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REDUCTION OF FOSSIL GAS CONSUMPTION IN GREECE: SCENARIOS AND RECOMMENDATIONS



Reduction of fossil gas consumption in Greece: Scenarios and recommendations

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Contents

Summary	i
Introduction.....	1
Assumptions.....	3
Results	5
Scenarios for achieving the -15% goal	7
Conclusions.....	10

Summary

On 20 July 2022, the European Commission recommended that all EU-27 Member States reduce fossil gas consumption during the August 2022-March 2023 eight-month period by 15%, as compared to the average consumption recorded during the respective time-periods of the previous five years (2017-2021). The primary aim of this proposed plan is to prepare the European Union for what will be the most uncertain winter in recent years due to Russia's war against Ukraine. However, certain member states, including Greece, have asked for and have received derogations that allow them to contribute less to the common European effort.

This analysis attempts to quantify the actual potential Greece has to reduce its total domestic consumption of fossil gas over the period in question. It focuses on the electricity generation sector, as the latter accounts for more than two thirds of final consumption. The main conclusions of the analysis are summarized below:

- The mere implementation of the government's announcements to install 2 GW of renewables in 2022 and to continue at the same rate during the first quarter of 2023 (500 MW) can reduce domestic fossil gas consumption by 12.2%, as compared to the average consumption of the past five years' (2017-2021) respective eight-month periods. In fact, this reduction can be achieved without the need to increase lignite production - compared to the previous eight-month period (August 2021-March 2022) - or to save fossil gas in the residential and industrial sectors - compared to the respective average of the last five-years' eight-month periods.
- Greece can increase its gas savings from -12.2% to -15% as set by the European Commission either by exceeding the government's renewables deployment target by 23%, or by increasing lignite-fueled electricity generation by 14.4%, as compared to the levels of last year's corresponding eight-month period in conjunction with a renewables deployment rate which complies with the government's announcements.
- The reduction in gas consumption in the buildings and industrial sectors compared to last year's increased levels can contribute significantly towards achieving the -15% target. In the case however, it is decided to not impose any measures in these sectors, meeting the -15% target will require increasing the use of lignite in electricity generation by 38%, as compared to the August 2021-March 2022 period, while conforming to the renewables deployment schedule announced by the government. Even in this adverse scenario, the required contribution of lignite does not double; in fact, it is clearly far from +100%, which was the proposed increase that was re-affirmed by the government at the last Council of Energy.
- If Greece chooses to invoke the derogation that allows it to keep total consumption at approximately the average level of the previous five years' eight-month periods, then the country's formal obligation can be met with a much lower deployment rate of renewables (-9.5% compared to the government's announcements) and a significant reduction in lignite-fueled electricity generation (-20% compared to the previous eight-month period). Therefore, opting for this derogation contradicts the government's announcements on both the deployment of renewables and the doubling of lignite's share in the electricity mix.

Introduction

On 20 July 2022, the European Commission recommended that all EU-27 Member States reduce fossil gas consumption during the August 2022-March 2023 eight-month period by 15%, as compared to the average consumption recorded during the respective eight-month periods of the previous five years (2017-2021)¹. The primary aim of this proposed plan is to stock up to 80% on fossil gas, as quickly as possible, and to prepare the European Union for what will be the most uncertain winter in recent years due to Russia's war on Ukraine.

This proposal is consistent with the REPowerEU plan that was presented by the European Commission on 18 May 2022² and agreed in principle by the member states. In addition to filling the EU's gas storage facilities to 80% of capacity by 1 November 2022, REPowerEU's main and longer-term goal for 2030 is the reduction in overall gas consumption -regardless of its source- by 64% compared to 2020 levels. This is more than double the EU's previous goal (-30%) and denotes that the theory of gas as a "transition fuel" is de facto being abandoned. Therefore, the Commission's recommendation for an immediate 15% cut in gas consumption is well in line with the above. Moreover, succeeding to fill gas stocks faster will also drive gas supply prices down; this, in turn, will help reduce electricity prices, whose surge over the past year is largely due to the escalation of gas supply prices. Thus, the -15% proposal will have a positive impact on both gas and electricity bills for households and businesses. These beneficial effects will be even greater if fossil gas, which will be reduced by 15%, is substituted by -much cheaper- clean energy from renewable sources (RES). Finally, the more forward-bearing EU's independence is from fossil gas in general, and Russian gas in particular, the more energy-independent it will be, while contributing to achieving peace in Ukraine.

However, upon the Commission's announcement, a storm of opposition erupted from 12 Member States, including Greece, caused by the potentially mandatory and horizontal nature of the measure³. As a result, at the Energy Council which was held a week later, on 26 July 2022, an agreement was reached on the -15% goal, but with numerous derogations⁴.

