School of Social Sciences

Master in Business Administration

EKO in the Era of Energy Transition

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To all climate activists

Abstract

Introduction: Climate change is the most important challenge that humanity will face in the rest of the 21st century. The transition to renewable energy sources becomes imperative to address it, implying the use of transitional fuels until the full transition to renewable energy sources is achieved. In this context, the European Union has from time to time promoted policies for various fuels, such as natural gas, biofuels and, more recently, hydrogen. The effective adaptation of fuel companies to this new era becomes imperative for the success of the energy transition.

Objective: The objective of the study was to examine the case of EKO in the era of energy transition.

Methodology: The research was based on a qualitative approach, using a semi-structured interview guide. The interviews were conducted with 10 employees of the company. The data was analyzed through thematic content analysis, followed by a SWOT analysis based on the data.

Results: There was a consensus among participants with regard to the necessity of shifting away from fossil fuels to transitional. Important progress has been made by EKO towards sustainability through its investments in renewable energy sources, such as photovoltaic parks and wind farms. The company has also expanded its network of electric vehicle charging stations and has promoted biofuels and sustainable aviation fuels. Yet, the high cost of implementation, the need for government support and the lack of knowledge are important problems. Among the study participants, there is no general agreement on which fuels should be prioritized, although some of them refer to hydrogen as highly promising. According to the participants, the company can achieve carbon neutrality by 2050. Through SWOT analysis, it is supported that the company has to position itself in the hydrogen market shortly. Emphasis on research and development, the creation of collaborations with other companies, and the company's turn towards the Balkan market are also related opportunities.

Conclusions: EKO has made some steps, but further progress is needed to better adjust in the era of climate change. The results of the present study could be useful for the company’s board to improve its strategy in the era of energy transition.

Keywords

climate change, EKO, energy transition, fuels, sustainability

Περίληψη

Εισαγωγή: Η κλιματική αλλαγή αποτελεί τη σημαντικότερη πρόκληση που θα αντιμετωπίσει η ανθρωπότητα κατά το υπόλοιπο του 21ου αιώνα. Η μετάβαση σε ανανεώσιμες πηγές ενέργειας καθίσταται επιτακτική για την αντιμετώπισή της, γεγονός που συνεπάγεται τη χρήση μεταβατικών καυσίμων μέχρι την πλήρη υιοθέτηση των ανανεώσιμων πηγών. Στο πλαίσιο αυτό, η Ευρωπαϊκή Ένωση έχει κατά καιρούς προωθήσει πολιτικές για διάφορα καύσιμα, όπως το φυσικό αέριο, τα βιοκαύσιμα και, πιο πρόσφατα, το υδρογόνο. Η αποτελεσματική προσαρμογή των εταιρειών καυσίμων σε αυτή τη νέα εποχή καθίσταται απαραίτητη για την επιτυχία της ενεργειακής μετάβασης.

Σκοπός: Ο σκοπός της μελέτης ήταν να εξετάσει την περίπτωση της ΕΚΟ στην εποχή της ενεργειακής μετάβασης.

Μεθοδολογία: Η έρευνα βασίστηκε σε ποιοτική προσέγγιση, χρησιμοποιώντας έναν ημιδομημένο οδηγό συνέντευξης. Οι συνεντεύξεις πραγματοποιήθηκαν με 10 εργαζομένους της εταιρείας. Τα δεδομένα αναλύθηκαν μέσω θεματικής ανάλυσης περιεχομένου, ακολουθούμενης από ανάλυση SWOT βασισμένη στα ευρήματα.

Αποτελέσματα: Υπήρξε συναίνεση μεταξύ των συμμετεχόντων σχετικά με την αναγκαιότητα μετάβασης από τα ορυκτά καύσιμα σε μεταβατικά. Η εταιρεία έχει κάνει σημαντικά βήματα προς τη βιωσιμότητα, επενδύοντας σε ανανεώσιμες πηγές ενέργειας, όπως φωτοβολταϊκά πάρκα και αιολικά πάρκα, ενώ παράλληλα επεκτείνει το δίκτυο σταθμών φόρτισης ηλεκτρικών οχημάτων και προωθεί τα βιοκαύσιμα και τα βιώσιμα αεροπορικά καύσιμα. Ωστόσο, το υψηλό κόστος υλοποίησης, η ανάγκη για κρατική υποστήριξη και η έλλειψη γνώσεων αποτελούν σημαντικά προβλήματα. Δεν υπήρξε γενική συμφωνία μεταξύ των συμμετεχόντων σχετικά με το ποια καύσιμα πρέπει να έχουν προτεραιότητα, αν και ορισμένοι αναφέρθηκαν στο υδρογόνο ως ιδιαίτερα υποσχόμενο. Σύμφωνα με τους συμμετέχοντες, η εταιρεία μπορεί να επιτύχει κλιματική ουδετερότητα έως το 2050. Μέσω της ανάλυσης SWOT, προκύπτει ότι η εταιρεία πρέπει να τοποθετηθεί σύντομα στην αγορά υδρογόνου. Η έμφαση στην έρευνα και ανάπτυξη, η δημιουργία συνεργασιών με άλλες εταιρείες και η στροφή προς την αγορά των Βαλκανίων αποτελούν επίσης σχετικές ευκαιρίες.

Συμπεράσματα: Η ΕΚΟ έχει κάνει ορισμένα βήματα, αλλά απαιτείται περαιτέρω πρόοδος για την καλύτερη προσαρμογή της στην εποχή της κλιματικής αλλαγής. Τα

αποτελέσματα της παρούσας μελέτης θα μπορούσαν να είναι χρήσιμα για τη διοίκηση της εταιρείας, ώστε να βελτιώσει τη στρατηγική της στην εποχή της ενεργειακής μετάβασης.

Λέξεις – Κλειδιά

βιωσιμότητα, ΕΚΟ, ενεργειακή μετάβαση, καύσιμα, κλιματική αλλαγή

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List of Abbreviations & Acronyms

BP British Petroleum

Co2 Carbon dioxide

COVID-19 Coronavirus Disease 2019

CCS Carbon Capture and Storage

CCUS carbon capture, utilization, and storage

GW Gigawatt

EKO Ελληνικά Καύσιμα Ορυκτέλεια

EU European Union

LNG Liquefied Natural Gas

MW Megawatt

NASA National Aeuronautics and Space Administration

NOx Nitrogen Oxides

PPC Public Power Corporation

SO2 Sulfur Dioxide

SWOT Strengths, Weaknesses, Opportunities and Threats

1. Introduction

Undoubtedly, climate change constitutes the most significant challenge humanity will face throughout the 21st century (Schwab & Malleret, 2020). In our country, this challenge has become particularly evident through various events that have taken place in recent years. Indicatively, the extensive forest fires of August 2021 in Greece highlighted the urgent nature of the climate crisis. Characteristically, following these events, a significant shift in public discourse was observed, with the Prime Minister adopting the term "climate crisis" instead of "climate change," suggesting that we have now entered the phase of the crisis that had been predicted for decades (Newspaper "Kathimerini," 15.08.2021).

In general, crises can be classified into two categories. The first category concerns Cobra-type crises, which appear suddenly and have immediate and severe impacts on both people and the environment. The second category is described in the literature as Python-type crises. In this case, the crisis manifests progressively, resulting in its consequences becoming visible over time. Crises caused by sudden accidents fall into the first category, while the climate crisis belongs to the second, as it evolves gradually and with increasing intensity (Seymour & Moore, 2002).

In Greece, the necessity of transitioning to green growth as a response to the climate crisis was highlighted in the Final Report of the Pissaridis Committee (2020, p. 210), which is expected to have a catalytic impact on shaping public policies in the coming years. Specifically, the Report emphasizes three key axes for addressing the climate crisis through green growth: 1) Circular economy 2) Actions for climate change (mitigation actions, such as energy transformation, and adaptation actions) 3) Biodiversity and bioeconomy.

Based on the above, it emerges that strategic plans for addressing the climate crisis have begun to take shape in Greece. This study examines an initiative that belongs to the second category, namely energy transformation. The company EKO was chosen as a case study. Specifically, a research conducted through semi-structured interviews with 10 employees of the company is presented. Based on the findings from the interviews and the broader literature, a SWOT analysis of EKO in the era of energy transition is conducted. Finally, as a function of the above, proposals are formulated for the company's management aimed at improving its strategic adaptation to the new energy challenges.

2. Literature Review and International Experience

2.1 Conventional, and alternative and transitional fuels

In order to study the concept of alternative and transitional fuels, it is first essential to understand the concept of conventional fuels. Throughout history, humans were always based on fuels. Their technological innovation was based on exploiting these natural resources for technological, economical and wider societal progress. Yet, this does not mean that this process was necessarily based on conventional fuels. For example, our ancestors developed shipping through wind energy, leading us to the conclusion that energy use was not always harmful for the environment (Dalio, 2021).

The problems appeared during the industrial revolution. During this period, there was a mass enthusiasm for the prospects of technological innovation. This enthusiasm, combined with lack of knowledge for the harmful effects on the environment, lead to the massive use of fuels such as coal, at first place, and others like gasoline, diesel, liquefied natural gas and petroleum gas from fossil sources. Hence, conventional fuels can be defined on a historical axis, considering them as the fuels of the industrial era (Dalio, 2021).

In general, the history of mankind could be divided in three main periods, the agrarian period, the industrial era and the information society. Traditional fuels helped humanity to move from the agrarian period to the industrial era. Yet, they continue to be used in the information society. In general, the period after the Fall of the Berlin Wall can be considered as the period of information society. This period is marked by the use computer technology, the internet, the mass spread of information and the increased awareness for the global dimension of modern problems, including climate change (Schwab & Malleret, 2020).

Alternative fuels have been used since the industrial era Yet, they did not gain the required attention till recently, since there was no high awareness for the impact of fossil fuels on the environment. Alternative fuels are those used in power generation but are other than coal and oil (Chapman & Boehman, 2024). An alternative fuel can also be transitional. The end point will be a situation in which there will be zero emissions. This will be carried out when fully renewable sources, such as solar and wind energy, will be the only way of power generation. Till that time, humanity has to be based on fuels with zero or minimum

environmental footprint, making essential policies to promote the use of transitional fuels (Schwab & Malleret, 2020).

Generally, the adoption of new types of energy and technological advancements take place in short periods. Chapman & Boehman (2024) note that at the first decade of the previous century the United States roads were filled up with horses. Only two decades later they were filled up with cars. As they note, the change between different types of fuels is much easier than the change from horses to cars, leading the conclusion that transition to alternative fuels can be carried out shortly.

2.2 Biofuels

2.2.1 The production of biofuels, benefits and weak points of biofuels

One of the major biofuels is biodiesel, which is a renewable fuel made from vegetable oils or animal fats. The creation of biodiesel is carried out through a process known as transesterification. Through this process, natural fats and oils are converted into methyl or ethyl esters. The production of biodiesel involves breaking down complex triglycerides into simpler esters. The production of biodiesel is carried out through the use of alcohol and a catalyst, leading in that way to the reduction of viscosity, while it significantly enhances combustion efficiency. The production steps that are followed are similar for biodiesel and conventional diesel. For that reason, biodiesel is easily applicable, not requiring significant modifications in the existing engines (Jaichandar & Annamalai, 2011).

Even though there are some common points between biodiesel and traditional diesel, the differences have to do with containments that harm the environment, which are of course absent from biodiesel. More specifically, there are no sulfur, aromatic hydrocarbons, and heavy metals in biodiesel, which make it a cleaner-burning alternative in comparison to traditional diesel. Biodiesel is also an oxygenated fuel, which helps in the reduction of harmful emissions, such as carbon monoxide. For that reason, biodiesel leads to a significant positive effect in overall air quality. One of its biggest advantages is its carbon-neutral nature. More specifically, since the plants used to produce the oil absorb CO_2 during their growth, the amount of carbon released when biodiesel is burned is effectively

balanced out. In addition, biodiesel has some indirect effects for the environment, leading to less damages in engines thanks to improved lubricity, which helps extending the life cycle of the engines (Jaichandar & Annamalai, 2011).

Yet, the adoption of biodiesel production comes with several challenges that need to be addressed for it to become a more viable and widely adopted fuel alternative. The most important obstacle when considering the mass adoption of this fuel is its high cost, due to the low availability of raw materials required for its development. Biodiesel is produced primarily from vegetable oils, from animal fats, as well as from waste oils. It is therefore a smart way to take advantage of waste, but finding such waste in large extends its difficult and, therefore, expensive. According to relevant analyses, the cost of raw materials alone makes up about 80-85% of the total production cost of biodiesel, which leads to some serious questions about its feasibility. In addition, the efficiency and recyclability of catalysts is in question, since, chemical catalysts, such as for example acids and bases, used to produce biodiesel, generate several unwanted byproducts, making it important to use additional purification. Enzyme-based catalysts are more environmental friendly, but the high cost debars their mass adoption. Hence, the cost-efficiency of biodiesel is a major problem (Mathew et al., 2021).

Apart from economic challenges, there are also technical challenges. Factors like the right alcohol-to-oil ratio, ideal reaction temperature, and proper catalyst concentration all need to be carefully adjusted to maximize biodiesel yield while keeping energy consumption and waste to a minimum. In addition, oxidation is a serious threat for biodiesel, as well as microbial contamination. These are common hazards for biodiesel and traditional, but biodiesel is much more prone to them, affecting performance over time. Moreover, it is essential to make some modifications in the existing network in order to biodiesel to be used. For those reasons, there are important technical challenges that have to be addressed in order to foster the mass adoption of biodiesel (Mathew et al., 2021).

Apart from biodiesel, an additional biofuel is biogas, which is developed through the process of anaerobic digestion. In anaerobic digestion, microorganisms break down organic materials (e.g. agricultural waste) in the absence of oxygen. There are four separate stages in this production process: hydrolysis, acidogenesis, acetogenesis, and methanogenesis. In the stage of hydrolysis, carbohydrates, proteins, fats and in general large organic molecules are broken down into simpler compounds, such as sugars, amino acids, and fatty acids. During the second stage, meaning acidogenesis, bacteria further

break these down into volatile fatty acids, alcohols, hydrogen, and carbon dioxide. In the third stage, acetogenesis, conversion of these intermediate products take place into acetic acid, hydrogen, and more carbon dioxide. These products are quite essential for the final stage of the production process, which is the stage of methanogenesis. At this last stage of the production, convertion of acetic acid, hydrogen, and carbon dioxide takes place, turning them into methane and water, leading to the final product of biogas, which usually is made up of 50-70% methane and 30-50% CO_2. In smaller amounts, other types of gas and hydrogen sulfide also exist (Kabeyi & Olanrewaju, 2022).

There is a wide range of factors that affect the production of biogas. More specifically, the type of feedstock, temperature, pH levels, retention time, and the design of the digester are some of the main factors that have to be taken into account regarding the production of biogas. Anaerobic digesters generally operate under mesophilic conditions (25-40°C) or thermophilic conditions (above 40°C). Between those two, thermophilic conditions have a significant advantage, since they lead to higher methane yields. After its production, biogas has several applications, used in cooking, in lighting and in heating. In addition, it can be turned upgraded into biomethane, which consists a more refined version with a higher methane content. Biomethane can be fed into natural gas grids or used as a fuel for vehicles. Biogas has also some applications apart from energy generation, since its leftover material from the process of digestion, can be used in agriculture, since it is a rich organic fertilizer. Hence, biogas has significant advantages since it is a clean type of energy and since its by-products and be used in line with the principles of circular economy (Kabeyi & Olanrewaju, 2022).

As with biodiesel, biogas also faces significant challenges. One of the biggest hurdles is the high cost of installation and the high cost of maintenance regarding biogas digesters, which often discourage businesses from investing in biogas. Even after the installation of essential systems, there is often lack of technical knowledge required to operate them efficiently. Apart from those factors, there seems to be lack for strong policy support regarding biogas, even in the European Union, despite its decisive steps to combat climate change in the last years (Ahmed et al., 2021).

2.2.2 The European Union's policy for biofuels

The latest report for the European policy regarding biofuels has been published by the European Court of Auditors (2023), under the title *"The EU's support for sustainable biofuels in transport – An unclear route ahead*" (Special Report No. 29/2023). According to the report, there are some majors challenges regarding the European Union's support for sustainable biofuels in the era of energy transition. As stated in this report, the policy of the European Union changed many times in the past and there is absence of a stable and long-term plan to promote the use of biofuels. The policy of the European Union could therefore be characterized by profound uncertainty, which negatively affect the development of the sector. Changes took place since and previous expectations regarding the massive use of biofuels can now be considered as non-realistic. In the past, the European Union aimed for a large scale reduction in greenhouse emissions in transport and in a general improvement in the footprint of the energy sector through fossil fuels. It was somehow considered that biofuels could "solve the problem", but by 2021, 93% of the energy consumed in the European Union's road and rail transport sector still came from fossil fuels. Even though specific targets have been set, most European Union countries failed to meet the 2020 goals regarding the penetration of renewable energy sources in transport. The priorities regarding the types of biofuels promoted have changed several times, reducing the sector's attractiveness for investment and increasing risks for investors due to uncertainty.

