NATIONAL BANK OF GREECE

SECTORAL REPORT

November 2022

Timely execution of investment plans could turn Greece into a regional energy hub by 2030

- The Russian invasion in Ukraine and the subsequent turmoil in the EU energy markets has created (i) urgent security and economic concerns (with an estimated direct loss of c. 3% to EU GDP in a scenario with a complete halt of Russian gas imports), and (ii) medium-term forces which are redrawing the European energy map.

- In this environment, Greece finds itself exposed to rising energy prices (250% higher than the 5-year average) due to significant import dependency (about $^{3}/_{4}$ of energy consumption vs $^{1}/_{2}$ in the EU). The additional cost to the economy is estimated at c. 10% of GDP (so far largely counterbalanced by fiscal measures and positive economic momentum), with $^{2}/_{3}$ affecting the business sector and $^{1}/_{3}$ burdening households.

- Natural gas stands out as the key risk, in view of the imminent threat of a sudden halt in Russian imports (covering c. 40% of Greek natural gas imports but only 9% of the country's total energy needs). Emergency plans, focusing on re-starting the operation of lignite plants and finding alternative suppliers of liquified natural gas, appear sufficient to cover domestic demand during this winter.

- Looking beyond the current chaos, Greece's energy plans have been brought forward, while new opportunities have arisen. By 2030:
  - Overall, domestic demand for energy will rise only slightly by the end of the decade as energy intensity is projected to decline by 20% by the end of the decade, reflecting end-use transformation through both energy efficiency initiatives (e.g. green buildings) and increased electrification (e.g. electric vehicles).
  - The domestically produced supply of energy will comprise solely RES, as lignite will be phased out by 2028. RES production capacity will increase by c.15GW, along with c.3.5-5GW of storage capacity to counterbalance the supply volatility of RES. This will allow Greece to meet the new target of 70% RES penetration in the electricity mix by 2030 (vs a previous one of c.60%), as well as electricity covering 33% of energy consumption (from 28% currently). As a result of those investments, fossil fuel's share in domestic energy consumption (lignite and oil) will decline from 57% to 39%. With existing RES investment projects satisfying comfortably these targets, the Plan's realization relies mainly on rapid licensing procedures and electricity grid expansion. Indeed, Greece will produce almost ½ of its total energy needs by 2030 (compared with ¼ currently), all comprising green energy.
  - Stronger international connectivity is also planned, both in electricity and natural gas. Electricity interconnection capacity will almost triple, (i) to support RES supply volatility and (ii) to exploit opportunities to operate as a transit country for green electricity between South Med countries (Egypt-Israel) and Europe. Though the share of natural gas in domestic energy consumption will remain broadly unchanged at 18-19%, new LNG terminals and planned natural gas interconnections, mainly with SE Europe (tripling both import and export capacity), are sufficient to allow Greece to play a key role as a regional natural gas hub (covering c.½ of SE Europe's needs), with total energy exports 1.7 times its own total consumption.

- The supply-side transformation (amounting to total investments of c. €35 bn up to 2030), along with the beneficial effects of energy efficiency investments (c. €20 bn), will cut back Greek net energy imports by c. €2.5-3.5 bn (i.e. -15-20%). Additional fees could arise from the regasification service of LNG terminals (concerning exports) and from the transit services of natural gas pipelines. Note that these gains underestimate the economy-wide effect as households and enterprises will have the advantage of lower electricity prices.

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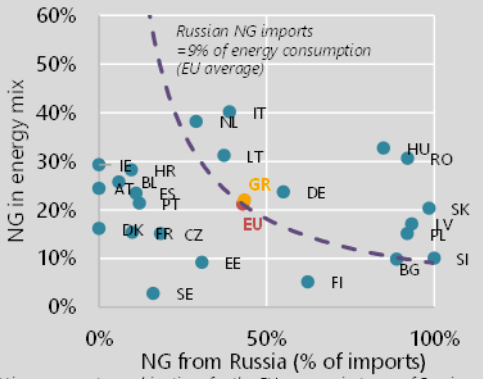
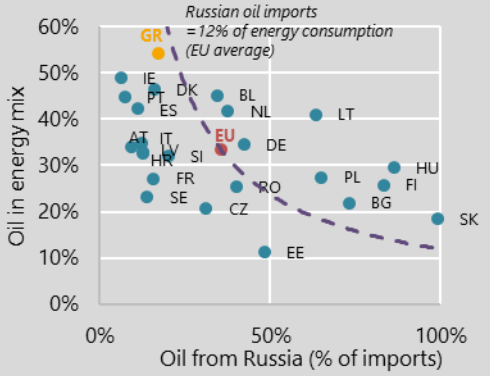
Natural gas: Dependency on Russian imports



*Line represents combinations for the EU average in terms of Russian imports as a share of consumption. Countries above the line have high dependency on Russian imports
**excluding Malta, Luxembourg, Cyprus (and relevant adjustment in the EU average)

Source: Eurostat, BP, NBG Estimates

Oil: Dependency on Russian imports



*Line represents combinations for the EU average in terms of Russian imports as a share of consumption. Countries above the line have high dependency on Russian imports
**excluding Malta, Luxembourg, Cyprus (and relevant adjustment in the EU average)

Source: Eurostat, BP, NBG Estimates

Conversion of units

	Mtoe	TWh	Bcm
Mtoe		11,11	1,19
TWh	0,09		0,11
Bcm	0,84	9,09	

Mtoe: Million tons of oil equivalent. A unit of energy defined as the amount of energy released by burning a million tons of crude oil.
Twh: Terawatt-hour. A unit of energy defined as the amount of energy equivalent to one TW delivered continuously for one hour.
Bcm: Billion cubic meters. A measure of natural gas volume.

