricity prices for industry consumers, above the European average of 0.0800 EUR per kWh (2017).
- Greece had the 7th higher electricity price for industry consumers among the other European countries, standing above Germany (0.0761 EUR per kWh), Italy (0.0829 EUR per kWh) and France (0.0733 EUR per kWh). Cyprus exhibited the second highest industry electricity price, with the largest market share.
- Electricity prices followed the same trend as in other European countries, increasing until 2015 and then decreasing, for both households and industry.

Electricity prices of households and industry in Greece are close to the European averages



Source: Eurostat – Energy Statistics, HEnEx, HAEE, Data processing: Alpha Bank

*There is no market share for Bulgaria and the Netherlands and thus are not included in the data. For Austria and the UK the data for the market share refers to 2013.

Although PPC still dominates the market, several steps have been made towards the liberalization and deregulation of the wholesale and retail power markets in order to increase competition

Liberalization of the electricity market

- The basis for the liberalization of the Greek electricity market was set in 1999, by Law 2773/1999, which regulated some key points of the national energy policy and introduced the Regulatory Authority of Energy (RAE) that monitors and controls the electricity market.
- In 2011, new legislation was introduced in order to transpose the 3rd EU directive into national law and reform the electricity sector, creating a new regulatory framework to assist the Internal Market for Electricity (IEM) and introduce the transition from the Independent System Operator to the Independent Transmission Operator (ITO) model, enhancing the role of the energy regulator (RAE).
- Greece has been fully liberalized in electricity prices since 2013, due to changes in supply and demand, generation cost, transmission, distribution and taxation levels.
- The system operation is run by LAGIE, the operator for the wholesale market, DAPEEP, which is responsible for renewable energy, the Independent Power Transmission Operator (IPTO or ADMIE), which is the electricity transition system operator and HEnEx, which is the clearing house for sale and purchase of energy. The distribution is made by DEDDIE, which is in charge of the operation, maintenance and development of the Greek distribution network.
- ADMIE is jointly controlled with State Grid of China.

The NOME model

- The introduction of NOME-type auctions (Nouvelle Organisation du Marché de l' Electricité) in 2016 was a tool for the reduction of the PPC's large market share, also setting the basis for ending the PPC's monopoly in the country's two cheapest sources of electricity production, i.e. lignite and hydropower.
- Based on this model, PPC is required to sell through auctions large amounts of electricity produced at its lignite-fired and hydropower stations to independent, private-sector competitors at prices related to the production cost.

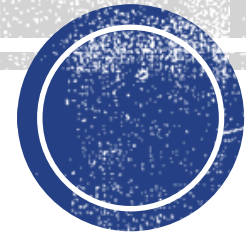
The Hellenic Energy Exchange (HEnEx)

- In 2017, the public company market operator LAGIE and the Athens Stock Exchange signed a memorandum of cooperation, aiming to establish the Hellenic Energy Exchange (HEnEx). The formation of the HEnEx is a basic reform in line with the European regulations, aiming to enhance competition.
- The HEnEx is designed to replace the current mandatory pool system by the end of 2019. It organizes and operates the new electricity, natural gas and environmental Greek markets.

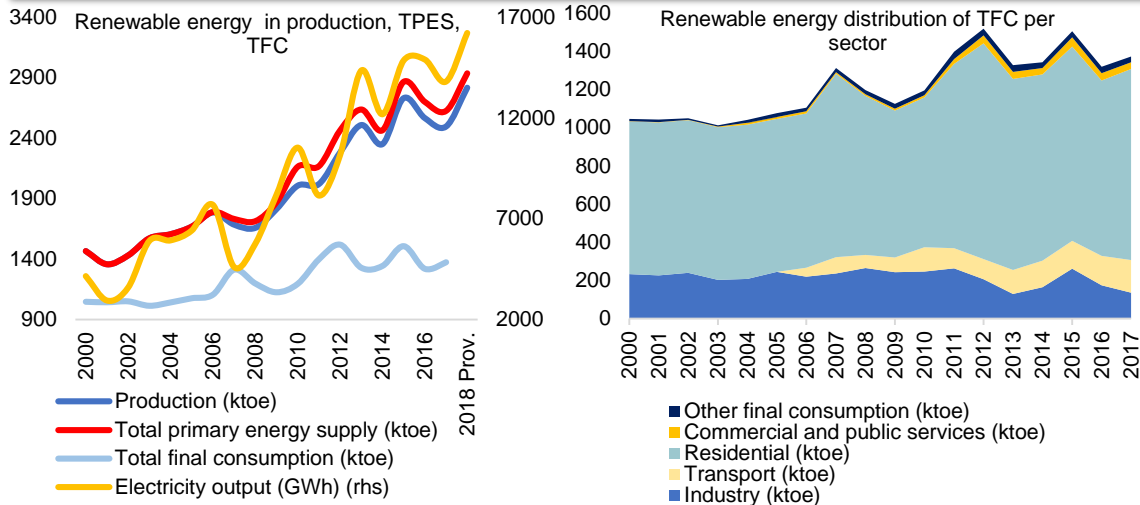
Electricity interconnections

- Greece has significant potential to grow the shares of RES in electricity production once its non-interconnected islands (NIIs) become integrated into the mainland electricity system. Currently, the level of electricity interconnectivity stands at 9.3%, as indicated in the Greek draft NECP.
- Interconnections are critical for enhancing the security of electricity supply. Interconnection projects are approved by RAE through the Ten-Year Network Development Plan (TYNDP). There are still 29 autonomous electricity systems of NII.
- There are 7 key projects with sub-projects to start being implemented before the end of 2021. They include: a) the first and second branch to Peloponnese, each of 400 kV, b) OHL Megalopoli-Patras-Achelooos and Megalopoli-Korinthos-Koumoundouros, c) Skiathos island interconnection, d) Crete interconnection (Phases I and II), e) New 400 kV interconnector to Bulgaria, f) N. Santa (GR)-Maritsa (BG) and g) Cycladic Islands interconnections (Phases A, B and C).

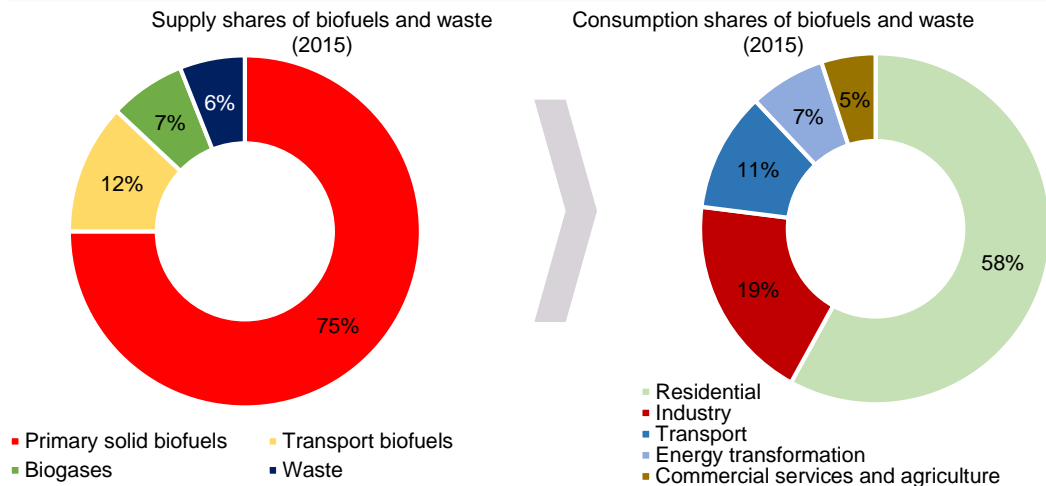
Renewable energy



Greece managed to rapidly develop high levels of renewable energy and diversify its energy mix



Biofuel demand comes from residential consumption, with only a small share from transport



Source: IEA database, Hellenic Association for Energy Economics, (HAEE), Data processing: Alpha Bank

Renewable energy in production, electricity, TPES and TFC

- Renewable energy includes RES (hydro, wind, solar), biofuels and waste. The latter account for almost half of renewable energy mix.
- RES are mainly used for electricity generation, whereas biofuels and waste are mostly used in energy consumption.
- Renewable energy in TPES increased by 71%, with a share from c. 6% in 2008 to 13% in 2018, mainly due to the rapid growth in wind and solar installed capacity.
- In domestic energy production, renewable energy increased by 70% in 2018 compared to 2008, with a share of 38%, up from 17% respectively.
- Greece held the 2nd higher share of solar photovoltaics (PVs) in TPES of all IEA countries, after Spain (2016).
- Renewable energy more than doubled in 2018 compared to 2008 in electricity, with a share of 36% in gross electricity generation (from 13%) and 31% in combined heat and power gross electricity generation.
- Renewable energy in TFC was 8% in 2017 (2007: 6%), absorbed primarily by the residential sector (73%) and then by transport (12%, from 6% in 2007), industry (10%), commercial and public services (3%) and other final consumption (2%).
- Renewable energy in TFC is in a large part in the form of biofuels and waste. A smaller part is RES, mostly in solar thermal collectors in residences and commercial solar heating and cooling installations.