As stated above, biofuels could also have some impact on the environment. In that context, this report mentiones that greenhouse gas emissions attributed to biofuel use are often unclear, raising concerns about the sustainability of these fuels. Further, as stated at this report, biomass production requires significant land use, which obviously has an impact on the environment. Problems such as deforestation, loss of biodiversity, and increased emissions due to land-use could therefore occur due to biofuels. Indeed, biofuels derived from food and feed crops could be considered as a threat, due to the change in the way that land is used, as growing demand could lead to turning forests into agricultural land. The European Union has used emission calculation methods to depict the impact of biofuels, since they could indirectly influence the environments impact to control emissions due to the loss of forest land, but, of note, this parameter has not been taken into consideration.

For that reason, the replacement of fossil fuels with certain types of biofuels may not help in the reduction of climate crisis, but could also further contribute to the problem.

Based on this report, the availability of biomass is a significant barrier regarding the development of biofuels, since the raw materials used in order to produce biofuels compete with other sectors, like the pharmaceutical industry, which might use similar sources. In the first decade of the century, approximately 90% of the biofuels that were consumed in the European Union were produced from domestic raw materials. However, the significant increase in demand from that point and on led to a higher dependence from imported raw materials, particularly for bioethanol and biodiesel. In Finland, it was estimated in 2021 that 90% of the biofuels consumed were produced from imported biomass, questioning the way that this biomass was developed in the first place. Waste and residues, such as used cooking oils, are considered a promising source of biofuels, but their availability is limited, and there are significant risks of fraud in the imports of such raw materials, with cases of mislabeling already recorded in the European Union.

As mentioned in the report, the high production cost makes biofuels uncompetitive compared to fossil fuels. Their production remains largely dependent on government subsidies and tax incentives, questioning the long-term economic sustainability of that market. Hence, in the lack of mandatory use through legislation, the biofuels market would not be able to survive in the competition, even though the cost of production differs based on the raw material and the technology that is applied and improvement in those parameters could somehow improve the cost-efficiency. A significant problem contributing to this situation is that, according to the report, advanced biofuels are, queerly, more expensive than first-generation biofuels. Of course, they are more efficient in order to set gas emissions under control, but their high cost debars their massive use. This problem is observed when analyzing the achievement of the goals set, since most European countries have continuously failed to achieve the goals they have set for the use of biofuels. This situation is therefore directly related with the high cost of latest generation biofuels.

Based on the above, the report of the European Court of Auditors is quite pessimistic. Hence, the future use of biofuels in the European Union is quite uncertain and a scenario of massive use of biofuels does not seem that realistic. Of note, the European Union policy does not provide clear direction for what has to be followed at the period after 2030. Yet, for the sectors of heavy-duty vehicles, aviation, and maritime transport, biofuels remain

one of the few available solutions for emissions reduction. Although the new ReFuelEU Aviation regulation mandates increasing shares of sustainable aviation fuels, the EU's production capacity remains extremely low. Similarly, the FuelEU Maritime regulation does not require a specific percentage of biofuel use, which is quite odd since it aims to significantly reduce emissions.

Finally, another significant problem noted in the report is the lack of transparent data. As stated in the report, there is not a consisted reporting system to calculate the percentage of biofuels used in several applications. Additionally, inconsistencies exist between the data collected by the European Commission regarding biofuel consumption and production, making it difficult to accurately assess the progress of member states.

For all the above reasons, this report concluded that there are several obstacles to be addressed. The progress is low and the poor cost-efficiency sets the future of biofuels in question. In general, the report concludes that there are two main barriers, first, the lack of a consistent framework, and, second, the low cost-efficiency of biofuels.

2.3 Natural gas

2.3.1 The production of natural gas

Natural gas, widely considered as a transitional fuel, is a fossil fuel that consists mostly of methane, together with some other hydrocarbons like ethane, propane, and butane, although in small amounts. Being highly combustible, natural gas is a highly efficient and, therefore, widely used source of energy. When compared with other fossil fuels, such as coal and oil, it is observed that it burns much cleaner, leading to a lower production of l sulfur dioxide, nitrogen oxides, and particulate matter. Hence, natural gas is a preffered source for electricity generation, as well as for heating and industrial applications. It should also be noted that natural gas is used in order to produce a wide range of chemicals and fertilizers (Faramawy et al., 2016).

Natural gas became quite popular at the last decades of the 20th century, since the downfall of socialism in the Soviet Union allowed massive exports from states like Russia and Kazakhstan. But, looking back at the history of natural gas, its use started gaining gradual popularity after the 19th century. The first known natural gas well was drilled in 1821 in

Fredonia, New York, by William Hart, who is often credited as the "father of natural gas". During the 19th century, its use took place in specific areas with related infrastructure, since there were no pipelines to allow its transportation in big distance. The next turning point is after World War II, due to the massive advancements in pipeline construction, allowing its use for home heating, industry, and power generation. Afterwards, the developments in liquefied natural gas (LNG) technology made it possible to transport natural gas across the world, increasing its use. The technological advancements and the open market of the former socialist states allowed the development of the sector (Faramawy et al., 2016).

Despite the technological advancements throughout history the production of natural gas followed a similar process and the difference regards the specific means and tools involved in the common steps of natural gas extraction. At first, geologists and geophysicists collaborate in order to find some potential gas reservoirs buried beneath the Earth's surface. Thanks to technological advamcenets, in modern times this process is carried out by the use of advanced tools like seismic surveys, sending waves to the ground to find sources of natural gas. The waves send to the ground bounce back and create a kind of "map" of the underground rock formations. Thanks to 3D seismic imaging, a high level of accuracy can be obtained. After finding a promising site, the following step is drilling an exploratory well and taking several core samples, used to confirm the presence of natural gas and to investigate its quality, so that it is determined if developing a larger project is sensible or not (EIA, 2021).

The second stage of the process is extracting natural gas. In this step, there are various methods that can be utilized, which depend on the type of reservoir. In conventional reservoirs, the gas flows easily to the surface once a well is drilled, while, unconventional (e.g. shale gas) make essential the use of more advanced techniques. Hydraulic fracturing, or "fracking" is among the most well-known methods. Fracking involves pumping a high-pressure mixture of water, sand, and chemicals into the rock, so for tiny fractures to be created, letting the gas to get off the ground. Another technique, horizontal drilling, is based on drilling vertically to a certain depth and then turning the drill sideways, so that a large era of the gas-rich rock can be accessed. These methods have opened up vast new supplies of natural gas that were once considered too difficult or expensive to reach. In general, the extraction of natural gas can be made through different processes and there is

no “correct” and “mistaken” way, since each one has to be examined as for its cost-efficiency (Wang et al., 2014).

Once the gas is out of the ground, it’s not ready for use just yet, since there are several impurities. Hence, water, carbon dioxide, and other gases have to be removed from gas in order to be used, a process that takes place at a processing plant, in which the gas goes through three different stages. The first stage is that of separation. The gas is separated from any liquids that might co-exist, like water. Followingly, it’s dehydrated to remove water vapor, since water vapor can lead to corrosion in pipelines or form ice-like blockages, which are described as hydrates. At the third and final stage of the process, contaminants like hydrogen sulfide, have to be taken out from gas, in order to make sure that essential quality standards are met. After all this process, the gas is sent through pipelines or is now converted into LNG, allowing its commercial use (Kidnay et al., 2019).

The current study does not focus on the process of natural gas extraction itself, but on the sustainability parameters that are associated with natural gas. Hence, special emphasis has to be given on its footprint. Estimating its footprint, natural gas is obviously cleaner when compared to coal and oil. Yet, this does not mean that there are no environmental concerns, especially due to methane leakage, a potent greenhouse gas, related to the phenomenon of climate change. Even though methane leakage is a problem, there are significant advancements in technology, helping to set these emissions under control. Apart from methane leakage, there is also another sustainability parameter not necessarily taken into account, which is water use in fracking. Fracking requires vast amounts of water, restraining local resources when taken of the ground. Yet, this concern can also be set under control by using non-potable water sources or through water recycling (Allen et al., 2013).

In general, the environmental and geopolitical parameters associated with natural gas are inter-correlated. Natural gas has a geopolitical identity. As stated above, the interest for natural gas increased after the fall of the Soviet Union and the development of poor and high in natural resources states, which had to make use of that resources to foster their development, making them prone to not giving attention to the environmental parameters that had to be taken into account. In any way, the open market of former socialist states allowed investments and exports, leading to an increased interest for natural gas by the West (Dalio, 2021). But the 90’s were also a period of increased awareness for climate

change. Hence, the environmental benefits of natural gas were extensively studied in that period. According to Van Egteren (1993), one of the biggest environmental benefits of natural gas is that it burns much cleaner than the traditional fossil fuels, meaning coal and oil. When used for power generation, natural gas produces almost no sulfur dioxide (SO_2) emissions, which means it doesn't contribute to acid rain. It also emits about 50% less CO_2 per kilowatt-hour than coal, contributing to the effects for reduced emissions. Additionally, natural gas combustion results in around 80% lower nitrogen oxides (NO_x) emissions in comparison to coal, which helps improve air quality by reducing smog formation.

As supported by Van Egteren (1993), this increased interest lead to technological innovations in order to further reduce the environmental footprint of natural gas. Advances in gas-fired combined cycle technology have further increased efficiency, allowing power plants to generate more electricity while keeping emissions low. Unlike coal, which produces large amounts of solid waste like ash and sludge, natural gas burns cleanly and leaves no solid waste behind. In addition, as he supported, technologies like selective catalytic reduction have been developed to further cut NO_x emissions, bringing them down to nearly zero, leading to the conclusion that it is a more environmental friendly choice.

2.3.2 The European Union's policy for natural gas

Europe's power generation has been highly dependent from natural gas. Over the years, it became a preferred fuel because of its lower emissions compared to coal and oil and its ability to complement renewable energy sources. It seems that Europe took a type of decision to base its development on natural gas, since the development and expansion of pipelines and LNG terminals during the previous decades made natural gas highly accessible. This allowed many European countries, such as Germany, to gradually shift away from coal and oil, partially replacing them with natural gas. By the last decade of the previous century, natural gas had become a key player in Europe's energy transition. During the previous decades, its prices were generally stable and competitive when compared to other energy sources. These factors drove the interest and demand for natural gas (Mitrova et al., 2016).

Based on the aforementioned factors, the European Union developed a Bridge Strategy. The Bridge Strategy was the use of natural gas as a temporary but necessary step between

traditional fossil fuels and fully renewable energy sources, such as solar and wind power. Due to the ability of natural gas to burns cleaner and its higher efficiency than coal, it was considered as a very practical way to reduce emissions, continuing the development and progress in renewable energy sources, till the end point of zero carbon economy. For that reason, the European Union encouraged the construction of gas-fired power plants, which provided a flexible energy source that could easily adjust to fluctuations in electricity demand (Mitrova et al., 2016).

This strategy of the European Union was first questioned and afterwards destroyed. The questioning phase took place during the Russian invasion in Crimea. This event was a turning point in how Europe viewed its dependence on Russian natural gas. Before the Russian invasion, Russia was the primary supplier of natural gas to European countries. Central and Eastern European countries, as well as Germany, were highly dependent from Russia. However, the geopolitical tensions that followed the invasion of Russian in 2014 lead to very serious concerns about the use of natural gas as a mean of geopolitical influence. At that time, European leaders expressed their fears that Putin could manipulate the supplies of natural gas in order to exert influence over their policies. In response, initiatives such as the proposed "Energy Union" gained increased interest, with leaders like former Polish Prime Minister Donald Tusk proposing the need for a unified energy strategy among the European Union countries. The main axes of the proposed strategy were collective purchasing agreements, improved energy infrastructure, and diversification of the supplies, including investments in LNG terminals and alternative pipeline routes (Stern et al., 2014; Van de Graaf et al., 2017).

A second point of concern after the invasion of Crimea, although not widely recognized, was the fast development of infrastructure to export natural gas to China. In a scenario that Russia used natural gas as a geopolitical weapon, restricting resources to European countries, its economy would face a significant negative impact. The pipelines in East Asia were considered as a silent strategy of Russia in order to export its gas eastwards, allowing Putting to cut off energy supply to Europe whenever he considered it to be for the benefit of Russia (Stern et al., 2014).

Over time, several European countries developed plans aimed at reducing and, if possible, eliminating Russian gas imports by the early 2020s. Collectively, the European Union explored new pipeline projects to tap into gas reserves from regions like the Caspian Sea and the Middle East (Stern et al., 2014). Yet, it was more difficult than it was considered

to cut ties with Russian gas. European domestic gas production was in decline, and while alternative energy sources and LNG imports helped reduce dependency, Russian gas remained very competitive. For those reasons, the European countries silently accepted the situation as it was before the Russian invasion in Crimea, ignoring the threat (Stern et al., 2014; Van de Graaf et al., 2017).

The destruction of the Bridge Strategy took place in February 2022. Relations between the European Union and Russia deteriorated rapidly and European governments responded with several rounds of sanctions, in order to weaken the economy of Russia. In retaliation, Russia imposed its own countermeasures, including demanding that gas payments be made in rubles, stopping exports to those not complying. This counteract of Russia exposed Europe's vulnerability and led to urgent discussions regarding its energy security. The European Union unveiled the REPower plan in March 2022, with an ambitious goal of cutting Russian gas imports by two-thirds before the end of the year and fully eliminating reliance on Russian fossil fuels by 2030. In the short term, the Union sought to ramp up LNG imports from the United States and Qatar, even with much higher cost (Lambert et al., 2022).

Even in that case, Europe encountered major hurdles in fully breaking free from Russian gas. One of the biggest challenges was lack of proper infrastructure, since LNG import terminals were mostly located in Western Europe, making Eastern European countries vulnerable to this type of energy war. Additionally, many of Qatar's and the United States' LNG shipments were already committed to long-term contracts with Asian buyers, limiting how much could be redirected to Europe. While Algeria and Azerbaijan pledged to increase exports, their production capacity was low and not sufficient to cover the needs of European Union. In addition, Europe's domestic gas production had been declining for years, further exacerbating the supply crunch (Lambert et al., 2022).

Another pressing concern during that period was gas storage, a problem that gained attention after the middle of 2022. More specifically, by August 2022, European storage facilities were only 67% full, raising fears of shortages as winter approached. The awareness of this situation had a domino effect on the economy, leading to high energy prices and, therefore, to high inflation. Hence, European countries faced significant negative consequences due to their inability to gradually reduce the dependence from Russia after the alarm of the Crimea invasion in 2014 (Lambert et al. 2022).

2.3 Hydrogen

2.3.1 The different types of hydrogen

The latest trend in the adoption of alternative and transitional fuels is hydrogen, which, for several reasons that will be presented followingly, can be considered as a transitional fuel. The history of hydrogen as a fuel goes back several centuries, with the first experiments that laid the foundations for its modern use starting in the 16th century. Afterwards, Paracelsus, a prominent Swiss alchemist, dissolved metals in acid and observed the production of a flammable gas, later identified as hydrogen. More specifically, hydrogen was officially recorded as a separate and flammable gas in 1766 by Henry Cavendish, describing it as 'combustible air'. Afterwards, several scientists developed a significant interest to study hydrogen. In the 1800s, William Nicholson and Anthony Carlisle discovered electrolysis, a method of splitting water into hydrogen and oxygen by electricity, which remains to this day a key way of producing hydrogen, particularly in combination with renewable energy sources (Grimaldo Guerrero et al., 2021).

The scientific interest regarding hydrogen increased during the two following centuries. More specifically, the first fuel cell was developed in 1839 by William Grove. Grove converted managed to convert the chemical energy of hydrogen into electricity, making use of an electrochemical reaction. The next interesting time-point is the 1920s, when hydrogen was tested as a fuel in internal combustion engines. Afterwards, the Second World War lead to emphasis on fossil fuels, but in the mid-20th century major developments regarding hydrogen fuel cells took place. Thanks to those developments NASA's Gemini and Apollo programs made use of hydrogen fuel cells space missions with the use of hydrogen fuel cells. This remarkable event was followed by a wider interest on hydrogen as a reliable and clean type of energy. In general, its use in space missions was a milestone for its practical applications (Grimaldo Guerrero et al., 2021).

Despite the interest on hydrogen, the wider application at that time was quite limited. But, this event lead to the idea of a 'hydrogen economy', first mentioned in the early 1970s, mainly in academic circles. Immediately after this early trend in the early years of this decade, the world energy crisis of 1973, as well as the crisis of 1979, increased interest in exploring new energy systems, including the use of hydrogen. The International

Association for Hydrogen Economy was founded in 1974, in order to promote the study and development of related technology. Yet, at that time point nuclear power was considered as the main source to develop hydrogen, debarring its massive production (Yap & McLellan, 2023).