The Russian invasion upsets the status quo in global energy markets

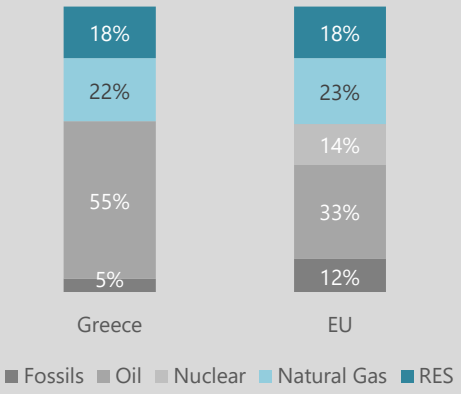
The world is eight months into the Russian invasion of Ukraine, with the rising energy costs initially attributed to the reopening of the economies after the pandemic, skyrocketing as Russian natural gas has been turned into a weapon, threatening both economic growth as well as the transition to a zero-emissions economy.

Russia's decision to respond to EU sanctions by either halting natural gas exports altogether to some countries (i.e Bulgaria and Poland) or by reducing flows to others (e.g. Germany), raised issues that were underestimated by many in previous energy policy initiatives - that of energy security and diversification of energy sources. Indeed, both the European Green Deal and its extension, Fit-for-55, relied greatly on natural gas to serve as transitory fuel until renewable energy sources and other supplementary technologies scaled up to cover at least 40% of the EU's energy needs. However, as geopolitical tensions have put the Union up against its largest natural gas supplier (c. 40% of EU's natural gas imports in 2021), a shift in policy is necessary to ensure that affordable, uninterrupted energy supply is guaranteed for both households and businesses, without undermining the green transition process.

To this end, in May 2022 the EU presented the REPowerEU policy initiative which, among other things, sets more ambitious targets for RES[1] (c.45% of total energy consumption by 2030, vs a previous target of 40%) and for other promising technologies (such as hydrogen), along with a diversified fossil fuel supply strategy, in an attempt to lower its dependence on natural gas. Specifically, the aim is to decrease Russian natural gas imports by 2/3 by the end of 2022 and to stop them completely well before the end of the decade (with a 50% reduction having already been achieved as of June 2022[2]). Additional EU initiatives aim to limit the impact of high energy prices by introducing initiatives to limit energy demand and by redistributing

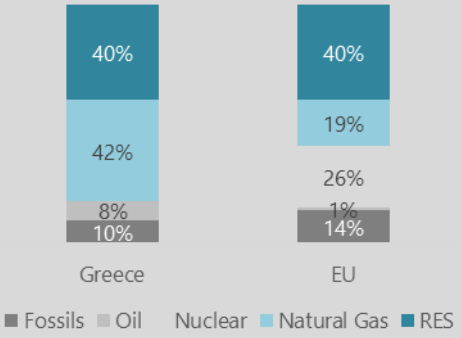
[1] With the EU accelerating its plans for RES capacity additions, it needs to address potential shortages in the supply of critical metals and other materials (copper, lithium, nickel, cobalt), while avoiding new import dependencies (source: 'Metals for Clean Energy', Eurometaux, July 2022)
[2] Source: Brugel estimates

Total energy mix*
(2021, % share, Mtoe in parentheses)

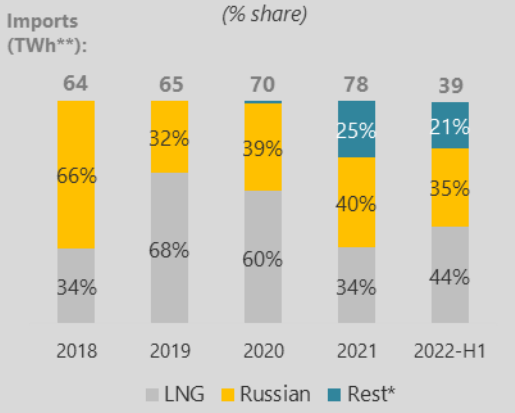


** Production and net imports*

Electricity mix structure
(2021, % share)



Natural gas imports
(% share)



**Imports from Turkey and Azerbaijan that may include Russian imports in their natural gas mix*

Sources: HEDNO, IPTO, Enex, Eurostat, NBG estimates

windfall profits from energy producers who still face low production costs.

In the short term, the situation is escalating with the scenario of a sudden halt of all natural gas supply from Russia an imminent possibility, that would cause a hit to EU GDP[3] up to 3% (c.1% for Greece vs up to 6% for certain countries). In this environment, the key challenge for countries across the EU is to ensure energy sufficiency in the short term[4]. In the medium to long term, it also poses an opportunity for some countries (with Greece being among them) to eventually emerge as new major energy players after the crisis. Our analysis reviews both issues, assessing the tools at Greece's disposal to face short-term challenges as well as exploring potential long-term gains from the redrawing of the regional energy map.