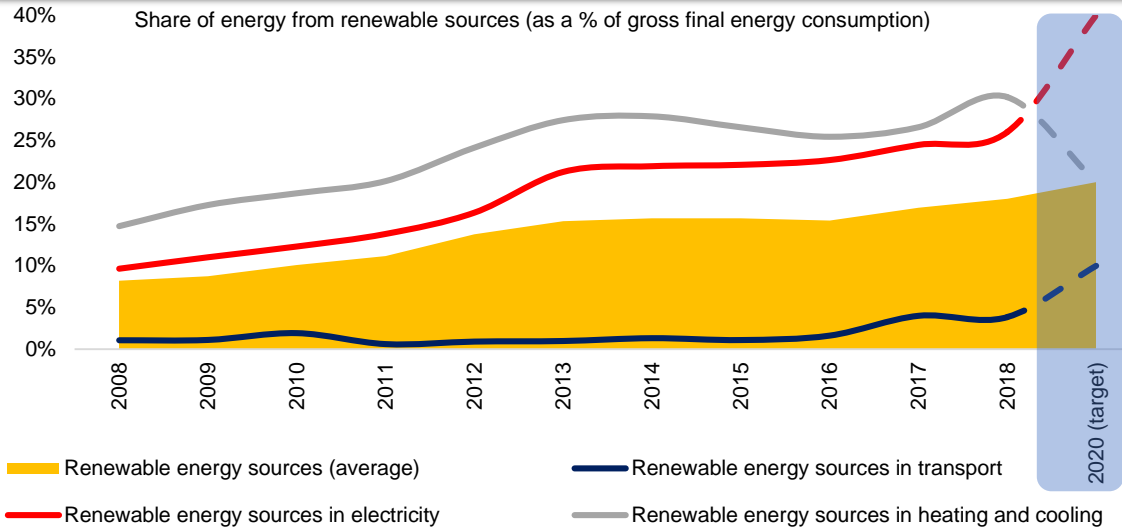
Biofuels and waste

- A large part of renewable energy is biofuels and waste, out of which primary solid biofuels (75%), transport biofuels (12%), biogases (7%) and waste (6%) (2015).
- Biofuels and waste are used by residences (58%), industry (19%), transport (11%), energy transformation (7%), commercial services and agriculture (5%).
- Solid biofuels are used for heating in residential boilers. Biomass* is used in food and wood industries for space and process heating.

* Include mainly straw, olive pruning, olive kernels, cotton stocks, wood residues



Greece is close to its 2020 renewable energy target (20%), standing at 18% in 2018



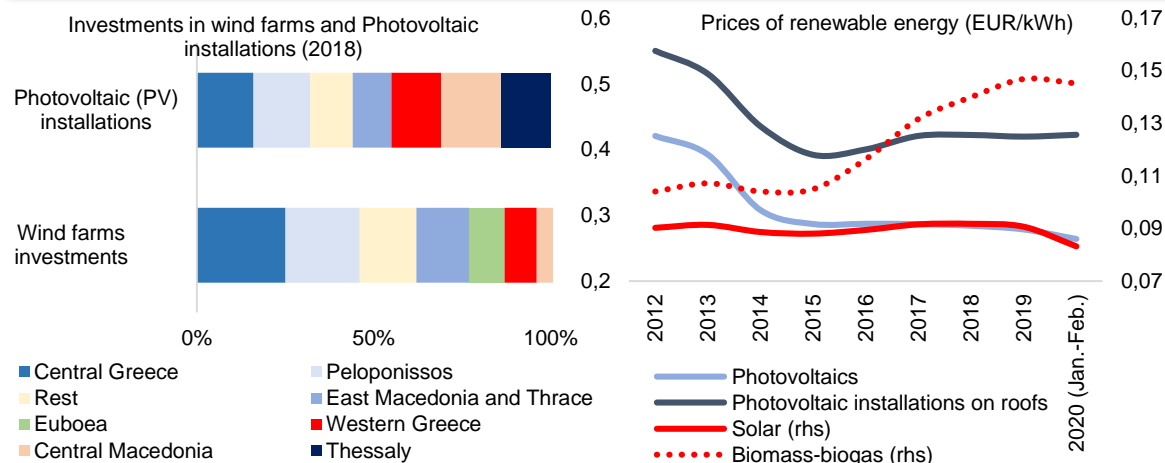
Renewable energy targets

- Renewable energy share of gross final consumption* (definition of cf. Article 2f of Directive 2009/28/EC) in Greece was 18% in 2018, close to the 20% 2020 target.
- Greece stood at the EU-28 average in 2018, ranked 13th among EU countries, higher by 10 p.p. in heating and cooling and lower by 4 p.p. in transport.
- The sectoral targets for gross final consumption share in 2020 are:
 - Heating and cooling, at least 20%, above that target in 2018 (30%)
 - Electricity, at least 40%, below that target in 2018 (26%)
 - Transportation, at least 10%, below that target in 2018 (4%)
- Although renewable energy use increases, Greece's ample potential for wind, solar, geothermal and biomass energy exploitation is not fully developed yet.

Renewable energy market and prices

- Investments in RES in Greece exhibited a dynamic growth until 2013, spurred by a generous framework and followed by an abrupt slowdown after 2014.
- Photovoltaic installations for solar power are spread uniformly across regions (16% of total capacity in Central Greece, Peloponnissos and Central Macedonia in 2018).
- Wind power farms in Central Greece and Peloponnissos accounted for 46% of total investment in 2018.
- The wind power sector comprised ten large producers in 2018: Terna Energy, Anemos (Ellaktor), Iberdola Rokas, EDF Hellas, EREN Group, ENEL Green Power, Mytilineos Group, CF Ventus, PPC Renewables, ENTEKA, Eunice and RF Energy. Terna recently bought the wind farms of RF Energy, with an expected total power of more than 400 MW.
- Installed capacity per manufacturer in wind power is dominated by four firms, namely by Vestas, Enercon, SGRE and Nordex.
- The PPC owns all hydro assets.
- Regarding prices of electricity from renewable sources, a great fall was recorded in photovoltaics (to EUR 0.264/kWh in 2020) and photovoltaic installations on roofs, with the latter being the most expensive form of renewable energy, at EUR 0.422/kWh at 2020.
- Solar power has much lower prices and it also exhibits a downward trend, although slighter, currently standing at EUR 0.083/kWh (2020).
- On the contrary, the price of biomass/biogas is constantly increasing since 2015, whereas in the first 2 months of 2020 it reached on average EUR 0.1451/kWh.

Prices for photovoltaics have been reduced significantly, although they remain relatively high



Source: Eurostat – Energy Statistics, LAGIE-DAPEEP, Data processing: Alpha Bank

*Gross final energy consumption refers to the energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production, and including losses of electricity and heat in distribution and transmission

Renewables in Greece can increase energy supply security, promote energy interconnections and support economic growth

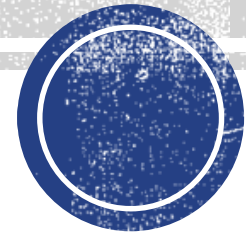
Policies and measures for renewable energy in Greece

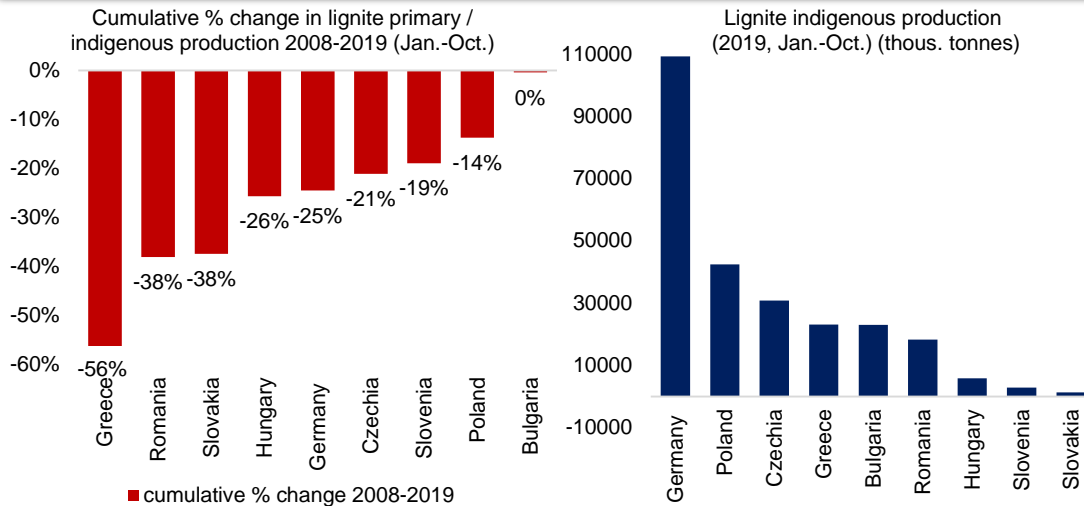
- Since the 1990s, electricity generation was mainly driven by hydroelectric plants, with wind turbines emerging after a decade, increasing their share. Law 3468/2006 was the first legislative framework to promote electricity generation from solar power, setting a high priority in promoting the RES energy production.
- Greece developed its policy framework under the EU Renewable Energy Directive (Directive 2009/28/EC). During 2006-2015, Greece promoted electricity generation from renewable energy sources through Feed-in-Tariffs (FiT). A new legal framework in 2016 introduced a renewable energy support program in order to integrate renewable energy sources into the electricity market.
- In recent years, various regulatory measures were adopted in order to help increase the penetration of renewable energy, by providing operational support/guidance to renewable energy installations for commercial or pilot operations in the interconnected electricity transmission system and distribution network, but also by reducing the time required in the licence process. Two support schemes are available: an FiP (Feed-in-Premium) above the electricity market price and a fixed price support.
- The entities that work together closely to support the development of the renewable energy in Greece are the Ministry of Environment and Energy, the Regulatory Authority for Energy (RAE), the market operator (LAGIE), the Independent Power Transmission System Operator (ADMIE), the Hellenic Electricity Distribution Network Operator (HEDNO) and the Centre for Renewable Energy Sources and Saving (CRES).
- In the current crisis emerging due to the COVID-19 pandemic, investing in renewable energy is expected to be more resilient than other energy forms, not so much because of its “greenness”, but more because of the stability of cashflows from underlying assets (Centre for Climate Finance and Investment, ICBS).

