The energy sector in Greece: A focus on renewable energy in the era of COVID-19

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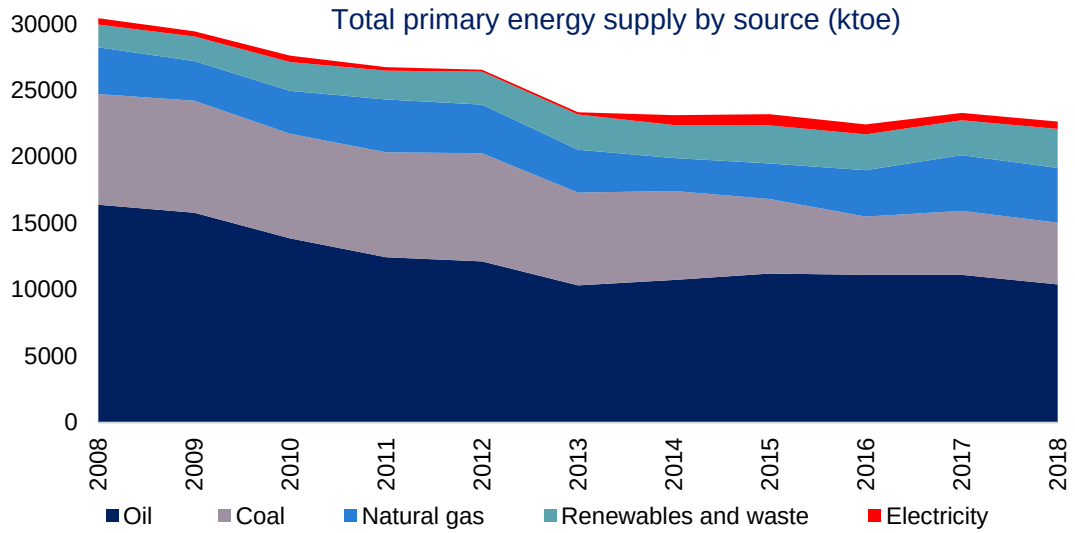
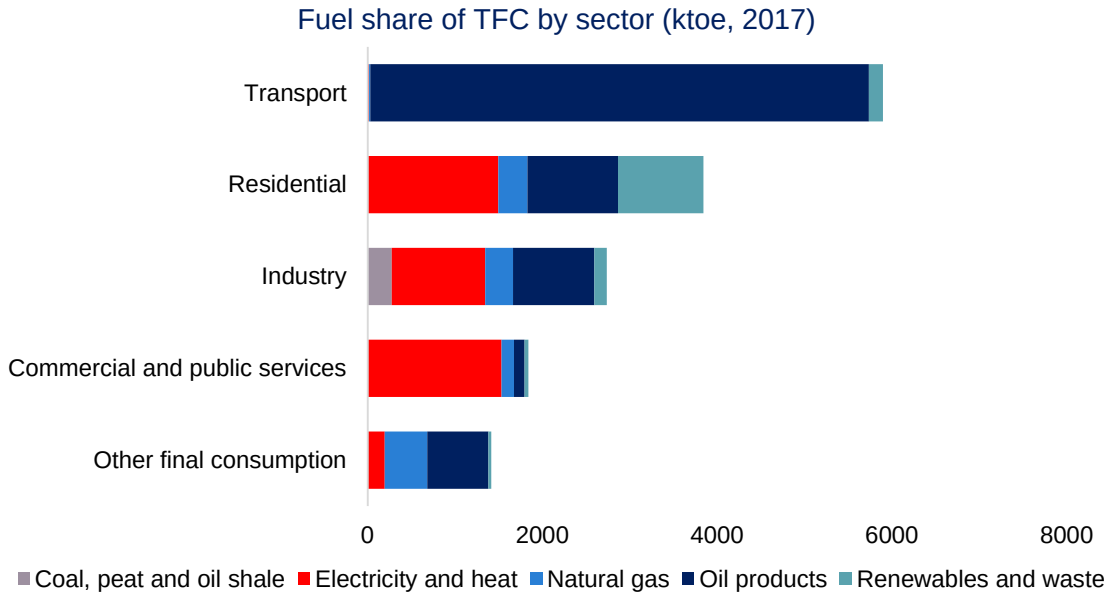
Energy production, supply and consumption mix