After this historical circle was completed, the second phase began in the 1980's and continued till the end of the century, characterised by stagnation in the development of the hydrogen economy, since the interest of the industry and of the governments gradually declined. The scientific community became aware of the significant technological and economic challenges that hydrogen economy could phase. But this was not the only factor explaining the reduced interest in hydrogen. More specifically, the end of the oil crisis lead to lower and, generally, stable oil prices. During these years, although research continued, there was no significant progress in the commercial adoption of hydrogen. At the same time, electrolysis and fuel cell technologies were being developed, but high costs and limited infrastructure continued to be barriers to implementing the hydrogen economy on a large scale (Yap & McLellan, 2023).

Coming to the end of the century, the climate change problem started gaining significant attention. For that reason, the hydrogen economy began to attract renewed interest, since it became obvious that emissions had to be reduced. The Kyoto Protocol (1997) and the Paris Agreement (2015) reinforced the international commitment to renewable energy and greenhouse gas emission reductions, although there was no specific mention regarding hydrogen. At the early 2000's, the interest in hydrogen development programs started to rise, with renewable electrolysis emerging as one of the most viable options. In addition, there was further progress on fuel cell technology, helping in more applications of hydrogen in transport and in the industry. The key issue in this period was the economic viability of hydrogen (Yap & McLellan, 2023).

In general, at that period energy security and climate change started gaining significant attention. For those reasons, researchers, industries and governments started to consider alternatives, including hydrogen. Water electrolysis was significantly developed in that period, leading to an improvement in the efficiency of hydrogen production, especially this process took place through renewable resource. At this latest historical circle, many advanced countries are investing in hydrogen infrastructure and technology. In Europe, Germany is one of the most prominent cases, since there are hydrogen-powered trains in the rail network of the country, while hydrogen fuel cell-equipped vehicles have been

develop by Japanese manufactures (e.g. Toyota Mirai). At the same time, governments and industries are exploring the role of hydrogen in reducing carbon dioxide emissions, focusing their efforts on high-emission sectors such as transport and heavy industry. As such, hydrogen has established itself as an important factor in the transition to a more sustainable energy system, representing both historical innovation and contemporary efforts towards environmental sustainability (Grimaldo Guerrero et al., 2021).

When examining hydrogen, it should be noted that not all types are friendly for the environment. One type of non-friendly hydrogen its grey hydrogen. This is mainly produced through the methane steam reforming process, where natural gas, consisting mainly of methane, reacts with steam under high temperatures and pressure to produce hydrogen and carbon monoxide. A reaction takes place between the carbon monoxide and steam, in the water-gas reaction, which consists a secondary reaction that results in the production of additional hydrogen and carbon dioxide. It is a low cost and widely used method, quite efficient for the production of hydrogen in large scale, but it emits a significant amount of CO_2, which contributes to greenhouse gas emissions. For that reason, grey hydrogen is obviously considered as less friendly for the environment when compared to other types of hydrogen (Dash et al., 2023).

Coal gasification is another way utilized to produce that type of hydrogen, based on heating coal in the presence of oxygen and steam. A mixture of hydrogen, carbon monoxide and other gases, is the result of this process, which is known as syngas. Coal gasification is the basis of this process, taking place in areas in which coal is abundant and natural gas is scarce (e.g. in specific areas of China). This process also leads to significant CO_2 and other pollutants, questioning its impact on the environment. For that reason, grey hydrogen from coal and natural gas can be regarded as a transitional solution, but not as a sustainable long-term way to produce energy (Dash et al., 2023).

Another type of hydrogen is blue hydrogen. Blue hydrogen is a low in emissions form of hydrogen. Its production takes place by the use of fossil fuels, when combined with other related technologies, described in the literature as carbon capture, utilization, and storage (CCUS) technologies. Reduction in greenhouse emissions is possible by CCUS, meaning by capturing and storing the carbon dioxide that is produced during the production process of hydrogen. For that reason, blue hydrogen is considered to be a more friendly method compare to the others. Hence, blue hydrogen has a significant role in the bridge strategy towards a carbon free economy (Yu et al., 2021; Zapantis, 2021). While this type of

hydrogen has a smaller impact on the environment, it still relies on fossil fuels, making it impossible to contribute to decarbonization in the long run. (Aguilera & Inchauspe, 2022).

Another form of hydrogen is brown hydrogen. Brown hydrogen is produced through the gasification of coal, a process in which coal reacts with oxygen and steam at high temperatures to generate hydrogen, leading to high carbon dioxide emissions, making it quite harmful for the environment. In order to minimize this impact, carbon capture and storage (CCS) technology has been developed, but even when CCS is applied, fully capturing all emissions is impossible (Bridges & Merzian, 2019). Yet, the production of this type of hydrogen is quite more cheap when compared to green hydrogen, due to the low efficiency of renewable sources when compared to fossil fuels, making it, unfortunately, a quite attractive option (Bridges & Merzian, 2019).

The fourth related type is yellow hydrogen, a type of hydrogen produced through the electrolysis of water, with the primary energy source based only on solar power. For that reason, the specific type of hydrogen is in line with the goal to reduce greenhouse gas emissions, while being dependent from solar power it is also considered as totally sustainable. The production of yellow hydrogen takes place in areas where there is high solar irradiance, but there are significant challenges related to energy storage and to the inconsistencies of solar energy itself (Malek et al., 2024).

In any case, the main advantage of this type is the low environmental footprint compared to hydrogen produced by fossil fuels. Yet, there are some concerns regarding the life cycle of photovoltaic systems. But if producers adopt environmentally responsible practices for the sourcing and management of photovoltaic panels, the impact on the environment can be zero. This does not mean that yellow hydrogen is totally environmentally friendly. More specifically, there is need for water involved in electrolysis and for batteries to store the energy when solar availability is limited. Despite these limitations, yellow hydrogen is generally considered as one of the most environmentally friendly types of hydrogen (Ajanovic et al., 2022).

The fifth and last type is green hydrogen is green, which is also produced through electrolysis, but uses generally renewable sources, not only solar energy, like green hydrogen. Since it is produced by the use of electrolysis, there are no fossil fuels involved in hydrogen generation (Newborough & Cooley, 2021). There are specific sectors where green hydrogen shows particularly strong potential and it has become quite popular and promising as a viable alternative fuel in shipping. In shipping, this type of hydrogen can be

stored as a cryogenic liquid, using it in long-distance routes. Yet, the storage of hydrogen requires extremely low temperatures (around -253°C) and, when compared to coal or oil, it cas a lower energy density by volume, requiring either further stops to refuel either more space for storage. (Atihan et al., 2021).

In general, several countries have shown an increased interest for this type of hydrogen. Among them, China is highly promoting green hydrogen in order to meet the national goal set by the government for carbon neutrality by 2060. For that reason, China has developed several projects in order to expand the use of hydrogen fuel cells in transportation (Liu et al., 2022).

2.3.2 The European Union's policy for hydrogen

The interest of the European Union for hydrogen emerged quite recently. The European Union developed a compressive strategy for hydrogen before five years, in 2020. More specifically, in 2020 the European Union introduced the "Hydrogen Strategy," an initiative aimed to help Europe achieve its well-known goal for climate neutrality by 2050 (European Commission, 2020). In "Hydrogen Strategy", this type of alternative fuel is mentioned as an important tool helping Europe reduce its emissions, especially in sectors high in emissions, helping in the promotion of the Green Deal and in the achievement of carbon neutrality by 2050.

Since the Union developed a specific strategy, it is worth mentioning its steps. More specifically, the strategy developed consists of here different phases, with the first one belonging to the past (2020-2024). In this first stage, the European Union aimed to install electrolysis cells with a total capacity of at least 6 GW, having the ability to produce up to 1 million tons of renewable hydrogen every year. In the second phase (2025-2030), in which we are now, full integration into the energy system will take place. In this stage, there is a goal to reach electrolyzer installations with a total capacity of 40 GW and to be able to produce every year at least 10 million tons of renewable hydrogen. This phase has also three additional objectives, which are the promotion of hydrogen in shipping, the reduction of its cost and the transformation of gas pipelines in order to support hydrogen. The last phase will take place from 2030 to 2050, therefore starting in five years from now. In the final phase, hydrogen should have matured and been widely implemented

across all sectors of the economy, not just in high-emission sectors (e.g. shipping). At this final stage renewable hydrogen should be the only type of hydrogen used in the European Union, avoiding the harmful for the environment types described in the above section. At the same time, large-scale infrastructure for hydrogen storage and transportation will have been developed.

Following these steps has a high cost and requires significant investments. According to the European Union, significant investments have to be carried out, reaching €470 billion by 2050. For that reason, the European Clean Hydrogen Alliance was established. The Alliance has as a primary goal to bring together industry representatives, national and local authorities, and civil society. Through their collaboration, the goal is to help in the promotion of plans required for the transition to hydrogen economy. To support the required infrastructure, the European Union strategy includes funding through European programs, such as InvestEU and NextGenerationEU, as well as specialized funds for research and the development of new technologies, which are necessary for the cost-efficiency and the large scale adoption of hydrogen. In this context, the Union's sustainable finance policy focuses on attracting private investments and strengthening the hydrogen market. In addition, the European Union supports collaboration between member states, in order to formulate similar national strategies.

In any case, when the strategy was developed the needs were different compared to those existing now, but these changing circumstances are even more favorable for the adoption of hydrogen in the economy. More specifically, the original goal of the European Union was to use hydrogen in order to combat climate change. In 2020, energy security was not an issue, since Europe felt secured based on natural gas imports from Russia. However, the subsequent geopolitical tensions with Russia have added a new dimension to this strategy, highlighting the potential of hydrogen to promote energy independence. Indeed, the war in Ukraine questioned the European Union's heavy reliance on Russian natural gas, leading the Union to search for essential alternative, which could also be sustainable. For that reason, the focus on green and yellow hydrogen has become a strategic priority, as it can replace fossil fuels and contribute to the Union's energy security (Nuñez-Jimenez & De Blasio, 2022).

Based on the above, the European Union has accelerated its efforts to promote investments in hydrogen infrastructure, in order to crease a secure and sustainable hydrogen economy. This does not mean that all efforts are carried out by members of the Union, since other

countries also have a significant role. More specifically, a key part of this strategy is increasing the production capacity of electrolyzers and deepening collaborations with neighboring countries such as Morocco and Norway to create a diversified supply chain (Nuñez-Jimenez & De Blasio, 2022).

2.4 Energy transition in Greece

The arrival of the Industrial Revolution took place in different times in different countries (Dalio, 2021). In Greece, industrialization took place later compared to Western Europe, since our country was massively industrialized after the end of World War II. The post-world war economic development of our country was highly dependent on the use fossil fuels, since they were cheap and easily available. Lignite became the most frequently source of energy for Greece, supporting its economic growth. Today, our country has undoubtedly entered the era of lignite phase-out, a general trend observed in European Union. This policy is shaped by various factors. One such factor is the national priorities in the field of energy and electricity generation, as outlined in the National Energy and Climate Plan. A second factor is the economic viability of investments in lignite-based power generation. A third factor is our country's legally binding environmental obligations, as expressed through the European Green Deal and the European Energy Roadmap. A fourth factor is our country's international commitments, such as those under the Kyoto Protocol and the Paris Agreement. Finally, the fifth factor is the technological advancements in renewable energy production, which now make energy transition possible (Chrysikou, 2023).

Within this framework, the end of the lignite era appears inevitable. According to the National Energy and Climate Plan, the end of 2023 had initially been set as the deadline for the complete decommissioning of existing lignite units. Irrespective of if this was achieved, it is widely accepted that our country has entered the post-lignite era. The first signs of this transition appeared in previous years, as evidenced by statistical data. Greece's peak lignite-based energy production occurred in the early 2000s, specifically in 2002. Since then, there has been a gradual decline in lignite use, which was initially less

pronounced but has become more evident in recent years compared to the 2000s and 2010s (Kartsounis, 2019).

The National Energy and Climate Plan, approved in December 2019 by the New Democracy government, sets the goal of fully phasing out lignite from the national electricity generation system by 2028 and increasing the share of renewable energy sources to 61%-64% of the energy mix by 2030 (Kartsounis, 2019). However, a significant contradiction arises here. While at the political level it is considered a given that we are in the era of lignite phase-out, with a clear goal of ending lignite-based energy, in practice lignite units continue to operate, albeit on a reduced scale. Despite the widespread acceptance of lignite phase-out as a policy choice, both by the government and the European Union, its implementation in practice appears to be delayed (Chrysikou, 2023).

The decarbonization in Greece primarily concerns the regions of Megalopolis and Ptolemaida. The lignite units in Megalopolis and Ptolemaida served a broader plan, which needs to be carefully examined. According to information from its website, the Public Power Corporation (PPC) was established in August 1950 with the aim of fully electrifying the country, supported by the Marshall Plan. PPC began its operations in two sectors: electricity production and lignite exploitation. Soon after, the construction of the thermoelectric power plant in Aliveri began, along with the development of two lignite mines with a total production of 3,000 tons of lignite per day. In 1954, the Louros hydroelectric plant in Preveza was developed, while the following year, the Ladon hydroelectric plant near Megalopolis in Arcadia was developed. Yet, these units did not have the sufficiency to meet our country’s needs. Thus, 1959 marked a significant milestone in PPC's history, as the company acquired 90% of the shares of LIPTOPO S.A., a mining company in the Ptolemaida region. This move allowed PPC to supply lignite to the under-construction Ptolemaida complex. The Ptolemaida power plant began operations in 1959 with a single power generation unit of 70,000 KW, which was at the time the tallest structure in Greece, with a chimney reaching 110 meters.

The Megalopolis power plant was developed later. Its construction began in 1970, with two units initially put into operation, while a third unit was added in 1975. A fourth unit was added much later, in 1991. The different timeframes and locations of the two plants led to their different utilization over time. Following the development of the Ptolemaida power plant, Greece achieved energy self-sufficiency and even began exporting energy,

while also being able to import through the same infrastructure. PPC's grid was interconnected with the Yugoslav system via a transmission line from Ptolemaida to a monastery in Yugoslavia, following an agreement for the exchange of electrical energy between the two countries.

However, in the following period our country experienced as significant industrial growth, making imperative the use of additional energy sources. For that reason, the development and upgrade of the Megalopolis plant was of most importance, in order to meet the domestic needs and to support the industry. The station in Ptolemaida was also upgraded, not only to support the country's industry, but also to allow energy exports, improving the country's strategic position in the Balkans.

Today, decarbonization is imperative, and plans have been developed for the energy transition in both regions. Both areas are affected by the impacts of lignite units. For example, in 2007, environmental violations were recorded in both Ptolemaida and Megalopolis. There are also concerns about the health of residents, with studies indicating an increase in respiratory diseases and neoplasms (Marinakis et al., 2020; Sichletidis et al., 2003).

Based on the negative impact of lignite-based power plants, a comprehensive strategy was formed to help Greece transition from lignite to clean energy sources by 2050. At that time point, total transition must have been obtained, and lignite power plants must have stopped their operations by the late 20's. According to the original plan, natural gas was expected to have an important role, in line with the Bridge Strategy. But, the geopolitical conflict with Russia created significant obstacles due to sanctions against Russia, minimizing natural gas availability, also leading to higher energy prices. For that reason, the government, although supporting decarbonization, faced the challenge of finding alternative transitional fuels to progress toward its ultimate goal of complete reliance on renewable energy sources, without being able to effectively continue the bridge srategy (Chrysikou, 2023).

The conflict between Russia and Ukraine is not the only factor affecting lignite phase-out efforts, since the pandemic was also a related challenge. While the pandemic and climate change appear to be distinct threats, they are inextricably linked. The pandemic caused a shift in investments from climate actions to public health protection, while simultaneously diverting public attention from long-term threats, such as climate change, to immediate

needs. This shift in priorities hindered systematic climate action and, consequently, the lignite phase-out process (Schwab & Malleret, 2020).

However, there is also a third factor that may have been examined to a lesser extent so far. It is a fact that in the past decade, geopolitical tensions have once again intensified in many regions of the world, following a period of relative stability—except for the Middle East. The Arab Spring, the election of President Trump in the United States and Bolsonaro in Brazil have increased global tensions (Schwab & Malleret, 2020). In the early years of this decade, two major conflicts and three emerging and equally concerning ones have been observed. The first conflict is the aforementioned war in Ukraine, which was began by Russia's invasion in February 2022 (Johannesson & Clowes, 2022). The second is the war between Israel and Hamas, which begain in October 2023 (Hitman & Itskovich, 2023). The three other conflicts that also periodically attract attention but have not yet received the necessary focus are the dispute between Azerbaijan and Armenia over the Nagorno-Karabakh region (Saparov, 2023), the renewed confrontation between Serbia and Kosovo (Mohammed, 2023), and China's aggressive policy against Taiwan (Chen, 2022). It is therefore evident that we have entered a period where any previous stability has been shaken, with increasing geopolitical tensions emerging in multiple and diverse parts of the world.