Hybrid systems

- Hybrid renewable energy systems are power systems for providing electricity to remote areas, by using advanced technologies and allowing for energy to be stored and efficiently distributed. They usually consist of two or more renewable energy sources, which are combined in order to increase energy system efficiency.
- Higher variable renewable energy penetration can be achieved via hybrid systems and integration of energy storage technologies. RAE has prepared a new energy storage support framework to foster renewable energy growth.
- Only 10% of the total installed renewable energy capacity (excluding hydro) is located on the islands since demand is lower compared to the mainland and also because of technical restrictions due to the variable nature of wind and solar energy. Hybrids can help with the energy storage in the Greek islands. The PPC constructed a hybrid energy station in Ikaria, which combines solar and hydro energy stored in batteries, being the first operating in Europe.
- In March 2020, RAE approved the first licenses for hybrid systems electricity generation projects in nine non-interconnected islands, unblocking c. 170 other relevant applications. These first licenses concern the German company Accusol which has already installed a pilot hybrid system in Karpathos.
- Renewable energy penetration in addition to the existing achievements of Greece involves taking more technical measures, in order to further integrate solar and wind power. Greece also needs to strengthen its internal transmission network and interconnect many NIIIs with the main network.

Fossil fuels

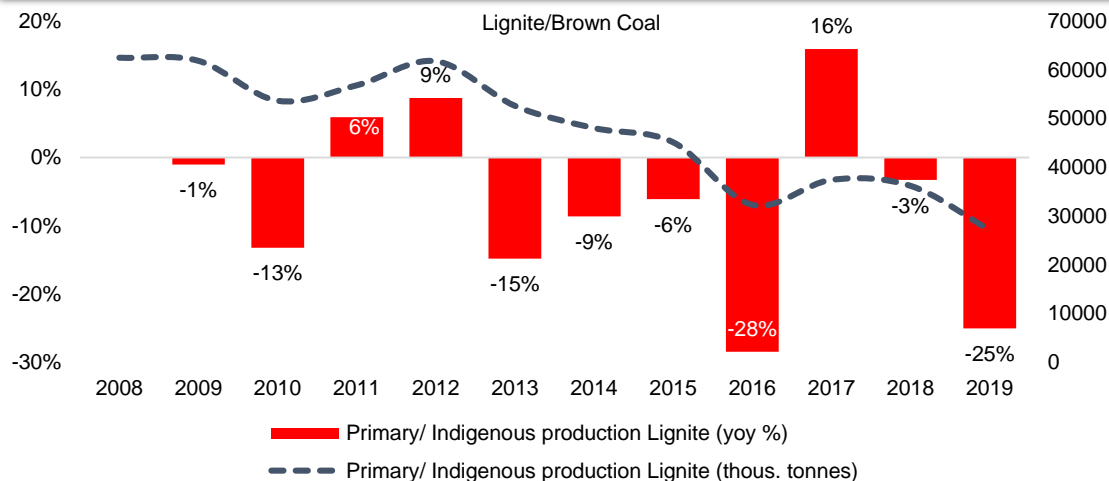


Lignite in Greece has the largest decrease among other producing countries from 2008 to 2019

Coal and lignite

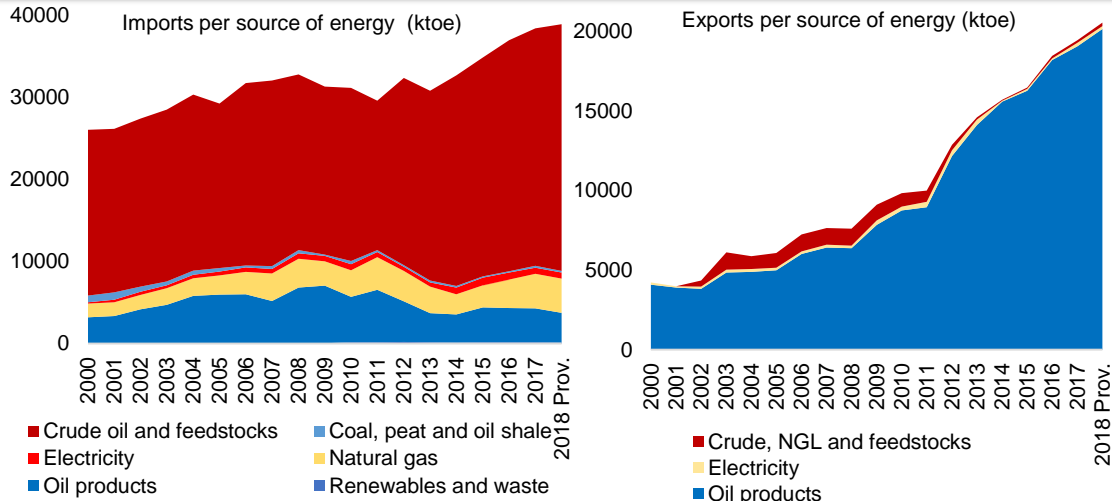
- Coal use has been reduced in various regions across the globe, in Europe but also in USA, while demand continues to rise in China and India.
- Mainly used in electricity generation, coal was nearly halved worldwide in the decade 2006-2016, due to decreasing energy generation by coal-fired plants and substitution by other forms of energy, like renewable and nuclear energy.
- Lignite or brown coal is the lowest quality coal, producing high levels of air pollutant emissions.

Lignite in Greece and the EU-28

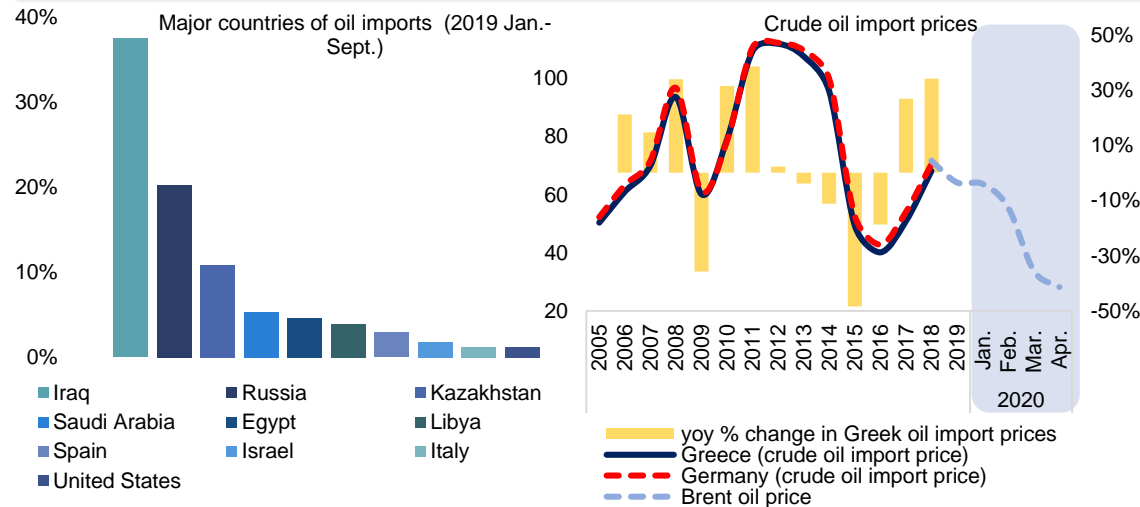
- Greece is nearly self-sufficient in lignite production and ranks 4th in 2019 among the EU-28 countries that produce it, after Germany -the largest producer- Poland and Czechia.
- Other countries not in the EU-28, but larger lignite producers than Greece are Turkey and Serbia.
- Lignite production in Greece cumulatively decreased by c. 56.5% from 2008 to 2019, since it is gradually being replaced by RES and natural gas-fired plants.
- This fall was the highest among the first 5 largest EU-28 producers (-38% in Romania and Slovak Republic, -19% in Slovenia).
- Greek lignite is the 2nd dominant fuel in TPES, accounting for 20% in 2018, down from 27% in 2008.
- Lignite is mostly used in electricity generation in Greece, for which it is the dominant fuel, with the PPC owning all the lignite assets.
- The access to lignite production by third parties and/or the sale of PPC lignite production sites is required by the European Commission.