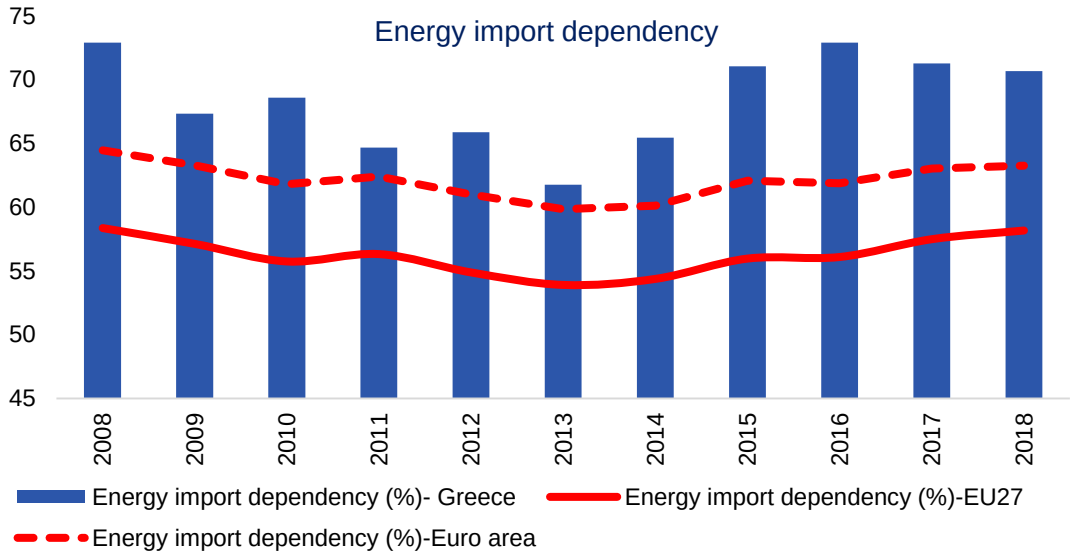


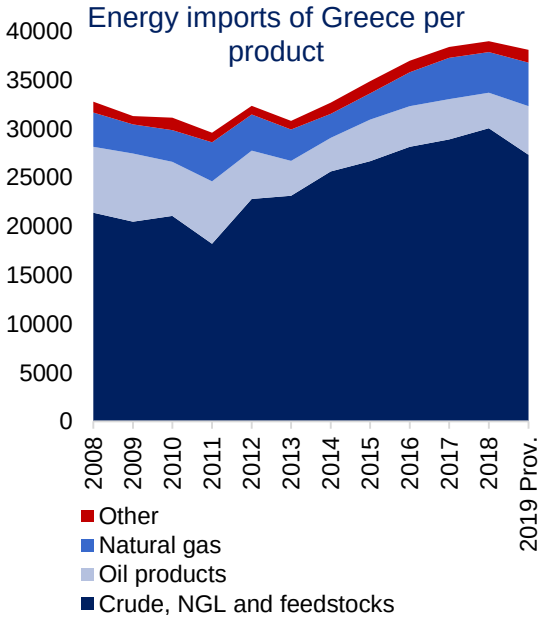
Source: International Energy Agency database (IEA), Data processing: Alpha Bank

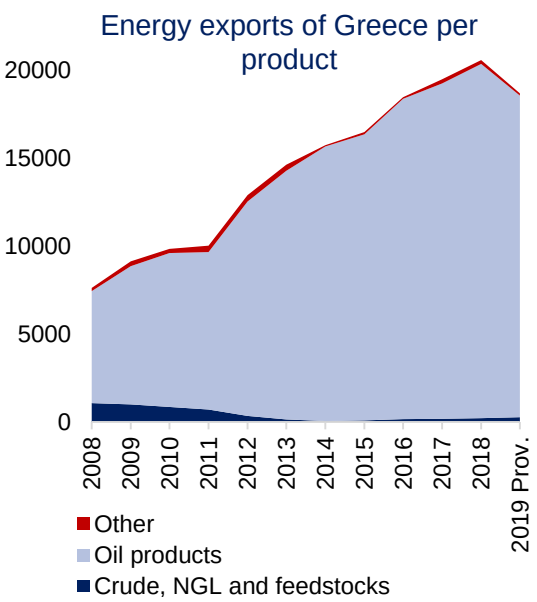
Energy chain mix has undergone changes over the last decade.

