

A COMPARATIVE STUDY OF THE PETROLEUM INDUSTRY ENVIRONMENTALLY-RESPONSIBLE GREEN MANAGEMENT IMPLEMENTATIONS

* **Ozge KOCMAN** (Orcid ID: 0000-0002-6324-8957)

* **Ozlem ATAY** (Orcid ID: 0000-0002-2563-825X)

*Ankara University, Turkey

ABSTRACT

Energy is an indispensable requirement in all areas of social life and economic activities. According to the latest data, fossil fuels such as petroleum, natural gas and coal constitute 83.1% of the energy consumed in the world. Oil and natural gas have a wide range of uses as energy sources such as industry, transportation and residential heating. However, in the petroleum and natural gas sector, a large amount of emissions and wastes occur due to production and processing (especially crude oil refining), causing environmental pollution and various environmental problems. Petroleum enterprises have to use advanced production and processing technologies to reduce waste, prevent environmental pollution and other problems. In addition, in Turkey and other countries, petroleum companies have tended to understand that they have to fulfill their responsibilities for environmental problems in terms of sustainability while working within this framework. In this context, petroleum companies have adopted a green management approach including technical and organizational implementations in order to minimize the environmental impacts of their operations. "Green Management", adopted within the framework of the sustainability approach, is a modern understanding in which the activities of the enterprises are aimed at not only minimizing the damage to the environment but also protecting it. Green Management studies also provide resource savings to the enterprises and increase their efficiency. For Turkish petroleum enterprises, green management is also a modern approach in terms of efficient and sustainable operations. The aim of this article is to understand the green management implementations in the petroleum industry and to contribute to green management implementations in Turkish petroleum industry within the framework of green management principles.

Key words: *energy, crude oil, petroleum refinery, environmental problems, green management.*

INTRODUCTION

Energy has become an indispensable requirement in almost every field of social and economic life. Currently, while energy is obtained from many energy sources in the world, fossil fuels such as petroleum, natural gas and coal constitute 83.1% of the energy resources consumed. The development of the production and processing (refining) sector, depending on the need for petroleum and natural gas in Turkey and other countries, the increases that have occurred over the years, especially in the crude oil processing capacities of refineries, are continuing. The petroleum industry differs from other industries in terms of production and processing size. Emissions, solid and liquid wastes arising from production and refining processes are high and their effects on the environment reach impactful levels. Therefore, environmentally-responsible green management has gained importance in the petroleum industry in order to create a healthy environment due to the effects of wastes arising from processes.

In this article, the emergence of the "Green Management" approach, which prioritizes the environment and the efficient use of natural resources, ensures environmentally-responsible behavior in the management of emissions and wastes arising from production and processing, gathers all the issues required by laws to protect the environment is discussed. The general situation of the petroleum industry and environmentally-responsible green management implementations in the industry are analyzed. Green management includes all technical and organizational practices with the aim of eliminating or minimizing the environmental impacts of petroleum enterprises. Green management is an integrated approach guiding the management of energy, clean water and waste in production and processing activities, managing social pressure, legislation and environmental policies in the petroleum sector.

THE SITUATION OF THE PETROLEUM INDUSTRY

The Situation of the World Petroleum Industry

The world petroleum industry is based on crude oil production and processing (refining). In places where petroleum is likely to be found, first exploration and if petroleum is found, production is made by drilling. Produced crude oil is transported, stored and purified in the refineries. Petroleum products (gasoline, diesel, kerosene, jet fuel, LPG...etc.) obtained by refining are delivered to the relevant consumers through distribution companies. Therefore, the world petroleum industry is an integrated sector consisting of national and multinational enterprises operating in the fields of exploration-production, transportation, processing (refining) and marketing.

According to 2020 data, petroleum, having the largest share in the primary energy requirement in the world, meets 31.2% of the world's energy consumption and 24.7% of natural gas (Table 1). Besides, the proven total reserves of the regions where crude oil is produced in the world is 244.5 trillion tons, and the annual production has reached 4165.2 million tons (Table 2). It is the Middle East region with the largest petroleum reserves and with the highest production in the world. The reserve in this region is 113.2 trillion tons and constitutes 48.3% of the world's reserves. In this region, the annual production is 1297.3 million tons and 31.1% of the world production is met (BP, 2021: 16-19).

Table 1: 2020 Primary Energy Consumption Ratios in the World

Primary Energy	Petroleum	Natural Gas	Coal	Nuclear Energy	Hydroelectricity	Renewables	Total
Consumption	31.2%	24.7%	27.2%	4.3%	6.9%	5.7%	100.0%

Source: BP Statistical Review of World Energy, 2021:12.

Petroleum consumption in the world is generally realized according to the reserves and production amounts of the regions. However, this situation is related to the population and development level of the countries in the region, and the consumption gap is met by imports and the refining capacity in the developed countries. Asia-Pacific countries with large population are in the first place in petroleum consumption with 1,657.3 million tons (37.3%) in 2020, North American countries are in the second place with 1,019.5 million tons (22.9%), and Europe countries are in the third place with 703.2 million tons (15.8.1%) (BP, 2020: 22).

