



## International Journal of Financial Management and Economics

P-ISSN: 2617-9210  
E-ISSN: 2617-9229  
IJFME 2024; 7(1): 16-25  
[www.theeconomicsjournal.com](http://www.theeconomicsjournal.com)  
Received: 13-10-2023  
Accepted: 21-11-2023

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### The green economy and its importance in the operations of the oil refining industry in Iraq

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DOI: <https://doi.org/10.33545/26179210.2024.v7.i1.253>

#### Abstract

Investment oil companies operating in the refining operations of the Iraqi oil industry and oil fields in different regions of the country are committed to treating the pollutants resulting from extraction and exploration operations by relying on modern technologies to treat the oil pollution resulting from these operations through the use of the green economy and the mechanism of its application in the operations of the Iraqi oil refining industry. Oil refining operations in Iraq are considered one of the most important pillars of the national economy through the production and supply of all types of fuels to citizens and other service sectors, stressing that these projects provide significant financial returns in supporting the economy and increasing national production of types of fuel production that contribute directly to covering part of local needs and reducing The share of foreign imports, as well as distinguishing the new units as conforming to international health and safety standards and being environmentally friendly.

**Keywords:** Green economy, environmental protection, oil refining operations

#### Introduction

The green economy is considered one of the modern concepts that has received the attention of many researchers due to its role in its use in the field of clean energy in order to enhance the treatment of economic and environmental issues, and to which various countries of the world have given great importance in building their economies and ensuring a sustainable future for all individuals in the country due to the high rates of pollution and the spread of several factors. external impacts on the environment negatively, so that countries, with their various governmental bodies and the private sector, seek to take measures and strategies that would contribute to obtaining a green economy by adopting their efforts in carrying out green projects that rely on clean energy and creating green job positions for unemployed individuals by submitting proposals. At various conferences related to sustainable development by producing modern economic growth, based on improving the well-being of individuals, as it includes the economic, social and environmental sectors. The rapid progress in industrial and technical development and the negative effects it has left on infrastructure and society in various fields in general and the industrial field in particular have led to economic and social turmoil in many countries that sought to achieve their goals, the most important of which is preserving natural resources for future generations on the one hand. On the other hand, human life and health have become important, as has the safety and cleanliness of the environment in which he lives. Hence, environmental pollution resulting from the oil industry, which has a great ability to cause disruption to the ecosystem and its components as a result of excessive use of natural resources and the emission of gases that cause major environmental pollution. The oil refining industry in the world in general faces many difficulties and challenges, including Iraq, especially as a result of the increasing burden of meeting the requirements of environmental legislation to limit the release of pollutants resulting from petroleum products into the environment.

#### Chapter One: Research Methodology

##### First: the problem of the study

Economic units face the problem of wasting natural resources and the negative

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environmental impact resulting from the elimination of oil industrial waste in the environment, which I named the economic unit represented by the study sample to focus on achieving its goals of environmentally friendly products by adopting modern technologies. The methods and applications focused on the areas of modern economic indicators and preserving Natural resources for future generations, as well as effective management of natural resources, increasing production, reducing internal discharges and effective use of resources and production capacities, which require indicators and manufacturing systems through which the studied economic unit can be rehabilitated to keep pace with global industries. Based on the above, the research problem can be defined. By asking the following questions.

To what extent can the green economy and its implementation mechanism contribute to oil refining operations and reduce the impact of oil industry pollutants on the environment?

### **Second: The importance of research**

#### **The importance of the study can be stated as follows**

1. The importance of the study stems from its importance in integrating green economy indicators.
2. The research also gains its importance through the orientation of the nature of the Iraqi economy towards implementing the green economy as it is an economy that preserves the environment
3. The green economy as a new model and the extent of its application mechanism in oil refining operations in the Iraqi economy.

### **Third: The aim of the research**

The aim of the research is to shed light on a number of objectives, including.

1. Identify the nature and concepts of the green economy in the Iraqi economy.
2. Identify the most important requirements for the transformation of the green economy, the mechanism of its application in oil refining operations, and how to benefit from it.
3. Learn how to apply some technologies that contribute to reducing emissions and some environmental pollutants resulting from oil refining operations.