- Energy mix: fossil fuels, RES and electricity.
- Domestic Energy Production, Total Primary Energy Supply (TPES) and Total Final Consumption (TFC).
- Domestic energy production uses mainly lignite and RES.
- TPES fell by c. 27% from 2008-2018.
- Oil in TPES accounted for c. 47% in 2018 (55% in 2008).
- Natural gas comprises 17% of TPES (2018), 3rd mostly used fuel, after lignite and oil.
- RES (including biomass) share 13% (2018) in TPES, over doubled since 2008.
- TFC of fuels by end users reduced by 26% (2008-2018).
- Transportation the largest energy consumer (37% of TFC)
  - Oil: 97% of transportation consumption, biofuels: 3%.
- RES in TFC: residential (72%), transport (12%), industry (11%)
  - Biofuels, biowaste, solar thermal collectors, commercial solar heating and cooling installations.
- Natural gas in TFC increased by 30% in decade 2008-2018.

Energy import dependence





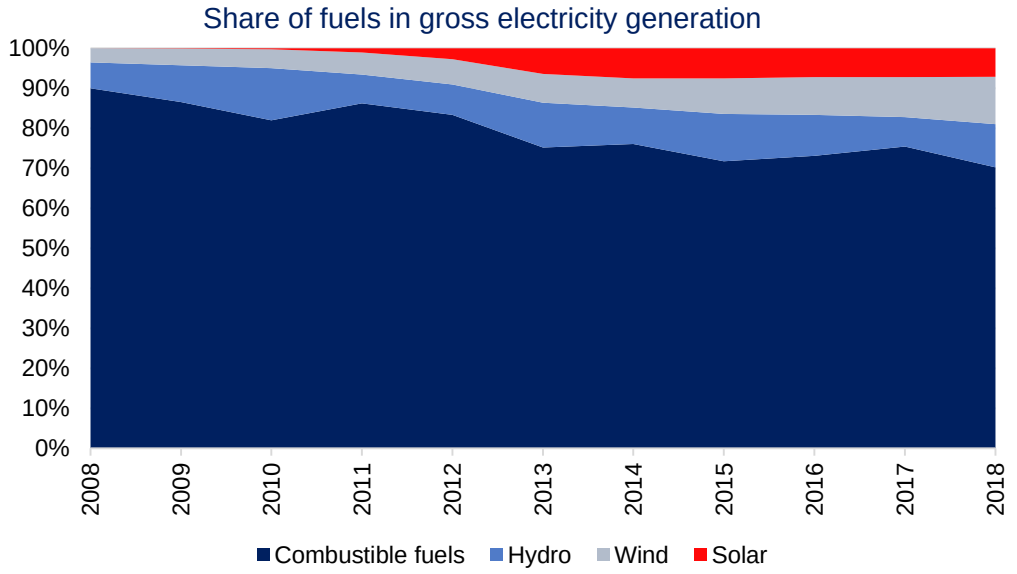


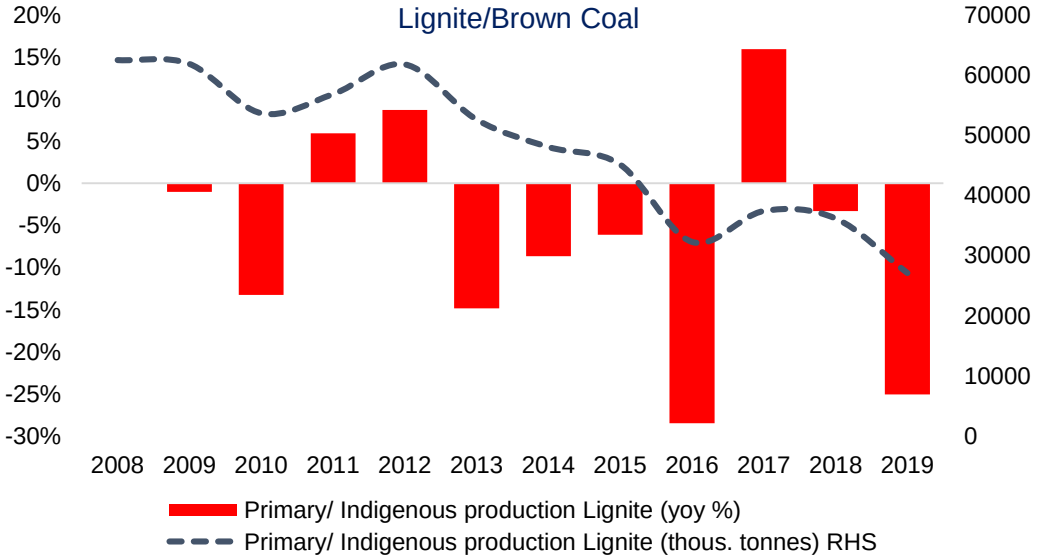
Energy import dependence higher than the European average, implying that supply security remains a high priority.

- Energy import dependence of Greece at 71% (2018), 10th more dependent and above the Euro area average (63%), implying high dependency on imports.
- Malta, Luxemburg and Cyprus are the most energy dependent European countries and Norway and Estonia the least.
- Energy import dependence and energy security interconnected
  - higher dependence from sources outside a country's control, lower security, increasing possibility of energy flows disruption.
- Greek energy sector still largely dependent on fossil fuels, most of which are imported.
  - Greece imports almost all of its crude oil and natural gas, which account for c. 2/3 of TPES.
  - Crude oil and feedstocks are the main imported energy products, 72% of total energy imports (2019), increasing trend.
- However, energy exports have more than doubled (2008-2019), more than the increase of energy imports (in ktoe)
  - Greece exports mostly refined petroleum and oil products (c. 30% of total exports).