Overall, energy has transformed into a tool of geopolitical influence. States and their alliances seek to secure affordable energy to strengthen their economic growth and geopolitical standing. In a world where fossil fuels remain a cheap energy source and geopolitical tensions are rising, the transition to green energy is systematically undermined (Dalio, 2021; Schwab & Malleret, 2020). The use of energy as a geopolitical weapon debars our country's efforts to decarbonize energy production, leading to an era that smart and decisive actions are of most importance in order to combat climate crisis (Chrysikou, 2023).

2.5 The case of EKO

EKO, a subsidiary of HELLENiQ ENERGY, is a leading company in the energy sector in our country. In Greece, EKO operates through and extensive network of 1,631 service stations. These stations operate under two different brands, EKO and BP. In addition,

EKO manages a total of 16 fuel storage and distribution facilities, 23 aircraft refueling stations at major airports of our country, two liquefied petroleum gas (LPG) bottling units, and one lubricant production and packaging facility. At an international level, EKO has established a notable presence in several countries in the Balkans, specifically in Bulgaria, Serbia, Montenegro, and North Macedonia, as well as in Cyprus. In all these countries, EKO operates 323 service stations, including 25 under the OKTA brand. In Cyprus and Montenegro, its local subsidiaries hold leading positions in their respective markets, while its presence in Bulgaria and Serbia is more limited (HELLENiQ ENERGY, 2024a).

In 2023, year of the latest available data while writing this study, the company successfully increased its market share in various fuel categories (automotive fuels, industrial fuels, aviation fuels, and marine fuels). At this year, EKO expanded its "net-zero energy network" program, which aims for energy neutrality, supported by solar panels placed in service stations. Apart from that, EKO enhanced its customer rewards program, "EKO Smile," through the introduction of several new offers (HELLENiQ ENERGY, 2024a).

A notable point for EKO's sustainability its entry into the electricity market in Cyprus, which was carried out using a green and environmentally friendly approach. More specifically, this was carried out with the acquisition of two photovoltaic parks, which have a total capacity of 15 MW. The company’s subsidiary, EKO Energy Cyprus Ltd, started operating in the renewable energy sector, making use of the photovoltaic parks owned by HELLENiQ ENERGY in Cyprus (HELLENiQ ENERGY, 2024a).

The company has given significant emphasis on sustainable development and environmental responsibility. Through a wide range of initiatives and actions, EKO aims to reduce its footprint on the environment, to improve energy efficiency, and to contribute to the protection of the natural environment. In 2023, the company participated in actions of forest and natural environment restoration. With regard to energy transition, EKO has been significant investments in order to minimize CO_2 emissions and to promote sustainability in transportations. In that context, the company operates a total of 319 electric vehicle charging stations at EKO and BP stations, which are partially powered by photovoltaic systems (HELLENiQ ENERGY, 2024b).

In addition, the company has made a notable agreement for the promotion of sustainable aviation fuels. More specifically, it collaborates with AEGEAN to provide such fuels at Thessaloniki Airport, which are derived from renewable raw materials (e.g. animal fat).

According to the report of the company, these fuels lead to the reduction of CO_2 emissions by 87.18% in comparison to conventional ones. In addition, the company includes the use of biofuels, like biodiesel, in transportation fuels. From 2021 to 2023, the company has increased the proportion of biofuels in biodiesel (HELLENiQ ENERGY, 2024b).

Yet, according to the company's report, it faces pressure from stricter environmental regulations. Some additional challenges that the company phases are the need to reduce emissions and the demand for low-carbon technologies. The investments to that direction are quite demanding, making essential to develop collaborations in order to further promote sustainable fuels. In general, according to this report the transition to electrification requires significant investments and collaborations, while the market for sustainable fuels is still in its infancy, with challenges in the supply chain and costs. The company has made progress, but the efforts must be continuous and must be accelerated (HELLENiQ ENERGY, 2024b).

3. Methodology

3.1 Study design

The methodology applied in this research was qualitative. This approach contributes significantly to the analysis of attitudes and perceptions of the stakeholders regarding the phenomenon under study (Babbie, 2013), in this case the energy transition of EKO. In particular, the qualitative method has emerged as particularly useful in studying how people involved in a phenomenon shape their perceptions for it, as the tools it utilises, such as empirical observation and interviews, allow for a detailed exploration of their opinions and experience (Babbie, 2013; Robson, 2002). In contrast, quantitative methods, although efficient for statistically depicting phenomena, such as determining the percentage of individuals who exhibit certain beliefs, are not considered equally effective for investigating attitudes and perceptions related to complex phenomena (Babbie, 2013). Therefore, given that this study focused on a deeper analysis of participants' attitudes and perceptions, the choice of a qualitative approach was deemed to be the most appropriate.

The research was also phenomenological. Interpretive phenomenology is based primarily on philosophical considerations of social knowledge, rather than on strict methodological principles of qualitative research. As Schutz (1967) notes, knowledge is assumed to exist

'out there', and the role of the scientist is to capture and interpret it with scientific accuracy. This approach is also characterised by a particular dimension of power concerning the relationship between the individuals who experience a phenomenon and the knowledge produced around it. Rather than being shaped through a 'top-down' process, social reality is shaped through a 'bottom-up' approach. This is because the interactions between individuals and groups involved in the process are the main mechanism for constructing and structuring social reality (Maynard & Clayman, 2003). Hence, this study does not investigate the status of energy transition in EKO, rather than the attitudes and beliefs of workers' towards this transition.

3.2 Participants

The participants of the present study were 10 people working in management positions in EKO. No further inclusion and exclusion criteria were set.

3.3 Measurements

The participants were asked to complete a socio-demographic data recording sheet, followed by a semi-structured interview to explore their attitudes towards the issue under consideration (Appendix). The choice of this approach to data collection is best justified through an understanding of the difference between unstructured, fully structured and semi-structured interviews. Unstructured interview guides are preferred in situations where there is limited knowledge about the subject of the research, with the aim of not limiting the scope of the investigation. The questions in this case are very general, leaving the course of the interview to the discretion of the participant. In contrast, fully structured interviews are used to confirm specific aspects of an issue, but tend to limit the scope of the investigation and the flexibility of responses, which may prevent new insights from emerging. Semi-structured interviews lie in between, offering a balance between the broad exploration of a topic and the need for a more specific focus. Prior literature knowledge can help shape the interview guide questions, thus reducing the need for unstructured

interviews of a very general nature (Babbie, 2013; Robson, 2002). In this study, the extensive literature review that preceded it formed the basis for the interview guide, while providing methodological justification for the choice of semi-structured interviews. Hence, based on the previous knowledge regarding energy transition, a semi-structured interview was developed, focusing on the case of EKO.

3.4 Process

Participants' recruitment was carried out using convenience sampling. A convenience sample is a type of non-random sample where participants are selected based on their ease of access by the researcher. It usually includes people who are readily available or willing to participate, with no strict selection criteria (Robson, 2002). The participants were recruited by the researcher's professional network, since he works in the company. More specifically, they were verbally informed for the study purpose and asked to participate. If they agreed, a meeting was arranged, in which they signed an informed consent. Afterwards, the interview was carried out. The interview was carried out in a quiet place, chosen by the participants and, after receiving their consent, it was recorded. The interview was afterwards transcribed, in order to be analyzed.

3.5 Data analysis

The method of data analysis is vital for describing, understanding and presenting results in qualitative research. According to Kollias (2014), since the early 20th century, researchers such as Berelson developed systematic and evidence-based approaches to qualitative data analysis. Early efforts focused on analyzing data from newspapers, as it was found that they could not be analyzed in quantitative terms. Although the analysis initially focused on print discourse, it was soon expanded to include data from other sources, including interviews.

The analysis of qualitative data should be considered along two main axes. The first concerns the scope of the research. In general, qualitative analysis aims to form a clear picture of the phenomena being studied, with the aim of contributing to social change. It does not refer to a static reality, but to a dynamic and evolving situation. Since the 1930s,

qualitative content analysis in the United States was systematized to capture social representations that impeded progress in the rights of people of color (Kolias, 2014). Consequently, content analysis focuses not only on describing social phenomena, but also on understanding the need for continuous social evolution, reinforcing the dynamic character of social reality.

The second axis to be considered when analysing qualitative data concerns the reliability and validity of the applied process. Reliability has been the subject of thorough study since the 1920s, with emphasis on issues such as sampling and the accuracy of coding. The evolution of qualitative research towards a more scientifically based content analysis intensified in the second half of the 20th century (Robson, 2002). A key point of this transition was the realisation that the analysis focused exclusively on the 'manifest' content of communication, neglecting the wider context. This limited approach ignored important parameters such as the characteristics of the participants, the possible reasons for their responses and the wider social context in which they were embedded (Babbie, 2013).

The need to overcome these limitations led to the development of thematic content analysis, a method that aims to assess both explicit and implicit content (Kolias, 2014). This shift towards thematic analysis allowed for a more comprehensive and valid understanding of phenomena, highlighting the dynamics and complexities that characterise social interactions. Lydaki's (2001) thinking offers a particularly illuminating perspective on the two dimensions of data analysis mentioned above. In her view, qualitative research contributes to both scientific and social change, with thematic content analysis as a key tool. The element that emerges as central to qualitative data analysis is the absence of a predetermined starting point. This flexibility allows for free exploration of the data, leading to emergent knowledge and thus to the promotion of social change. The close link between scientific validity and the social dimension of thematic analysis underlines the potential of this method.

In this study, the data analysis method of Colaizzi (1978) was adopted. This method is based on a phenomenological view of social reality, in line with the principles of social constructivism. The main aim of the method is to understand the experiences of the participants, giving priority to their experience.

The process of qualitative data analysis based on the Colaizzi (1978) method involves identifying critical information relevant to the issue under study, categorising it into sub-themes and, finally, organising it into central themes. This approach allows for a detailed

and structured understanding of participants' experiences, contributing both to scientific knowledge and a deeper understanding of social reality.

In Colaizzi's (1978) method of data analysis, the process evolves through successive steps, ensuring a systematic and complete analysis of the data. These steps are as follows:

1. Review of socio-demographic characteristics: In the initial stage, the researcher reviews the sociodemographic characteristics of each participant. The purpose of this review is to obtain a global and detailed picture of the sample, facilitating an understanding of the context in which the responses are given.

2. Isolating critical passages: The analyst identifies and isolates statements from participants that he or she considers important for understanding the phenomenon under study. At this stage, the extracts are quoted in their entirety to ensure the accuracy and fidelity of the data.

3. Interpretation and thematic analysis of statements: The important statements are assessed for their significance and interpreted, while relevant themes are developed.

4. Grouping of themes and development of core categories: Themes that have similarities or similar content are grouped together. Through this process, central thematic categories are created that capture the overall observations of the research.

5. Writing up results and validation: In the final stage, the researcher writes up the results of the analysis. At the same time, he/she maintains constant contact with the original data in order to ensure the correctness and accuracy of the coding at all stages of the analysis.

At next, SWOT analysis was applied. More specifically, SWOT is considered an imporant strategic tool. It is applied in order to evaluate internal and external factors that affect an organization, a project or a policy. Its objective is to identify strengths and weaknesses, as well as opportunities and threats from the external environment, in order to formulate strategies that enhance competitiveness and sustainability (Hugner & Wheelen, 2004). The SWOT analysis provides a structured framework for decision-making, allowing the assessment of the current situation and the formulation of long-term strategies.

The thematic content analysis and the literature review were used to develop the SWOT analysis for EKO's energy transition. The thematic analysis revealed internal factors, such as technological readiness and human resource perceptions, which were placed in the categories of strengths and weaknesses. At the same time, the literature review enabled the identification of external trends, such as technological developments and regulatory requirements, which were assessed as opportunities or threats. The synthesis of these findings lead to a detailed picture of the strengths, weaknesses, opportunities and threats of the company’s energy transition.

4. Results

4.1 Results of the interviews

The sociodemographic data of the study participants are presented at the following table. As indicated by the table, two participants did not complete the relevant form, although giving full responses through the interview. These participants were no3 and no5. In addition, many of them, such as no4 and no7, had missing responses. This could be attributed to their preference for anonymity, making it impossible to trace their responses after reading this study. This preference of the participants was considered as reasonable and they were not by any means pushed to provide further information.

Interview No.	Gender	Age	Educational Background	Position in Company	Years in Position	Total Years in Company
1	Male	32	MBA	Sales Executive	5	11
2	Male	60	University degree	Head of Sales Attica	10	33
3	N/A	N/A	N/A	N/A	N/A	N/A
4	N/A	58	Economic studies	Retail Sales Department Manager EKO, South Greece	10	35
5	N/A	N/A	N/A	N/A	N/A	N/A
6	Male	58	Electrical Engineering	Retail Sales Department Manager	7	30
7	N/A	55	Business Administration, University of Piraeus	Network Training Team Leader	2	31
8	N/A	45	Chemist, MSc, PhD	Head of Retail Sales	8	18
9	N/A	56	University	Manager of Retail Sales	5	23
10	N/A	53	Master	N/A	10	N/A

Table 1: The sociodemographic data of the participants

Through the interviews with the research participants, various interesting findings emerge. One level of coding and analysis concerns the broader thoughts of participants regarding the relationship between fossil fuels and climate change. This issue is highlighted through the interview with the third participant in the study. As stated, there is a widely recognized link between the use of fossil fuels and climate change. Specifically, in his interview, he mentions the following: "The link between fossil fuels and climate change is extensively documented and widely recognized within the scientific community. The combustion of coal, oil, and natural gas results in the release of large quantities of CO_2 and other

greenhouse gases into the atmosphere. These gases create a heat-trapping effect, contributing to global warming and the broader phenomenon of climate change. Over the years, substantial research has reinforced the understanding that human activities, particularly the burning of fossil fuels, are the dominant force behind the ongoing climatic shifts." Even participants who do not elaborate as extensively confirm the connection between fossil fuel use and climate change. Notably, the fourth participant in the study states: "Climate change is having an ever-increasing impact on human health due to dependence on fossil fuels and the resulting rise in global temperatures." Consequently, a relevant theme could emerge with the title: "The Inextricable Link Between Fossil Fuel Use and Climate Change."

A second level of coding concerns how EKO should adapt to the new energy reality. From the perspective of the study participants, the use of alternative fuels is proposed as an intermediate stage toward a sustainable transition. This issue is highlighted through the interview with the first participant in the study, who notes the following: "An essential task is to step up investment in the fuels – such as hydrogen, ethanol, biodiesel and biofuels generally speaking – that might contribute significantly to the energy system benefits of gas and oil without net carbon emissions." In any case, the study participants do not refer solely to the use of alternative fuels but also to the ultimate goal of complete transition to renewable energy sources. This issue is highlighted by the fifth participant in the study, who emphasizes the following: "EKO should start investing in renewable energy, improve energy efficiency, and adopt greener practices. This means cleaner fuels, cutting down on carbon emissions, and maybe even some carbon offset projects and simultaneously investing in electric energy." Consequently, a new relevant theme could be developed with the title: "The Need for EKO to Use Alternative Fuels Until the Complete Transition to Renewable Energy Sources."

The research participants were also asked, through the third question of the interview guide, about the strategies EKO is following to achieve the energy transition. From their responses, a clear emphasis emerges on the company's focus on renewable energy sources, such as photovoltaic parks and wind turbines. This issue is highlighted by the ninth participant in the study, who states: "Like I said earlier, better make more efficient products and use better machinery and methods for that. Also, invest in forms of renewable sources of energy, such as P/B parks and wind farms." A similar stance is expressed by the eighth participant, who notes: "Increase of investment in forms of

renewable sources of energy, such as photovoltaic and wind farms." Consequently, an additional relevant theme could be developed with the title: "EKO's Current Focus on Renewable Energy Sources."

Clearly, the energy transition is perceived by the participants as a particularly significant challenge. Their statements highlight key obstacles, such as the high cost of the energy transition, the need for the company's workforce to develop new knowledge, government support, and EKO's research and development strategies. These barriers are mentioned at various points in the interviews and are summarized by the sixth participant in the study, who states: "The main challenges include the high cost of implementing new technologies and the need for staff training." On the same issue, the seventh participant remarks: "Critical factors include government support, investment in research and development, and staff training." Consequently, a new sub-theme could be developed with the title: "The High Cost of the Energy Transition, Workforce Knowledge Development, Research and Development, and Government Support as Key Barriers to the Energy Transition."

Another particularly important issue concerns the selection of the most suitable transitional fuels. Regarding this matter, there does not appear to be a common trend in the responses of the research participants. Some participants highlight a particularly wide range of alternative fuels, even if they express a preference for certain ones. A characteristic example is the interview with the fifth participant in the study, who states: "Natural gas, hydrogen and biofuels are good bets. Natural gas is cleaner than coal and oil, and biofuels come from renewable resources and have lower carbon emissions." However, other participants take a different stance by emphasizing only one transitional fuel. A relevant example is the statement of the first participant in the study, who notes: "Hydrogen; It’s renewable and readily available. Also, it’s more powerful and energy efficient than Fossil Fuels and it’s more efficient when compared to other energy sources with almost zero emissions. It’s ideal for populated areas considering its low carbon footprints, low noise and visual pollution." Consequently, a relevant theme could be developed with the title: "Participants’ Diverging Views on the Transitional Fuels That Should Be Utilized." While all participants recognize the necessity of using transitional fuels, there is no agreement among them on which specific fuels should be used.