Lignite production in Greece is almost continuously decreased during the period 2008-2019


Greece is totally dependent on oil imports, while refined petroleum is the top exported product



Could there be a negative impact on global oil markets amid SARS-CoV-2 spread?



Oil imports and exports

- Crude oil and feedstocks are the main imported energy products in Greece, reaching 77% of total energy imports, up by 41% in 2018 compared to 2008. Oil imports account for c. 100% of TPES, due to insignificant crude oil production.
- Oil import sources have been diversified successfully over the years, so that dependence from the OPEC countries has been reduced. The still dominant oil suppliers are Iraq (38%) and the Russian Federation (20%).
- The Greek energy exports comprise refined petroleum and oil products, with a share of 98% (2018). Greece exports oil products to European markets, but also in Lebanon, Egypt, Saudi Arabia, Turkey, Singapore, South Korea and other countries.
- Exports of refined petroleum increased substantially during the economic crisis, due to low domestic demand and is the top exported product (27% of total exports).

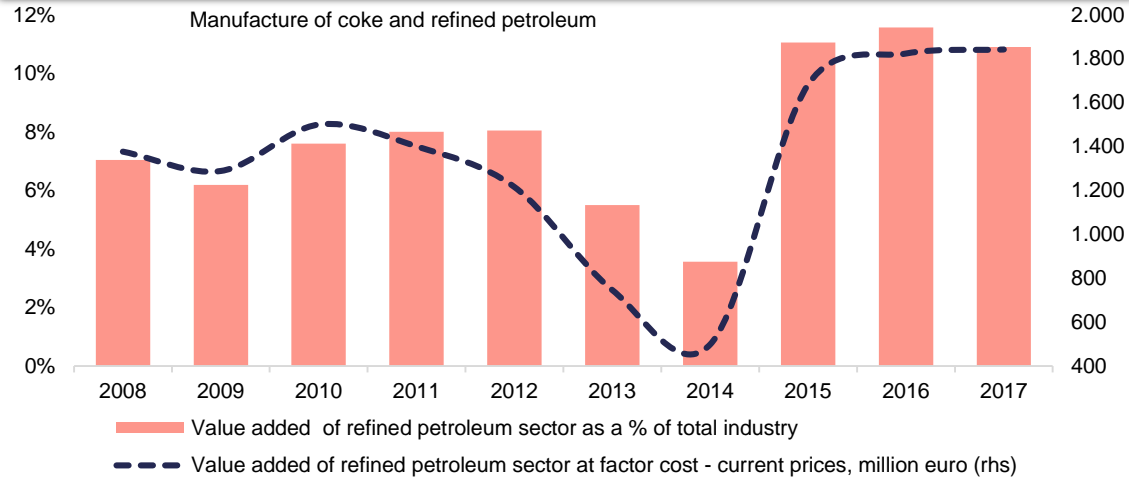
Great fall in oil prices amid SARS-CoV-2 spread

- The crude oil import price rose by 34% yoy in 2018, to USD 68.14/barrel, the highest since 2014 (USD 50.81/barrel in 2017), after a 4 year fall. The trend of the Greek crude oil import price is the same as Germany's.
- Brent oil has been decreasing since 2018, standing at USD 33.7/barrel* on average in March and at USD 28.1/barrel during the first 23 days of April 2020.
- Oil markets are currently crashing at the worst rate since the first Gulf war in 1991, amid a price war between Russia and Saudi Arabia.
- Prices are also affected by the new COVID-19 pandemic, since supply chains are stretched, labor shortages are emerging and travel is limited.
- Demand for oil has fallen faster and further than any other time. On April 12th the world's largest oil producers reached a new deal to try to support prices. OPEC and Russia would reduce production by 9.7 mn barrels a day from May to the end of June and restrain output for two years.
- Lower energy prices affect oil export countries and drill companies, but they could also affect even clean energy companies that will be less competitive as the cost of oil plummets.
- According to McKinsey, rebound is expected but a long-term effect is considered likely amid a continuation of virus spread and a further depression of prices.

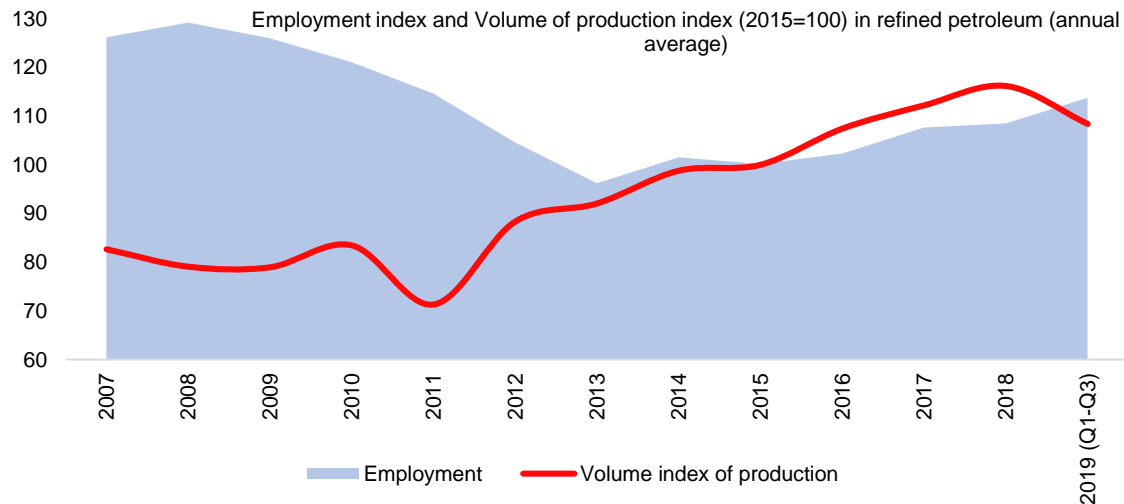
*Averages based on daily data. Brent oil prices might differ from crude oil import prices, but exhibit on average the same trend. According to OECD, crude oil import prices come from the IEA's Crude Oil Import Register and are influenced not only by traditional movements of supply and demand, but also by other factors such as geopolitics.



Refined petroleum sector GVA has risen after a great fall during the crisis



The large fall in employment during the crisis was slightly reversed since 2014



Source: Eurostat – Structural Business Statistics, Data processing: Alpha Bank

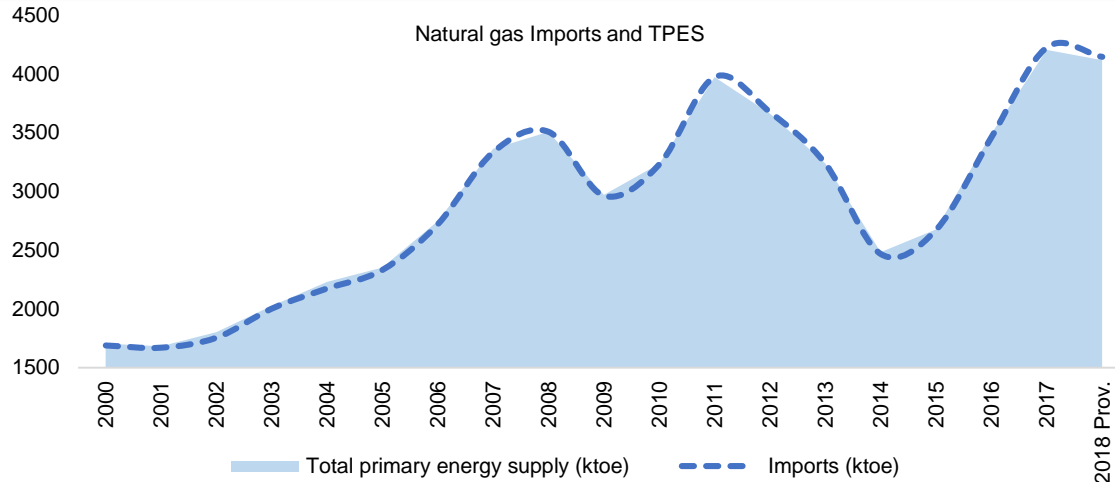
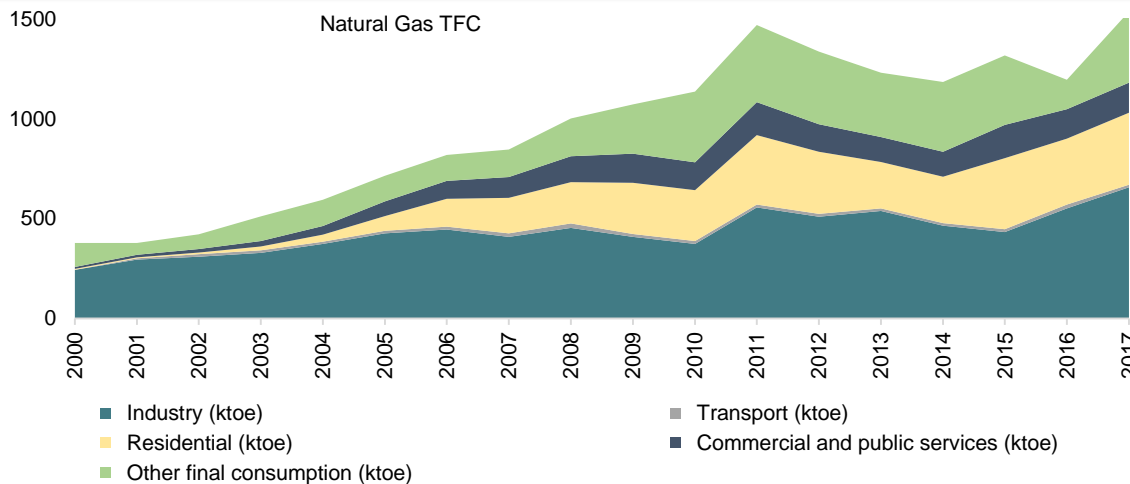
Production and employment