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

Gross electricity generation mix and RES



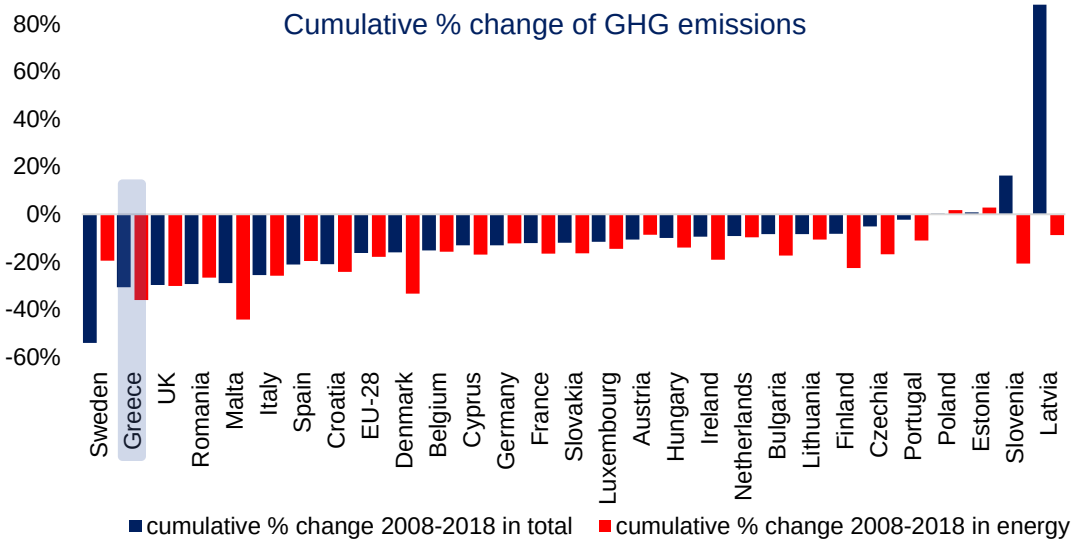


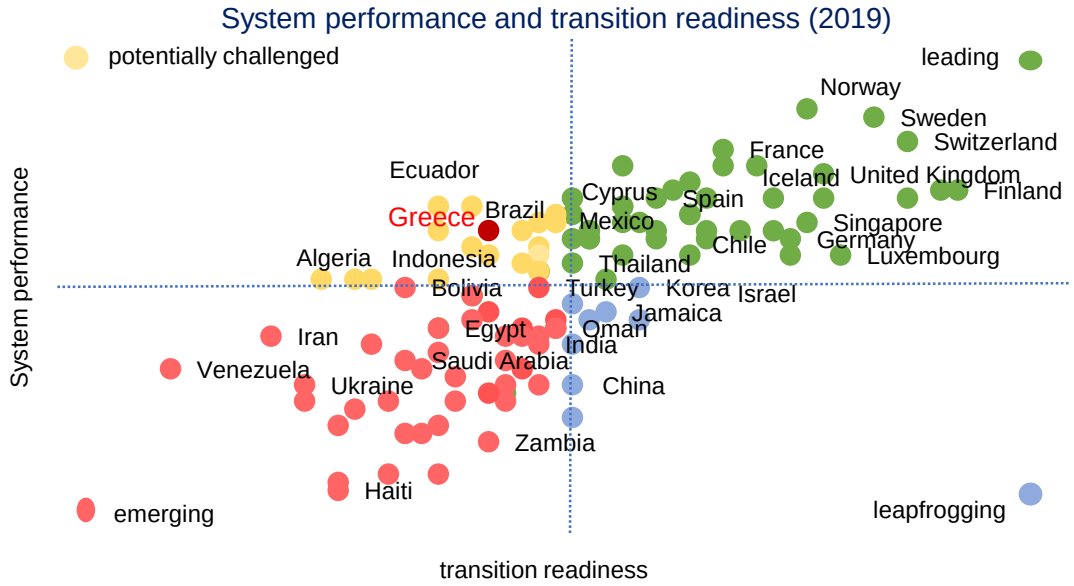
Wind, solar and hydro are powering a cleaner energy transition.

- Gross electricity generation by main activity producers in Greece went down by c. 17% in 2008-2018.
- Combustible fuels: c. 70% of electricity generation (2018).
- Electricity generation still uses lignite as dominant fuel, although shifted energy mix towards RES and natural gas.
- RES in gross electricity generation over doubled in 2008-2018, standing at c. 30% of production in 2018 (25% in 2017).
- The growth of RES in electricity production was due to the rapid growth in wind and solar installed capacity, with
  - Solar energy at 7% (2018), from c. zero in 2008.
  - Wind energy at 12%, being almost tripled since 2008.
  - Hydro power share at 11%, from 8% in 2008.
  - Before 2016, hydro accounted for the largest share of renewable electricity.
- Lignite production decreased by c. 55% from 2008 to 2019.
  - Largest reduction among the biggest European lignite producers, followed by Slovakia and Romania.
  - However, Greece ranks 5th (2018) in lignite production, implying still high carbon intensity.

Source: Eurostat – Supply and transformation of solid fuels and Energy Statistics, Data processing: Alpha Bank