Another significant aspect is the participants’ perspective on what the success or failure of EKO’s energy transition would entail. Naturally, there could not be a completely uniform set of responses among the research participants. However, it appears that all of them

understand the implications of the company's success or failure in the energy transition. These consequences are summarized by the fifth participant in the study, who states: "If EKO succeeds in the transition, it'll be seen as a leader in sustainable energy, attracting eco-conscious customers and investors. If it doesn't, it risks losing out to greener competitors and facing regulatory penalties and finally becoming obsolete." Therefore, an additional relevant theme could be developed with the title: "Energy Transition as a Win or Lose Situation."

Finally, the participants' perspectives on whether EKO will have achieved the energy transition by the middle of the century are also of interest. Responding to the final question of the interview guide, which concerns what the company will look like in the middle of the century, the participants perceive the goal of the energy transition as achievable. This is reflected in the interview with the third participant in the study, who states: "Looking ahead to the 2050s, EKO could find itself at the forefront of the global energy transition if it successfully adapts to key shifts in the energy landscape. By this time, fossil fuels may still play a limited role in its operations, but the company will likely have significantly diversified its portfolio, prioritizing renewable and low-carbon energy solutions." Similarly, the fifth participant in the study notes: "I see EKO becoming a fully integrated energy provider, offering a mix of renewable and traditional energy sources."

Clearly, this question was not only about 2050 but also about 2100. However, the participants respond in a way that suggests that by 2050, the goal of the energy transition will have already been achieved. A characteristic statement is that of the eighth participant, who mentions: "Fossil fuels will remain for many more years, at least the next 20 years, we will simply have to turn to gradual decarbonization for environmental reasons." Consequently, an additional relevant theme could be developed with the title: "The Complete Achievement of the Energy Transition by 2050."

The original themes and the final themes of the study are presented at Table 2. As indicated by the table, 7 main themes emerged. Themes no1, no4, no5, no6 and no7 were maintained in the final analysis, since they were not directly linked to other themes. Themes no2 and no3 were related, leading to a new theme, entitled "EKO'S Current Focus on Renewable Energy Sources Instead of Transitional Fuels". Indeed, despite the need to focus on transitional fuels and first and to renewable sources in the long run, the study participants support that the company focuses primarily on renewable sources and not on transitional fuels.

Theme Number	Original theme	Final theme
1	The Inextricable Link Between Fossil Fuel Use and Climate Change	The Inextricable Link Between Fossil Fuel Use and Climate Change
2	The Need for EKO to Use Alternative Fuels Until the Complete Transition to Renewable Energy Sources	EKO'S Current Focus on Renewable Energy Sources Instead of Transitional Fuels
3	EKO's Current Focus on Renewable Energy Sources	
4	The High Cost of the Energy Transition, Workforce Knowledge Development, Research and Development, and Government Support as Key Barriers to the Energy Transition	The High Cost of the Energy Transition, Workforce Knowledge Development, Research and Development, and Government Support as Key Barriers to the Energy Transition
5	Participants' Diverging Views on the Transitional Fuels That Should Be Utilized	Participants' Diverging Views on the Transitional Fuels That Should Be Utilized
6	Energy Transition as a Win or Lose Situation	Energy Transition as a Win or Lose Situation
7	The Complete Achievement of the Energy Transition by 2050	The Complete Achievement of the Energy Transition by 2050

Table 2: The original and final themes of the study

4.2 SWOT Analysis

Based on the background of the study and the results of the interviews, SWOT analysis was performed regarding the energy transition of EKO. Regarding strengths, one of the core strengths in energy transition is the company' s strong reputation as a leader in Greece's fuel marketing sector, as well as in the Balkans in general. The solid strategic position in the market means that there is a good starting point allowing to shift toward sustainable energy. The company has already made some progress to the direction of energy neutrality through its Net Zero program. For example, solar panels have been already installed in various stations, providing the opportunity to charge electric vehicles without harming the environment.

A second important strength is the company's partnership with AEGEAN Airlines. This agreement has been developed in order to supply sustainable aviation fuels in airplanes. It is an initiative that shows its dedication to cutting carbon emissions in transportation and could be used as a guide for similar cooperation with other companies in the future. EKO is also pushing for greater use of biofuels like biodiesel and bioethanol in its fuel mix. Additionally, the company has entered the renewable energy market by acquiring two solar parks in Cyprus, signaling a move away from fossil fuels. Hence, the steps already carried out are a significant strength in the company's effort for energy transition.

The company's commitment to corporate social responsibility is an additional strength that has to be reported. More specifically, EKO has developed initiatives like reforestation and disaster recovery projects not only boost its public image but also align with EU environmental goals. Hence, the company's emphasis on corporate social responsibility is another strength.

Finally, being part of HELLENiQ ENERGY, a larger energy group, gives EKO access to financial resources and strategic support. For example, research and related knowledge is of most importance to support energy transition, as indicated by the interviews of the study. Access to these resources is easier through the wider network of HELLENiQ ENERGY. Hence, being part of HELLENiQ ENERGY is another strong point.

Apart from the strong points, there are also some major weaknesses that EKO faces in its effort for energy transition. One major weak point is the company's heavy reliance on fossil fuels, as its core business still revolves around traditional fuel products. While the

company is working to incorporate alternative energy sources, the transition is slow, since most of its operations focus on fossil fuels.

A second weak point is the high costs of shifting to renewable energy. Indeed, significant investments are needed for research, development, and infrastructure upgrades. The interviews highlight the importance of government support, meaning that it might be extremely difficult from EKO to use its own resources in order to make the shift.

Third, the size of the Greek market might be an additional weak point. In our country, the electric vehicles market is small when considered with other countries, despite the significant increase in electric vehicle sales during the previous years. The small size of the market, which limits the immediate returns on EKO's investments in electric vehicles charging stations.

Regarding the opportunities for EKO, the global trend regarding green energy and decarbonization offers a significant growth opportunity. The policies of the European Union, like the Green Deal, which aim to reduce carbon emissions, provide subsidies, tax incentives, and funding programs that EKO can use to speed up its transition. EKO could take advantage of those, in order to further support its energy transition.

The growing market of vehicles using non-fossil energy sources is an additional advantage. The company can position itself as a leader in electric vehicles charging infrastructure, positioning before a spike in demand. In the following years, the trend of using hydrogen in cars and transportation vehicles could also emerge. For that reason, it is of most importance to position the company order to be able to take advantage of those opportunities.

In addition, partnerships with renewable energy companies could help EKO expand its solar and wind energy projects. Currently, there is a green energy crisis in Greece, due to the high supply of energy provided though photovoltaic stations. EKO could take advantage of a possible drop in the sale price of already developed projects.

Moreover, with more and more consumers prioritizing sustainability, EKO can stand out by strengthening its environmental commitments, offering certified sustainable fuels. Following this strategy, EKO could boost customer loyalty and market share.

Finally, the most important opportunity for the company its hydrogen market. Even though the war in Ukraine might be over shortly, in the future it will be difficult for anyone to trust Russia for gas supply. In addition, it will be difficult for geopolitical reasons to trust the alternative supply, provided by Azerbaijan and Turkey, since they

could use it as a geopolitical weapon against Greece, mimicking what Russia did in Ukraine. In order to increase the geopolitical strength of our country, using hydrogen as a transitional fuel is a smart option and this trend could generally be followed by the European Union in the future, since 2025 is the first year of the mid-term plan to support hydrogen. Hence, EKO has to position itself in the hydrogen market before its competitors.

Apart from opportunities, there are also some serious threats for the company's energy transition. The first threat is a stock market crisis, which currently affects indexes like the S&P 500, reducing the value of energy shares. To date, it is impossible to forecast or attribute this market crisis taking place while this study is written (in the first trimester of 2025). However, it is possible to make the hypothesis that this reduction in the value of energy sector shares and generally in the value of the S&P 500 during the first months of 2025 is attributed to three factors, first, the introduction of a new player, Deep Seek, and, second, the tariffs announced by Donald Trump, and, third, his energy policy. The introduction of Deep Seek was crucial, since it gives the promise of Artificial Intelligence (AI) with significantly lower energy consumption, leading to a reasonable question for the need of investments in energy to further support the development and use of AI. Second, the tariffs might lead to difficulty in the export of essential materials to develop renewable energy projects and electric vehicles. Finally, the policy of Trump is favoring fossil fuels. In case that this trend is followed by European governors favoring Trump policies (e.g. Orban, Fico), this could block the progress carried out in the European Union. The changing landscape after Donald Trump's election is a serious threat for the energy transition of EKO.

A second threat is the cost-effectiveness of fossil fuels. As stated in the background of this study, fossil fuels are cheap, while alternative fuels, such as biofuels, failed to become for cost-efficient. However, there is a silent promise that the cost of transitional fuels and renewable energy will decrease due to scale economy and technological innovation. Yet, in case that this does not happen, governments will have to choose between continuing to pollute the environment in order to save the economy or saving the planet by sacrificing the economy. Hence, a lack in the progress of transitional fuels and renewable energy cost-effectiveness is another significant threat.

Finally, EKO gives emphasis to renewable energy sources, but not that much to transitional fuels. Of course, there are initiatives, such as the cooperation with AEGEAN

for biofuels. Nevertheless, through the interviews it was found that the emphasis is given more to the endpoint of energy transition and not to the previous steps that have to be followed.

Category	Main Points
Strengths 1. Strong reputation in Greece and the Balkans' fuel marketing sector, providing a solid foundation for energy transition 2. Partnership with AEGEAN Airlines to supply sustainable aviation fuels, demonstrating commitment to cutting carbon emissions 3. Expansion into renewable energy with biofuels and acquisition of solar parks in Cyprus 4. Corporate social responsibility initiatives, such as reforestation and disaster recovery projects, aligning with EU environmental goals	**Weaknesses** 1. Heavy reliance on fossil fuels, slowing down the transition to sustainable energy. 2. High costs of shifting to renewable energy, requiring significant investments in research, development, and infrastructure. 3. Small Greek market for electric vehicles, limiting immediate returns on investments in EV charging stations.
Opportunities 1. EU policies, such as the Green	**Threats** 1. Stock market instability affecting

Deal, offering subsidies, tax incentives, and funding to accelerate the energy transition 2. Growing market for non-fossil energy vehicles, providing an opportunity to lead in EV charging infrastructure 3. Potential for hydrogen adoption in transportation, positioning EKO strategically before market demand spikes 4. Partnerships with renewable energy companies to expand solar and wind energy projects 5. Consumers prioritizing sustainability, increasing demand for certified sustainable fuels and boosting customer loyalty	energy sector investments, potentially delaying transition projects 2. High cost-effectiveness of fossil fuels compared to biofuels and renewables, potentially slowing the adoption of alternative energy sources. 3. Low focus on transitional fuels

Table 3: The main points of the SWOT analysis

5. Conclusions

Climate changes is considered as the most important threat that humanity will face in the 21st century (Schwab & Malleret, 2020). In that context, this study focused on the challenges that EKO faces in the era of energy transition. Through this study, it was found that there is high awareness between the workers of the company regarding the association of fossil fuels with climate change. Hence, there is high awareness for the problem, which could be used as a basis to develop transitional strategies. Participants unanimously agreed on the urgent need to shift toward alternative energy sources to address climate risks, in line with existing research that identifies coal, oil, and gas as major drivers of global warming (Dalio, 2021). However, EKO seems to be focusing more on renewable energy and less on transitional fuels. History offers a glimmer of hope—rapid technological shifts, such as the move from horse-drawn carriages to automobiles in just two decades, show that energy transitions can happen quickly with the right incentives and innovations (Chapman & Boehman, 2024). Yet, in order to achieve that goal it is essential to focus on a Bridge Strategy, meaning on transitional fuels (Mitrova et al., 2016). EKO seems more willing to make the final steps, without focusing that much on transitional fuels, although this former step is also essential.

According to the findings of the study, one of the most pressing challenges identified for energy transition is the economic feasibility of alternative and transitional fuels, leading to less competitive options compared to fossil fuels. Indeed, fossil fuels are still cheaper than biofuels and other renewables, raising concerns about the financial viability of large-scale energy shifts (Mathew et al., 2021). In the study carried out, participants voiced worries about the high costs of research, development, and infrastructure changes needed for EKO's transition. The participants do believe that energy transition is feasible, but these necessary steps might make energy transition more difficult. The skepticism by the study participants is in line with earlier findings indicating that the high costs of biodiesel production, since raw materials alone make up 80-85% of total expenses (Mathew et al., 2021). In order to address these barriers, the European Union has tried to tackle these obstacles through subsidies and tax incentives (European Court of Auditors, 2023). Yet, the gap in cost-efficiency might be too big to be covered through that way.

In EKO, there is also skepticism on which fuels might be prioritized. Some participants believe that emphasis has to be given to natural gas, hydrogen and biofuels at the same time, while others favor hydrogen. In the European Union, it is true that hydrogen has been prioritized during the last years, due to the Union's emphasis in hydrogen to achieve carbon neutrality by 2050 (European Commission, 2020). Yet, EKO follows a more comprehensive approach, also using biofuels. The partnership between EKO and AEGEAN Airlines to supply sustainable aviation fuels, significantly reducing CO_2 by 87.18% compared to conventional fuels (HELLENiQ ENERGY, 2024b) is extremely important to reduce the environmental footprint of the company. In general, the company's gradual increase in biodiesel proportions in diesel reflects the company's strategy to emphasize on biodiesel. Yet, this emphasis could lead to some skepticism as for the impact of this strategy. As stated in the literature review of this study, land-use changes driven by biofuel production are associated with problems such as deforestation, leading to significant concerns the sustainability of biofuels (Ahmed et al., 2021). Moreover, the policy implemented by the European Union's with regard to biofuel policies has led to significant criticism, due to the continuous changes and the lack of a consistent framework (European Court of Auditors, 2023). Hence, the company's strategy regarding the use of biofuels could be dealt with skepticism.

Through this study, it was also found that the company has made significant investments in electrification, particularly in installing electric vehicle charging stations across its network in Greece. This strategy followed by EKO could be considered as in line with the global push toward vehicle electrification, an important way to reduce transport-related emissions (Schwab & Malleret, 2020). Yet, as indicated by the SWOT analysis that was performed, the limited market for such vehicles in Greece in the region means that return on investments might be problematic. Hence, a low Return on Investment could prevent EKO from further investing in electric vehicles charging stations.

Finally, it was found that social responsibility initiatives are important for EKO's public image and stakeholder engagement. Reforestation projects, investments in disaster recovery, and participation in carbon offset programs that have been developed by the company during the last years (HELLENiQ ENERGY, 2024b) are in line with align with the European Union's environmental goals and lead to an increase of the company's reputation as a socially responsible organization. The aforementioned efforts contribute to sustainability, but also increase the strategic position of EKO. Hence, while regulatory

pressures are a key driver of corporate sustainability, voluntary initiatives are also important for EKO in the era of energy transition.

Based on the above findings, certain proposals can be developed for the management of EKO. First, further emphasis on hydrogen is imperative, as it is a fuel actively promoted by the European Union. The end of the war in Ukraine will not necessarily lead to the restoration of trust in Russian natural gas, which may create favorable conditions for the promotion of hydrogen as a transitional fuel. EKO must be at the forefront of this energy trend, quickly adapting to the relevant changes. Therefore, it is necessary for the company's management to further prioritize research, development, and the implementation of hydrogen technologies.

Second, strategic collaborations are necessary to enhance the cost-efficiency of biofuels. A key issue is the fact that these fuels are characterized by limited efficiency, which dictates the need for significant investment in research and development of more efficient biofuels. The company's management must turn in this direction, forming collaborations with research centers, universities, and other industrial partners to develop new innovative technologies that will enhance the sustainability and economic efficiency of biofuels.

Finally, considering the broader international environment, it is imperative for the company to develop an outward-looking orientation. In recent years, the company has taken steps to expand into the Balkans, with the turn of the Western Balkan countries towards the European Union favoring this expansion. Indeed, if these countries seek to join the EU, they will be required to meet certain conditions regarding environmental protection. Therefore, EKO may strategically benefit from promoting alternative fuels in these countries, given that competition may be limited. The third proposal, therefore, for improving the company's position in the context of the energy transition concerns strategic expansion into the Balkans.