One of these derogations allows Member States that show increasing trends in their dependence on fossil gas to aim at a smaller reduction in gas consumption. Specifically, member states whose consumption in the past year's eight-month period (August 2021 to March 2022) was at least 8% higher than the average of the respective eight-month periods of the previous five years (hereafter also referred to as the five-year average, always with regard to the August-March reference period) are allowed to use the high consumption levels of the previous year - instead of the proposed five-year average- as a baseline to determine the 15% reduction. Therefore, as compared to the European Commission's original proposal, the European Union is

¹ European Commission: "Save Gas for a Safe Winter: Commission proposes gas demand reduction plan to prepare EU for supply cuts". Press release . 20 July 2022. <https://bit.ly/3Qcogwa>

² European Commission: "REPowerEU: affordable, secure and sustainable energy for Europe". 18 May 2022, <https://bit.ly/3oISqeO>

³ Euractiv, "Brussels' plan to curb gas use faces opposition from EU countries", 21 July 2022, <https://bit.ly/3Q9XpB7>

⁴ Council of the EU: "Member states commit to reducing gas demand by 15% next winter", 26 July 2022, <https://bit.ly/3Sfiww>

practically accepting a much lower contribution to the gas reduction effort from certain Member States that meet this condition.

Based on Eurostat data⁵ on monthly domestic fossil gas consumption, in Greece, the average consumption during the past five years' reference period (August-March) was 3.877 billion cubic meters (bcm); however, gas consumption during the reference period of the previous year alone (August 2021-March 2022) was 14% higher (4.433 bcm). Therefore, according to the decision of the Energy Council, Greece meets the condition of the aforementioned derogation, as the difference between the two 'baselines' is greater than +8%. If the government opts to use the past year as a reference point, the country's contractual obligation for total gas consumption in the coming eight months will amount to 3.768 bcm, namely, a practically negligible reduction when compared to the five-year average. If, on the contrary, Greece does not employ this derogation, it will have to limit its consumption during the coming eight months to 3.295 bcm. Thus, opting for the derogation will curtail the country's mandatory gas consumption cut by 0.473 bcm.

The real question, however, is whether Greece actually needs to invoke this derogation, due to its failure to meet the 15% reduction goal as originally set, namely, based on the five-year average. In order to address this question, it is necessary to quantify the country's actual potential to reduce gas consumption in the coming eight months, which in turn requires the examination of the following more specific questions:

- In order to achieve the -15% target, is it necessary to reduce gas consumption in the residential and industrial sectors or will it suffice to limit gas use in electricity generation, given that the latter holds the lion's share of gas end-uses?
- Is increasing the use of lignite a one-way street in order to reduce fossil gas consumption by 15% or can the same result be achieved by accelerating the development of renewable energy sources in the electricity generation sector?
- If so, what are the required levels of RES penetration and how do these compare with the government's announcements to install a total of 2 GW of new wind and photovoltaic (PV) capacity in 2022⁶, and continue at the same rate in 2023, as stated by the Minister of Environment and Energy at the last Energy Council on 26 July 2022⁷?

The above questions shall be approached by combining electricity generation data by the Independent Power Transmission Operator S.A. (IPTO), the latest data on the installed RES capacity in the interconnected grid of the Renewable Energy Sources Operator & Guarantees of Origin SA (DAPEEP), as well as fossil gas consumption data by the Hellenic Gas Transmission System Operator SA (DESFA). The main assumptions made in order to estimate the consumption of fossil gas over the next eight months are outlined in the next section. Subsequently, the results of the basic calculations are presented; the effect of various parameters shall be assessed by examining 3 scenarios through which Greece can reduce its

⁵ Eurostat, "Supply, transformation and consumption of gas - monthly data", [nrg_cb_gasml], <https://bit.ly/3jp7c4g>

⁶ Energypress.gr: "K. Skrekas, Minister of the Environment and Energy: 2 GW of new RES capacity is foreseen for this year - Through the change in the distribution grid, the target set is to construct 200,000 small PV systems - What will change regarding expropriations", 20 June 2022, <https://bit.ly/3Sffs5W>

⁷ Minister K. Skrekas at the EU Council of Energy on 26 July 2022: "...Every year from now on we are going to deploy more or less 2000 MW of new renewables." <https://bit.ly/3OKpSfP>

total gas consumption by 15%, compared to both the five-year average (European Commission's proposal) and the consumption of the past year's respective eight-month period alone (opting for the derogation).

Assumptions

The estimation of fossil gas-based electricity generation during the coming eight months (August 2022-March 2023) constitutes the starting point for all calculations. This estimation shall be based on assumptions regarding the monthly course of electricity demand in the interconnected grid, the net imports, electricity generation from lignite, as well as from wind, photovoltaics, large hydro and other RES (small PV, small hydro, biomass/biogas) and Combined Heat and Power systems (CHP). The assumptions made for the reference scenario considered here are as follows:

Demand: The electricity demand during each of the coming eight months was assumed to be equal to that of the respective month of the previous year, so as to simulate the case in which no additional consumption limitation measures are imposed.

Net imports: Given that the previous year was not representative as net imports were very low compared to other years, for each of the coming eight months, net imports were assumed to be equal to the respective month's five-year average.

Lignite: In the reference scenario considered, each month's lignite-based electricity generation was assumed to be identical to that of the previous year's respective month; in addition, the sensitivity analysis performed and presented below considered a range of values for lignite electricity generation levels -both higher and lower than those of the previous year's eight-month period. Here, it is important to note that, at the last Council of Energy, the Greek Minister announced the government's intention to impose a doubling of lignite-based electricity generation in 2022 (from 5 TWh to 10 TWh) on Greece's Public Power Corporation (PPC), even though, according to IPTO data, lignite had contributed less than 2.5 TWh of electricity in the first half of 2022.