Greenhouse gas emissions and energy transition to a low carbon economy



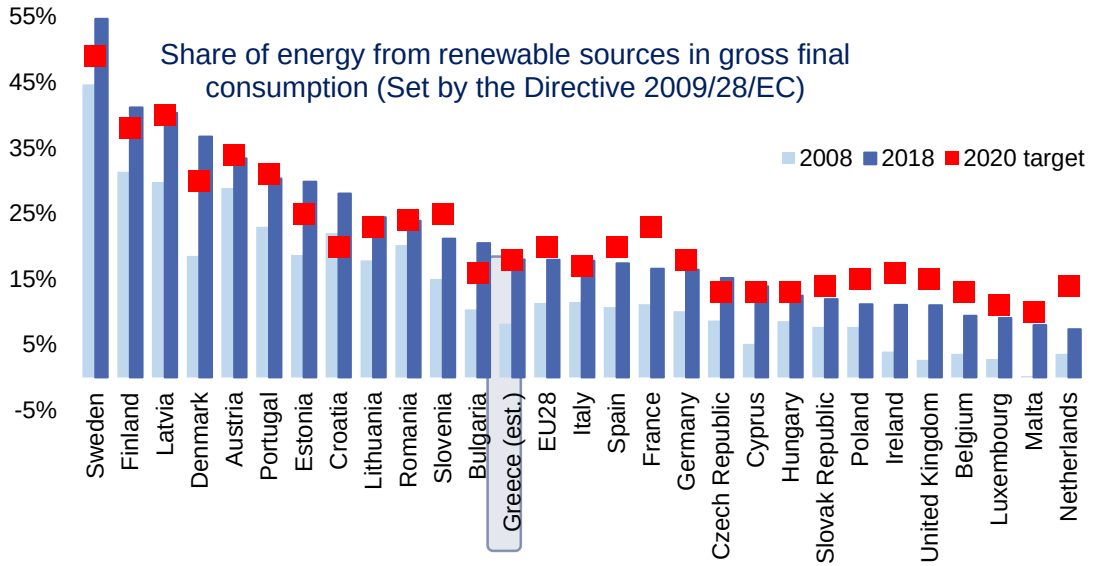


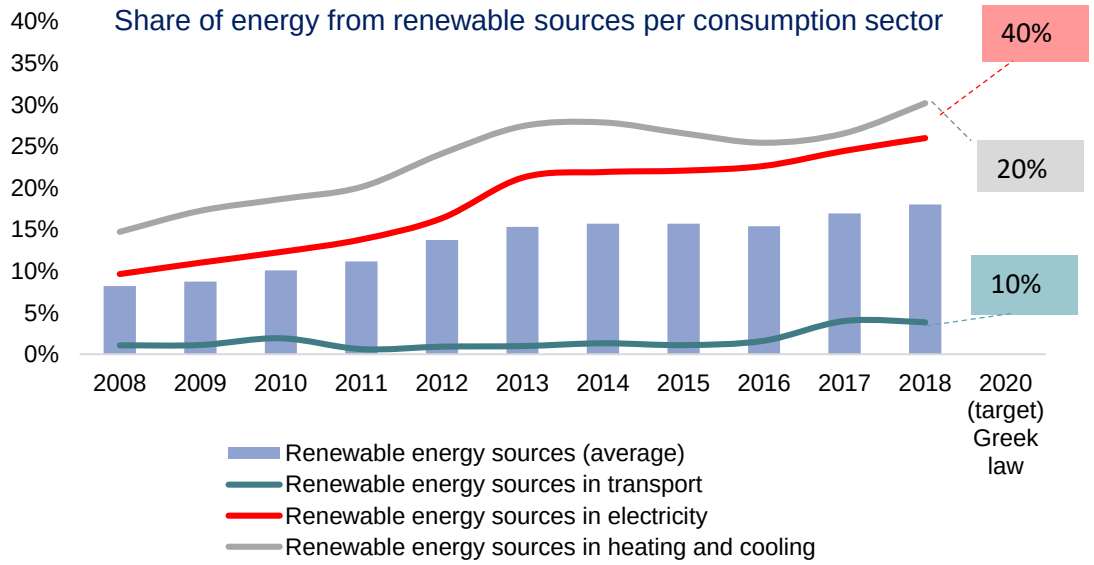
Significant transformation of the energy system the past decade worldwide, slower than required to achieve Paris Agreement objectives to combat climate change.

- Energy sector is the biggest source of human-caused GHG emissions, responsible for 73% worldwide.
- Within the energy sector, generation of heat and electricity, followed by transportation, is responsible for most emissions.
- The Greek energy sector's GHG emissions share in total is 75% and 83% in EU-28 (2018).
- In EU-28, although declined (-16%, 2008-2018), GHG emissions still fall short of long-term goals (-40% in 2030 and -80% in 2050).
- In Greece, GHG emissions fell by 31% in 2008-2018 (and -36% in energy), achieving national target of 20% reduction (from 1990).
- Energy Transition: Greece among potentially challenged countries, lagging most EU countries, ranking 54th/115 (2019).
- System performance: ranking 38th, 1st in electrification as % of population, but 101st in net energy imports as % of energy use.
- Transition readiness: below the global average, ranking 79th.
  - 1st in energy efficiency investment, 102nd in innovative business environment, 114th in policy stability.