Table 2: 2020 Proved Oil Reserves, Production and Consumption by Region in the World

2020	Total Proved Reserves			Total Production			Total Consumption		
	Thousand Million Barrels	Thousand Tonnes	Share of Total (%)	Million Barrels	Million Tonnes	Share of Total (%)	Million Barrels	Million Tonnes*	Share of Total (%)
North America	242.9	36.1	14.0%	8585.2	1060.0	25.4%	7581.8	1019.5	22.9%
Middle&South America	323.4	50.8	18.7%	2131.0	300.3	7.2%	1925.0	274.1	6.2%
Europe	13.6	1.8	8.8%	1306.3	167.1	4.0%	4667.6	703.2	15.8%
CIS	146.2	19.9	8.4%	4926.0	660.1	15.8%	1514.4	192.3	4.3%
Middle East	835.9	113.2	48.3%	10097.4	1297.3	31.1%	3037.2	408.4	9.2%
Africa	125.1	16.6	7.2%	2505.7	327.3	7.9%	1299.0	190.4	4.3%
Asia Pasific	45.2	6.1	2.6%	2710.1	353.1	8.5%	12269.5	1657.3	37.3%
World Total	1732.3	244.5	100%	32263.1	4165.2	100%	32294.5	4445.2	100%

Source: BP Statistical Review of World Energy, 2020-2021:16-23.

A continuous increase is observed in the amount of crude oil refining in the world in order to meet the increasing need over the years. Although there was a decrease in demand due to the 1973 and 1979 world petroleum crises, large investments have been made in this field since 1980. While increasing the capacity in the refining sector, especially with the investments made in the European Union and other developed countries, production can be made at European Union standards with advanced technologies. In parallel with this, the raffination sector has grown gradually and reached a capacity of 101,947 million barrels'/day in 2020 from 93,871 million barrels'/day capacity in 2010. The refineries in seven petroleum regions of the world, as shown in Table 3, 35.8% of crude oil processing capacity is in Asia Pacific, 21.4% in North

America, 15.3% in Europe, 10.0% in Middle East, 8.2% in Commonwealth of Independent States (CIS) and 3,3% in the African region (BP, 2021: 31).

Table 3: 2020 Oil Refining Capacity by Region in the World

Region	Thousand Barrels Daily	Million Barrels Yearly	2020 Share (%)
North America	21766	7944,59	21.4%
Middle&South America	6168	2251,32	6.1%
Europe	15617	5700,205	15.3%
CIS	8340	3044,1	8.2%
Middle East	10220	3730,3	10.0%
Africa	3343	1220,195	3.3%
Asia Pasific	36492	13319,58	35.8%
World Total	101947	37210,29	100%

Source: BP Statistical Review of World Energy, 2021: 31.

The Situation of the Turkish Petroleum Industry

The Petroleum Law No.792 was legislated for the first time in Turkey in 1926, and with this law, the rights to explore and operate petroleum within the borders of the country were given to the state, thus ending the privileges of foreigners and their partners in the country (Taşman, 1949: 18). Later, for an institutional organization that would carry out petroleum-related operations, the "Gold and Petroleum Exploration and Operation Administration" was established in 1933 with the Law No. 2189 to search for gold and petroleum mines throughout the country and to operate the suitable ones. This institution was later transferred to the Mineral Research and Exploration Institute (MTA), which was established in 1935, petroleum and all other mineral exploration tasks were assigned to this institute. As a result of further exploration in Turkey, the first productive petroleum field was found in the Raman Mountain region of Batman in 1940. As a result of the persistent efforts in the region, the existence of petroleum in Turkey was now proven (Özcan, 2006: 42).

In the process called "National Period" between 1923-1954, the state played an active role due to the economic and strategic values of petroleum, but the expected domestic production could not be achieved due to capital and technological inadequacies (Akalm and Tüfekçi, 2014: 56). Under the circumstance, statism practices were abandoned in 1954, and liberal practices in petroleum policies were adopted with the Petroleum Law No. 6326. With this law, including liberal regulations, petroleum exploration and all kinds of petroleum operations through domestic and foreign private initiatives are stipulated. Again, based on the same law, a new institutional arrangement was made in Turkey, the Turkish Petroleum Corporation (TPAO) was established in 1954 and the petroleum-related duties of the Mineral Research and Exploration Institute were transferred to this institution. TPAO initially undertook duties such as petroleum and natural gas exploration, drilling, production, refining and marketing on behalf of the Turkish Republic. Since its establishment, TPAO has tried to carry out operations in all fields within the framework of investments determined by the state and within the scope of possibilities. BOTAŞ, carrying out crude petroleum and natural gas transportation operations with pipelines, was removed from the status of subsidiary of TPAO in 1995 and was structured as a State-Owned Enterprise (SOE). The marketing company POAŞ 2002, the refinery company TÜPRAŞ 2005, and the petrochemical company PETKİM 2008, which were among the public institutions operating under TPAO until the 2000s, were privatized. TPAO still carries out oil exploration, drilling and production operations in Turkey and abroad.

Exploration operations are carried out in order to provide petroleum and natural gas, being among the energy resources that Turkey needs to a large extent, primarily from domestic and foreign sources. While TPAO continues its exploration and drilling operations in land and sea basins where oil and natural gas presence has been determined in the country, it also carries out exploration and production projects with private and foreign capital enterprises.

Crude petroleum production in Turkey was 1,276,129 tons in the 1942-1958 period, and it was produced by MTA and TPAO, which are all public institutions. In addition to TPAO, domestic and foreign capital companies have also participated in production since 1959.