### **Fourth: Research methodology**

The research relied on the descriptive and analytical approach based on presenting the nature, concept and definition of the green economy and its importance, and how to transform economic sectors, especially in the Iraqi oil sector, in order to reduce emissions and pollutants resulting from oil waste. As for the analytical approach, it was adopted by completing some data and statistics containing the activities of refineries. Iraqi oil.

### **Fifth: Research hypotheses**

1. The research is based on the hypothesis that oil refining operations represent a major source of environmental pollution and threaten its security and stability.
2. The green economy treats the waste produced by the oil process and maintains the protection of the environment from environmental pollution.
3. Although Iraq possesses many economic components that qualify it to achieve a green economy, it has not

applied these components for the purpose of transitioning to a green economy transition.

## **Chapter II**

### **Theoretical framework for the research**

#### **First - What is the green economy?**

Economic projects of a different nature than their activities aim to achieve economic performance aimed at maximizing their profits. However, through their activities, they cause a set of negative effects on the environment, including pollution and depletion of natural resources, society's irrational exploitation, increased interest in environmental issues and problems, and the importance of achieving environmental management. Sound natural resources.

#### **The concept of the green economy**

- The concept of the green economy is considered one of the basic concepts for enhancing human well-being without harming the environment, as it is one of the new models of rapid economic development, which depends primarily on good knowledge of the environment, the most important of which is addressing the mutual relationship between human economies and the natural ecosystem by relying on renewable energy, which is the foundation. The mission of the green economy: The concept of the green economy includes three basic elements or indicators (UNEP 2009) <sup>[21]</sup>, which are.
- Environmental elements are the elements that contribute to reducing the reduction of carbon dioxide gas in the air and protecting biological diversity, as well as working to achieve the optimal use of energy and natural resources.
- Social elements that do not pollute the environment, which include creating suitable job opportunities, achieving justice, reducing poverty, increasing well-being, and improving the standard of living The economic elements include pushing, innovating, encouraging technology transfer, maintaining sustainable economic growth, and working to achieve sustainable development.

#### **Definition of the green economy**

The green economy is considered one of the modern aspects of the economy for a number of developing countries. There have been many definitions presented in this regard, as the United Nations Environment Program defines the green economy as the economy that improves human well-being and achieves social justice, while significantly reducing environmental risks and relative scarcity ([www.unep.org/green\\_economy](http://www.unep.org/green_economy)).

The International Labor Organization defines the green economy as a low-carbon, resource-efficient, and socially inclusive economy in which there is growth in income and employment through investments from the public and private sectors. The objectives of reducing carbon emissions and pollution, enhancing the efficiency of energy and resource use, and generating green jobs that ultimately reduce. The environmental impact of institutions and economic sectors to the levels at which sustainability is achieved (Habib Asiya, 2021: p. 304) <sup>[10]</sup>. There is another definition of the green economy that indicates that it is a new model of rapidly growing economic development models that is based on knowledge of environmental

economics that aims to address the mutual relationship between economies. Humanity, natural ecosystems, and the adverse impact of human activities on climate change and global warming. It is noted that this takes into account all historical, economic, environmental, and human aspects (Al-Feki: 2014, p. 5) <sup>[11]</sup>.

It is also known as an economy that depends on green development, based on respect for the environment, rationalization of the use of natural resources, and optimal use of energy resources, as it does not produce forcefully, but rather in a manner that suits and preserves the environment without any emissions that negatively affect the environment and humans, and provides job opportunities and sustainable development. It is based on To reshape and correct economic activities to be more supportive of the environment and social development, so that it constitutes a path towards sustainable development (Najati 2014, p. 18) <sup>[26]</sup>.

### **Objectives and importance of the green economy**

The green economy aims to stimulate economic growth and build a new model of economic development that relies primarily on large green investments in several sectors, the most important of which are the oil sector, renewable energy, and the environment. One of the most important basic goals that it hopes to achieve is (Ladia and Nasima: 2018, p. 117) <sup>[7]</sup>.

1. Protecting the environment with the aim of providing sufficient and predictable resources to mitigate the dangers of disasters and in order to enhance the ability of societies to withstand disasters in accordance with what their circumstances and capabilities permit
2. Providing great opportunities for green jobs in various sectors
3. The strategic importance of the green economy.

The green economy is considered one of the most important things that must be implemented in the economy that results in some environmental waste through the following: (Qahham, Wahiba, and Sharqq Samir, 2016, p. 440) <sup>[7]</sup>.