Source: Eurostat – Energy Statistics, World Economic Forum, Energy Transition Index, Data processing: Alpha Bank

RES targets for 2020





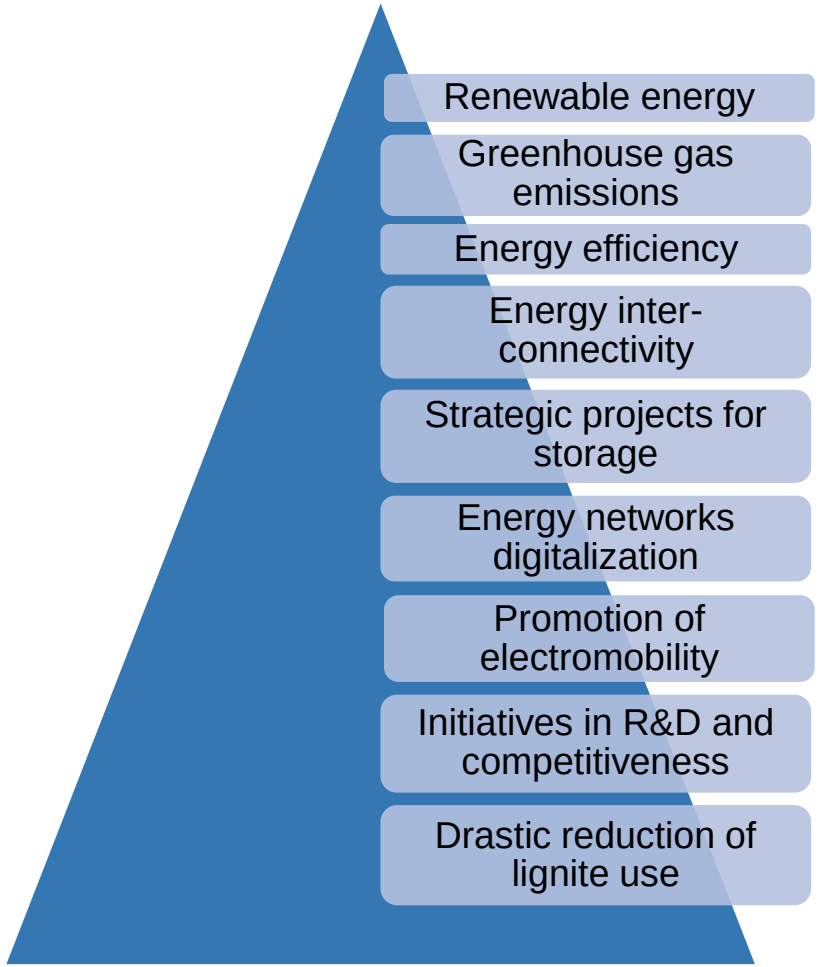
Source: Eurostat – Energy Statistics, LAGIE-DAPEEP, Data processing: Alpha Bank

Greece has seen an impressive increase in the share of renewables in electricity generation.

- Renewable Energy Greek Law 3851/2010: accelerate RES deployment and combat climate change.
- To achieve the national target of 20% share of RES in gross final energy consumption by 2020, the law establishes the targets:
  - 40% share RES in electricity production
  - 20% share RES in heating and cooling
  - 10% share RES in transport
- Renewable energy share of gross final consumption in Greece was 18% in 2018, equal to that of EU-28.
  - Close to the 20% Greek target for 2020 and equal to the target set by Directive 2009/28/EC on the promotion of the use of energy from renewable sources.
- Greece stood at the EU-28 average in 2018, 13th in EU, higher by 10 p.p. in heating and cooling and lower by 4 p.p. in transport.
- Greece holds the 2nd higher share of solar PVs in total supply of IEA countries, after Spain (2016).
  - Showing a significant fall in PV prices, a small decrease in wind prices and a large increase in biomass prices from 2012 to 2019.

Clean energy package and national energy and climate plan towards 2030

Greek National Energy and Climate Plan 2030 targets



Greece has set ambitious energy and climate targets in its NECP.

Clean energy for all Europeans package

- In 2019, the EU completed a new energy rulebook, significant step for the implementation of the energy union strategy.
- Aspiring that EU will become the first climate-neutral continent by 2050.
- It sets up a governance system for the EU: each member obliged to create national energy and climate plans and explain how targets will be achieved.
- Provides an 8 legislative acts framework to meet energy and climate targets aiming among others for
  - accelerating the clean energy transition and increase energy security
- In Greece adopted in 2019.