Large hydro: In order to mitigate the significant variations in electricity generation from hydro systems over the years, the monthly contribution from large hydropower units in each of the coming eight months was assumed to be equal to the respective month's five-year average.

Other RES (small PV, small hydro, biomass/biogas) & CHP: DAPEEP has put forward projections regarding capacity increases in small hydro (10 MW), biomass (15 MW) and CHP plants (15 MW) in 2022⁸; nevertheless, in this analysis, the capacity of these technologies was assumed to remain constant and equal to that reflected in DAPEEP's May 2022 bulletin. Furthermore, these sources' contribution to electricity generation during each of the coming eight months was assumed to be equal to that of the past year's respective month. Exceptionally, the present capacity of systems using net metering was added to the electricity generated from small PV systems; this capacity was assumed to remain constant over the next months.

⁸ DAPEEP, RES, CHP & storage Special Account Bulletin, April-May 2022, <https://bit.ly/3PP52Nu>

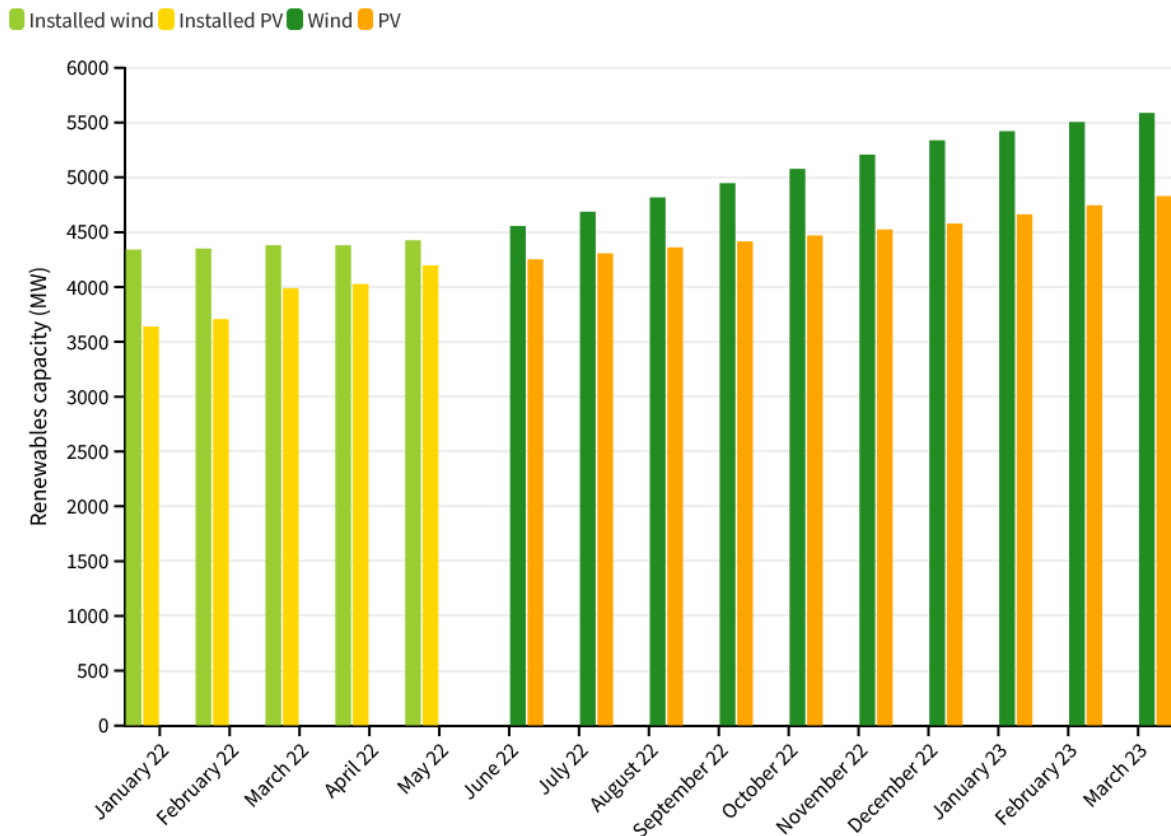


Figure 1: Evolution of wind and photovoltaic capacity in the interconnected grid from January 2022 to March 2023: specifically, with regard to the January-May 2022 period, the figure presents DAPEEP’s actual, official data for installed wind and photovoltaic systems <https://bit.ly/3zcX5uw>, while, for the remaining months, it displays projections based on the government’s announced targets.