Changing from year to year the total annual domestic crude petroleum production, on the other hand, amounted to 22.5 million barrels by the end of 2020, 16.6 million barrels of which were produced by TPAO. Crude petroleum production areas in Turkey are limited and scattered. Only 7% of the crude petroleum requirement processed and consumed in our country is provided by domestic production (TPAO Petroleum and Natural Gas Industry Report, 2020: 57- 63).

Crude petroleum processing (refining) operation in Turkey started at the Raman Testing Refinery, established in 1942, and served until the Pilot Refinery became operational, established in Batman in 1945, three years later. Having started its trial studies in 1955, Batman Refinery has been operating since 1956 with a petroleum processing capacity of 330,000 tons/year. The crude petroleum processing capacity of this refinery has been expanded and reached 1.4 million/year.

TPAO obtained permission in 1959 to establish a refinery with an annual capacity of 1 million tons in the Tütünçiftlik region on the northern shore of the Gulf of İzmit. İzmit Petrol Refinery A.Ş. (İPRAŞ) was established to meet the petroleum products needs of industry, society and the Turkish Armed Forces. The foundation of the refinery was laid in 1960 and it started operating in 1961. İPRAŞ started production with a capacity of 1 million tons/year and then expansion investments were made in different years. The production increased to 11.3 million tons/year with the capacity increases realized over the years.

Having been put into operation in 1972 in order to meet the increasing demand for petroleum products in Turkey over the years, İzmir Aliğa Refinery started production with a crude oil processing capacity of 3 million tons/year. As a result of the refinery's capacity increases over time, its crude oil processing capacity has reached 11.9 million tons/year.

Kırıkkale Refinery is Turkey's newest and third largest refinery. It started its operations in 1986 with a crude oil processing capacity of 5.0 million tons/year. Kırıkkale Refinery still processes 5.4 million tons/year of Crude oil. The crude oil supply of the refinery is provided from the Ceyhan Terminal of BOTAŞ using the Ceyhan-Kırıkkale pipeline.

In 1983, İzmit Petroleum Refinery (İPRAŞ), Batman, İzmir Aliğa and Kırıkkale refineries belonging to the public, with the arrangements made for more efficient operation of the State Owned Enterprises (SOE) were gathered under the name of Turkish Petroleum Refineries Corporation (TÜPRAŞ). TÜPRAŞ was privatized in 2005 and there is no public share left in this sector. Apart from domestic production resources, TÜPRAŞ refineries supply crude oil from producing countries through imports. It is a fact that our country's import of crude oil increases every year and domestic production is not sufficient (Table 4).

Table 4: Amount of Crude Oil Processed in Turkish Refineries

Year	Domestic Production	Import	Refined Crude Oil
	Million Tonnes	Million Tonnes	Million Tonnes
2000	2.2	19.6	21.3
2001	2.4	20.4	22.8
2002	1.9	22.4	23.3
2003	1.9	22.5	23.9
2004	2.9	22.3	24.5
2005	2.2	23.5	25.5
2006	2.2	24.3	26.2
2007	2.1	23.3	25.6
2008	2.1	21.4	24.2
2009*	2.2	14.2	17.0
2010*	2.5	17.3	19.9
2011	2.4	18.5	20.5
2012	2.3	19.7	22.1
2013	2.4	18.7	21.6
2014	2.4	17.9	20.0
2015	2.6	24.8	27.6
2016	2.6	25.2	28.3
2017	2.6	25.1	28.5
2018	2.7	21.8	24.5
2019	2.9	23.9	27.2
2020*	2.7	18.8	22.6

(*) Due to economic crisis and uncertainty refining was made in line with domestic demand.

Source: TÜPRAŞ Annual Reports (2000-2020) and EPDK Industry Reports (2005-2020)

The processing of crude oil and the production of petroleum products in Turkey are mainly carried out in refineries owned by TÜPRAŞ. Total crude oil processing capacity of TÜPRAŞ is 30.0 million tons/year according to 2020 data, making it the seventh largest refinery company in Europe (TÜPRAŞ Sustainability Report, 2020: 7).

ENVIRONMENTAL IMPACTS OF THE PETROLEUM INDUSTRY

Currently, the use of energy resources is an indispensable requirement in all businesses, as well as in residential heating and transportation operations. However, it is known that the currently used energy sources greatly affect the natural environment and cause environmental problems during the production, processing, transportation and consumption stages. Fossil resources such as petroleum (31.2%), coal (27.2%), and natural gas (24.7%) constitute the largest part of the energy resources used currently (BP, 2021: 12). Energy sectors using these resources should continue their operations without causing environmental destruction and without disturbing the ecological balance. Having an important place in the energy sector, production and refining operations of the petroleum industry can cause environmental problems such as air, soil and water pollution, which have an impact on human life. Petroleum exploration and extraction is the first stage of crude oil production. At this stage, exploration, drilling and crude oil production are complex processes in terms of their impact on society, health and the natural environment. Crude oil production processes on land, in coastal areas and offshore have impacts on ecosystems, human health and local life activities. Petroleum companies carry out studies to determine petroleum reserves by technical methods such as satellite observations, geology and geophysics. When the reserves are determined, enterprises build roads, platforms, pipelines, drilling rigs, and transport tons of materials with heavy-duty vehicles. Production operations begin when test wells are drilled and petroleum is discovered. During petroleum production, there is a change in the natural state by affecting the environment. These effects on the environment may cause problems such as deforestation, ecosystem destruction, chemical contamination, especially in soil and water, damage to animal and plant populations over time, human health and safety risks, and displacement of local communities. For example, the construction of roads to access petroleum production areas and the clearing of vegetation from the production land lead to erosion and deforestation. A large amount of water is used during well drilling. This water causes water and soil contamination due to the oil wastes. These chronic effects on natural ecosystems, e.g. in the seas, severely damage coastal plant and animal populations. Tons of barium, a toxic heavy metal, is used well drilling, which can be chemically mixed into the water. During the drilling process, barium goes into a liquid state and creates hazardous waste spreading to the environment during weak reinjections (O'Rourke & Connolley, 2003: 594-595).