In any case, this study faces certain limitations that must be highlighted. First, the data were collected from a relatively small sample consisting of only 10 participants. Second, data collection was conducted through interviews, which may have caused reservations among participants regarding whether their responses would remain confidential. This could have led to different answers than those they truly wished to provide, out of fear that the data would be evaluated by the company or other third parties. This is reflected, moreover, in the high rate of unanswered questions in the sociodemographic characteristics form. Third, the energy transition is a dynamically evolving issue,

significantly influenced by international geopolitical developments. Therefore, the findings of this study may have limited explanatory value for EKO's energy strategy in the near future.

Based on the above, continuous research is imperative for understanding and monitoring the particularly critical issue of the energy transition. At the same time, similar studies could be conducted in other companies in the fuel sector in Greece, to examine the extent to which employees' perceptions of the energy transition are similar. Such research is deemed necessary, as it can contribute to the creation of a collaborative foundation among companies, promoting common strategies rather than competition, which could increase the chances of success in transitioning to a more sustainable energy future.

In conclusion, this study leads to the finding that EKO has taken some significant steps through its investment in biofuels, while the next challenge concerns investment in hydrogen. At the same time, emphasis on research and development, the creation of collaborations with other companies, and the company's turn towards the Balkan market are imperative. Through these means, EKO will be able to further improve its position in the era of energy transition.

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Appendix

Measurements

Sociodemographic data

Gender: Male

Female

Other

Age:……

Educational background:……

Position in the company:……

Years in this position:…….

Total years in the company:…….

Semi-structured interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?
2. How do you believe companies like EKO should adapt to this situation?
3. Which are the current policies and practices in EKO regarding energy transition?
4. What are the main challenges EKO faces during the transition to more sustainable energy forms?
5. From your point of view, on which transitional fuels must the company focus and why?
6. How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?
7. How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?
8. How could this transition become more successful? Which factors do you consider as crucial?

9. What would you change in a policy level to help companies like EKO in their energy transition?
10. Which is your personal vision regarding the future of companies like EKO at the middle and at the end of this century?

The informed consent form

Title of the Study:

EKO in the Era of Energy Transition: Case Study

Purpose of the Study:

This study aims to explore the attitudes and perceptions of EKO management staff regarding the company's transition to more sustainable energy forms. The findings will contribute to understanding the challenges and opportunities faced during this process and inform future strategies.

Procedures:

- Participation involves a semi-structured interview lasting approximately 30-45 minutes.
- The interview will include questions about your views on energy transition policies, challenges, and the role of transitional and alternative fuels in EKO.
- The interview will be audio-recorded with your consent to ensure accurate data collection.
- Your responses will be anonymized and used solely for research purposes.

Voluntary Participation and Withdrawal:

Participation is entirely voluntary. You may decline to answer any question or withdraw from the study at any time without explanation or penalty. If you withdraw, all data collected from you will be destroyed.

Confidentiality:

- Your personal information and responses will remain confidential.
- Data will be stored securely and accessed only by the research team.
- Results will be reported in a way that ensures anonymity.

Potential Risks and Benefits:

There are no anticipated risks associated with participation. Benefits include contributing to a better understanding of energy transition challenges and supporting EKO's strategic development.

Contact Information:

If you have questions about the study or your participation, please contact: Oikonomou Spyridon, 69516671967

Consent:

I have read and understood the information provided about the study. I agree to participate and understand that I can withdraw at any time without penalty.

Signature: _____

Name (Printed): _____

Date: _____

Researcher's Signature: _____

Date: _____

The transcribed interviews

Interview no1

Sociodemographic data

Gender: **Male**

Female

Other

Age: **32**

Educational background: **MBA**

Position in the company: **Sales Executive**

Years in this position: **5**

Total years in the company:**11**

Semi-structured interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?

Fossil fuels, oil and gas – are by far the largest contributor to global climate change.
With the proper use and development of technology, we can reduce pollution and improve the productive resources used by society.

2. How do you believe companies like EKO should adapt to this situation?

An essential task is to step up investment in the fuels – such as hydrogen, ethanol, biodiesel and biofuels generally speaking – that might contribute significantly to the energy system benefits of gas and oil without net carbon emissions.

3. Which are the current policies and practices in EKO regarding energy transition?

The energy transition is one of the most important tools for achieving Carbon Neutrality, a goal set by different countries and oil Companies.
EKO, during the last years, invests in knowledge and practices in order to reduce pollution and energy consumption.

More specifically, it has created departments and teams that deal exclusively with electric chargers, net zero, the installation of photovoltaics at gas stations and the investment in photovoltaic parks / plants

5. **What are the main challenges EKO faces during the transition to more sustainable energy forms?**

Transitioning to lower emission fuels production requires collaboration, investments, and financial incentives.
The transition to fuel production with lower emissions requires cooperation, investment and financial incentives.
The state should also be a supporter of this effort and support such investments
Finally, the regulatory frameworks should be clearer and more direct

6. **From your point of view, on which transitional fuels must the company focus and why?**

Hydrogen; It's renewable and readily available.
Also, it's more powerful and energy efficient than Fossil Fuels and it's more efficient when compared to other energy sources with almost zero emissions
It's ideal for populates areas considering its low carbon footprints, low noise and visual pollution

7. **How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?**

I believe that it will only have positive results as new jobs will be created, research will be done and human resources will also contribute. New jobs will be created
All of this, if all the above are implemented correctly
In theory, it will be cheaper and we'll have energy with a minimal footprint
Energy that everyone will be able to access. Even in the most remote areas

8. **How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?**

Generally speaking, in case it succeeds, our lives will be better and energy will be cheaper and accessible for more. Our climate will be healthier, and our cities more viable
On the other hand, in case companies drop off this 'project' the impact will be huge. Expensive fuels (resource reduction) and toxic climate

9. **How could this transition become more successful? Which factors do you consider as crucial?**

First, the regulatory frameworks should be clearer and more direct

Everyone should be well informed

Investments should be done like photovoltaics parks

10. **What would you change in a policy level to help companies like EKO in their energy transition?**

The regulatory frameworks and easier process

11. **Which is your personal vision regarding the future of companies like EKO at the middle and at the end of this century?**

If EKO or any other country, won't take care the climate and its resources, then the climate won't take care its environment. In that case no at the middle nor at the end of this century, EKO will exist. As result, our lives will be immediate affected.

Interview no2

Sociodemographic data

Gender: Male

Age: 60

Educational background: University degree

Position in the company: Head of Sales Attica

Years in this position: 10

Total years in the company: 33

Semi-structured interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?

I believe that the connection exists, even though nowadays is less strong than In the past due to the improvement of technology of the fossil fuels. In the past the fossil fuels were producing more CO2 than today.

2. How do you believe companies like EKO should adapt to this situation?

They should improve their production lines to improve their products, create better fuel additives for better efficiency and less emissions and adopt new age/alternative fuels whether they are liquid or not.

3. Which are the current policies and practices in EKO regarding energy transition?

It is adapting to the energy transition by participating in all of the above, as well as in electricity production (through other company of the group of companies) and distribution of electricity to the customers.

4. What are the main challenges EKO faces during the transition to more sustainable energy forms?

The company should certainly face the need to lessen the core of it' s business, by reducing the sales of traditional fuels and add all the alternative forms of energy. It needs to invest and/or produce it's own means to create the opportunity to succeed.

5. From your point of view, on which transitional fuels must the company focus and why?

It should look up to the new age e-fuels produced by ethanol or harvested raw material as well as on electricity. The first because it is as close to it' s current core business, thus it is considered easier to apply both economically and technologically and the second because it' s also easy through it's gas stations network to offer it.

6. How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?

Along with this transition, comes the need for expertise other than what it already has. So the need to look I the market for employees of different background of knowledge and working experience.

7. How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?

The company will not fail, because it has all it needs to make to the new era of energy transition. You can also look up to publications that say that the process already has begun.

8. How could this transition become more successful? Which factors do you consider as crucial?

The transition will become a success if there will be no obstacles whatsoever by the market or the laws. For example, this change requires a period o time to adapt. If this is enough, the success is a given. Also, if the funding is friendly , the success is also a given.

9. What would you change in a policy level to help companies like EKO in their energy transition?

There really is nothing, as far as I know, that I would change on this matter. The company is working on it on all levels and it seems that the transition will succeed.

10. Which is your personal vision regarding the future of companies like EKO at the middle and at the end of this century?

I would like to see better technologies in the near future regarding to more environmental friendly liquid fuels produced by the company, because any other change will affect many people's jobs. Yes, we want clean environment, but in ways to have a win-win situation for all people.

Interview no3

Sociodemographic data

Gender: Male
Female
Other
Age:
Educational background:……
Position in the company:……
Years in this position:…….
Total years in the company:…….

Semi-structured interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?

The link between fossil fuels and climate change is extensively documented and widely recognized within the scientific community. The combustion of coal, oil, and natural gas results in the release of large quantities of carbon dioxide and other greenhouse gases into the atmosphere. These gases create a heat-trapping effect, contributing to global warming and the broader phenomenon of climate change. Over the years, substantial research has reinforced the understanding that human activities, particularly the burning of fossil fuels, are the dominant force behind the ongoing climatic shifts.
Organizations such as the Intergovernmental Panel on Climate Change have consistently emphasized that the rise in global temperatures, the increase in extreme weather events, rising sea levels, and disturbances in ecosystems are directly linked to human-induced emissions. The scientific consensus underscores the urgent need for action to curb emissions and transition to more sustainable energy sources. Many experts advocate for a shift away from fossil fuels in favor of renewable energy alternatives such as solar, wind, and hydroelectric power. While such a transition is widely regarded as necessary to

mitigate climate change, it is not without its challenges. Economic dependencies, political considerations, and existing energy infrastructure create significant obstacles to an immediate shift. As a result, the process of moving toward cleaner energy solutions is gradual, requiring coordinated efforts from governments, industries, and communities worldwide.

2. How do you believe companies like EKO should adapt to this situation?

Companies like EKO, which operate in the fossil fuel industry, must adapt to the evolving energy landscape by prioritizing sustainability and transitioning toward cleaner energy solutions. One of the most effective strategies for this transition is investing in renewable energy sources such as solar, wind, hydrogen, and biofuels. By diversifying their portfolio, companies can reduce their dependence on fossil fuels while aligning with global decarbonization initiatives. Additionally, the development of low-carbon fuels, including synthetic fuels, carbon-neutral biofuels, and green hydrogen, allows these companies to remain competitive in the energy market while significantly cutting emissions.

Another crucial step in this transition involves improving energy efficiency across refining and distribution processes. Enhancing operational efficiency not only reduces emissions but also lowers costs, making sustainability a financially viable strategy. Companies can also implement carbon capture and storage technologies to reduce the carbon footprint of existing operations while gradually shifting toward greener alternatives. Engaging in carbon offsetting initiatives, such as reforestation projects, conservation programs, and carbon credit investments, further helps mitigate emissions and demonstrates a commitment to environmental responsibility.

In addition to technological advancements, adopting circular economy practices can play a vital role in reducing waste and optimizing resource use. By recycling waste products, minimizing pollution, and improving sustainability in production processes, companies can significantly lessen their environmental impact. Setting clear sustainability goals, including net-zero emissions targets and increased transparency in emissions reporting, enhances corporate credibility and aligns businesses with global climate agreements. Finally, educating consumers and engaging with stakeholders—such as governments, investors, and communities—on sustainable energy solutions can drive industry-wide transformation.

For companies like EKO, the challenge lies in balancing short-term profitability with long-term sustainability. As the global energy market moves away from fossil fuels, embracing innovative and environmentally responsible strategies will be key to ensuring continued relevance and long-term success.

3. Which are the current policies and practices in EKO regarding energy transition?

EKO, as a subsidiary of HELLENiQ ENERGY, plays a crucial role in the group's overarching energy transition strategy, known as "Vision 2025." This initiative is designed to facilitate a shift toward sustainable energy solutions while ensuring the company maintains its core operations. One of the primary focuses of this strategy is the reduction of carbon emissions, with HELLENiQ ENERGY setting ambitious targets, including a 30% decrease in Scope 1 and 2 CO_2 emissions by 2030 and a long-term goal of achieving net-zero emissions by 2050. These efforts underscore the company's commitment to mitigating its environmental impact in alignment with global climate objectives.

A key component of this transition is the expansion of renewable energy investments. The company aims to significantly increase its renewable energy sources portfolio, targeting an installed capacity of over 1 GW by 2025 and exceeding 2 GW by 2030. This growth is expected to be driven by strategic investments in solar, wind, and energy storage projects, positioning HELLENiQ ENERGY as a major player in the clean energy sector. In addition to these structural changes, the company's strategic rebranding in 2022—from Hellenic Petroleum to HELLENiQ ENERGY—reflects its broader commitment to green energy and digital transformation, signaling a clear departure from a fossil fuel-dependent model.

Furthermore, transparency and accountability are integral to the company's sustainability efforts. HELLENiQ ENERGY publishes annual sustainability reports that detail its Environmental, Social, and Governance performance. These reports provide insight into the company's ongoing energy transition initiatives and reinforce its dedication to responsible business practices. Through these concerted efforts, EKO and its parent company are proactively adapting to the evolving energy landscape, aligning with international decarbonization goals, and contributing to a more sustainable energy future.

4. What are the main challenges EKO faces during the transition to more sustainable energy forms?

EKO, like many traditional oil and gas companies, faces significant challenges in its transition toward more sustainable energy solutions. One of the primary hurdles is the high cost of transition, as shifting from fossil fuels to renewable energy requires substantial investments in infrastructure, research, and technological advancements. The development of wind, solar, and hydrogen projects demands considerable capital, and the return on

investment may take years, making financial planning a critical factor in ensuring long-term sustainability.

Another key challenge is the increasing competition in the renewable energy market. Established players in solar, wind, and battery storage already dominate the sector, making it essential for EKO to differentiate itself to secure a foothold in this evolving industry. Additionally, regulatory and policy changes add another layer of complexity. Government policies, carbon taxes, and stricter environmental regulations continue to evolve, requiring companies like EKO to invest in compliance efforts and continuously adapt to new sustainability mandates.

Despite efforts to transition, EKO remains heavily dependent on fossil fuel revenues, posing a financial challenge in balancing profitability with sustainability. As the company moves away from traditional fuel sales, it must navigate the risks of revenue fluctuations while exploring alternative income sources. At the same time, the development of clean energy solutions such as green hydrogen, carbon capture, and advanced biofuels necessitates significant technological innovation and infrastructure upgrades. To bridge these gaps, EKO will need to collaborate with industry partners or invest heavily in research and development.

Consumer demand and public perception also play a crucial role in shaping the company's transition strategy. While there is growing demand for cleaner energy, many consumers and businesses still rely on fossil fuels. Educating customers on sustainable alternatives and effectively managing public perception will be essential for gaining support in this transition. Additionally, supply chain and resource availability present challenges, as securing materials for renewable energy projects—such as lithium for batteries and rare earth metals for wind turbines—can be complicated by global supply chain disruptions and geopolitical factors.

The energy transition also impacts the workforce, requiring retraining programs and the recruitment of new talent with expertise in renewables, digital technologies, and sustainability. This workforce transformation can be complex and costly, necessitating careful planning to ensure a smooth shift. Finally, EKO faces increasing pressure from stakeholders, including investors, regulators, and environmental organizations, all demanding faster action on sustainability. Balancing these expectations while maintaining business stability requires a strategic and well-executed approach.

To successfully overcome these challenges, EKO must adopt a phased and well-planned transition strategy. By leveraging partnerships, investing in R&D, and aligning with global sustainability trends, the company can navigate the complexities of the energy transition while ensuring financial viability and long-term competitiveness in the evolving energy landscape.

5. From your point of view, on which transitional fuels must the company focus and why?

If EKO aims to sustain profitability while transitioning to sustainable energy, it should strategically prioritize natural gas and low-carbon liquid fuels as key transitional energy sources. Natural gas, in both its liquefied and compressed forms, presents a viable bridge toward cleaner energy. It emits approximately 50% less carbon dioxide than coal and produces significantly fewer pollutants than oil, making it a lower-emission alternative. Many industries, power plants, and transportation sectors still require a dependable energy source before fully shifting to renewables, positioning natural gas as a practical solution. Additionally, the existing LNG infrastructure in Greece and across Europe facilitates expansion without the need for substantial new investments. As Europe reduces its dependence on Russian gas, regional suppliers stand to benefit from growing demand, enhancing energy security and market opportunities.

Low-carbon liquid fuels, such as biofuels and synthetic fuels, also offer significant advantages in this transition. Advanced biofuels, including biodiesel and hydrotreated vegetable oil, can serve as drop-in replacements for traditional diesel and gasoline, allowing for a reduction in carbon intensity without necessitating major modifications to existing infrastructure. These fuels are particularly critical for sectors such as aviation, shipping, and heavy trucking, where electrification and hydrogen adoption remain long-term goals rather than immediate solutions. Furthermore, European Union policies actively support the integration of biofuels as part of broader decarbonization strategies, making them a promising area for investment.