Wind & Photovoltaics: The development of wind and PV capacity over the coming eight months was assumed to be consistent with the government’s announcements. According to the latter, 2,000 MW of renewables will be installed in 2022 and approximately the same capacity will be installed each year thereafter. Therefore, it was assumed that a total of 2,500 MW will be installed during the 15-month period from January 2022 to March 2023. Moreover, the total capacity was assumed to be shared equally between the two technologies, in line with DAPEEP’s projections for 2022. After subtracting the capacity that had already been installed during the first five months of 2022, according to the latest available DAPEEP bulletin (May 2022), the remaining new capacity per technology was divided equally to each month and added to the existing capacity. Figure 1 presents DAPEEP’s data on wind and PV capacity for the first five months of 2022 and the evolution of these two technologies’ capacity up until the end of the coming winter, based on the above assumptions. In order to estimate the electricity that will be generated from wind and PV during each of the coming eight months, this analysis used the capacity factors of the past year’s respective month, as stated in DAPEEP’s monthly bulletins.

Once the monthly electricity generation from fossil gas was calculated based on the above assumptions, it was converted to primary energy by combing the data from DESFA and ADMIE⁹.

⁹ The primary energy from gas corresponding to the estimated contribution of gas to electricity generation is calculated using a combination of ADMIE’s data on total gas-fired electricity generation in 2021 (20.87 TWh) and DESFA’s data on the amount of primary energy from gas used for electricity generation (48.03 TWh). The result is then converted into billions of cubic metres of gas (bcm), again using DESFA’s data for 2021, according to which the

Finally, having obtained an estimate for the total consumption of fossil gas over the coming eight months, its distribution to end uses (electricity generation, residential sector and industries) was assumed to remain the same as in 2021, with 68.65% of total domestic consumption being channeled to electricity generation.

Results

Based on the above assumptions, Figure 2 shows each electricity source's contribution to meeting electricity demand over the eight-month period of August 2022-March 2023.

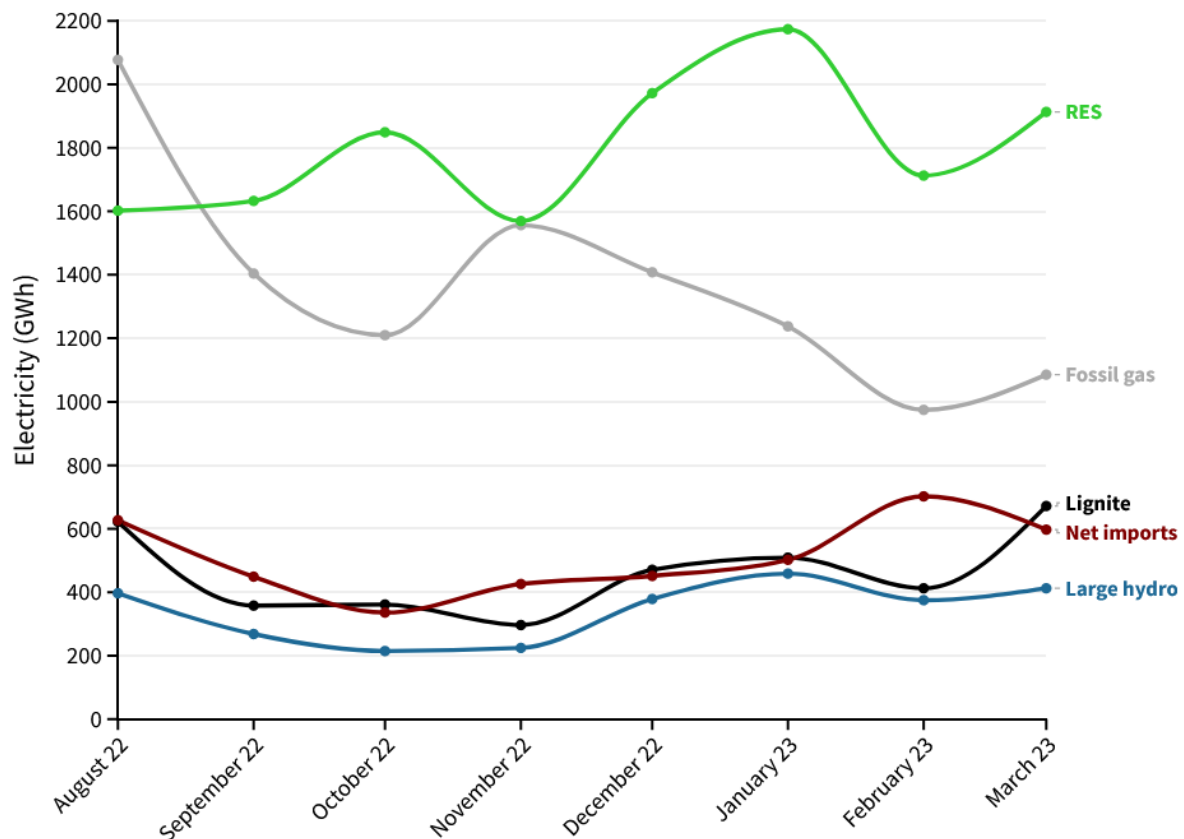


Figure 2: Contribution of the various sources of electricity generation over the eight-month period of August 2022-March 2023, according to the reference scenario in which the government's announcements on the development of renewable energy are upheld, lignite production remains as in 2021 and no additional measure is taken.