Gas emissions and spills occur during crude oil production, sometimes directly, sometimes due to poor processes. These emissions and spills from well equipment and support vehicles cause significant air and environmental pollution. On the other hand, chronic health problems occur in workers during well drilling and production. Various chemicals used in production cause dermatological and pulmonary reactions, asthma, hypersensitivity, and lesions on the face and neck. Explosion and fire risks, injuries and accidental deaths often occur during petroleum production (O'Rourke & Connolley, 2003: 596).

Petroleum refineries are facilities converting crude oil into a wide variety of petroleum products by using physical and chemical techniques. The refining of crude oil involves many processes, from production sites to the plant, including transportation. Some gas and solid waste products are released during transportation from the production areas to the refinery and during all operations in the facility. In addition, wastes from various materials, water and energy units used in in-refinery processes occur. For this reason, petroleum refineries are major pollutants in the regions where they are located. Indeed, the wastes, particles and emissions released during the refining of crude oil create serious environmental problems. Oil refineries are also sources of toxic air pollutants. Refineries release air pollutants such as nitrogen oxides (NO_x), carbon monoxide (CO), hydrogen sulfide (H₂S) and sulfur dioxide (SO₂). These chemicals are not only harmful to health, but also cause the greenhouse effect by accumulating in the atmosphere, thus causing global warming.

Refineries also have impacts on groundwater and surface water contamination. Because refining processes require a large amount of water, some refineries use groundwater through deep well drilling. These used waters are discharged as waste. Most of the waste water is re-injected into the underground layers or reused

after treatment. During the refining, the water used in each process is contaminated with many pollutants and turns into waste water as process water. Wastewater contains petroleum residues and other harmful elements. After being treated according to certain standards, waste water may contain sulfates, suspended elements and some other compounds (Hazardous Substance Research Centers Program, 2003: 1-3).

There is also soil contamination problem in refinery areas. During refining processes, some hazardous wastes, coal dust from energy units, leaks from tank bottoms, sludges, and debris during transportation may mix with the soil (Hazardous Substance Research Centers Program, 2003: 1-3).

The technologies of petroleum refineries in different countries are not developed to the same extent. Different results have been obtained in studies on the environmental effects of refineries. It is emphasized that refineries may lead to water, air and soil contamination, damage to animal and plant populations, and ultimately to the deterioration of ecosystem balance.

ENVIRONMENTALLY-RESPONSIBLE PETROLEUM INDUSTRY: THE EMERGING OF GREEN THINKING AND GREEN MANAGEMENT APPROACHES

Various enterprises, especially large complex enterprises, have an impact on the emergence of all environmental problems at the local and global level. The production, type and amount of the raw material used by the enterprises and the emissions arising from the processes, solid and liquid wastes affect the environment. This has made businesses responsible for the environment and society. In the context of sustainable development principles, enterprises have four basic responsibilities: social, economic, resource use and ecological (Marangoz, 2004: 77-78). Due to these responsibilities, enterprises today have adopted the concept of "Environmentally-Responsible Industry: Green Management", which acts in accordance with the principles of sustainable development, protects the natural environment and uses limited resources responsibly. Adopted in the context of sustainability, green management is a modern understanding in which the damage to the environment is minimized, with the aim of protecting the natural environment in the operations of enterprises.

Until the late 1960s, few people (and organizations) paid attention to the environmental consequences of their decisions and actions. However, a number of environmental disasters have brought a new spirit of environmentalism. In the late 1960s, the effects of economic growth and industrialization on the environment in the world negatively affected economic development as well as human health, the idea of focusing on environmental problems arose. Understanding environmental problems are not local and national but a global issue, countries began to take measures and pursue policies in this direction. In this context, the Stockholm Conference was held under the leadership of the United Nations in 1972, and the United Nations Environment Program was established for the first time at this conference. This program can be considered as an initiative that pioneers common environmental policies in the world (Yaman and Gül, 2018: 203). This initiative brought the idea that nature and the human environment were destroyed due to many factors, this destruction had consequences that negatively affected economic development/human health, a national and international solution should be found for this issue. In this framework, the European Union did not remain indifferent to environmental problems, and became an internationally pioneering organization.

As Aydın and Çamur stated, while the European Union was still in the European Economic Community (EEC), environmental problems were included in an independent section for the first time in the Single European Act, signed on 17 February 1986, and entered into force on 1 July 1987. The legal framework of the "Common Environmental Policy" was drawn in the provisions covered under the VII. Title. According to the provisions of the Single European Act, the target and scope of the environmental policies and practices adopted by the community are specified. The Single European Act defines environmental problems under the headings of "protection of air and water quality, control and management of wastes, protection of plants, animals and landscapes, control of chemicals and limitation of noise" (Aydın and Çamur, 2017: 31).