### **Facing environmental challenges**

The importance of the green economy is focused on reducing carbon emissions resulting from the production and consumption of energy and oil industries, and working as much as possible to expand the use of renewable energies as a basic foundation for preserving the environment on the largest scale, which is considered among the most important mechanisms of the environmental economy.

### **Stimulating economic growth**

The green economy aims to build a new model of economic development that relies primarily on natural resources for

waste management and focuses on environmentally friendly investments with high efficiency.

### **Eradicating poverty and creating job opportunities**

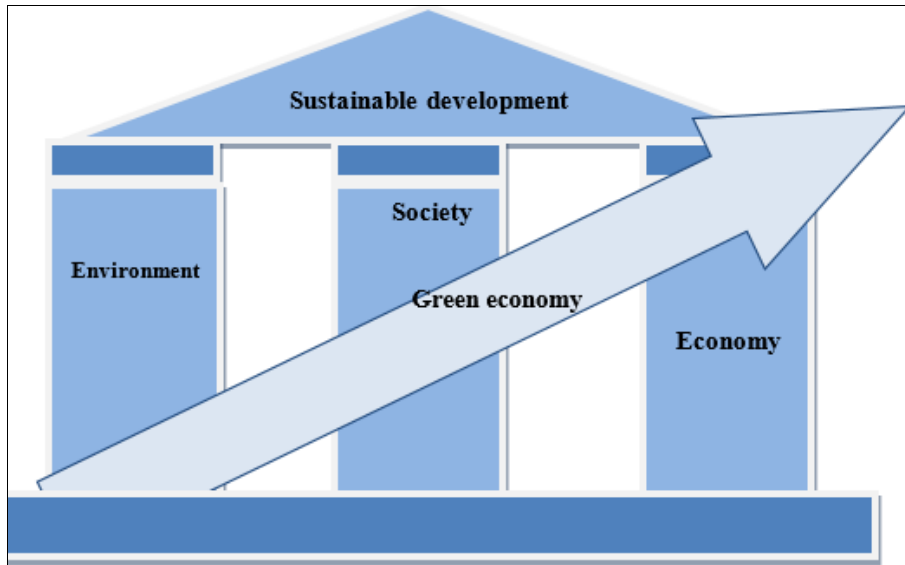
Adopting the transition to a green economy provides more employment opportunities to create a large number of jobs in various economic sectors and generates greater income. It also helps to alleviate poverty, especially in rural areas, by preserving natural resources and creating new activities that depend on labor intensity in local sectors.

## **Chapter III**

### **Requirements for the transition to a green economy**

The transition to a green economy is not an immediate event that can be achieved with a single decision taken at a high level. Rather, it is a long and arduous process directed by a political view from the top to the bottom and with the participation of all parties of society. It also requires the provision of a set of plans and transformations that must be taken into consideration. The transformation and transition process is directed by Some of the challenges that stand in the way of the complete and successful success of this science relate to all countries of the world in general and Iraq in particular (Asia, 2023, 22).

1. In order to facilitate the transition and transition to a green economy, several assumptions must be made: (Khanfar 2014, p. 56) <sup>[8]</sup>.
2. Review and repeat government procedures to stimulate changes in production, consumption and investment patterns.
3. Paying attention to rural development with the aim of reducing rural poverty while increasing wealth resources.
4. Paying attention to the water sector, controlling its use and rationalizing it to prevent pollution.
5. Working to invest and manage sustainable energy to increase energy efficiency.
6. Developing low-carbon strategies for industrial development and adopting more efficient production techniques in modern factories.
7. Support the contribution of the public transport sector
8. Developing and approving systems for using environmental standards.
9. Addressing the problem of solid waste and investing in what is useful and environmentally friendly by focusing on achieving development goals. The transition to a green economy can be achieved within the framework of poverty eradication and sustainable development by including environmental issues in all current activities, i.e. activities of transition to a green economy, and future activities, i.e. launching projects. Green, as shown in the following figure.



Source: United Nations, Economic and Social Commission for Western Asia, ESCWA, First Issue, New York, 2011, pp. 73-80.

Fig 1: The process of transition to a green economy

**Green transformation in key economic sectors**

(Dr. Sultan: <https://marsad.ecss.com.eg/68544/28/2023>).