In contrast, maintaining a focus on traditional oil and coal is becoming increasingly unsustainable. Coal, due to its high carbon footprint, is being rapidly phased out across Europe, and demand for oil-based fuels is expected to decline as electrification and renewable energy continue to gain traction. Moreover, the tightening of emissions

regulations and the introduction of carbon taxes make traditional oil refining less economically viable over time. Given these trends, EKO must adopt a forward-thinking strategy that gradually reduces its reliance on oil refining while expanding biofuel production and investing in LNG infrastructure. Developing research and development capabilities in synthetic fuels and hydrogen will also be crucial for ensuring long-term sustainability.

By strategically positioning itself in the natural gas and low-carbon fuel markets, EKO can maintain its competitive edge while aligning with the global energy transition. This approach not only secures financial stability in the short term but also establishes the company as a key player in the evolving sustainable energy landscape.

6. How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?

The energy transition in companies like EKO has significant societal and economic implications, presenting both opportunities and challenges. From a societal perspective, one of the most notable effects is the transformation of the workforce. As the renewable energy sector expands, new job opportunities emerge in fields such as energy efficiency, sustainable technologies, and clean energy infrastructure. However, this shift also requires retraining for workers in the traditional oil and gas industry, leading to temporary job displacement and the need for reskilling initiatives. Another key societal aspect is energy access and affordability. While investments in renewables have the potential to reduce long-term energy costs, short-term expenses may rise due to the need for infrastructure upgrades and compliance with carbon tax regulations, impacting consumers. Additionally, the transition offers public health benefits by reducing reliance on fossil fuels, leading to lower air pollution levels and a decrease in respiratory diseases and related healthcare costs. At the same time, consumer behavior is evolving, with more people adopting electric vehicles, energy-efficient homes, and alternative fuels. Greater public awareness of sustainability is also influencing purchasing decisions and lifestyle choices, further driving the shift toward a low-carbon economy.

On a broader economic scale, the transition fuels industrial growth and creates investment opportunities in emerging sectors such as renewable energy, green hydrogen, and battery

storage. Companies like EKO can capitalize on European Union funding programs and green finance incentives to support their shift toward sustainability. However, economic disruptions in traditional energy markets remain a challenge, particularly for oil-dependent economies and businesses that have relied on fossil fuel revenues. As demand shifts away from conventional energy sources, companies must strategically manage declining profits while directing capital into cleaner energy ventures. The transition also impacts energy security and geopolitics, as reducing reliance on imported oil and gas enhances national energy independence. However, new dependencies arise, particularly in securing raw materials for renewable technologies, such as lithium and rare earth metals, which are concentrated in specific global regions. Another critical factor is infrastructure modernization, requiring substantial investment in grid upgrades, charging stations, and energy storage solutions. Governments and private sector stakeholders must collaborate to facilitate a smooth and efficient transition.

7. How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?

If EKO successfully navigates the energy transition, it has the potential to establish itself as a leading energy provider in a decarbonized economy, securing a competitive advantage in the evolving market. By expanding into renewable energy sources, biofuels, hydrogen, and energy storage, EKO could strengthen its presence in Greece and Southeast Europe, positioning itself as a regional leader in clean energy. A diversified energy portfolio would not only reduce reliance on oil and gas revenues but also create new opportunities for growth in emerging energy sectors. Additionally, by investing in green technologies such as carbon capture and sustainable fuels, the company could become a key player in energy innovation. Collaborations with governments and research institutions would further enhance its technological capabilities, driving innovation and reinforcing its influence in the energy market.

Financial sustainability would be another major benefit of a successful transition. By shifting to low-carbon solutions ahead of regulatory changes, EKO could avoid future carbon taxes and other policy-driven penalties. Access to green financing, as well as Environmental, Social, and Governance-focused investments, would provide additional financial stability while enhancing profitability. Moreover, a successful transition would

strengthen EKO's brand and public perception. Demonstrating a commitment to sustainability would improve its reputation as an environmentally responsible company, fostering customer loyalty and boosting investor confidence in its long-term growth strategy.

However, failure to adapt to the energy transition could have severe financial and operational consequences. As demand for fossil fuels declines, EKO risks losing market share and profitability to competitors that have successfully integrated sustainable energy solutions. Regulatory costs, carbon pricing, and stricter environmental policies could further erode its competitive position, making traditional operations increasingly costly. Non-compliance with European Union and global climate regulations could expose EKO to legal and financial risks, including fines, operational restrictions, and a decline in government support.

Beyond financial and regulatory challenges, reputational damage could significantly impact EKO's future prospects. If the company is perceived as lagging in sustainability efforts, it may face backlash from investors, consumers, and environmental organizations. Additionally, as the energy sector shifts toward greener industries, retaining and attracting top talent could become increasingly difficult. Many professionals are seeking careers in sustainable energy, and a failure to transition effectively could lead to difficulties in workforce recruitment and retention.

In the long term, failure to adapt could place EKO at risk of business decline. As oil and gas demand continues to decrease, companies without a clear transition plan may struggle to remain viable in a low-carbon economy. Financial distress, the need to divest assets, or even the possibility of acquisition by a more forward-thinking competitor could be potential consequences.

Ultimately, EKO's ability to balance short-term profitability with long-term investments in renewables and clean energy innovation will determine its future success. A well-executed energy transition strategy would secure its position as a modern and sustainable energy leader, while failure to adapt could result in financial instability, reputational setbacks, and a diminished role in the evolving energy landscape.

8. How could this transition become more successful? Which factors do you consider as crucial?

For EKO to successfully transition to sustainable energy, it must strategically address a range of internal corporate decisions and external factors that shape the broader energy landscape. A clear vision and long-term commitment are fundamental, requiring a well-defined strategy aligned with global sustainability goals. This includes setting ambitious, measurable targets for emissions reduction, renewable energy adoption, and clean technology investments. Senior leadership must also demonstrate full commitment, effectively communicating the company's sustainability vision to stakeholders and ensuring that corporate values reflect a strong dedication to environmental responsibility.

Investment in research and development will be another crucial factor in ensuring EKO's competitiveness in the clean energy sector. Prioritizing innovation in areas such as carbon capture, green hydrogen, and advanced biofuels can position the company as a leader in energy transformation. Strategic partnerships with universities, research institutions, and industry peers can further accelerate progress and share the financial risks associated with new technology development. Alongside R&D, diversification of the energy portfolio is essential. Expanding into renewable energy sources such as wind, solar, and hydroelectric power will reduce reliance on fossil fuels and align with market demand for cleaner alternatives. Additionally, investments in energy storage solutions and modernized grid infrastructure will enhance supply reliability and improve the efficiency of renewable energy integration.

Aligning with policy and regulatory frameworks will also be key to mitigating compliance risks and leveraging new opportunities. Proactive engagement with governments on carbon pricing, emissions targets, and renewable energy incentives will allow EKO to stay ahead of regulatory changes. Advocacy in policy discussions can also shape future regulations in ways that support the company's sustainable energy ambitions. At the same time, ensuring financial flexibility and securing access to green finance are necessary to sustain the transition. Green bonds, sustainability-linked loans, and other funding mechanisms can provide the capital needed for renewable energy projects, while risk management strategies will help EKO navigate market fluctuations in both traditional and renewable energy sectors.

A successful transition will also require investment in workforce development. As the company moves toward clean energy, reskilling initiatives will be necessary to equip employees with the expertise needed for emerging technologies and sustainable business practices. Additionally, positioning EKO as an attractive employer in the green energy

sector will help recruit top talent in engineering, clean technology, and sustainability-focused roles. Public and stakeholder engagement will further support the transition, with transparency in sustainability reporting building trust among investors, regulators, and consumers. Educating customers about clean energy alternatives and EKO's role in reducing carbon emissions will also strengthen brand loyalty and increase the adoption of sustainable products and services.

Strategic partnerships and collaborations will play a vital role in accelerating the energy transition. Partnering with renewable energy providers in solar, wind, and battery storage will help EKO expand its capabilities while benefiting from shared expertise and infrastructure. Collaboration with companies involved in carbon capture, storage, and hydrogen production will also facilitate cost-effective scaling of new technologies. Understanding consumer demand and market trends will be equally important, enabling EKO to tailor its offerings to meet the shift toward sustainable energy. Investments in electric vehicle charging infrastructure, biofuel production, and green electricity tariffs will help capture emerging market segments while reinforcing the company's commitment to sustainability.

Finally, risk mitigation and adaptability will be critical to navigating the uncertainties of the energy transition. A flexible strategy that can pivot in response to technological breakthroughs, policy changes, or market disruptions will be essential for long-term resilience. Developing multiple transition scenarios will allow EKO to anticipate different future trajectories and remain agile in adjusting its approach as the renewable energy landscape evolves. By integrating these strategic priorities, EKO can position itself as a leader in sustainable energy while ensuring financial stability and long-term success in a decarbonized economy.

9. What would you change in a policy level to help companies like EKO in their energy transition?

For companies like EKO to successfully navigate the energy transition, a supportive policy framework is essential. Governments and regulatory bodies must implement measures that provide financial incentives, regulatory clarity, and market structures that encourage the shift toward cleaner energy. One of the most critical elements is the establishment of clear and stable regulatory frameworks. Long-term policy consistency regarding carbon emissions, renewable energy targets, and energy efficiency standards will reduce

investment risks and allow companies to commit to sustainable projects with confidence. Additionally, mechanisms such as carbon pricing—through either increased carbon taxes or cap-and-trade systems—can create financial incentives for reducing emissions while making fossil fuels less economically attractive. Governments could also develop transition roadmaps, offering detailed guidance on decarbonization milestones to help businesses align their strategies with national and global climate objectives.

Financial support for transition investments is another crucial component. Green financing mechanisms, including green bonds, tax credits, and low-interest loans, could help companies like EKO secure funding for renewable energy projects and infrastructure development. Direct subsidies or tax incentives for clean energy production, energy storage, and grid modernization would further reduce the initial financial burden of transitioning. Public-private partnerships could also be leveraged to mitigate financial risks associated with large-scale renewable projects, particularly in emerging technologies such as hydrogen, carbon capture, and advanced biofuels.

Market structures must also be reformed to encourage clean energy adoption. Governments can implement carbon-free energy pricing models that provide financial advantages to renewable energy producers, ensuring that wind, solar, and hydropower sources remain competitive. Mandating that large consumers source a specific percentage of their energy from renewables would stimulate demand and create new opportunities for companies like EKO. Additionally, incentivizing the development of energy storage technologies would enhance grid stability and increase the reliability of intermittent renewable energy sources, making them more viable replacements for fossil fuels.

Technological innovation must be a central focus of the transition. Increased funding for research and development in renewables, energy storage, and carbon capture would accelerate technological advancements, making clean energy solutions more efficient and cost-effective. Public-private partnerships between governments, corporations, and research institutions could further drive innovation, ensuring that new technologies are developed and commercialized more rapidly. Government-backed infrastructure projects—such as smart grids, charging stations, and green hydrogen production facilities—would also lower barriers to adoption and facilitate the expansion of sustainable energy systems.

Beyond corporate and technological factors, a just transition for workers and communities is vital to mitigating the social impact of the energy shift. Retraining programs should be

introduced to equip workers from fossil fuel industries with skills relevant to the renewable energy and green technology sectors, preventing job losses and ensuring career continuity. Policymakers could also design regional transition plans for communities historically reliant on fossil fuel industries, promoting job creation, infrastructure investment, and economic diversification. Ensuring that energy transition policies are inclusive and benefit marginalized populations would further enhance the social sustainability of the shift to clean energy.

Stronger international collaboration is another important factor. The establishment of harmonized global standards for renewable energy development would reduce barriers to cross-border investments and improve the scalability of emerging clean technologies. Trade incentives for green technology exports—such as solar panels, wind turbines, and battery storage solutions—could help domestic companies expand into international markets and increase demand for sustainable energy solutions worldwide.

Finally, enhanced transparency and ESG (Environmental, Social, and Governance) reporting standards would strengthen corporate accountability in the energy transition. Governments could introduce mandatory ESG reporting regulations, requiring companies to disclose their progress on emissions reductions, renewable energy adoption, and social impact initiatives. Standardized sustainability frameworks would further help businesses measure and communicate their contributions to climate goals, ensuring consistency in corporate sustainability reporting.

In conclusion, policy-level support is a critical enabler for companies like EKO as they navigate the energy transition. A combination of clear regulations, financial incentives, market structures that promote clean energy, and support for innovation and workforce development will create a strong foundation for decarbonization efforts. By implementing these policies, governments can help energy companies transition while ensuring economic competitiveness, energy security, and long-term environmental sustainability in a low-carbon future.

10. Which is your personal vision regarding the future of companies like EKO at the middle and at the end of this century?

By the middle and end of this century, companies like EKO have the potential to evolve into global leaders in sustainable energy and innovation. Their long-term success will depend on how effectively

they transition from their current reliance on fossil fuels to becoming multi-faceted, low-carbon energy providers. This transformation will require a combination of technological advancements, strategic investments, and a strong commitment to environmental and social responsibility.

Looking ahead to the 2050s, EKO could find itself at the forefront of the global energy transition if it successfully adapts to key shifts in the energy landscape. By this time, fossil fuels may still play a limited role in its operations, but the company will likely have significantly diversified its portfolio, prioritizing renewable and low-carbon energy solutions. Solar, wind, and hydropower will likely be dominant energy sources, alongside cutting-edge technologies such as green hydrogen, advanced biofuels, and large-scale energy storage. Traditional oil and gas operations may persist in a reduced capacity, focusing on cleaner natural gas alternatives or biofuels as transitional energy sources.

Hydrogen could emerge as a core component of EKO's energy strategy, particularly in industries that are difficult to electrify, such as steel production, aviation, and shipping. As global demand for zero-emission energy carriers rises, EKO could position itself as a key player in hydrogen production, distribution, and storage. The company may also play a leading role in supplying clean energy to emerging markets, where investments in affordable renewables could support both energy security and global decarbonization efforts. Decentralized energy solutions such as microgrids could also become a major focus, particularly in regions with unreliable infrastructure, ensuring greater energy resilience.

By mid-century, EKO could achieve carbon neutrality—or even negative emissions—by integrating carbon capture and storage technologies into its operations. The company may also employ carbon removal methods such as direct air capture and reforestation projects to offset any remaining emissions. In addition to decarbonization efforts, advanced digitalization and artificial intelligence are likely to play a transformative role in optimizing energy efficiency. Technologies such as blockchain, the Internet of Things, and AI-driven smart grids could enhance energy distribution, reducing waste and ensuring that renewable energy is utilized effectively. Through these advancements, EKO could lead the way in creating a more resilient and intelligent energy system.

Looking further ahead to the end of the century, companies like EKO may no longer resemble their current form. The complete phase-out of fossil fuels would be a reality, and businesses would be fully integrated into a sustainable and circular economy. By the 2100s, EKO could be operating under a model where sustainability is embedded in every aspect of its business, ensuring that no resources are wasted. This could involve repurposing materials from renewable energy production, recycling solar panels, and reusing battery storage components. The company may also specialize in energy systems that integrate multiple clean technologies, optimizing their synergy to maximize efficiency and sustainability.

EKO may extend beyond energy production to become a key player in deep decarbonization across industries. Instead of simply supplying clean energy, it could provide comprehensive sustainability solutions that support transportation, heavy industry, agriculture, and even space exploration. Advanced technologies such as nuclear fusion, quantum computing-driven grid management, and space-based

solar power could redefine how energy is generated and distributed. By integrating these cutting-edge innovations, EKO could remain at the forefront of a rapidly evolving global energy landscape.

By the end of the century, EKO could also operate within a globally interconnected renewable energy ecosystem. Advances in energy storage and long-distance transmission could allow for seamless cross-border energy sharing, ensuring that regions with excess solar or wind energy can supply power to those with higher demand. Such a system would promote energy equity and resilience, ensuring that all regions, including developing countries, have access to clean and affordable energy. EKO could play a pivotal role in facilitating these global energy exchanges, positioning itself as a leader in energy cooperation and sustainability.

Beyond energy production, the company may shift its focus toward broader environmental restoration efforts. By investing in projects that promote biodiversity, ecosystem preservation, and sustainable land management, EKO could contribute to a more holistic vision of sustainability that goes beyond carbon reduction. Additionally, the company could take a human-centric approach to energy access, prioritizing solutions that enhance the quality of life for communities worldwide. Energy equity, particularly in historically underserved regions, could become a central focus, ensuring that technological advancements in clean energy benefit all of humanity.

For EKO to thrive through these transitions, continuous investment in emerging energy technologies such as hydrogen, nuclear fusion, and energy storage will be essential. Strategic partnerships with technology firms, governments, and environmental organizations will facilitate the integration of innovative solutions and accelerate the energy transition. Ensuring a just transition for workers and communities affected by the decline of fossil fuels will be crucial for maintaining public trust and social stability. At the same time, the ability to adapt and pivot in response to new energy technologies and evolving market conditions will be key to long-term resilience.