The name of the European Economic Community was transformed into the European Union at the summit held in Maastricht, Netherlands in 1991. Environmental policies have an important place in the Maastricht Treaty, signed in 1992 and entered into force in 1993. In the agreement, it was foreseen to expand the environmental articles in the Single European Act and to develop environmentally friendly sustainable

development (Yaman and Gül, 2018: 205). With the Amsterdam Agreement, entered into force in 1999, the European Union not only made sustainable development the objectives of the union, but also aimed to improve the high level of environmental protection and quality (Sarıkaya, 2004: 1-2). Later, with the Lisbon Treaty, entering into force in 2009, the European Union expanded the scope of the steps to be taken regarding the environment. With this treaty, the European Union emphasized the need not only to take precautions, but also to finance studies related to the environment. This situation enabled the countries that are members of the European Union to take concrete steps regarding the environment, especially in terms of environmental protection and prevention of contamination (Aydın and Çamur, 2017: 34).

The implementation of the decisions taken by the European Union regarding the environment in the agreements entered into force in different years has been realized with the "Environmental Action Programs". The European Union has developed environmental policies since 1973 and these policies have been implemented in seven Environmental Action Programs. While the main subject of the first four Environmental Action Programs was prevention of contamination, the fifth program was explained under the title of sustainable development and responsibility sharing, and the sixth program was explained under the title of "Environment: 2010: Our Future is Our Choice ". In this program, issues such as climate change, protection of nature and biodiversity, reducing the factors that adversely affect the environment, health and quality of life, and protection of natural resources were emphasized. In the Seventh Environment Action Program covering the period of 2010-2020, priority targets such as protecting and strengthening the natural environment, expanding the implementation of the environmental legislation of the European Union, ensuring the necessary investments for environment and climate policies, and ensuring the integration of the environment into other policy areas were specified (Yaman and Gül, 2018: 209-213).

In order to raise awareness and to find solutions in the international arena against the problems experienced due to climate change in the world, conferences were held in Rio in 1992 and Kyoto in 1997. In these conferences, it was aimed to reduce emissions in order to keep global warming below 2°C. In case this threshold is exceeded, it is foreseen that all ecosystems and societies on earth will suffer serious damage. However, the increase in global emissions that caused this problem could not be stopped and the targeted measures could not be realized. In 2005 and 2006, within the framework of policies to reduce the effects of human-induced climate change, the issue of limiting the global temperature increase with 2 °C has been brought to the agenda. With the participation of 192 countries, this target was agreed upon at the Copenhagen Summit held in 2009. The idea of reducing emissions is based on the idea that fossil energy reserves are kept underground, not operated and never used. Accordingly, one third of all oil reserves, half of natural gas reserves and 80% of coal should not be extracted. In order to realize these ratios, there must be a strong political will (Kuban, 2015: 11). In the assessment reports prepared at the Intergovernmental Panel on Climate Change (IPCC) within the United Nations (UN), it is foreseen that due to the current state of the world's climate system, urgent steps should be taken to keep the temperature rise below 2°C. According to the calculations of the IPCC, in order to keep the temperature rise below 2°C until the end of the 21st century, countries will be able to release a total of 1,000 gigatons of CO₂ into the atmosphere. However, as of 2011, the amount of CO₂ released by countries has reached 515 gigatons (Oksay, 2015: 10-11).

The Paris Agreement, considered a turning point in the global fight against climate change, entered into force on 4 November 2016, as a result of meeting the condition that at least 55 parties which accounts for 55% of global greenhouse gas emissions, ratify the agreement. Turkey, on the other hand, signed the Paris Agreement with the representatives of 175 countries at the High Level Signing Ceremony held in New York on April 22, 2016. "The Law on Approval of the Paris Agreement" approved by the Turkish Grand National Assembly and entered into force after being published in the Official Gazette dated 7 October 2021 and numbered 31621. With the ratification of the Paris Agreement, Turkey, according to the Intended National Contribution Statement, which is also highlighted in 11th Development Plan 2.4.7. Environmental Protection Goals promises that its greenhouse gas emissions will increase to 1 billion 175 million tons in 2030, but with the given statement, this amount can be kept at 929 million tons. In other words, it is aimed to reduce Turkey's greenhouse gas emissions by 21% from the increase in 2030 compared to the reference scenario (Figure 1). The Paris Agreement entered into force for Turkey on 10 November 2021, the 30th day after the approval notification to the UN Secretariat, confirming Turkey as the 192nd country to be a party to the agreement. While the importance of the Paris Agreement process is known both for the world and for Turkey, the studies for the implementation of this agreement are also important.

The states of the world previously focused only on economic development. The necessity to take measures to stop this trend and even to develop these measures arose upon the irresponsible use of natural resources and the understanding of the negative effects of economic growth on the environment. Likewise, it was understood that the environmental policies implemented due to the gradual aggravation of environmental problems would not be sufficient and it was necessary to question the economic growth-environment relationship. In parallel, the economic development efforts of underdeveloped and developing countries, following the developments in Western countries, led to the increasing globalization of environmental problems. Environmental problems gained importance and remained on the agenda with the contribution of academic comments and discussions. These developments in the intellectual field opened a wide area of discussion of the environmental problems and new approaches emerged. Thus, in this new era, the intellectual actions known as “Green Theory or Green Thinking” took place in this movement, together with the discussion of keeping the environment and environmental problems on the agenda and seeking solutions to the problems. According to Tarhan, green thinking separated from some environmental movements and modernists with its perspective on environmental problems and progressed in a way that centers the environment (Tarhan, 2018: 155). The main purpose of this idea is to make suggestions that put the environment and people in the center and offer solutions to the problems with a real ecological perspective beyond a narrow understanding of environmental problems. Green theory, as green thinking, corresponds to a period when environmental problems became global (Tarhan, 2018: 164-165). In this period, due to uncontrollable environmental problems, diseases threatening human health increased and natural resources decreased. Climate change and global warming became measurable in this period and the global ecological crisis began. Green thinking that reveals this trend is the product of this period. (Şahin, 2012: 24).