- Imported crude oil is refined in domestic refineries and refined petroleum is the main oil product manufactured in Greece.
- Manufacture of coke and refined petroleum produced 11% of the Greek industry's GVA (2017 at factor cost) and c.1% of GDP, significantly increasing after 2015, recovering the losses of the previous years.
- Refined petroleum output increased by 57% from 2011 to 2016, due to various upgrading and expansion projects. The rise continued until 2018, but during 2019 (Q1-Q3) there was a small drop.
- The large fall of employment in manufacture of coke and refined petroleum during the crisis has been reversed, but employment still lags the pre-crisis levels.

Market and infrastructure

- In the Greek oil market there are two refining companies, Hellenic Petroleum (HELPE) and Motor Oil, with their subsidiaries in the wholesale and retail markets.
- HELPE operates 3 refineries (Aspropyrgos, Elefsis, Thessaloniki), accounting for 65% of total refining capacity. Motor Oil's Agioi Thodoroi refinery produces 35%.
- Greece's four refineries (out of 75 EU-28 refineries), have a primary refining capacity of 21.2 mn tonnes/year, representing 3.3% of total EU-28 capacity (2018).
- In the retail market, Motor Oil operates its subsidiaries, Avin Oil and Shell network, while HELPE merged its two retail companies (EKO and Hellenic Fuels) in 2016.
- Entry barriers in the market were reduced in 2013 and 2016.
- Greece has two oil pipelines, but only one of them (53 km) is operational, connecting HELPE's Aspropyrgos refinery to Athens International Airport.
- There are 7 ports in Attica and 3 in Thessaloniki, making a total of 10 oil terminals.
- Greece's combined storage capacity was c. 64 mn barrels (2015), sufficient to meet the IEA's 90 day oil storage capacity obligation (22 mn barrels).



Natural gas supply, almost fully covered by imports, stands at higher than pre-crisis levels

Natural gas consumption was more than doubled in the decade 2007-2017

Natural gas and Liquefied Natural Gas (LNG)

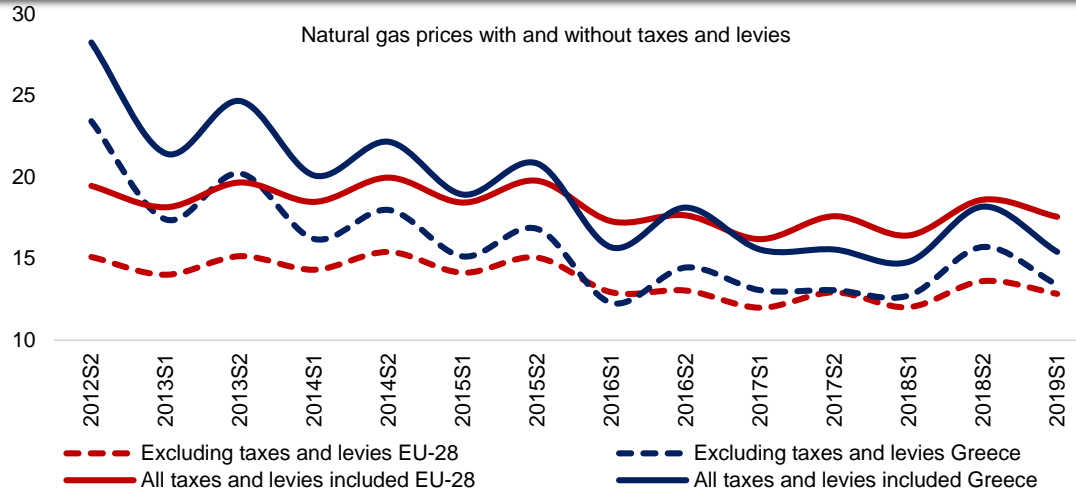
- Natural gas is a low pollutant emissions fossil fuel, identified as the transition fuel to a low-carbon economy (goal of the NECP-National Energy and Climate Plan, December 2019).
- Liquefied Natural Gas (LNG) comes from cooling down natural gas, transforming it into liquid form and then store and transport it in LNG tanker ships.
- Going forward, LNG could play a significant role in the energy market, since:
 - it can be transported by tanker ships
 - it does not necessitate the construction of large and expensive pipes
 - the respective technology is rapidly evolving
 - it is more environmentally friendly

Natural gas in TPES and TFC

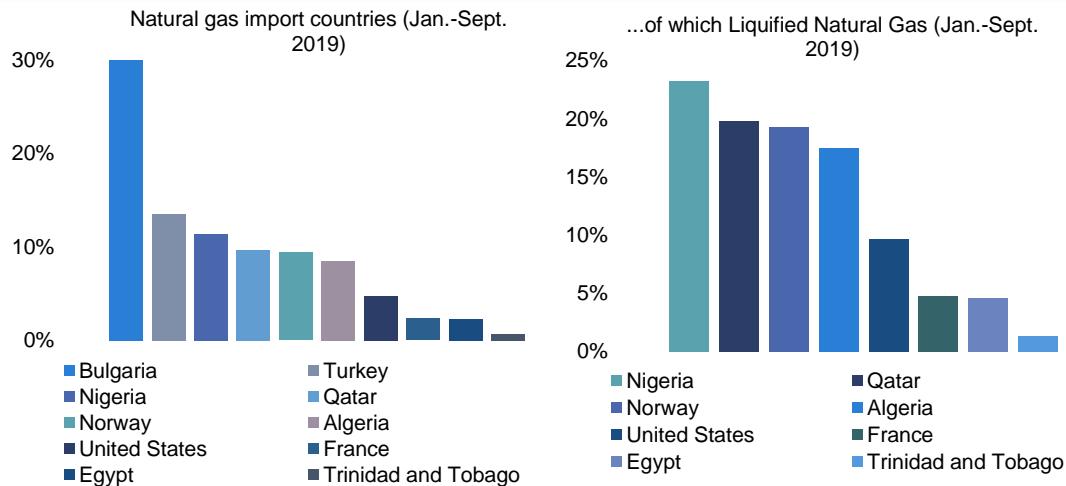
- Natural gas in Greece was the 3rd dominant fuel in 2018, accounting for 18% of TPES, up from 11% in 2007.
- Natural gas consumption increased cumulatively by 82% in the decade 2007-2017, while its share in TFC was more than doubled, from 4% to 9%, still relatively low compared to other IEA countries.
- It is a basic fuel for industry (43%), residential sector (23%) and other final consumption (23%).
- Natural gas-fired power production accounts for c. 66% of demand: retail market is c. 20% and the big industrials the remaining 14%.
- In Q4 2018, electricity generation gas-fired plants of Elpedison, Heron, Korinthos Power, Mytilineos and PPC contributed 40.4% of total (6.5%, 3.5%, 5.0%, 7.5%, 19.9%, respectively), up from 18% in 2013.
- Consumption is expected to increase due to the lower use of lignite and the subsequent rising production of natural gas-fired power plants, the expansion of the pipeline network and the higher use of LNG technologies for remote areas.