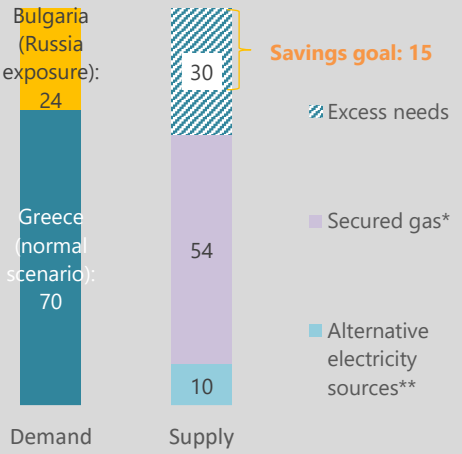
Despite having to withstand high costs, Greece's short-term target for energy security is attainable

Greece's energy structure provides it energy security but at high prices. Specifically, several alternative energy sources bring the country in a position to withstand even a potential halt in Russian natural gas exports, which comprised c. 40% of Greek natural gas imports in 2021 in terms of volume (i.e. about 9% of Greek total energy consumption, similar to the EU average). Aiming to estimate the potential natural gas deficit for Greece in this extreme scenario, we examine the demand needs as well as alternative supply sources (for the period August 2022-July 2023). Specifically, the total natural gas needs are estimated at 94 TWh, of which 70 TWh concern Greece's total demand (based on 2021 performance) while the remaining 24 TWh concern Bulgaria's natural gas supply from Russia. This demand could be covered by the following options:

- In terms of electricity (absorbing 70% of natural gas imports), alternative sources could provide about 10 TWh. Specifically, increasing the operations of reserve lignite plants could offer

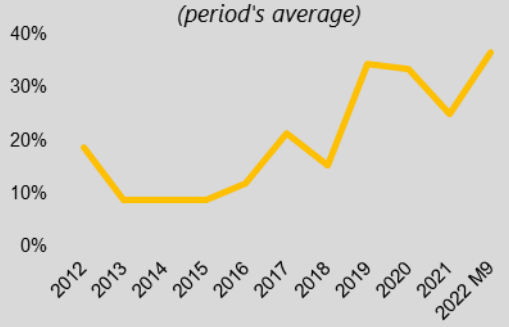
[3] IMF (July 2022), Working paper "Natural Gas in Europe, The Potential Impact of Disruptions to Supply", Gabriel Di Bella et al
[4] Something that seems to have been achieved given that EU natural gas storage facilities are more than 90% full, thus postponing the problem for the next winter.

Natural Gas balance over next 12m
Russian Gas cut off scenario (TWh)



**LNG secured by long term agreements, the DEPA strategic agreement of 10 TWh of LNG over the next 5 months, gas stored in Italy and flows from TAP and Kipoi pipelines.*
***Increased production in lignite powered plants, switching to diesel fuel in gas powered plants where possible and RES increase according to trend.*

Revythousa Gas liquefaction capacity utilization
(period's average)



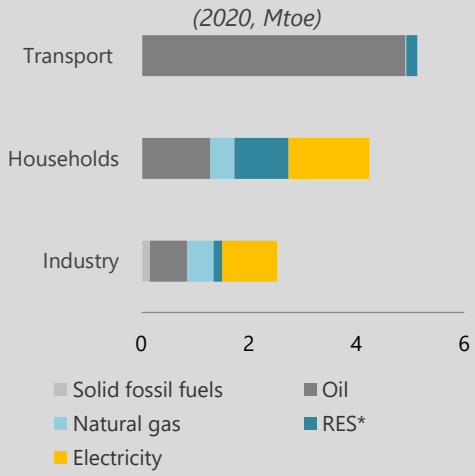
Sources: HEDNO, IPTO, ALSI, Eurostat, NBG estimates

significant short-term substitution capacity of 5 TWh, increasing the lignite share in electricity to 19% (vs 9% in 2021). Further reduction in natural gas electricity needs is expected to be achieved by shifting from natural gas to diesel fuel in the five power plants (of combined capacity of 1.8 GW) that are designed to operate on either fuel (covering 2.6 TWh of the natural gas shortfall). Finally, another 2-3 TWh are expected to be covered by the gradual capacity additions of RES (already 1 TWh higher in 2022 vs 2021).

- LNG from Revithoussa (with max capacity of c.80 TWh) and Greece's access to other pipelines (such as TAP), would cover the largest natural gas needs. Indicatively, during the first semester of 2022, Russian gas imports were partly substituted by higher LNG flows from the Revithoussa terminal, which contributed 44% of total natural gas imports in 2022:H1 from 34% in 2021. Note that Revithoussa has only been operating at 30% of its send-out capacity (of 270 GWh/day) and 65% of its storage capacity[5], with supply coming mainly from the US (50% of LNG supply). In case of a complete Russian gas shut-off, the terminal will play a pivotal role as it will be the main source of gas supply. The extent to which LNG can substitute Russian gas will largely depend on market tightness, as the limited global LNG supply would have to meet growing demand, along with a forced redirection of LNG flows[6]. To that end, 10 TWh of LNG shipments have already been secured by DEPA for the following (winter) months (on top of another c29 TWh with booked time-slots), while Greek authorities have planned another 1.5 TWh of natural gas storage reserves in Italy. The abovementioned secured LNG shipments, along with 14 TWh expected from existing pipelines add up to natural gas supply of 54 TWh.
- The remaining needs (of c. 30 TWh) should either be covered by (i) a further tapping of the LNG market (whenever possible[7]) or

[5] Expansion by 70% in July 2022 from 225 10^3m^3 to c. 380 10^3m^3
[6] Indicatively, with capacity utilization already averaging nearly 95% across US LNG facilities and natural gas prices expected to remain high in the near term.
[7] Note that LNG availability is expected to become more challenging in the next winter, due to higher demand from EU countries in an effort to refill their natural gas reserves.