With the exception of August, it is estimated that in the remaining seven months of the eight-month period, electricity generation from RES (excluding large hydro) will exceed that from fossil gas. This difference will peak in the first trimester of 2023, mainly due to the increase in wind capacity, combined with these months' high capacity factors. A similar trend is observed when comparing monthly electricity generation from renewables (including large hydro) to that from fossil fuels (lignite and fossil gas). With the exception of August, when fossil fuels are projected to undercut clean energy by 700 GWh, and November, when the difference is estimated to be slightly in favor of fossil fuels (59 GWh), for each of the remaining six months of

total domestic consumption (69.96 TWh) of primary energy from gas corresponded to 6.07 bcm, <https://bit.ly/3ziHd9W> and <https://bit.ly/3oEBne2>

the eight-month period, electricity generation from RES and large hydro is estimated to be higher than that from fossil fuels; differences range from 139 GWh (September) to 886 GWh (January).

Figure 3 illustrates the contribution of fossil gas to electricity generation, as estimated for the eight-month period of August 2022-March 2023, and as compared to that recorded during the respective period of the previous two years. Compared to the 2021-2022 reference period, the estimated electricity generation from fossil gas shows a decline for each of the months studied. With the exception of August, November and February, the same is true when comparing the coming period to that of 2020-2021.

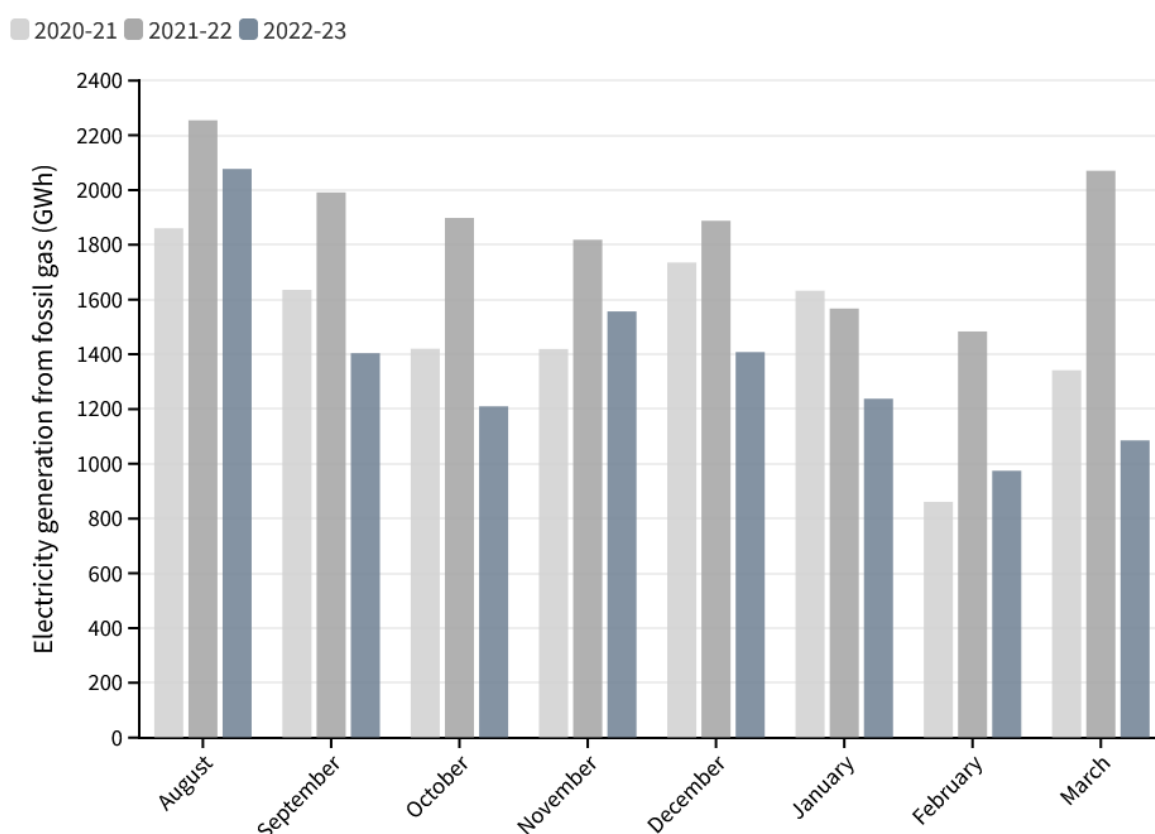


Figure 3: Comparison of the estimated fossil gas-fired electricity generation over the eight-month period of August 2022-March 2023 with that of the last two years' respective periods.

Adding up the electricity generation of each of the coming eight months, it is estimated that there will be a 26.8% decrease in gas-fired electricity generation compared to the August 2021-March 2022 period, but a much smaller decline (-8%) compared to the August 2020-March 2021 period (Table 1).