Greek National Energy and Climate Plan 2030 targets:

- Min. 35% RES share in energy consumption, >60% in electricity.
- Over -42% of GHG emissions compared to 1990.
- +38% energy efficiency– emphasis on buildings, transportation.
- Drastic reduction of lignite use in electricity production.
- Significant increase in electricity interconnectivity.
- A new model operation of electricity market and development of strategic projects for storage.
- Digitalisation of energy networks and promotion of electromobility.
- Initiatives in R&D and competitiveness.

Source: European Commission, National Energy and Climate plans, Data processing: Alpha Bank

Green priorities, projects and investments

RES expected to be more resilient and sustainable in 2020 than other energy forms, although with expected lower investments due to pandemic crisis.

- Investments in energy: down by 20% globally in 2020, oil and gas by 32%, RES at a lower rate (10%) (IEA).
- Cost of RES installations decreased substantially over the years, RES technologies are getting cheaper compared .
  - Greater introduction of RES and technological development, benefits of mass production, market competition.
  - New investments in installation projects can prove more economic than those for fossil fuels.
- In April and May, the Ministry of Development approved licenses of 14 RES projects, centralised and fast procedures.
- The recent modernisation of environmental legislation includes measures for RES projects licensing simplification and reduction of licensing time.
- The Greek government has announced its plan to close down all lignite-fired units for electricity production by the end of 2028 in order to meet the EU targets for decarbonisation and green energy.
- Recovery and Resilience Facility, Next Generation EU' s central pillar amounting to EUR 672.5 bn, includes green and sustainable recovery targets
  - All national recovery and resilience plans must include a min. of 37% of climate related expenditure.
  - Countries encouraged to foster RES investments and use, modernise networks and increase interconnectivity.

The energy sector in the era of COVID-19

ALPHA BANK

Outbreak of COVID-19 pandemic an unprecedented crisis with compounded disruptions.

Worldwide

- COVID-19 pandemic had severe impacts, affecting energy and causing excessive supply and low demand.
- Demand for oil fell faster and further than any other time, but gas and secondarily electricity also impacted.
- Significant price reductions – especially Brent in oil sector – supply chains stretched, and labor shortages emerged.
- IEA estimates a fall of energy demand by 6% globally in 2020, 7 times larger than the 2008 financial crisis.
- RES expected to be more resilient renewable energy demand and increase by about 1%.
- Also negatively affected: hydrocarbon exploration, construction and maintenance of energy and industrial plants, electricity providers, manufacturers of PV panels and wind turbines, batteries producers for electric vehicles.
- Global CO_2 emissions expected to decline by 8%, to the levels of ten years ago, the largest ever yoy reduction (IEA).

Greece

- Largely affected oil sector, petroleum refineries' demand and exports of supply market.
- Demand for natural gas fell, prices and revenues affected in a milder way, due to seasonal retail market, mostly limited to heating in October-March.
- Significant reduction of electricity, decrease of energy-intensive industries and commercial consumption, with parallel increase of household consumption.
- Reduced liquidity and cancelled /delayed projects under construction, renovation and energy upgrade projects of buildings, major RES and energy storage projects and ongoing RES investments.

Conclusions

- The momentum of energy transition could be impeded by the COVID-19 pandemic
  - after large energy demand and price shocks and reallocation of public funds and private investment to tackle the effects of the pandemic.
  - The implications of the pandemic for energy systems and clean energy transitions are still evolving.
- Energy security remains a cornerstone of economies, especially during these uneasy times.
- Clean energy transitions must be at the center of economic recovery and stimulus plans.
- Although a fall in CO_2 emissions is anticipated as of the slowdown of economic activity and transport, the effect will not be permanent, unless policies and strategies are adopted towards cleaner, green energy and RES.
- 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.
- COVID-19: opportunity to further deploy and use low-carbon technologies to foster faster transition towards more resilient and sustainable energy systems.
- Greece: better exploitation of its renewable energy potential could result in a more balanced energy mix and contribute to increasing energy security.