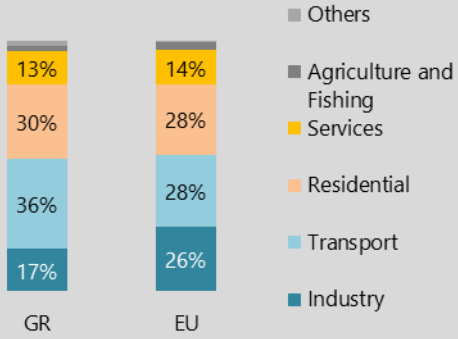
Final consumption per fuel Greece



**RES consumption in households is primarily solar water heating*

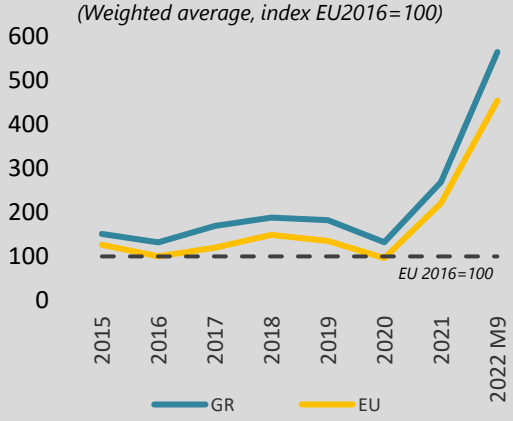
Final consumption per sector

(2020, % of total final consumption)



Energy cost

(Weighted average, index EU2016=100)



Sources: European Commission, Eurostat, IMF, Ember, NBG estimates

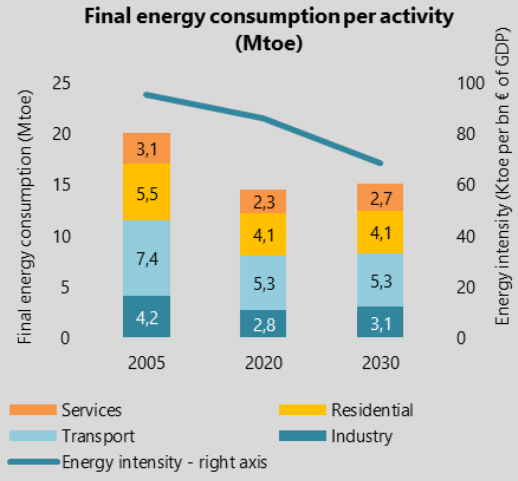
(ii) by electricity and natural gas savings both domestically and in neighboring countries (in this case Bulgaria). Note that based on Repower EU targets for lowering natural gas consumption by 15%[8], natural gas savings (mainly concerning electricity) will cover ½ of remaining needs.

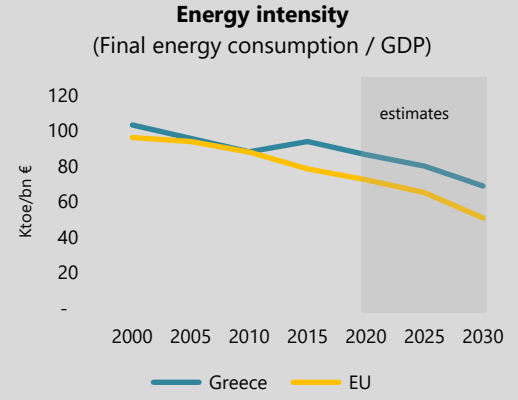
Greece's high energy import dependency (c. ¾ of total energy consumption vs c. 60% in the EU) is its Achilles' heel in the current global energy markets:

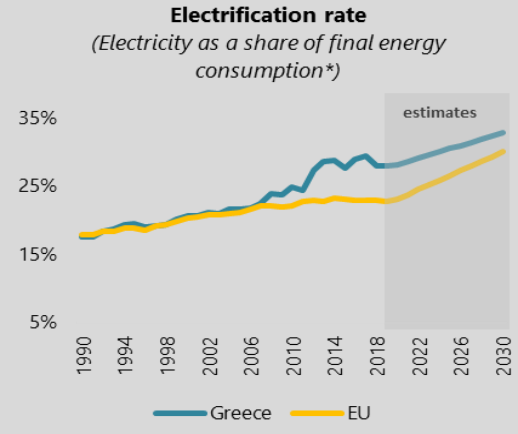
- Oil is predominant in Greece's energy mix (55%, vs 33% in the EU), mainly used in transport, where substitution options are limited due to technology constraints (contrary to industry for example). Note that Greece has relatively higher transport needs, as reflected in the higher passenger-km[9] per capita (13 vs 10 in the EU), while the transport sector suffers from inefficiencies such as an old vehicle fleet (16 years old vs 12 years in the EU) and limited penetration of electric vehicles (with geological characteristics not favoring rail networks, while also requiring significant water transport). As a result, transport accounts for 36% of the total energy mix (vs 28% in EU), of which 10% is domestic maritime and aviation transport (vs 2% in EU).
- Natural gas (22% of energy consumption, similar to the EU) is mainly used in electricity production (70% of natural gas consumption concerns electricity vs 13% in the EU). This allows some options for changes in the energy mix (contrary to residential uses for example), however RES and electricity storage capacity need to be scaled up for substitution away from natural gas to be viable.
- Greece has no nuclear plants in contrast with the EU (accounting for 26% of EU electricity mix).

Other than to reduce consumption, Greece has no choice but to absorb the increased energy costs. More specifically, it is estimated that Greece's energy cost (weighted wholesale cost, adjusted for fuel

[8] Note that natural gas consumption has already decreased by c.11% in Greece and by c.14% for Bulgaria in the first 7 months of 2022 (vs. the same period of 2021).
[9] Passenger kilometers: number of trips multiplied by average trip distance (for road, rail, air and maritime transport).