The most important sectors that would contribute to the process of transition to a green economy, according to the outcomes of the Rio Janeiro Summit in 1992, are.

1. Waste management operations, which include recycling waste and its uses in various fields, and treating toxic waste that pollutes the environment.
2. Renewable energy, which includes the production of energy from renewable, non-conventional, and environmentally friendly sources, such as the production of electricity from solar energy, wind energy, biofuels, ground energy, and others.
3. Water management is done by using wastewater and reusing it in agriculture and collecting rainwater and floods.

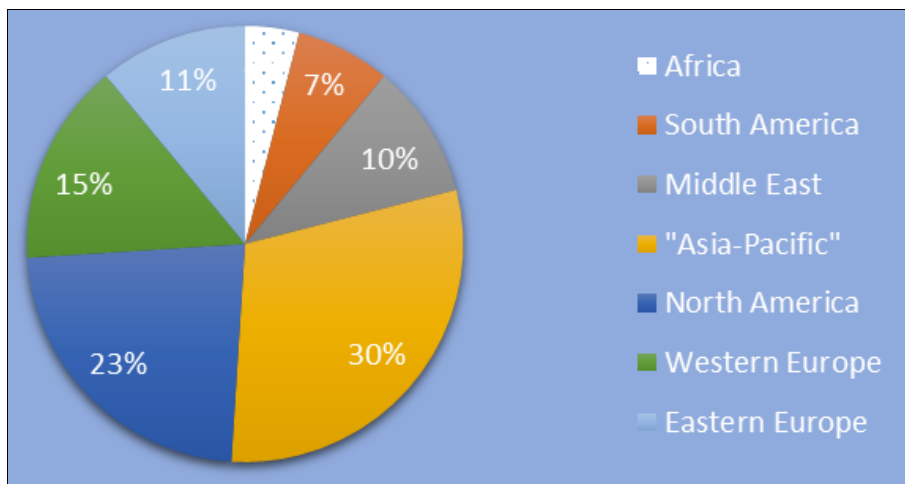
**Tourism:** This is done through the expansion of the establishment of tourist complexes and the proliferation of

green spaces and water bodies.

Current means of transportation and green buildings, which require the establishment of environmentally friendly means of transportation in addition to the expansion of construction with environmentally friendly materials to green the existing industry.

**An introductory overview of oil refining**

It is the stage that aims to manufacture petroleum in refineries with the aim of converting it from its raw form into various forms of petroleum commodities to meet and satisfy local or foreign needs for petroleum products with different types of local fuel in addition to many products that enter into subsequent, multiple, successive industrial stages. This stage is called Naming the industrial stage, which is the sifting of petroleum in order to obtain petroleum products of various types, which are included in many petroleum products in advanced industrial stages. (Al-Rawi, 2016, p. 47)<sup>[2]</sup>.



Source: Organization of Arab Petroleum Exporting Countries OAPEC, "The Oil Refining Industry in the World," Kuwait, October 2019, p. 56.

Fig 2: Distribution of the percentage of refining capacity of oil refineries operating in regions of the world at the end of 2018

The figure above shows that the total refining capacity of oil refineries in the world reached 89.92 million b/d at the end

of 2018. The Asia-Pacific region comes in first place, with a refining capacity of 4.27 million b/d and a percentage of

30% of the total refining capacity in The world, followed by North America with a refining capacity of (62.21) million b/d, a percentage of 23%, then Western Europe, with a refining capacity of (24.14) million b/d, a percentage of 15%.

### Refining operations in the oil industry in Iraq

The magnitude of Iraq's previously discovered oil wealth, when compared to some oil-producing countries, assumes that the oil refining industry is at its highest levels, but reality indicates the opposite of that hypothesis, as it is still very modest compared to some oil-producing countries, which Iraq preceded by decades in discovering oil and doubling the oil reserves. Iraq today relies heavily on the import of oil derivatives at an amount exceeding \$4 billion, which is a very large number, as a country with huge oil reserves purchases oil derivatives with this amount. Therefore, wisdom and building the future necessitate

investing the money from selling oil in building a group of new oil refineries. With modern specifications, without the need to import oil derivatives, and to provide tens of thousands of job opportunities.