While referring to the origin of green thinking, Barry summarizes the following events and developments: The Industrial Revolution and the resistance of the working class against capitalism, the spread of mechanization and the factory production system, the decrease in the rural population could not provide a harmony between economic and social life. By the 1960s, social, political and economic organizations could not be fully developed for an advanced lifestyle in the face of environmental degradation caused by the unprecedented levels of economic operations, especially industrialization, and especially the contamination created by energy production facilities. The social perception that developed due to the "ecological crisis" emerged in the 1960s and progressed in the 1970s, petroleum crises in the 1980s and 1990s, climate change peaked. For sustainable and social development, the establishment of worldwide human rights in principle, economic equality and the desire of states for democratization played a fundamental role in the emergence of green thinking as a trend (Barry, 2014: 155). Green thinking, as an intellectual movement, coincided with the 1960s and 1970s, when environmental and social problems became global. This theory puts people and mostly the environment at the center. For this reason, the mindset advocated by the “Green Theory” can be considered as a protection against the destruction of nature caused by humans, for humans, but against humans (Mutlu and Zenginoğlu, 2019: 462).

According to Tarhan, green thinking strengthens the normative view by adopting a more solution-oriented approach to environmental problems and getting to the center of the problems. Due to the effects of the period in which it emerged and its theoretical richness, it envisages interdisciplinary work. The economic sustainability pillar of the thought, which aims to make systemic changes by going down to the source of the problems, constitutes both the output and the cornerstone of the theory (Tarhan, 2018: 166).

The foundation of green thinking is the economic approach called “Green Economy”. The green economy is an economic concept:

- a. Aiming at minimizing the destructive effects of human on nature and thus making the living life and human civilizations in the world permanent,
- b. Rejecting that economic growth and development is unlimited,
- c. Based on production-consumption relations on a human scale, in harmony with nature close to the soil, against huge scales (Şahin, 2012: 24).

The management style of this concept is “Green Management”. Essentially, green thinking is a concept focusing on solutions to environmental problems and goes to the root of the problems. This approach leads to an integrated corporate and environmental management, that is, environment-friendly green management, as the pillar and starting point of sustainability in the economic field. As a matter of fact, green thinking has passed from theory to implementation, and it has been used in every field of economic

sectors such as green business, green production, green marketing, green accounting and even green building...etc. Green management is an approach that will minimize the pressures on the environment and natural resources in all production processes; it will be effective in reducing waste and creating a healthy environment. In other words, green management is an approach guiding nature not only in production methods, but also in business-society relations, within the scope of social responsibility. The green management approach, based on the principle of environmental protection, predicts that problems can be prevented before they turn into major damage. As a matter of fact, managers acting with green management principles can provide solutions to environmental problems with the organizations, management units and mechanisms they create. Increasingly, managers have begun to consider the impact of their organization on the natural environment.

GREEN MANAGEMENT IMPLEMENTATIONS IN TURKISH AND OTHER COUNTRIES' PETROLEUM INDUSTRIES

Petroleum and natural gas are among the critical energy sources. The most important issue within the scope of this requirement is the emergence of negative environmental impacts in the production of large quantities of crude petroleum and natural gas. Therefore, there is an obligation and responsibility to carry out production operations in the petroleum industry without harming the environment or reducing the effects. Green management is one of the most suitable environmental management models for planning, coordinating, directing and controlling activities of the petroleum industry firms to determine problems and solutions. Petroleum companies generally develop integrated environmental management models by using national legislation, international agreements and developing technologies on environmental protection and management. For example, the petroleum industry in the UK has organized its environmental management models in line with the environmental policies and objectives of the European Union, in the context of the following principles:

- Protecting the environment and improving its quality,
- Protecting human health, using natural resources in a predictable and reasonable manner,
- Developing measures against environmental problems at the international level (Gonzales, 2015: 34-35).

ExxonMobil is the United States' largest multinational petroleum and gas production company. The company's head office is located in Irving, Texas. It works as a pioneer in environmental management. According to the sustainability report, ExxonMobil acknowledges environmental issues and makes assessments to reduce the impact of environmental risks at every stage of the project. It applies appropriate standards in the places where it operates by complying with environmental laws and applicable contracts. Operations are managed by ExxonMobil to improve environmental performance and keep it up to standard. The company complies with the requirements of the international environmental management standard ISO 14001 and the American Chemistry Council Care to set environmental standards. The ISO 14001 Environmental Management System Standards help in finding suitable conditions for progress in environmental impact management. It also helps realizing the duty and obligation on the environment. ExxonMobil implements projects in petroleum producing regions to understand environmental, socio-economic characteristics and assess impacts on health. In order to avoid environmental/ socio-economic impacts and to reduce effects at an acceptable level, management plans based on project results are carried out. ExxonMobil has also focused on emissions issues to reduce environmental impacts and climate change risks. While implementing existing technologies in a planned manner, ExxonMobil supports carbon collection and low emission research (ExxonMobil, Sustainability Report, 2018: 1-2).