*Final energy is energy in the form it is consumed by end consumers

Sources: European Commision (FF-55 scenario), Ministry of Environment and Energy, NBG estimates

mix[10]) in the first nine months of 2022 was c. 250% higher than the average of 2015-2020 (with oil prices increasing almost 100% and natural gas and electricity prices more than 300% vs their 5Y average). This cost is c.32% higher than the EU average, with i) 28% higher wholesale electricity prices (due to high natural gas in the Greek electricity mix, compensating for the lack of nuclear plants) and ii) slightly higher electrification (28% of energy consumption concerns electricity in Greece vs 23% in the EU). Indeed, energy costs are c.10% of GDP higher in 2022 than in 2021 (with c. 2/3 concerning enterprises and 1/3 households). However, it is important to note that they are counterbalanced by the dynamic growth of the Greek economy entering the crisis (with labor income projected to increase by c.6% and enterprise profits by c.12% in 2022), and a strong tourism season (with receipts in July-August 2022 surpassing their 2019 level) as well as by fiscal measures of c.€13 bn (8% of GDP).

The outlook for 2023 energy prices is very uncertain. Energy demand should decline materially due to the global slowdown from the supply shock and the tightening of monetary policy. However, energy prices are expected to remain high, especially for natural gas, given the tight global supply conditions.

Looking ahead to the next decade, the focus shifts to a significant transformation of the broader energy model …

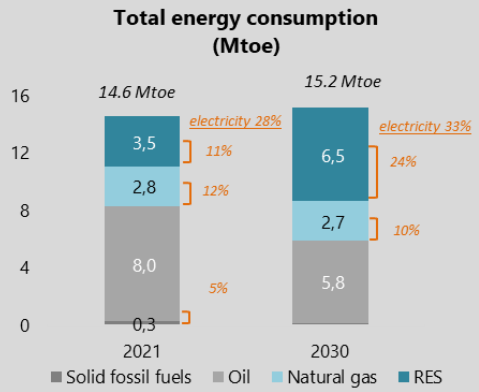
Though currently experiencing energy market turbulences, it is crucial not to lose sight of Greece's medium-term goals. According to European Commission estimates (by the PRIMES model), Greece's final energy consumption will remain relatively stable up to 2030 (at c. 15 Mtoe), implying a decrease of about 20% in terms of energy intensity (proxied by the ratio of final energy consumption to GDP).

Moreover, the new energy model demands a transformation to allow for higher penetration of electricity in the energy mix. Currently, electricity accounts for 28% of final energy consumption in Greece and

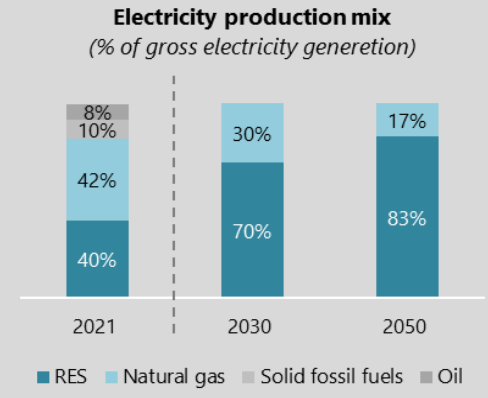
[10] International prices for Oil, Coal, Natural Gas, RES and Wholesale electricity prices, weighted according to their corresponding shares on gross final energy consumption (excluding ETS price impact). Weights for 2021 onwards are based on 2019-2020 average cost

Energy transformation Investment needs up to 2030 (bn €)	
RES production and storage	20
Electricity network	5
Electricity interconnections*	7
Natural gas network	1
Natural gas interconnections	2
Supply-side investments	**35**
Energy upgrade of buildings and facilities	20
Demand-side investments	**20**
Total Investments	**55**

** Investments of €6-7 bn concern Greece as well as other involved countries (e.g. Egypt, Israel)*



**Yellow brackets indicate the participation of each fuel in electricity*



Sources: IPTO, HEDNO, European Commision (FF-55 scenario), Ministry of Environment and Energy, NBG estimates

is projected to go up to 33% in 2030 (and reach c. 43% by 2050). This requires significant investments of c. €55 bn until 2030, targeting higher electricity production as well as sufficient capacity for increased energy trade flows (necessary for a sustainable green energy mix[11] as well as energy security in SE Europe). These concern i) €35 bn in electricity production capacity and networks infrastructure (to ensure that the national electricity grid can safely support additional capacity) as well as ii) €20 bn for end uses, mainly for energy efficiency in residential and industrial buildings. The investment in production and energy efficiency will be undertaken to a large extent by the private sector (businesses for the former and mainly individuals for the latter), with the public sector investments concerning the electricity grid.

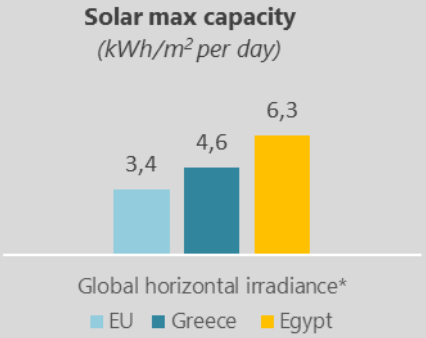
… through i) higher green energy production aiming towards ambitious EU targets…

Analyzing the supply-side transformation required by 2030, Greece aims to both i) increase electricity production (from 46 TWh to 67 TWh) and ii) change its electricity mix to meet EU RES targets (70% of electricity in 2030). For this two-fold goal to be achieved, RES capacity must be significantly increased to c. 25 GW (from 10.6 GW in 2020), while natural gas input will act as the counterbalancing force against the stochastic nature of RES and a significant decline in petroleum use will be achieved (-23% in domestic consumption of oil during 2020-2030).