If EKO successfully embraces these factors and aligns itself with the evolving energy landscape, it could not only survive but thrive in a world that increasingly prioritizes sustainability and innovation. By the end of the century, companies like EKO could be fundamental pillars of a low-carbon global economy, ensuring that energy systems are not only sustainable but also equitable and resilient for future generations.

Interview no4

Sociodemographic data

Gender: Male

Female

Other

Age: 58

Educational background: Economic studies

Position in the company: Retail Sales Department Manager EKO, South Greece

Years in this position: 10

Total years in the company: 35

Semi-structured interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?

Climate change is having an ever-increasing impact on human health due to dependence on fossil fuels and the resulting rise in global temperatures.

2. How do you believe companies like EKO should adapt to this situation?

Ways must be found to contribute to addressing the impacts of climate change through its energy transformation.

3. Which are the current policies and practices in EKO regarding energy transition?

Through the group, EKO provides biofuels, which are the only immediately available fuels currently on the market. It contributes to the promotion and operation of sustainable mobility by supporting initiatives aimed at transforming the technological structure, fuel mix, and modes of transport to facilitate the transition to a low-carbon economy. The goal is to develop an extensive network of electric vehicle charging stations and offer corresponding e-mobility services

4. What are the main challenges EKO faces during the transition to more sustainable energy forms?

EKO should remain a leading company and, despite the unfavorable economic environment, implement comprehensive development policies.

5. From your point of view, on which transitional fuels must the company focus and why?

EKO's priority is the production and marketing of high-quality products that fully satisfy the demands of the consumer. The improved composition of economy fuels is friendly to humans and the environment (fewer emissions). Also, premium ayto fuels contribute to engine protection, providing more kilometers per fill-up and reduced emissions of harmful gases.

6. How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?

EKO, by prioritizing the safety and health of its employees, partners and local residents, as well as the protection of the environment, remains a leading force in the field.

7. How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?

EKO, as a member of the HELLENIC ENERGY group, integrates sustainable development into its strategy. Beyond improving conventional fuels and expanding its charging station network, it also installs photovoltaic power generation systems at its service stations. As a result, EKO demonstrates its commitment to environmentally and consumer-friendly growth, combining sensitivity and innovation with its well-known customer benefits. In any case, EKO will remain a leading company in its sector, regardless of the success or failure of its energy transition.

8. How could this transition become more successful? Which factors do you consider as crucial?

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Through the HELLENIC ENERGY group, in collaboration with Greek university institutions and research institutions, it invests in supporting research programs and pilot applications of alternative propulsion technologies and technological innovations in general. However, all of this requires high-level investments, while the relevant

legislation within Greece and by extension the European Union will also play an important role.

9. What would you change in a policy level to help companies like EKO in their energy transition?

Companies like EKO will have to come to terms with the new conditions they will have to face. Accelerating training programs is a key prerequisite for improving performance and enhancing competitiveness and innovation across all activities.

10. Which is your personal vision regarding the future of companies like EKO at the middle and at the end of this century?

EKO is and will be a brand with a long history and participation in the development of the country's economy. It invests in the future, developing new technologies and introducing innovative products to the Greek and European markets, so that its legacy for future generations can strengthen the vision for a better tomorrow.

Interview no5

Sociodemographic data

Gender: Male
Female
Other
Age:……
Educational background:……
Position in the company:……
Years in this position:…….
Total years in the company:…….

Semi-structured interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?

Fossil fuels are a big deal when it comes to climate change. Burning them releases greenhouse gases, which messes with the climate, causing things like global warming and extreme weather.

2. How do you believe companies like EKO should adapt to this situation?

EKO should start investing in renewable energy, improve energy efficiency, and adopt greener practices. This means cleaner fuels, cutting down on carbon emissions, and maybe even some carbon offset projects and simultaneously investing in electric energy.

3. Which are the current policies and practices in EKO regarding energy transition?

EKO is already on it with policies for energy transition. They're investing in renewable projects, making operations more energy-efficient, and pushing for alternative fuels such as hydrogen and bio fuels

4. What are the main challenges EKO faces during the transition to more sustainable energy forms?

The big hurdles are the high costs upfront, tech barriers, regulatory issues, and balancing short-term profits with long-term sustainability along with personnel reluctance to change

5. From your point of view, on which transitional fuels must the company focus and why?

Natural gas, hydrogen and biofuels are good bets. Natural gas is cleaner than coal and oil, and biofuels come from renewable resources and have lower carbon emissions.

6. How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?

The energy transition can create jobs in new industries, improve public health by reducing pollution, and bring long-term economic benefits. But, it might also cause some short-term disruptions in traditional energy sectors along with increased uncertainty

7. How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?

If EKO suceeds the transition, it'll be seen as a leader in sustainable energy, attracting eco-conscious customers and investors. If it doesn't, it risks losing out to greener competitors and facing regulatory penalties and finally becoming obsolete

8. How could this transition become more successful? Which factors do you consider as crucial?

Strong leadership, investment in R&D, collaboration with stakeholders, and supportive government policies are key. Employee engagement and public awareness are also crucial.

9. What would you change in a policy level to help companies like EKO in their energy transition?

I'd push for policies that offer financial incentives for renewable projects, streamline regulatory processes, and support R&D in sustainable tech.

10. Which is your personal vision regarding the future of companies like EKO at the middle and at the end of this century?

I see EKO becoming a fully integrated energy provider, offering a mix of renewable and traditional energy sources. By the end of the century, I hope EKO will lead the way in innovation and environmental stewardship.

Interview no6

Sociodemographic data

Gender: Male

Age:……58……

Educational background:…Electrical Engineering……

Position in the company:……Retail Sales Department Manager

Years in this position:……7 years…….

Total years in the company:……30…….

Semi-structured Interview

1. **What are your thoughts on the association between fossil fuels and climate change?**
   Fossil fuels significantly contribute to climate change due to the carbon dioxide and other greenhouse gas emissions produced during their combustion.
2. **How do you believe companies like EKO should adapt to this situation?**
   Companies should invest in renewable energy sources and develop/use technologies that reduce greenhouse gas emissions.
3. **What are the current policies and practices at EKO regarding energy transition?**
   EKO has adopted policies to reduce emissions through the use of new technologies applied in this sector. Additionally, in recent years, the company has been actively promoting the use of renewable energy sources.
4. **What are the main challenges EKO faces during the transition to more sustainable energy forms?**
   The main challenges include the high cost of implementing new technologies and the need for staff training.
5. **From your point of view, on which transitional fuels should the company focus and why?**
   The company should focus on biofuels, synthetic fuels, and/or hydrogen, as these can reduce emissions compared to traditional fossil fuels.
6. **How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?**
   The transition can create new jobs and boost the economy, but it may also lead to job losses in traditional sectors.

7. **How would you describe the company's strategic position if it succeeds in the energy transition and if it fails?**
   The company is already a successful player, holding a leading position in the renewable energy market in the Balkan countries.
8. **How could this transition become more successful? What factors do you consider crucial?**
   Critical factors include government support, investment in research and development, and staff training.
9. **What would you change at a policy level to help companies like EKO in their energy transition?**
   I would propose providing incentives for investments in renewable energy sources and implementing stricter regulations on industrial emissions.
10. **What is your personal vision regarding the future of companies like EKO in the middle and at the end of this century?**
    I believe that companies should be fully sustainable and rely solely on renewable energy sources by the end of the century.

Interview no7

Sociodemographic Data

Gender: Male

Female

Other

Age: 55

Educational Background: BUSINESS ADMINISTRATION UNIVERSITY OF PIRAEUS

Position in the Company: NETWORK TRAINING TEAM LEADER

Years in This Position: 2 YEARS

Total Years in the Company: 31 YEARS

Semi-structured Interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?

It is certain that the use of fossil fuels is contributing to climate change.

2. How do you believe companies like EKO should adapt to this situation?

Because companies provide energy, they must gradually change their product mix towards products produced from renewable sources.

3. Which are the current policies and practices in EKO regarding energy transition?

We are developing a network of electric chargers at our gas stations, increasing the number of our gas stations that use electricity generated by solar energy, and gradually changing the fleet of company vehicles by using more cars that run on electricity.

4. What are the main challenges EKO faces during the transition to more sustainable energy forms?

A major problem is the high cost of the transition. Also, the number of vehicles using electric power remains low compared to the rest of Europe, resulting in a delay in the transition.

5. From your point of view, on which transitional fuels must the company focus and why?

Although I am not an expert on this subject, I believe that electricity should be used as a transitional fuel because it can be easily produced from the sun and wind, which we have in abundance in Greece. The infrastructure for storing this energy is also now being created.

6. How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?

It is mandatory for us to proceed with the transition actions. The impact will be positive for our image in society, which is very important. The economic impact for the first few years will not be positive, but I believe that in the long term it will improve.

7. How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?

I believe that if the energy transition succeeds, the result will be particularly important from all sides. If it fails, it will cause disruptions in the company's financial results.

8. How could this transition become more successful? Which factors do you consider as crucial?
I believe that for it to succeed, a stable political will is required so that the data does not change. This way, companies will be able to follow their business plan.

9. What would you change at a policy level to help companies like EKO in their energy transition?
The state will have to create a stable environment for investments to be made. It will also have to create the regulatory framework to facilitate those who wish to invest in this sector. It will also have to create the necessary infrastructure.

10. Which is your personal vision regarding the future of companies like EKO in the middle and at the end of this century?
Companies like EKO will have to pioneer in technological changes and contribute to the wider society by returning a portion of their total profits to them. If they fail to adapt to the new environment, they will not be able to survive.

Interview no8
Sociodemographic data

Gender: Male
Female
Other
Age: 45 yo
Educational background: Chemist, Msc, PhD
Position in the company: Head of Retail Sales
Years in this position: 8
Total years in the company: 18

Semi-structured interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?

I believe that there should be gradual decarbonization in accordance with the rules set by the EU regarding climate change and a gradual shift towards alternative forms of energy.

2. How do you believe companies like EKO should adapt to this situation?

It should sharing it' s energy mix. Percentage of it to include renewable forms of energy (wind, solar, etc.) in the production of electricity

3. Which are the current policies and practices in EKO regarding energy transition?

Increase of investment in forms of renewable sources of energy, such as photovoltaic and wind farms.
Also, it should sponsor university research centers, promoting researchers to find new and better ways of production of renewable sources of energy.

4. What are the main challenges EKO faces during the transition to more sustainable energy forms?

It focuses on the introduction of alternative energy sources into the hydrocarbon mix. This means that it begins to work on new projects, unknown to the Company before.

5. From your point of view, on which transitional fuels must the company focus and why?

From my point of view, electricity and it' s production from renewable forms seems to be the only clear form. The only thing that sets back this form is the lack of providence of recycling of it' s material (panels, wind turbines etc)

6. How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?

The gradual decarbonization, the reduction of the carbon footprint due to climate change affecting society can only be good to the society and thus to EKO.

7. How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?

I strongly believe that EKO is a pioneer in the transition with the right strategic plan the right time in the energy transition.

8. How could this transition become more successful? Which factors do you consider as crucial?

The main factor, crucial for the successful energy transition is of course the change in European policy and the shift to binding policies in EU countries in increasing of the alternative sources of energy mix

9. What would you change in a policy level to help companies like EKO in their energy transition?

EU should consider to offer more subsidies, because clean energy is still expensive and also subsidizing research of hydrogen, a technology that still remains prohibitive due to increased production costs.

10. Which is your personal vision regarding the future of companies like EKO at the middle and at the end of this century?

Fossil fuels will remain for many more years, at least the next 20 years, we will simply have to turn to gradual decarbonization for environmental reasons.

Interview no9

Sociodemographic data

Gender: Male

Female

Other

Age: 56 years

Educational background: University

Position in the company: Manager of Retail Sales

Years in this position: 5

Total years in the company: 23

Semi-structured interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?

I think fossil fuels are only a part of the cause of the climate change. But it is not the only one. A main cause is considered to be the mass destruction of forests and the total lack of their restoration. Another example is the policies and laws of all countries about the old technology machines factories use.

2. How do you believe companies like EKO should adapt to this situation?

I think EKO should do what it already does. That is use modern machinery and methods of productions and invest on new products and other means to meet the future successfully.

3. Which are the current policies and practices in EKO regarding energy transition?

Like I said earlier, better make more efficient products and use better machinery and methods for that. Also, invest in forms of renewable sources of energy, such as P/B parks and wind farms.

4. What are the main challenges EKO faces during the transition to more sustainable energy forms?

The challenge is one. To make it through the change and keep being a leader company in the market. To do that it will need new expertise in order to adapt and overcome the obstacles of this transition.

5. From your point of view, on which transitional fuels must the company focus and why?

EKO should focus on as many transitional fuels as possible. It has the power to do that as a leading company. Ιτ ηας το be in position to offer environmentally friendly fuels such as e fuels, maybe hydrogen and electricity for sure, produced by renewable sources of energy.

6. How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?

On one hand if it succeeds it will be good for us all people. If not, we will certainly face a variety of problems. This transition will affect positively or negatively our health, our jobs, our prosperity. Our life quality in general.

7. How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?

EKO is already into the transition many years now. It has a strong plan for it. It is going well so far as I can see. If it goes well till the end, it will be certainly a big success, remain a leading company with much to offer to people. I really do not think the plan will fail, because everyone in the company is working for the best result. Also, the investments (in means, methods and new skillful staff) make us all think that the company has a long future ahead.

8. How could this transition become more successful? Which factors do you consider as crucial?

The transition will be successful by using all of the above means and focus on the plan to get the best result.

9. What would you change in a policy level to help companies like EKO in their energy transition?

What I do not like and would change for sure, is the lack of communication between the ones who make the policies and the companies. They should work together, in order to make the transition as smooth as possible for every aspect it affects. Some steps are to be made fast, some other need more time to be applied.

10. Which is your personal vision regarding the future of companies like EKO at the middle and at the end of this century?

Companies like EKO should differentiate their core of business through the coming years. Otherwise, there will face failure. It is quite clear that sooner or later, fossil fuels will be replaced in some level and no company will be able to survive unless it expands it' s activities.

Interview no10

Sociodemographic data

Gender: Male
Female
Other
Age:53
Educational background: Master
Position in the company:
Years in this position: 10
Total years in the company:…….

Semi-structured interview

1. Which are your thoughts regarding the association between fossil fuels and climate change?

I think there is a connection between them, however this is not the main problem of the climate change. Fires and bad use of water resources have a bigger effect.

2. How do you believe companies like EKO should adapt to this situation?

Due to the fact that the market is changing, for example more electric cars are getting into circulation every year and even ship companies are changing into more ecofriendly fuels regarding their fleet, EKO should increase it's electricity supply through it's gas stations.

3. Which are the current policies and practices in EKO regarding energy transition?

Solar panels are being installed by the company at the gas stations for the production of electric energy, as well as electric charges due to the increasing electric car fleet. The standard fuels as gasoline and diesel have additives and offer better consumption with less co2

4. What are the main challenges EKO faces during the transition to more sustainable energy forms?

The main challenge is the delay of passing through the message of change to retail partners and loosing several gas stations and volumes.

5. From your point of view, on which transitional fuels must the company focus and why?

I think electric energy will not be the major alternative fuel and Hydrogen will be the major transitional fuel when it becomes of use.

6. How would you describe the societal and wider economic impact caused by energy transition in companies like EKO?

It will have great impact as the sales of fuel volumes decrease and as a result the income will be less. Alternative fuels will contribute less in the year to year EBITDA of the company

7. How would you describe the company's strategic position in case it succeeds in the energy transition and in case it fails?

The company's strategic position is not as linked with the fuel transition as it is with the exploratory drilling in Crete after the completion of the two-dimensional seismic surveys. If the volume of fuels found is not as expected then the company will struggle financially in the future and its strategic position will diminish.

8. How could this transition become more successful? Which factors do you consider as crucial?

It would be more successful if it manages to get the most out of the current position on the market (through fossil fuels) and in the mean time speed up the investments necessary to catch up with the new technologies and apply them in production and supply of the new-age environmental friendly energy products.

9. What would you change in a policy level to help companies like EKO in their energy transition?

I would not change much. EKO is trying hard (and succeeds) through the years to offer the best products to consumers. The current fuels are already produced with strict environmental specs, that is to get maximum power with as less fumes and as better motor protection as possible.

10. Which is your personal vision regarding the future of companies like EKO at the middle and at the end of this century?

Only because of the current common beliefs, I suppose that the energy mixture will include less fossil fuels through the years, so EKO in order to survive (objective goal) will enhance other forms of energy supply and also step steadily in other market sectors (retail etc).

Author's Statement:

I hereby expressly declare that, according to the article 8 of Law 1559/1986, this dissertation is solely the product of my personal work, does not infringe any intellectual property, personality and personal data rights of third parties, does not contain works/contributions from third parties for which the permission of the authors/beneficiaries is required, is not the product of partial or total plagiarism, and that the sources used are limited to the literature references alone and meet the rules of scientific citations.