Table 1: Cumulative fossil gas-fired electricity generation during the August-March eight-month periods of the years 2020-2023

August - March	2020-2021 (data)	2021-2022 (data)	2022-2023 (estimate)
Electricity Generation (GWh)	11,903.32	14,969.29	10,952.14
% change	-7.99%	-26.84%	-

Using both DESFA's data on Greece's consumption of primary energy from gas and IPTO's data on gas-fired electricity generation in 2021, it is estimated that the primary energy from gas corresponding to the electricity generation calculated above, with regard to the eight-month period of August 2022-March 2023, is 2.19 bcm. Assuming that other fossil gas uses in the residential and industrial sectors remain unchanged compared to the five-year average, with an aggregate share equal to that of 2021 (31.25%), the total domestic gas consumption over the coming eight months (August 2022-March 2023) will drop to 3.4 bcm. This represents a 12.2% cut compared to the average domestic fossil gas consumption recorded in the 2017-2021 eight-month periods, and is only 2.75% short of the 15% reduction goal proposed by the European Commission (0.107 bcm)¹⁰.

Therefore, the mere implementation of the government's announcements to install 2 GW of wind and photovoltaics in 2022 and to continue at the same rate in the first quarter of 2023 (500 MW) can reduce domestic fossil gas consumption by 12.2% compared to the five-year average. In fact, this is achieved without the need to increase lignite production -compared to the August 2021-March 2022 period- or to reduce fossil gas consumption in the residential and industrial sectors -compared to the respective five-year average.

Scenarios for achieving the -15% goal

As highlighted above, by materializing the announced RES installation rate, Greece is 107 million cubic meters (mcm) short of achieving a 15% reduction in domestic gas consumption by the end of March 2023. The question, therefore, arises as to what additional measures Greece can take to reach the -15% goal without invoking derogations.

Increasing the rate of energy efficiency upgrading in residences that use fossil gas for heating and the rate of fossil gas boilers' substitution by heat pumps, together with the installation of domestic renewable energy systems with net metering over the coming eight months, may halt the increasing gas use trends in the residential sector and increase gas savings. In addition, fossil gas savings could also be achieved in the industrial sector through projects to increase energy efficiency and/or fuel substitution in certain industrial processes.

It is evident that these changes must be initiated immediately in order for Greece to achieve its climate goals, while protecting homes and industries from current and future energy price fluctuations. Nevertheless, the above initiatives will probably have a limited impact on reducing fossil gas consumption in the immediate future, namely, over the next eight months, mainly due to the time required for their implementation. Therefore, the efforts to close the gap in gas consumption so as to reach the EU 15% reduction target should focus on the electricity generation sector, especially in view of the latter's very large share among the three main sectors of domestic fossil gas end uses.

¹⁰ The decrease will be smaller if we assume that consumption in the residential and industrial sectors remains equal to that recorded during the respective 2021-2022 eight-month period, and, thus, significantly higher than the corresponding five-year average. In this case, the total domestic consumption in the coming eight months will reach 3.58 bcm, which corresponds to a 7.8% decrease compared to the five-year average. However, if we assume that the baseline for calculating the total change in all uses is the consumption recorded in the eight-month period of August 2021-March 2022, instead of the five-year average, then the reduction achieved will be 19.3%.

A further reduction of fossil gas use in electricity generation can rely exclusively on domestic alternatives, thus avoiding an increase in electricity imports. This can be achieved either by accelerating the installation of renewables' deployment over the coming period to exceed the government's announcements or by increasing lignite-fired electricity generation -or by combining both options.

In order to investigate the impact of different parameters on the country's potential to achieve the -15% target, 3 scenarios were considered; all possible combinations of lignite and RES that achieve the goal in question were calculated for each scenario. More specifically, the following scenarios were analyzed:

Reference scenario: In this scenario, the baseline used to calculate the -15% goal is the one that will apply to the majority of EU-27 member states, namely, the average consumption of the respective eight-month periods of the previous five years (i.e. five-year average). The electricity demand, net imports, electricity generation from large and small hydro, biomass, CHP and small PV are exactly as in the assumptions, while gas consumption levels in the residential and industrial sectors are considered equal to the respective five-year average.

Scenario of increased consumption in the residential and industrial sector: In order to consider distinctly the impact of the residential and industrial sectors' consumption on the final outcome, this scenario assumes that these sectors' gas usage levels are higher compared to the five-year average and equal to the high levels recorded over the previous eight-month period (August 2021-March 2022). All other parameters are the same as in the reference scenario.

Derogation scenario: this scenario simulates the derogation agreed at the Council of Energy Ministers, which can only apply to member states that in the previous eight months recorded an increase in gas consumption of 8% -or higher- compared to the five-year average. Greece does meet this condition, as it significantly increased its fossil gas consumption over the past year. In order to examine the derogation's effect, in this scenario, as in the previous one, the consumption of the residential and industrial sectors is assumed to be equal to that recorded over the August 2021-March 2022 eight-month period; in addition, the total consumption of the aforementioned period -rather than the five-year average- is considered as the baseline for calculating and achieving the -15% goal. The remaining assumptions are exactly the same as in the reference scenario.

Figure 4 shows the possible combinations of electricity generation from lignite and renewables that achieve the 15% reduction goal for each of the 3 aforementioned scenarios. In the case of lignite, results are expressed as a percentage difference from the lignite production recorded over the eight-month period of August 2021-March 2022; in the case of renewables, results indicate the percentage difference from the reference scenario, the latter reflecting the government's announcements to install 2 GW of wind and PV in 2022 and continue at the same pace during the first quarter of 2023. Obviously, all points representing pairs of percentage differences of lignite and renewables that lie above the respective line, indicate a greater than 15% reduction in fossil gas consumption.