Over the past five years, significant steps have already been made toward green energy, with RES accounting for 40% of the electricity mix in 2021 and lignite representing 10% of electricity production (from 60% in 2005). With the National Energy and Climate Plan expected to be finalized within the next year, RES targets for 2030 are expected to be set at 70% of electricity (and 45% of energy consumption), with the remaining 30% being covered by natural gas. Note that delignification is expected to be accomplished by 2028

[11] Note that the upgrade in electricity international network as well as electricity storage investments will allow both i) electricity demand to be met in case of low energy production (e.g. low winds or sunlight), as well as ii) excess supply to be channeled to areas/countries with electricity deficit (e.g. there were days during spring 2022 when Greece exported renewable energy).

Electricity			
	2020	2030	%change
Electricity Infrastructure (GW)			
Renewables	**10,6**	**25,0**	***136%***
Hydro	*3,5*	*4,0*	
Wind	*4,1*	*10,0*	
Solar	*3,0*	*11,0*	
Fossil fuels	**11,0**	**8,2**	***-25%***
Solid (lignite)	*4,0*	*0,0*	
Oil	*2,0*	*0,6*	
Naural gas	*5,0*	*7,6*	
Total (GW)	**21,6**	**33,2**	***54%***
Electricity Production (TWh)			
Renewables	**17**	**47**	***178%***
Fossil fuels	**29**	**20**	***-30%***
Total (TWh)	**46**	**67**	***47%***



**Global horizontal irradiance is the total amount of shortwave radiation received from above by a horizontal surface. This value is of particular interest to photovoltaic installations.*

Sources: European Commision (FF-55 scenario), Ministry of Environment and Energy, Solar Atlas, NBG estimates

instead of 2023, while petroleum is expected to almost entirely be removed from the electricity mix.

To meet 2030 targets, the national plan calls for additional RES capacity of about 15 GW by 2030 (to 25 GW vs c.10.6 GW currently) as well as RES storage of 3.5-5 GW (given the uncertain nature of wind-PV energy). For the viability of higher RES production, complementary investments are needed concerning the upgrade of the national electricity grid (to support additional capacity). To this end, the Greek Power Transmission Operator (ADMHE) plans investments of c. €5 bn for the next decade (mainly concerning network upgrade and islands connectivity), which are expected to double the size of the Greek electricity network and increase the capacity for RES connections to c. 29 GW in 2030 (c.15% higher than the national target), vs 17 GW currently. Overall, the investment for increasing RES production capacity are estimated at €25 bn by 2025.

Since Greece has significant competitive advantages in terms of RES (with solar and wind dynamic about 35% higher than the EU average), it is not surprising that there is already sufficient expressed interest from private investors to meet those targets (to a large extent by big players in the energy market). The realization of those plans will increase Greece's share in EU RES production to 2.5% in 2030 (vs 2% in 2020, and 1% in 2010), which is double its GDP share.

Apart from production capacity investments, a critical factor for the timely realization of those projects is the effectiveness of the legal framework reform (also included as a prerequisite in the RRF plan), mainly concerning:

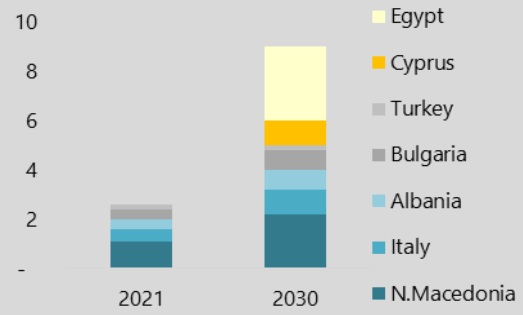
- faster licensing procedures[12] (targeted to 14 months vs 5 years currently),
- clear rules for energy storage and offshore wind[13], as well as
- dealing with the labyrinthine land use framework.

Assuming that the abovementioned efficiency and electrification targets are accomplished by 2030 and should the abovementioned

[12] e.g. through allowing certain steps of the procedure to be made in parallel, instead of one by one
[13] only c. 25% of Greek onshore wind dynamic has been tapped into

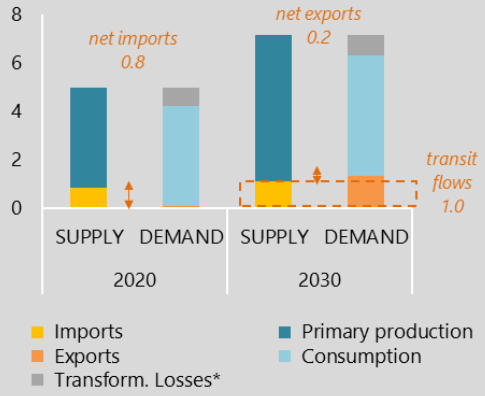
Greek electricity interconnections capacity

(GW)



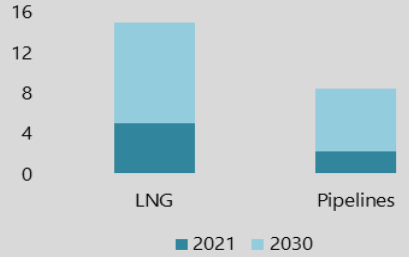
Supply-Demand mix: Electricity

(Mtoe)



**Transformation-losses concern energy consumed in the energy production and transport process (e.g. maintining pipeline pressure), or lost due to network quality.*

Natural gas networks capacity (bcm)



Sources: Eurostat, Ten-year Network Development Plan (IPTO), NBG estimates

RES projects pipeline be completed, Greece's electricity production is expected to reach 67 TWh in 2030, c.50% higher than 2020, arising from an increase in electricity capacity from 21.6 GW to 33.2 GW[14]. This increase in production will be directed i) ½ towards covering higher domestic electricity demand (55 TWh in 2030, i.e. 21% higher than 2020) and ii) ½ to allow more electricity exports, upgrading Greece into a net electricity exporter (net exports of 3 TWh net exports in 2030 vs 8 TWh net imports in 2020).