Although Iraq has the largest number of oil refineries in the Middle East, with 12 refineries and a refining capacity of (802) thousand barrels per day, most of these refineries rely on direct air distillation products, while the share of conversion operations to produce oil derivatives with standard specifications meets the growing demand. The global markets for these derivatives are the lowest in the Middle East and the world as a whole (Kitan, 2020) <sup>[16]</sup>, as we note that the average percentage of gasoline improvement capacity in Iraq's refineries is still very low, amounting to about 6.55% of the oil refining capacity at the end of 2018, which is lower than the percentage Average world refineries (Samia Kulab, 2018) <sup>[3]</sup>.

**Table 1:** Iraqi refinery activities, February 2018

Average recent consumption (barrels/day)	Nominal capacity (barrels/day)	Governorate	The filter
<b>Liquidation companies in northern Iraq</b>			
40.000	56.000	Kirkuk	Kirkuk
10.000	16.000	Anbar	Modern
4000	20.000	Nineveh	Qayyarah
3000	20.000	Salahaddin	Chinese
<b>Liquidation companies in central Iraq</b>			
120.000	180.000	Baghdad	aldora
30.000	30.000	Double	Smawa
30.000	30.000	Al-Najaf Al-Ashraf	Najaf
10.000	10.000	Diwaniyah	Diwaniyah
<b>Liquidation companies in southern Iraq</b>			
210.000	210.000	Basra	Popularity
30.000	30.000	Dhi Qar	Nasiriyah
30.000	30.000	Maysan	Architecture
<b>Liquidation companies in the Kurdistan region</b>			
15000	110.000	Erbil	all for you
60.000	60.000	Erbil	Nineveh
33.000	40.000	Salmaniya	Bazian
0	20.000	Salmaniya	Dukan
635.000	862.000	Total summation	

*Source:* Al-Bayan Center for Studies and Planning, Iraq, 2018

Table No. 1 shows us that the opening of the Al-Siniya refinery in Salah al-Din Governorate had a nominal capacity of about (20) thousand barrels per day, but it was damaged due to time obsolescence and has not been completely repaired yet. In reference to this, the Minister of Oil, Jabbar Al-Luaibi, said in a statement he issued: When the refinery was reopened: "This refinery will cover the entire needs of the governorate, and will provide the power stations with the energy needed to operate them."

As for the Qayyarah refinery located in Nineveh - 60 kilometers south of Mosul - it returned to work in late September. In the past, this refinery produced (20) thousand barrels per day.

### Refinery capacity in Iraq

According to the ambitious program, which is an Iraqi program that aspires to raise new refineries in the year 2021, the most important of this program are the following: (An ambitious Iraqi program, Asharq Al-Awsat, Al-Arab First Newspaper, 2021 <https://2u.pw/yoYxcbM>).

- Increasing the capacity of Iraqi refineries of gasoline to reduce import rates by up to 50%.

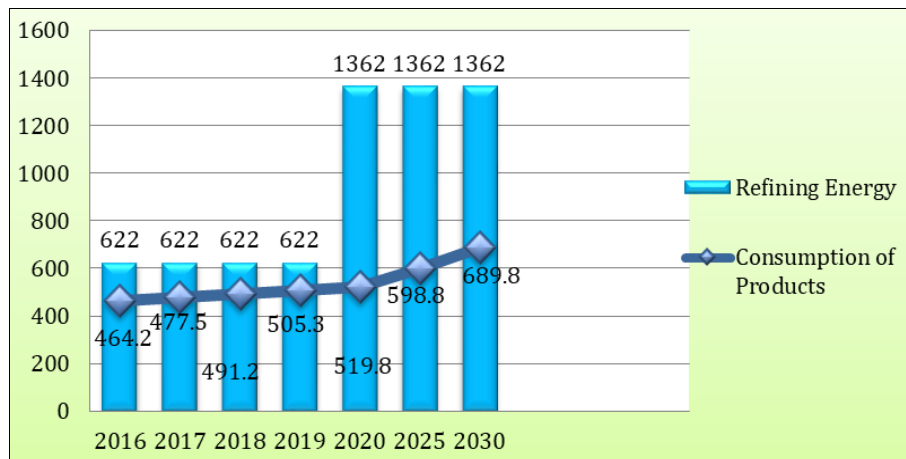
- It aims to reduce the proportion of fuel imports by (50%) before the end of the year 2021 AD and stop it in 2023 after opening a number of important projects in this vital sector.
- Iraq is currently working to attract foreign companies to build several crude oil refineries in various regions of the country, while completion rates have recorded advanced stages of building the Karbala oil refinery with a capacity of (140) thousand barrels per day.
- It was previously expected that his country would stop importing gasoline in 2023, and that its oil production would rise to (7) million barrels per day, starting in 2025, at a time when Iraq is accelerating its steps towards enhancing investments in the oil and energy sector - as its revenues contribute about (90%) of its budget.
- The new refineries being constructed are distributed from Nasiriyah with a capacity of 300 thousand b/d, Maysan with a capacity of 150 thousand b/d, Karbaa with a capacity of 140 thousand b/d and Kirkuk with a capacity of 150 thousand b/d.
- Rumaila field is the third largest producing field in the