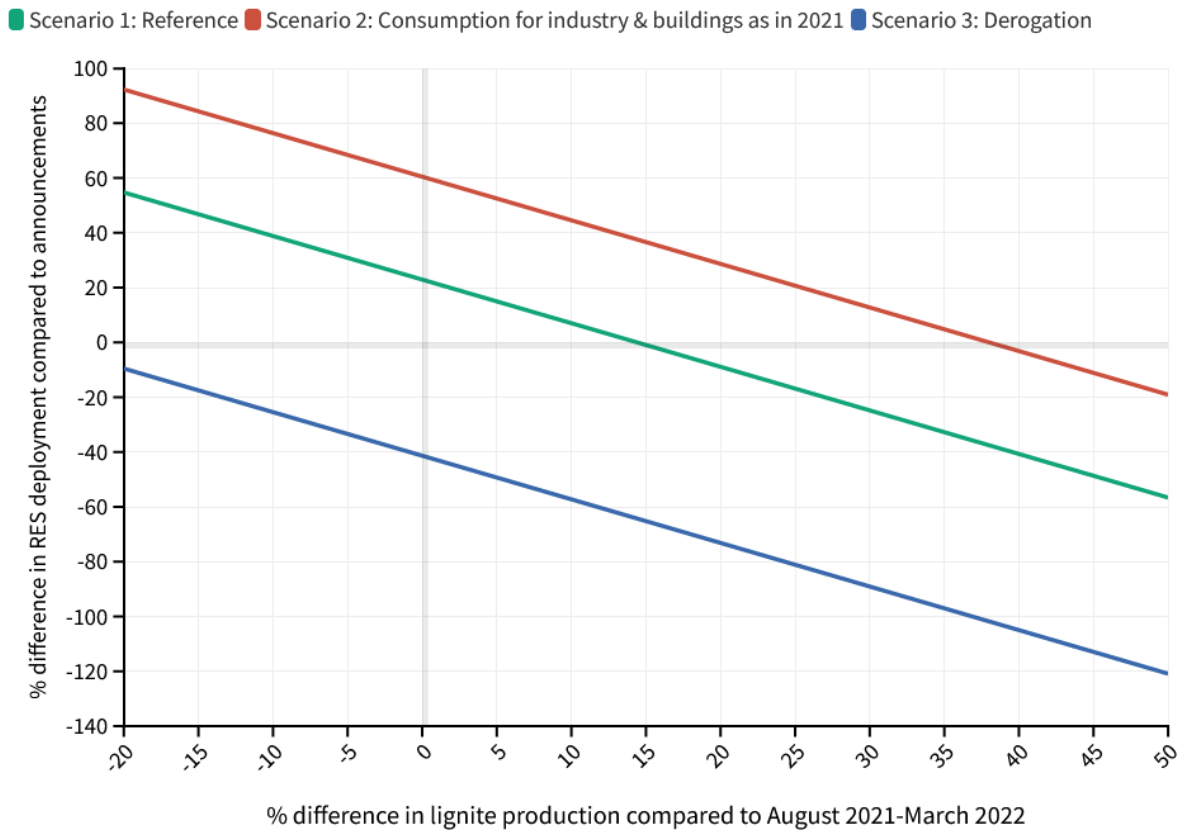


Figure 4: Combinations of electricity generation from RES and lignite in the eight-month period of August 2022-March 2023, which achieve a 15% reduction in fossil gas consumption, expressed as percentage differences from the reference scenario, as compared to either the five-year average (Scenarios 1 and 2) or the consumption recorded over the 2021-2022 eight-month period (Scenario 3).

Based on the results illustrated in Figure 4, the following are noted:

With regard to the reference scenario: In this case, cutting fossil gas consumption by 15%, as compared to the five-year average, is possible without increasing the lignite use levels of the previous year (August 2021-March 2022), provided that the rate of wind and PV installation exceeds the government's announcements by 23%; the latter corresponds to 3.075 additional MW of RES within the fifteen-month period of January 2022-March 2023. If increasing the RES installation rate beyond the government's announcements (2,500 MW) is not feasible, then achieving the -15% goal will require an increase in lignite use. The latter, however, will need to increase by 14.4% compared to the previous eight months (533 GWh) and not by 100%, as announced by the Greek Minister of Environment and Energy at the Council of Energy. Nonetheless, if PPC is forced to increase lignite-based electricity generation by more than 14.4% compared to last year, then the -15% goal could be achieved with a renewables capacity significantly below the government's announcements. For instance, if lignite-fired electricity generation is 50% higher than it was during last year's respective eight-month period, then just 1085 MW of new RES capacity would be required during the fifteen months of January 2022-March 2023. Considering that 707 MW of wind and PV have already been connected during the first five months of 2022, only 378 MW of additional RES capacity would have to be installed over the remaining ten months (June 2022-March 2023) so as to reach the -15% target; this would represent a 70% deceleration compared to the first five months of 2022.