Natural gas prices in Greece are lower than EU prices with taxes and levies included



Natural gas import sources have been successfully diversified



Natural gas prices

- Globally, natural gas indexed-pricing is gaining ground over oil-linked pricing.
- Natural gas prices in Greece are susceptible to market peaks.
- In the first months of 2017, when natural gas demand hiked, prices in domestic market increased.
- The natural gas price without taxes and levies stood at EUR 13.4/GJ in the first 6M of 2019 (S1 2012: EUR 23.4/GJ), close to the euro area and slightly higher than the EU-28 average (EUR 12.8/GJ).
- Natural gas price with taxes and levies stood at EUR 15.4/GJ in the first 6M of 2019 (S1 2012: EUR 28.3/GJ), lower than the euro area (EUR 19.7/GJ) and the EU-28 average (EUR 17.6/GJ).
- Taxes as a component of the natural gas price stand at:
 - 17% for households, close to the average of the IEA countries.
 - 21% for industry, one of the highest among the IEA countries.

Natural gas imports

- Natural gas imports and trading in Greece were initially introduced by Law 2364/1995.
- Few import sources still dominate the market: Bulgaria is the largest supplier of Russian origin natural gas (9M 2019: 38%), followed by imports of Azerian origin natural gas from Turkey (9M 2019: 14%).
- Among others, Algeria, Egypt, Nigeria, Norway are also Greece's natural gas import countries.

Natural gas market

- DEPA system (DEPA Trade and DEPA Infrastructure), currently a public corporation under privatization, is dominant in the wholesale and retail market.
- Both DEPA Trade and DEPA Infrastructure have drawn considerable investment interest.
- Five domestic and four international energy groups currently expressed interest for the acquisition of 65% of DEPA Trade: C.G. Gas Limited, Hellenic Petroleum SA&Edison International Holding N.V, Motor Oil Hellas Corinth Refineries SA & PPC SA, GEK Terna SA, MET Holding AG, Mytilinaios SA, Power Globe LLC, Shell Gas BV, Vitol Holding B.V. HRADF.
- Companies active in the market are mainly producers and suppliers of electricity. There are two dominant companies, Zenith and Aerio Attikis, and more than eight other suppliers, most of them combining electricity and natural gas offers.

Natural gas market has been fully liberalized and various investments, pipeline and terminals projects are underway

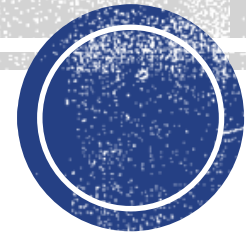
Regulatory framework

- Law 3428/2005 on the liberalization of the natural gas market was enacted, complying with the EU regulations. The Greek natural gas market has been fully liberalized since 2018.
- Since the liberalization of the market, DEPA has conducted auctions for part of the wholesale quantities sold, offering retailers the possibility to buy natural gas at low cost and increase competition.
- DEPA is the main importer of c. 76% of annual natural gas imports. DEPA has long term contracts with the Russian Gazprom until 2026, Turkish Botas until 2021 and Algerian Sonatrach until 2021.
- The retail market was transformed from a 3-player market (distributors and retailers) to a multi-player market. The market for big industrials and big commercials (B2B market) opened earlier, served by natural gas supply company DEPA, significantly penetrated by independent energy companies.
- Natural gas market operators and retailers operate in a 3 DSOs (Distribution System Operators) in Attiki (EDA Attikis), Thessaly and Thessaloniki (EDA THESS) and the rest of the country (DEDA DSO), with penetration rates at 36%, 54% and 10% respectively.
- EIB has announced that it will end financing for fossil fuel projects by the end of 2021, which except coal and oil, also include natural gas, a development that could block or delay the completion of future projects.
- Gas transport operator privatized (DESFA).

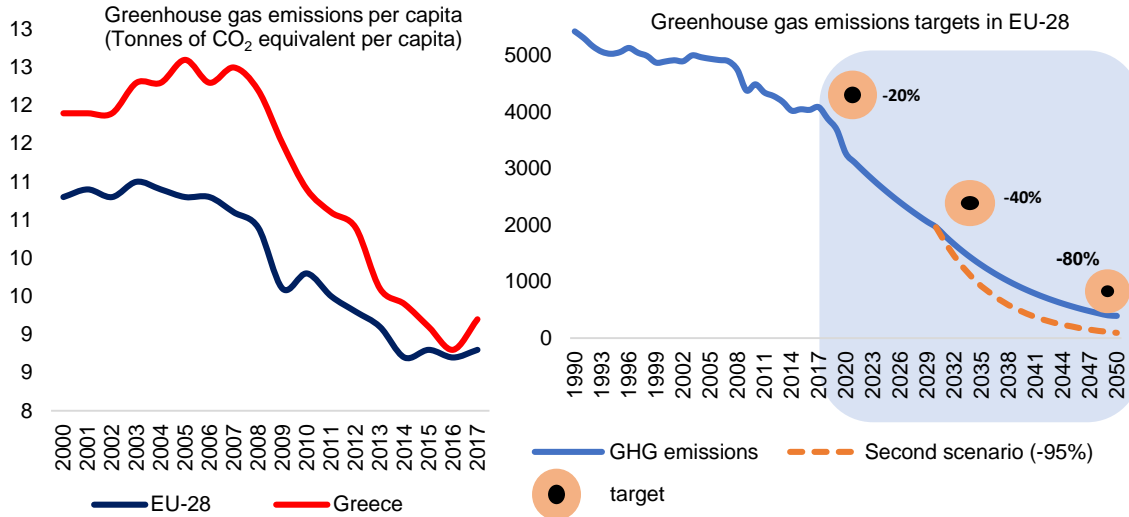
Natural gas and LNG projects

- According to the NECP, natural gas investment in international transport networks will reach 2.2 bn and in gas distribution and storage networks 2 bn.
- Europe worked at buying natural gas from the Caspian Sea and the Middle East, through the "Southern Gas Corridor" project, supported by the European Commission for a pipe network construction that would lead to the diversification of supply sources in Europe.
- The 1st part of the Natural Gas Interconnector Pipe Turkey-Greece-Italy (ITGI), connecting Turkey and Greece, started operations in 2017. However, the construction of the 2nd Greece-Italy (Poseidon pipe) part of the ITGI pipe is postponed due to the construction of TurkStream, replacing Azerian with Russian oil.
- Transadriatic Natural Gas Pipe (TAP) (91% completed in December 2019) is also competitive to ITGI.
- It transports the Azerian natural gas from Azerbaitzan to the West through the Caspian Sea and the "South Caucasus Pipeline", then through Erzerum in Turkey and TANAP (Trans Anatolian Natural Gas Pipeline) to the borders of Greece and Turkey and finally through TAP to Northern Greece, Albania and across the Adriatic Sea, to Italy.
- Interconnector Pipe Greece-Bulgaria (IGB), although initially planned to be connected with ITGI, will ultimately be connected with TAP.
- The intergovernmental agreement for EastMed, an offshore and onshore pipeline, at still low maturity level, was signed in January 2020 among Greece, Cyprus and Egypt.
- Underground Gas Storage (UGS) is under privatization process, aiming to exploit underwater natural gas field in South Kavala and currently standing at low maturity level.
- The construction of the Interconnector pipe Greece-FYROM (IGF) could also enhance Greece's position in the energy sector.
- By investing in LNG, Greece could become one of the most important liquefaction, storage and transport hubs in the broader geographical area:
 - Revithoussa LNG Terminal (station of storage and transport, export center): 2nd upgrade of the expansion completed.
 - Alexandroupolis Independent Natural Gas System (INGS) (offshore floating unit for reception, storage, re-gasification of LNG plus subsea and onshore gas transmission pipeline system): commercial operation expected to begin in 2022).

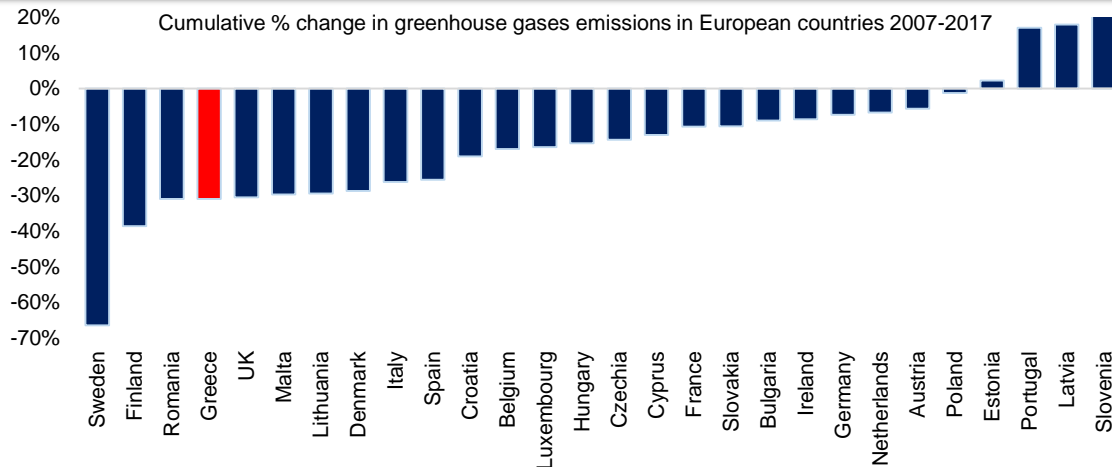
Energy and climate policies



Although higher in the past, Greek per capita GHG emissions have converged to EU-28 average