world, and its oil reserves are estimated at about (17) billion barrels recoverable.

**Expected development of the refining capacity production of oil refineries until the year 2030**

Figure No. 3 shows the future expectations for the development of Iraqi oil refining capacity and shows the

production of the four new refineries that began construction in the year 2020 and which were estimated on the basis of the average annual growth rate during the period 2000-2016, as the comparison results indicate an expectation of a surplus in the production of some oil products.



**Source:** The development of the oil refining industry in the Arab countries, present and future, Organization of Arab Petroleum Exporting Countries \* OAPEC \*, State of Kuwait, May, 2017, p. 147.

**Fig 3:** Evolution of refining capacity and consumption of petroleum products in the Republic of Iraq during the period 2016-2030” (A B/D)”

The Republic of Iraq is implementing a development project for operating refineries, especially those with high refining capacity, with the aim of improving their operational performance by distributing the energy of naphtha refinement operations and adding other events to enable refineries to stop refineries.

**Oil exploration in Iraq**

The work carried out by the Iraqi Drilling Company and the Oil Exploration Company during the year 2018 regarding

the fields managed by national oil companies and those managed by international oil companies under service contracts. It became clear to us that the most important oil exploration during the year planned and implemented for the year 2024 was with the contract concluded with some international companies, where most of the operating companies recorded a percentage exceeding (136%), which is the largest percentage. Of the Authority for Field Work and Field Seismic Surveys (Annual Report 2018, p. 14). As shown in Table 2.

**Table 2:** Iraqi exploration company data

Percentage % implemented for 2018 to plan	Port	2018	Measuring unit	Exploratory activity
		Scheme		
100%	2024	2024	Geological/Evaluation, Exploration, and Laboratories Authority (total percentages of completion).	
100%	2250	2550	km2	Processing and Interpretations Authority/Information Processing Department: - In three dimensions.
100%	25233	25295	Km-long	Processing and Interpretation Authority/Information Processing Department: - The Two Dimensions.
100%	3243	3243	km2	Processing and Interpretation Authority/Seismic Processing Department: - In three dimensions.
100%	164999	164999	Reflector/interpreter	Processing and Interpretation Authority/Seismic Processing Department: - Two dimensions.
114%	2968.7	2611.4	km2	Field Work Authority/Field seismic surveys: - In three dimensions.
136%	3269.7	2397.4	Km-long	Field Work Authority/Field seismic surveys: - Two dimensions.
101%	1210	1200	Information Technology Authority/Information Bank (volume of information required during the month).	

**Source:** Transparency Authority in Exploration Industries, Republic of Iraq, Annual Report 2018, p. 14

**Profits of oil refineries**

The decline in the profits of the General Company for Iraqi Refineries is linked to two main factors: (Yasin Iraq, 2021) [27].

**The First:** It relates to the quality of petroleum derivatives produced by obsolete Iraqi refineries, most of which date back to the seventies and eighties, and which are characterized by the predominance of black oil in their

products and the poor quality of other petroleum products.

**The second:** It relates to the low level of prices at which refineries sell their petroleum products to the General Company for Petroleum Products Distribution.

Depending on official sources, the composition of a barrel of refined oil (approximately 159 liters) produced in Iraqi oil refineries and the prices of each product sold to the Petroleum Products Distribution Company can be analyzed as follows.

**First:** Black oil or fuel oil = 79.329 litres.  
79.329 liters of black oil multiplied by 60 dinars per liter = 4759 dinars.