With regard to the scenario of increased consumption in the residential and industrial sectors, where no effort is made to curb the past year's (August 2021-March 2022) level of consumption in these sectors: Under these circumstances, achieving the -15% goal is a challenge, as compared to the reference scenario, where it is assumed that gas consumption in these sectors will not rise above the five-year average. More specifically, in order to maintain the lignite-fired electricity generation at August 2021-March 2022 levels, renewable energy installation would have to exceed the government's current targets by 60.5%, thus, making it very difficult to achieve the goal. Nonetheless, if the RES installation rate remains as announced by the government, the -15% target can still be achieved by increasing electricity generation from lignite by 38% compared to the August 2021-March 2022 eight-month period (approximately 1400 GWh). Again, however, this is a significantly smaller increase than the doubling of lignite-based electricity generation announced by the government.

With regard to the scenario in which Greece chooses to apply the derogation, namely, to use the eight-month period of 2021-2022 as the baseline for calculating the -15% goal instead of the five-year average: In this case, minimal effort is required to meet the gas consumption reduction target. Greece will not need to reach the RES deployment rate announced by the government, while it will be able to significantly further reduce lignite-fired electricity generation compared to last year's eight-month period. More specifically, as illustrated in Figure 4 (blue line), by using last year's eight-month period as a baseline, the -15% goal can be achieved even if the new wind and PV capacity announced by the Ministry of Energy is lower by 9.5% (i.e. installing approximately a total of 2,260 MW instead of 2,500 MW over the fifteen-month period of January 2022-March 2023) and lignite-based electricity generation is curtailed by 20% compared to the respective eight-month period of 2021-2022 (i.e. by approximately 740 GWh).

Conclusions

Greece is fully capable to make a substantial contribution to the European effort to reduce dependence on fossil gas over the next eight months without the use of derogations. The mere implementation of the government's announcements regarding the installation of 2 GW of wind and photovoltaics in 2022 and the continuation of the same installation rate during the first quarter of 2023 (500 MW) alone can decrease domestic fossil gas consumption by 12.2% compared to the average of the respective eight-month periods of the past five years (2017-2021). In fact, this decline can be achieved without the need to increase lignite production -in comparison to the August 2021-March 2022 eight-month period, nor to cut fossil gas consumption in the residential and industrial sectors -as compared to the average of the respective eight-month periods of the past five years.

Reducing gas consumption over the coming eight months by 15% compared to the five-year average as the EC proposed can be achieved by the contribution of fossil gas savings in the residential and industrial sectors, in addition to the electricity generation sector. However, if this is not feasible in the short term, Greece can still meet the -15% target through the electricity generation sector alone, as the latter holds the lion's share of fossil gas end-uses. More specifically, the goal can be reached via the following two paths: The first option is to exceed the government's renewable energy development targets, while maintaining lignite-

based electricity generation at levels lower than or equal to those of the 2021-2022 eight-month period (+23% RES if the last period's lignite electricity generation levels are maintained). The other option is to increase lignite-fueled electricity generation, while developing RES at levels equal to or lower than those announced by the government (+14.4% of lignite if 2500 MW of wind and PV plants are installed during the January 2022-March 2023 fifteen-month period, in line with the statements of the Ministry of Environment and Energy). Even if the second path is selected, the required increase in lignite-fueled electricity generation (+14.4%) is significantly lower than +100%, which the Greek Minister of Environment and Energy proposed to impose on PPC in his statement at the Energy Council.

Achieving the -15% goal becomes more challenging if no effort is made to reduce gas consumption in the residential and industrial sectors, given the higher levels recorded over the previous eight-month period. However, even in this scenario, and provided that RES penetration levels will match the government's announcements, the required increase in lignite-fired electricity generation will be 38%, still well below the government's suggested doubling.

The Eurostat data analysis shows that, if Greece chooses to invoke the derogation it is entitled to (namely, if it chooses to calculate the 15% reduction in total fossil gas consumption based on the respective 2021-2022 eight-month period rather than the five-year average), then, in contrast to the other EU-27 Member States, it will practically maintain its dependence on fossil gas at the level of the five-year average instead of reducing it by 15%. In this case, the -15% target nearly becomes a formality, as it does not require a reduction in the residential and industrial sectors' consumption, nor a particularly ambitious development of renewable energy sources or an increase in the use of lignite in electricity generation. The -15% goal, as determined on the basis of the derogation, can be reached even if RES penetration by March 2023, is 9,5% lower compared to the government's announcements and lignite-based electricity generation is reduced by 20% compared to the past year's respective eight-month period (August 2021-March 2022). Therefore, in the event that the government decides to use the derogation to set the 15% gas reduction target, even the slightest increase in lignite use cannot be justified -let alone its doubling, which was announced by the Minister of Environment and Energy at the Council of Energy.

Considering the results of the present analysis and given the lower electricity generation cost and the irrefutably lower climate footprint of renewables compared to fossil gas- and lignite-fired plants, it becomes evident that the public interest is best served if the government proceeds to:

1. Maximize the reduction in overall fossil gas consumption by not implementing the derogation to determine the -15% target.
2. Accelerate the development of renewables to exceed current governmental targets.
3. Limit lignite use to a level that does not exceed that of the previous year.
4. Implement measures and provide incentives to increase fossil gas savings in the residential and industrial sectors.