In Turkey, a unit named "Department of Occupational Safety and Environmental Protection" has been established within TPAO in order to prevent environmental damages arising from exploration, production operations and ensure occupational safety. Through this unit, mud pools are rehabilitated in drilling and production areas, and a significant part of solid waste is recycled. In order to reduce or eliminate the negative environmental effects of the wastes generated because of drilling operations, the drilling muddy water is dewatered. In addition, the waste water generated as a result of petroleum and natural gas production operations is injected underground. It is mixed at a rate of 0.01% in the crude oil produced for the recovery of waste oils. Barriers and pads are used against oil contamination to the environment. Operations within the scope of Integrated Management System (IMS) at TPAO are carried out within the framework of TSEN 14001 Environmental Management Standards and TS 18001 OHAS Occupational Health and Safety Management Systems Standards (TPAO Annual Report, 2018: 111-116).

Four refineries (Batman, İzmit, İzmir Aliğa and Kırıkkale refineries) operate under the umbrella of TÜPRAŞ, Turkey's largest oil refining company, with a total crude oil refining capacity of 27.6 million tons/year.

TÜPRAŞ revealed its approaches to environmental protection under the title of “Environmental Overview” in its 2010-2011 and 2017-2018 Institutional Sustainability Reports. In these reports, it is stated that environmental management in TÜPRAŞ refineries is carried out in accordance with the requirements of ISO 14001 Environmental Management Standards. "Environmental Management Units" were established to carry out environmental protection operations in all refineries belonging to TÜPRAŞ.

TÜPRAŞ considers the orientation towards climate-friendly technologies as its most important responsibility, as emissions generated in refining processes within the scope of environmental protection activities play a role in the problem of climate change. The increase in the amount of crude oil processed in refineries also increases energy consumption and emission values. For this reason, the main target is to process more crude oil with less energy and emissions by energy management in refineries (TÜPRAŞ, Corporate Sustainability Report, 2018: 24).

TÜPRAŞ controls the use of clean water with efficiency and recycling practices for the protection of water resources, and reduces environmental effects by keeping the quality of waste water from refining processes above normal. In this way, while refining efficiency increases, negative effects on water resources and natural receiving environment are eliminated. In terms of waste management, TÜPRAŞ follows the principles and methods of reducing the amount of waste, recycling the generated wastes by separating them at the source, and disposing of the non-recyclable wastes through licensed companies with appropriate methods (TÜPRAŞ, Corporate Sustainability Report, 2010- 2011: 22 and 2017-2018: 29).

The environment-friendly green management approach and practices of the two companies carrying out most of the crude oil production and refining operations in Turkey are briefly summarized. From these two organizations whose environmental protection and environmental management operations are reviewed, TPAO is a state-owned enterprise producing crude oil and natural gas. Engaged in petroleum refining activities, TÜPRAŞ is a large private owned company. Due to the nature of TPAO's crude oil and natural gas production operations, the natural environment is directly affected. For this reason, methods that can minimize environmental effects are applied during production operations and efforts to improve the environment after production are carried out. TÜPRAŞ, also uses environment-friendly methods and technologies, makes investments to develop them, as they have a high probability of affecting air, water and soil in crude oil processes.

CONCLUSION

As a result of industrialization, environmental problems, air pollution and climate change have gained a global dimension. These prominent problems have brought responsibilities to countries/ enterprises and have increased their concern about sustainability. For this reason, enterprises have focused on the protection of natural resources and solutions to environmental problems. The development of industry, population growth, urbanization and transportation have also increased the need for energy resources. According to the latest data, fossil fuels such as petroleum, natural gas and coal constitute 83.1% of the energy consumed in the world. Especially petroleum and natural gas have a wide range of use and consumption as energy sources. 31.2% of the energy consumed in the world is provided by petroleum and 24.7% by natural gas (BP, 2021: 16 and 19).

The petroleum industry is a large and integrated sector consisting of national and multinational enterprises operating in the fields of exploration, production, transportation, processing (refining) and marketing. However, production and processing operations during the exploitation of petroleum and natural gas resources directly affect the environment and cause environmental problems. Crude oil production processes on land, in coastal areas and offshore have adverse effects on ecosystems, human health and the living activities of local communities.

During the refining of crude oil transportation from production areas to refineries, gaseous emissions, particulates and waste products are released. In addition, wastes and pollutants originate from various materials, water and energy units used in-refinery processes. In this respect, petroleum refineries are major contaminating sources in the regions where they are located. Particles and emissions released into the air during crude petroleum refining cause serious environmental problems. As all emissions are harmful to

health, they accumulate in the lower layers of the atmosphere and cause the greenhouse effect, thus global warming and climate change.

Currently petroleum enterprises develop integrated environmental management models by using national legislation, international agreements and developing technologies for environmental protection, reducing problems and rational use of resources. In this context, enterprises in the petroleum industry adopt the green management approach, which is one of the most appropriate environmental management models, to determine solutions to the problems arising at every stage and to put them into practice. Green management is an approach directing the harmony with nature not only in production and processing activities, but also in business-society relations within the scope of social responsibility.