GHG emissions in Greece exhibit the 3rd largest reduction in EU-28 in 2007-2017



Greenhouse gas (GHG) emissions

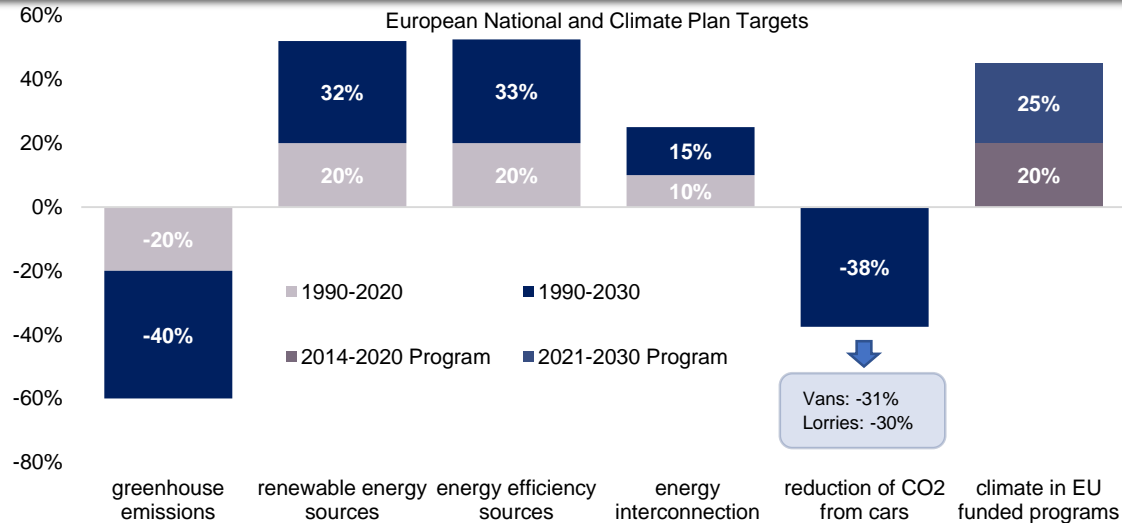
- Greenhouse gas (GHG) emissions rose by 2% globally in 2018, at the highest rate in recent times, after a decline in the period 2014-2016.
- Higher GHG emissions globally result from increasing energy demand and consumption, boosted by strong economic growth.
- Various countries contribute to the production of GHG emissions, while India and China, which are among the fastest growing economies, are also among the largest consumers of fossil fuels.
- GHG emissions in the EU-28, although largely declined over the previous decade, are still falling short of their long-term goals, as are also those in the USA.
- The EU targets for GHG emissions reductions are: -20% by 2020, -40% by 2030 and -80% (or -95% according to a second scenario) by 2050.

GHG in Greece and in the EU-28

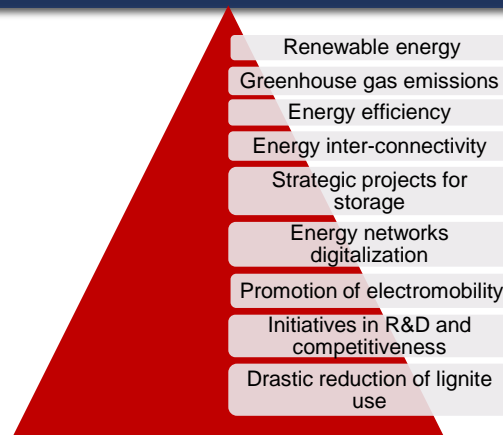
- The cumulative reduction of GHG emissions in Greece from 2007 to 2017 stood at -31%, the 3rd largest in the EU-28, after Sweden (-66%) and Finland (-39%).
- GHG emissions reached 9.2 tonnes of CO₂ equivalent per capita in Greece in 2017, at 2% of total EU emissions, with Germany holding the largest share (22%).
- Although slightly higher in Greece in 2017, per capita GHG emissions have converged to the EU-28 average since 2015.
- The energy sector held the largest share of total GHG emissions in Greece and in the EU-28, at 76% and 83% respectively in 2017.
- In Greece, the energy sector GHG emissions cumulatively decreased in 2017 by 35% since 2007, more than in the EU-28 (-17%).
- Greece still lags behind other countries in CO₂ emissions per capita and per TPES, but also in its nationally determined contributions to emissions reductions, according to the World Economic Forum Energy Transition Index (2019).



The Greek National Energy and Climate Plan sets more ambitious targets than the EU-28 plan...



...placing emphasis on renewable energy, efficiency measures for the acceleration of the islands' electricity interconnections



The Paris Agreement

- The Paris Agreement was the first global climate change agreement, adopted at the Paris climate global conference in December 2015, in the context of the further reduction of GHG emissions and economy decarbonization.

National Energy and Climate Plans (NECP)

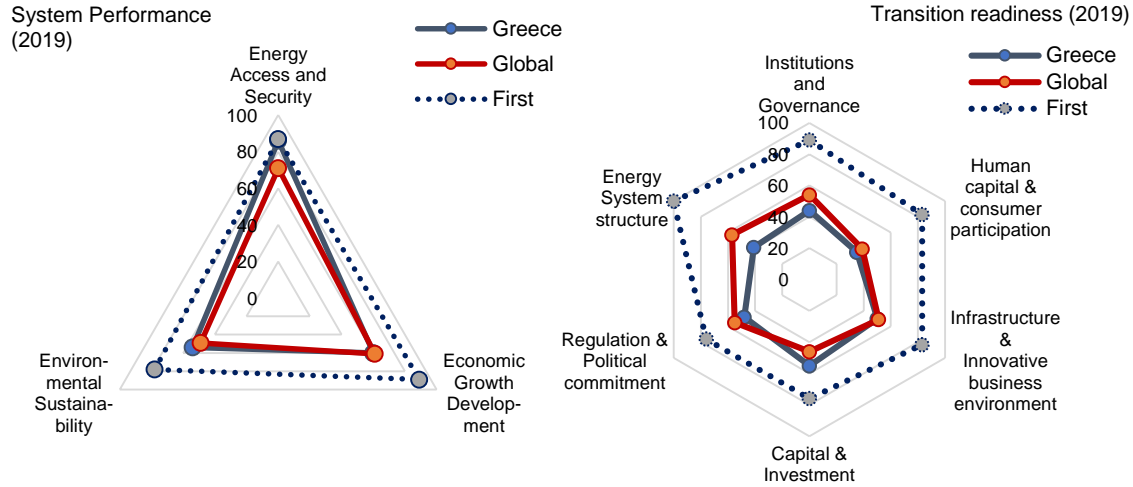
- In 2014, the European Council adopted the EU-28 2030 climate and energy framework, committed to deliver on its pledges under the Paris Agreement:
 - 40% of GHG emissions compared to the 1990 level
 - 32% share of RES in energy consumption
 - 32.5% of energy efficiency compared to the 1990 level
 - 15% of inter-connections compared to the 1990 level
 - 37.5% of cars' CO₂ emissions compared to the 1990 level
 - 25% of EU-funded climate related programmes, in the period 2021-2027.

The Greek NECP for 2030

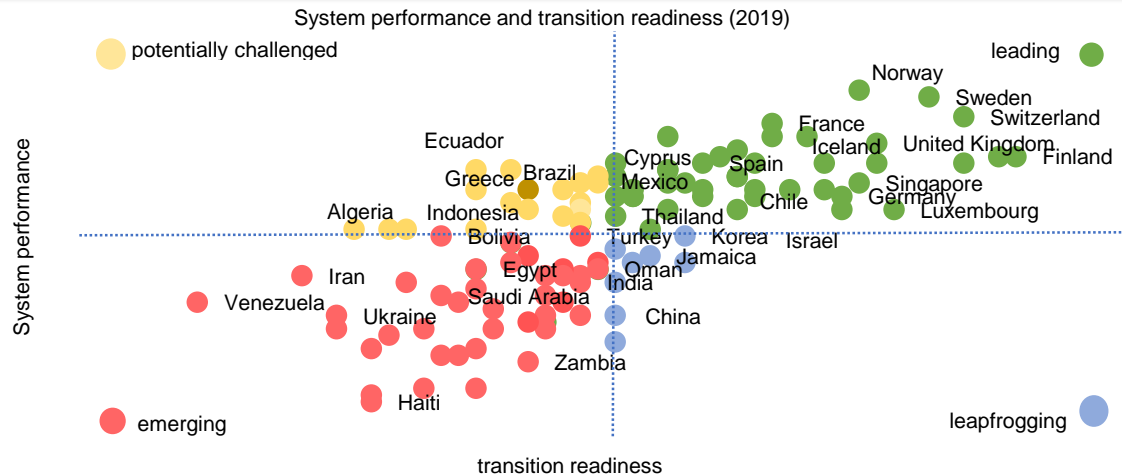
- Funding needs for energy policy according to NECP are estimated at EUR 43.8 bn for 2021-2030
- Over 42% reduction of GHG emissions by 2030 compared to 1990.
- At least 35% share of renewable energy consumption and higher than 60% in electricity.
- Energy efficiency improvement by 38% in 2030, with emphasis on buildings and transportation.
- Lower energy consumption in 2030 compared to 2017.
- Drastic reduction of lignite use for electricity production by 2028.
- Significant increase in electricity interconnectivity, reaching 15% by 2030.
- A new model operation of electricity market.
- Development of strategic projects for storage.
- Digitalization of energy networks.
- Promotion of electromobility.
- Initiatives in R&D and competitiveness.