… and ii) strengthening international networks of electricity and natural gas

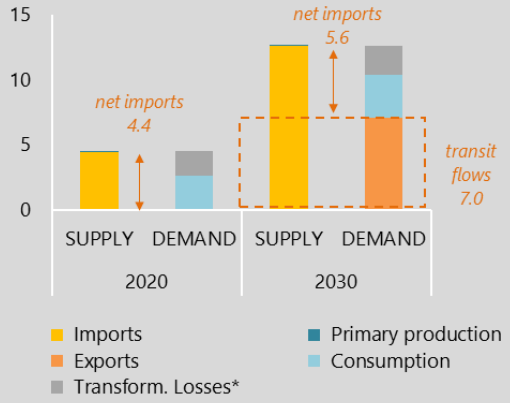
The gradual electrification of the energy mix, along with the central role of renewable energy sources (with a higher possibility of sporadic deficits and surpluses in electricity supply depending on weather conditions), increases the importance of international electricity interconnections, as does the goal of being an electricity exporter. To that end, there are plans to almost triple the capacity of the Greek international electricity network by 2030 (from 2.6 GW to 9 GW, demanding investments of c. €6-7[15] bn), both by boosting capacity in existing connections (with Bulgaria, Italy and Albania), as well as promoting new connections (with Israel and Egypt[16]). The latter will allow Greece to take advantage of its geographic position, connecting the "renewable-rich" Middle East/North Africa region[17] with the "energy-hungry" SE Europe[18]. Through this process, Greece will contribute to the energy security of Europe, establishing a hub potential capacity of transit flows amounting to 12 TWh (or c.1 Mtoe).

Turning to natural gas supply sources, the phasing out of Russian imports for European countries points to the redrawing of the energy map, as the flows towards central Europe will need to be sourced from LNG terminals from the south instead of pipelines from the north.

[14] Certain capacity for electricity generation from oil is expected to remain mainly concerning electricity generation in oil refineries (as well as covering the needs of small non-connected islands)
[15] Note that this amount refers to the total estimated cost of the investments (covered by all countries involved).
[16] Egypt's solar dynamic is estimated 35% higher than Greece and 85% higher than the EU
[17] Apart from Egypt and Israel, early discussions have started concerning electricity connection with Saudi Arabia for the transfer of green energy to EU countries through Greece along with exporting connections to Austria and South Germany.
[18] According to IEA, in 2021 MENA region electricity prices averaged at €10/MW vs €132/MW for Greece.

Supply-Demand mix: Natural Gas

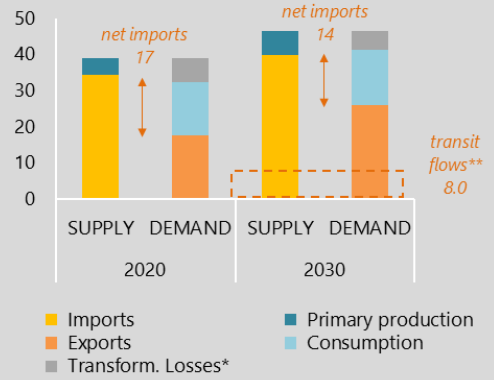
(Mtoe)



**Transformation-losses concern energy consumed in the energy production and transport process (e.g. maintining pipeline pressure), or lost due to network quality.*

Supply-Demand mix: Total energy

(Mtoe)



**Transformation-losses concern energy consumed in the energy production and transport process (e.g. maintining pipeline pressure), or lost due to network quality.*
*** Transit flows concern natural gas (7 mtoe) and electricity (1mtoe) imported for re-export, thanks to planed infrastructure investments, leading to higher interconnection capacity. The remaining energy exports mainly concern domestically refined oil (demanding imports of raw materials).*

Sources: Eurostat, European Commission (FF-55 scenario), NBG estimates

Already, many eastern and central European countries (e.g. Serbia, Romania) have expressed interest in importing natural gas from Greece (from the TAP or via LNG), with Bulgaria already performing an evident shift in 2022.

Planned investments in natural gas networks[19] (with potential to allow green hydrogen[20] transfer in the future) are estimated at €2 bn[21] concerning both:

i) Imports, targeting a capacity of 15 bcm by 2025 (vs c. 5 bcm currently), mainly through LNG terminals (Revithoussa, Alexandroupoli, Corinth) as well as

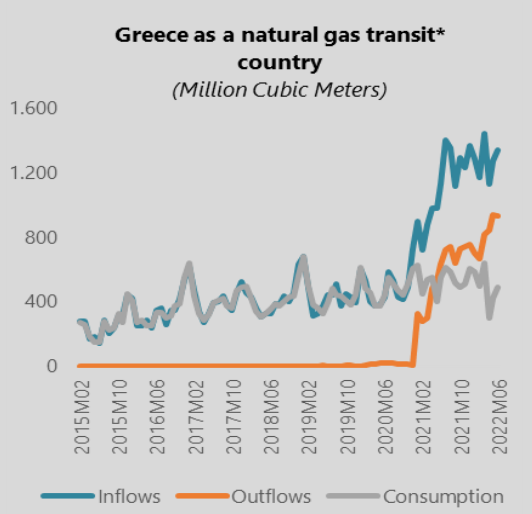
ii) Exports, targeting a capacity of 8.5 bcm (vs 2.3 currently), by upgrading natural gas pipelines (e.g. IGB with Bulgaria, IGNM with North Macedonia and TAP upgrade).