In Turkey, TPAO is active in crude oil and natural gas production, and TÜPRAŞ is active in refining to a large extent. Both organizations have established environmental management units to prevent environmental impacts and problems arising from their activities. Through these units, preventive works such as reducing emissions and wastes, protecting water resources and eliminating negative effects on natural receiving environments are carried out by environmentally-responsible green management techniques.

The Paris Agreement, considered a turning point in the global fight against climate change, entered into force on 4 November 2016 for most of the countries in the world, while it entered into force for Turkey on 10 November 2021. While the importance of the Paris Agreement process is known both for the world and for Turkey, the studies for the implementation of this agreement are also important. This article summarizes the emergence of negative environmental impacts of the petroleum industry in the world and in Turkey. The general situation of the petroleum industry and environmentally-responsible green management implementations in the industry are also analyzed. Additionally, the article focus on the importance of environmental protection and the greenhouse gas emissions reductions required by the Paris Agreement. We plan to compare the applicability of green management implementations for the petroleum industry in the world and in Turkey for future studies.

REFERENCES

Akalm, U.S. ve Tüfekçi, S. (2014), Türkiye'nin Petrol Politikaları ve Enerji Özelleştirmelerine Bir Bakış, İktisat Politikaları Araştırmaları Dergisi, 1 (1): 51-66.

Aydın A.H. ve Çamur, Ö. (2017), Avrupa Birliği Çevre Politikaları ve Çevre Eylem Programları Üzerine Bir İnceleme, Bingöl Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 7(139): 21-44.

Barry, J. (2014), Green Political Theory, In V. Geoghan & R. Wilford (Eds), Political Ideologies: An Introduction, 4.Ed., pp 153-178.

BP Statistical Review of World Energy, <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-full-report.pdf>, Son Erişim Tarihi: 10 Ekim 2021.

EPDK, Petrol Piyasası Yıllık Sektör Raporları, 2005-2020, <https://www.epdk.gov.tr/Detay/Icerik/3-0-94/yillik-sektor-raporu>, Son Erişim Tarihi: 15 Kasım 2021.

ExxonMobil 2018 Sustainability Report, <https://corporate.exxonmobil.com/-/media/Global/Files/sustainability-report/publication/2018-Sustainability-Report.pdf>, Son Erişim Tarihi: 10 Ekim 2021.

Gonzales, G. (2015), Sustainability and Waste Management: A Case Study On An UK Oil Refinery During day-to-Day and Turnaround Operations (A Thesis for the Degree of Master of Philosophy), University of Surrey, Faculty of Engineering and Physical Sciences, UK.

Hazardous Substance Research Centers / South & Southwest Outreach Program (June 2003), Environmental Impact of the Petroleum Industry, <https://cfpub.epa.gov/ncer/abstracts/index.cfm/fuseaction/display.files/fileID/14522>, Erişim Tarihi: 01 Ekim 2021.

Kuban, B. (2015), İklim değişikliği: Finans kapitalin gözü mü açıldı?, Cumhuriyet Bilim Teknoloji Dergisi, 11 Eylül 2015, Sayı 1486: 11.

Marangoz, M. (2004), İşletmelerin Çevresel Sorumluluğu: Türk Otomotiv Sanayiine Yönelik Bir Araştırma, Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 6 (3): 75-97.

Mutlu, M. ve Zenginoğlu, S. (2019), Yeşil Teori Perspektifinden Avrupa Birliği Çevre Politikası, Akademik Sosyal Araştırmalar Dergisi, 88: 459-469,

Oksay, R. (2015), İklim Değişikliği İle Mücadelede Çözüm Arayışları: Küresel Isınmanın Baş Sorumluları Şimdi Çözüm Peşinde, Cumhuriyet Bilim Teknoloji Dergisi, 11 Aralık 2015, Sayı 1499: 10-11.

O'Rourke, D. & Connolly, S. (2003), Just Oil? The Distribution of Environmental and Social Impacts of Oil Production and Consumption. Annual Reviews Environmental and Resources, 28, pp. 587-717.

Özcan, H. E. (2006), Fotoğraflarla Ulusal Petrol 1923-1954, TPAO Arama Dairesi Başkanlığı, Arşiv ve Tarih Yayınları 1, Ankara.

Sarıkaya, H. Z. (2004), Avrupa Birliği Uyum Sürecinde Çevre Politikaları ve Uygulamaları, Su Kirlenmesi Kontrolü Dergisi, 14 (1): 1-10.

Şahin, Ü. (2012), Yeşil Düşünceden Yeşil Ekonomiye, Yeşil Ekonomi, Yeni İnsan Yayınevi Yeşil Politika Serisi-2 (Kitapta Bölüm): 22-34.

Tarhan, K. (2018), Küresel Çevre Sorunlarının Politikleşmesi ve Uluslararası İlişkiler Teorileri Kapsamında Analiz, International Journal of Social and Humanities, 2 (1): 152-170.

TPAO Faaliyet Raporu, 2018.

TPAO Petrol ve Doğal Gaz Sektör Raporu, 2020.

TÜPRAŞ, Faaliyet Raporu, 2000-2020.

TÜPRAŞ, Kurumsal Sürdürülebilirlik Raporu, 2010-2011 ve 2017-2018, <https://www.tupras.com.tr/sr-raporlari>, Erişim Tarihi: 12 Eylül 2021

Yaman, K. ve Gül, M. (2018), Kuruluşundan Günümüze Avrupa Birliği'nin Çevre Politikası, Ekonomi İşletme ve Yönetim Dergisi, 2 (2): 198-217.