Greece performs well in system performance scores compared to the global average...



...but is potentially challenged in terms of transition readiness



Energy Transition Index (ETI)

- The Energy Transition Index (ETI) comprises 40 indicators and benchmarks countries on the performance of their energy system and readiness for energy transition to secure a sustainable, affordable and reliable energy future.
- Greece lags behind most European countries, ranking 54th in 115 countries' ETI.
- Greece belongs to the group of the potentially challenged countries.

System performance: Greece performs well, ranking 38th

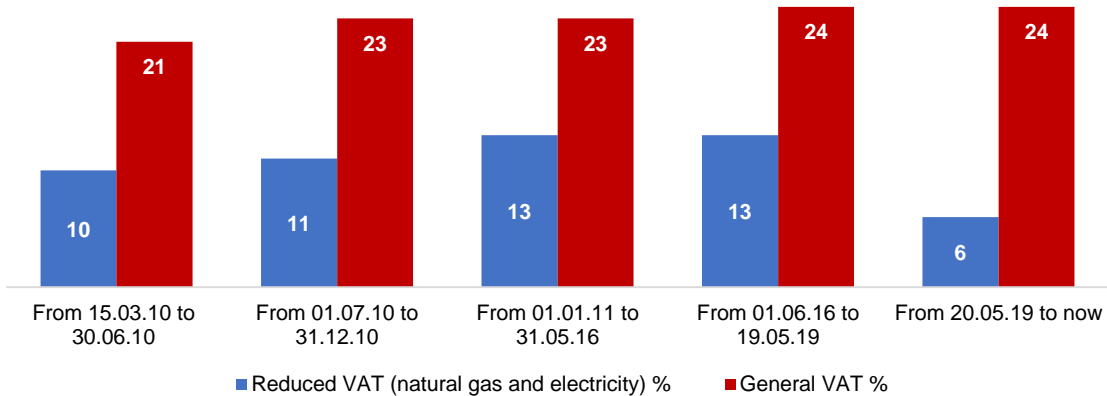
- In energy access and security, Greece ranks 29th, since it is 1st in electrification rate as % of population and 26th in quality of electricity supply, although among the last in net energy imports as % of energy use.
- In environmental sustainability, Greece ranks 44th, since its relatively low particular matter concentration is offset by high CO₂ emissions per TPES.
- In economic growth and development, Greece ranks 69th, mainly because of its low ranking in electricity prices for industry and fuel imports as % of GDP.

Transition readiness: Greece performs weakly, ranking 79th

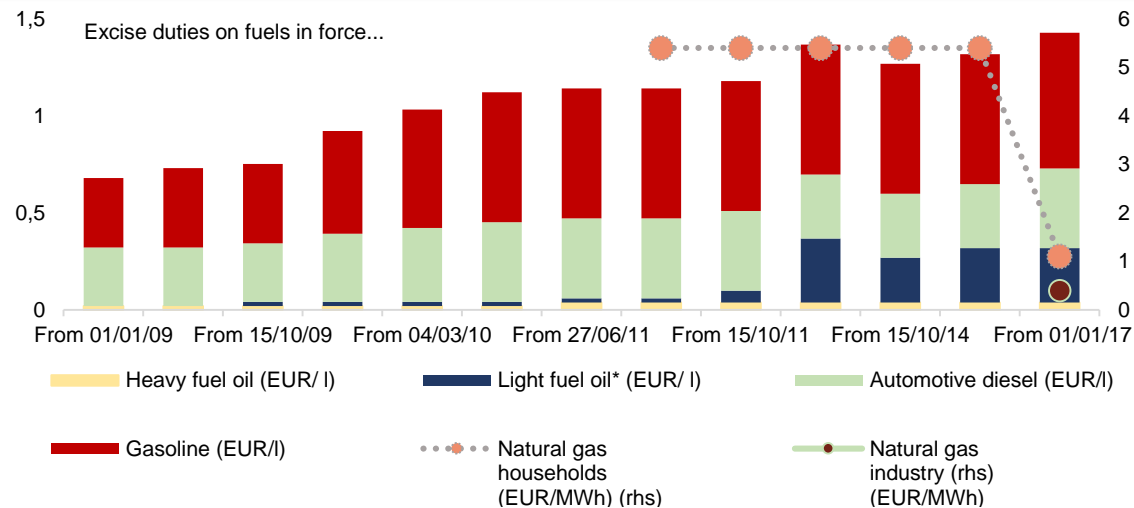
- In capital and investment, Greece ranks 39th, as the 1st place in investment in energy efficiency is offset by the low access to credit and the investment freedom.
- In infrastructure and innovative business environment, Greece ranks 53rd, as a result of its performance in logistics and quality of transportation infrastructure, despite its very low score in innovative business environment.
- In human capital and consumer participation, Greece ranks 57th.
- In regulation and political commitment, Greece ranks low (88th), mainly due to weak policy stability and low commitment to CO₂ emissions reductions, although it ranks 1st in energy access policies and 12th in renewable energy policies.
- In energy system structure, Greece ranks 89th, primarily due to its high share of coal in electricity generation and the low flexibility in electricity system.
- In institutions and governance, Greece ranks 77th, mainly because of its low position in the rule of law and the credit rating.

Special energy taxation, reduced VAT of 6% to natural gas and electricity

VAT in energy products



Taxes on fuels in Greece contribute on average c. 7% of tax revenues



Fuels taxation contribution and energy VAT

- Fuels taxation in Greece contributes on average c. 7% of tax revenues, standing at the EU-28 average.
- A reduced VAT rate of 6% applies to natural gas and electricity since 20.5.2019 (1.6.2016: 13%), while the general VAT rate stands at 24%.

Excise duties

- Diesel for heating during winter is subject to a lower excise duty rate.
- Natural gas for heating is subject to excise duties since 1.9.2011 and exempt for transportation and electricity generation.
- Coal for heating is subject to excise duties and exempt for electricity generation.
- Electricity is subject to excise duties since 2.5.2010.

Special levy on pollutant emissions

- Electricity consumers are subject to an additional tax that supports financial incentives for renewable energy generation and high efficiency combined heat and power facilities.
- Industrial consumers rates differ between low, middle and high voltage consumption, with a cap on total amount paid by individual consumers in a year.
- Residential consumers rates differ between consumption bands.

Public service obligation charges

- Electricity consumers are subject to a public service obligation charge imposed as a mechanism for financing the cost of public service obligations.
- Electricity suppliers are obliged to supply the non-interconnected islands at the same prices as the mainland, despite their higher production costs.
- Large families and low-income consumers are entitled to a discounted social tariff.
- Industry rates differ between low, middle and high voltage consumption.



Strengths

- Strategic geopolitical position
- Remarkable conditions for renewable energy deployment
- Fast developing renewable energy resources
- Marked decrease of GHG emissions
- High electrification rate and high quality of electricity supply
- Large and competitive operating oil refineries
- Low energy intensity and converting energy cost into GDP
- High investment energy efficiency
- High performance in logistics and transport quality
- Good performance in energy access
- Good performance in renewable energy policies

Weaknesses

- Still high use of lignite in electricity production, despite the significant reduction and gradual substitution by natural gas and renewable energy
- High energy import dependency, with potential creation of security issues
- High use of oil in transport and heating
- Limited electricity interconnections of the Greek islands
- Limited R&D in the energy sector
- Relatively high CO₂ emissions per capita and per TPES
- Low position in the rule of law and the credit rating
- Low access to credit

Opportunities

- Ample renewable energy potential
- Gas hub in South-Eastern Europe
- National Energy and Climate Plan targets aligned and more ambitious compared to the 2050 energy roadmap
- Investment opportunities in new energy projects in transmission and distribution of natural gas and electricity
- New projects of power generation in renewable energy
- Higher renewable energy penetration via hybrid systems and energy storage technologies
- Expansion of natural gas consumption via an extended distribution network
- Future financing of the EIB towards clean energy innovation, efficiency and renewable energy

Threats

- Potential difficulties in energy transition to higher use of renewable energy due to the extended use of coal
- EIB's end of financing fossil fuels related infrastructure projects (coal, oil, natural gas) by the end of 2021 and potential negative effect on Greek infrastructure projects
- Absence of cost-effective options for clean transportation
- Risks over security policies related to pipeline diplomacy affecting oil and gas supply
- Potential negative impact on global oil markets amid SARS-CoV-2 spread

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