These investments are critical for Greece to cover its domestic natural gas needs, which are expected to be 25% higher in 2030 vs 2020 (i.e. by c. 1Mtoe), mainly due to oil's partial substitution in the energy mix. Against this background, it is critical to build natural gas storage facilities to maintain strategic reserves,[22] thus providing adequate room for flexibility in times of high prices or shortages. Overall, Greece is at an advantageous position to potentially become a regional natural gas hub[23] (with potential transit flows of 7 Mtoe), covering c. ½ of the SEE region's needs[24].

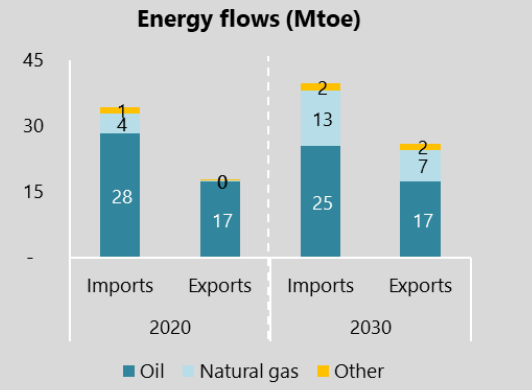
Reaping the benefits of a regional green energy hub

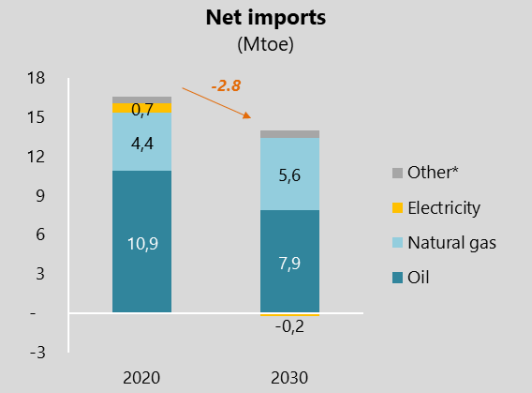
After the end of the current world energy crisis, Greece can find itself in a stronger position in the energy market. The increased efficiency in energy consumption, along with the higher share of its own production

[19] Not including the EastMed pipeline of expected capacity of 100 to 180 TWh per annum, whose construction (of c.€5 bn. cost) is still uncertain.
[20] Modern natural gas infrastructure is expected to be hydrogen ready. Successful integration of hydrogen in the supply and demand needs is expected to further reduce needs of natural gas and oil in industry and transport.
[21] Additional investments of c. 1 bn are planned concerning the upgrade of the national natural gas network
[22] Storage at FRSUs can only be for a limited time due to both technical and legal reasons.
[23] Greece's hub role (already scoring high among neighboring countries based on EFET hub rankings) can be further enhanced by the Greek Energy Exchange's natural gas trading, as prices will be determined by domestic supply and demand. Furthermore, financial trading of natural gas will generate government revenues via taxation.
[24] The natural gas needs of the SEE region (Bulgaria, Albania, N. Macedonia, Croatia, Slovenia, Romania, Serbia) are estimated to remain at c. 17 bcm (while Greek natural gas export capacity is estimated to reach 8,5 bcm by 2030). Bulgaria and Romania have already expressed interest in secure LNG spots at Revithoussa.



Natural gas flows include gas flows to Albania (and subsequently to Italy), which are provided directly by Azerbaijan through TAP. For these flows, Greece only receives revenue for pipeline services provided.





* Other net imports concern biomass and other solid fossil fuels

Sources: European Commission (FF-55 scenario), Eurostat, NBG estimates

of green electricity, will allow Greece to produce a higher share of its total energy needs (almost ½ in 2030 vs ¼ currently[25]), with net imports decreasing by c. 3Mtoe[26]. This reduction would result in a gain of about 1.5% of GDP (€2.5-3.5 bn annually), mainly through lower net imports of oil (30% decrease during 2020-2030 due to higher electrification and energy efficiency). In addition, Greece could turn into a net electricity exporter, increasing net exports by c. 1 Mtoe (c. 11 TWh).

Additional benefits are expected from the expansion of natural gas interconnections, along with competitiveness in terms of RES and geographic positioning, allowing Greece to possibly become a regional green energy hub. Moreover, transit energy flows through Greece could reach 8 Mtoe (based on expected interconnections upgrade for electricity and natural gas), i.e. corresponding to ½ of Greece's domestic demand. This will offer value-added potential through the regasification process of LNG terminals (of c. €0.2 bn) as well as fees for transit services of pipeline natural gas. Importantly, these energy sector gains underestimate the economy-wide effect of the green transition, given that the new energy mix will allow lower electricity prices, benefiting both households and enterprises.

For Greece to be able to survive the crisis and accomplish its long-term potential as a key green energy player in the region (both as a RES producer as well as an energy transit hub), it is crucial that the above-mentioned planned investments for energy supply transformation amounting to c.€35 bn by 2030 (with more than ½ concerning RES) are completed timely. This requires all parties playing their part, both suppliers (energy producers, energy network suppliers) as well as regulatory authorities for necessary reforms.

[25] A word of caution is appropriate so that higher RES penetration does not lead to further dependencies in terms of raw materials or RES production technologies (e.g. China is a great global supplier for specific materials).

[26] The potential decrease in net imports could be even greater in the event that i) Greece finds (and exploits) natural gas reserves (by the end of 2023 it should be more clear if such potential exists) or ii) new technologies allow alternative domestic production (e.g. biomethane) or higher energy efficiency.

SECTORAL REPORT

November 2022