**Second:** Car gasoline = 33.506 litres.  
33.506 liters multiplied by 200 dinars per liter = 6701 dinars.

**Third:** White oil = 13.216 litres.  
13.216 liters multiplied by 135 dinars per liter = 1784 dinars.

**Fourth:** Gas oil (gas oil) = 27.533 litres.  
27.533 liters at 175 dinars per liter = 4818 dinars.

**Fifth:** Liquid gas = 1.372 litres.  
1.372 liters at 42.8020.8 dinars per liter = 58.750 dinars.

**Sixth:** Jet fuel = 0.38 litres.

- 0.38 liters at 175 dinars per liter = 66.526 dinars.
- Total sales of a barrel of refined oil to the Petroleum Products Distribution Company = 18,188 dinars.
- The cost of one barrel = 6,300 dinars, the cost of purchasing a raw barrel + 6,750 dinars, the fees for refining the barrel = 13,050 dinars.
- Profit per barrel for Iraqi refineries 18188 - 13050 = 5138 dinars

## The Fourth Chapter

Transition towards a green economy in the oil sector  
Its mechanism is applied in refining operations.

### Oil refining industry in Iraq

#### First - The environmental impacts of the oil refining industry

The environment is an important element in human life, as it is the space in which a person practices all his productive and service activities and through which he can achieve his various goals, underestimating the various elements of the environment that help achieve those goals (Mira, 2015, p. 73)<sup>[9]</sup>.

There are many oil pollutants, and their quantity and impact on the environment and human health vary depending on the quantities of oil extracted and the means used in the treatment and refining processes. One of the most important Types of oil pollutants and their impact on the environment  
Gaseous pollutants.

These are the gases emitted from crude oil refining plants and the burning of fuel inside furnaces as a result of treatment operations, electric power generation, and contaminated water treatment units. They are divided into.

**Sulfur dioxide (SO<sub>2</sub>):** It is a gas produced by the

combustion of fuels such as coal and petroleum products.

- Hydrogen sulfide (H<sub>2</sub>S), which is one of the most dangerous elements of air pollution and is produced by the oil refining industry and the processes of extracting crude oil from wells. These gases cause deaths when their presence in the air is exceeded.
- Carbon monoxide and dioxide (CO) (CO<sub>2</sub>) occurs when the fuel is completely burned and as a result of the presence of gases in the air in large quantities, which affects environmental aspects.
- Hydrocarbons, which are organic compounds that contain carbon, hydrogen, and acetylene, and are considered harmful elements at high temperatures, in addition to the element particles and lead as a result of the mixture of gases or the manufacture of gasoline, which increases the combustion process in lead metal.

Solid pollutants are the waste produced by oil factories after the refining operations of the oil industry.

Liquid pollutants, which are pollutants resulting from the leakage of oil and its derivatives from pipes, pumps, or from contaminated water treatment units (Boualem: 2022, pp. 105, 106, 107)<sup>[11]</sup>.

Pollution resulting from the oil industry, whether it is the extractive, refining, or natural gas industry, constitutes the most prominent pollutants of the living environment and the most capable of causing disruption to the environmental system and the transition to the urban economy and its components. Thanks to the severe damage caused by the development operations of oil projects to the local population.

The oil fields in Iraq require treating pollutants resulting from extractive and exploratory operations by adopting modern techniques in treating oil pollution.

Second - Techniques for reducing oil refinery emissions: (Makki: 2018, p. 57)<sup>[12]</sup>.

#### Implications of reducing oil refinery emissions

The repercussions of implementing environmental legislation are not limited to improving the quality of atmospheric air in the environment, in a way that is compatible with human health and preserving the environment, but it also affects the profitability of the refining industry, as a result of the burdens that result in the costs necessary to take possible measures to comply with the requirements of environmental legislation. This is done through: Green economy skills in applying oil refining operations in Iraq and preserving pollution.

#### The implications of reducing oil refinery emissions on human health

Any reduction in the amount of oil refinery emissions into the air contributes to reducing the rates of disease resulting from the inhalation of gases that are harmful to human health, especially for people living in the vicinity of the refinery site. (Makki: 2018, p. 59)<sup>[12]</sup>.

#### The effects of reducing emissions from oil refineries on the environment

The role of oil refinery emissions in the formation of acid rain, with unpleasant odors that cause disturbance to residential communities adjacent to the refinery, especially in cases of high emissions into the atmospheric air when wind speeds are low. Which affects the environment.

### The implications of reducing emissions on the profitability of the refining industry

Despite the financial burdens that the refinery bears as a result of implementing emission reduction program procedures, it contributes to improving profitability by recovering hydrocarbon gases and benefiting from them by releasing them into the atmosphere or burning them, in addition to the moral value that the refinery gains to the public and neighboring residential communities. The latter is a result of its commitment to meet the requirements of environmental protection legislation from pollution.

These technologies ensure the reduction of emissions resulting from oil refining in the refinery, the preservation

of environmental pollution, the treatment of environmental problems resulting from the oil and gas activity of existing facilities, the reduction of CO<sub>2</sub> emissions, and the commitment to international standards in the fields of health, safety and environment (HSE) through internationally approved systems, including the use of technologies. It is environmentally friendly and works to increase environmental awareness, build an information base on the effects of oil pollutants, and build an integrated system for environmental monitoring and follow-up of this activity and address all environmental effects that have not been addressed yet.

As shown in the following table.

**Table 3:** Performance Indicators

Target value	Initial value	Measurement indicator	The goal
6.5	4.164	Million barrels/day	Crude oil production
5.25	3.302	Million barrels/day	Export capacities
80.4	24.7	million barrels	Storage capacities for crude oil
3500	2828.22	Maqmaq / day	Natural gas production (free + associated)
900	423	A thousand barrels	Increasing refining capacities
650	160	Disgusted	Ensuring a long-term supply of free gas.
2267	1942	Cubic meters	Enhancing the treasury's capacity for oil derivatives
25%	0	Percentage	Percentage of the private sector's contribution to investment in the refinery sector

**Source:** Ministry of Planning, "National Development Plan 2018-2022," Republic of Iraq, June 2018, p. 151.

It is clear from Table (3) that the gases emitted from electric power production stations are carbon monoxide and carbon dioxide, while oil refining stations emit, in addition to these two gases, ammonia and other gases sometimes, when a malfunction occurs in the stations, which have bad effects. On human health.

The increase in the amount of gases emitted is related to the increase in the height of the tower and the quality of the "filter" used. The oil refinery stations are far from the capital, Baghdad, but their expansion made them close to the city center.

### The green economy and its application in oil refining operations in Iraq

There are several means and ways to improve the reality of the oil refining operations sector in Iraq to implement the green economy, including.

- Implementing several projects to establish large refineries (such as the Nasiriyah Investment Refinery), represented by conversion refineries, and focusing efforts on implementing programs to improve performance and profitability by increasing the capacity of conversion processes, which consist of processes of improving high-octane gasoline and hydrogen treatment that enable them to meet the requirements of environmental standards. Concerning specifications for petroleum derivatives.
- Raising the capacity of heavy waste crushing operations, which enables refineries to transform heavy picks into light, high-quality products, and thus adjusting the production structure in accordance with the structure of demand for petroleum derivatives.
- Exporting products to markets requires strict specifications, through the implementation of programs to rationalize energy consumption, and the use of technologies that enable them to produce clean fuel, and reduce the release of pollutants into the environment.

- On the need for the Ministry of Oil to move the Doura refinery outside the borders of the capital, Baghdad, to preserve the environment as it is a source of pollution.
- Rehabilitation of old refineries, or those that were damaged by military operations, which led to them being out of work in 2014.
- Diversifying the economy, that is, we must work to neutralize the negative effects of the oil sector on the economy and even employ it in a way that feeds other economic sectors, especially the refining sector, so that it can play a major role in light of the decline in crude oil prices.
- The thermal cycle power station is considered one of the most polluted stations, compared to the Dora refinery and the south Baghdad station, according to Fattah, who explained that emissions from these stations greatly affect the diameter of a circle of (5000) meters within the center of the station, as it leads to polluting gases in this station. The area is outside the permitted limits of the World Health Organization and the Ministry of Health and Environment.
- Supporting scientific research activities and enhancing cooperation between oil research institutes in the world in the field of developing the performance of the oil refining industry, and selecting advanced technologies that help oil refineries improve their ability to comply with the requirements of environmental legislation.

The success of the green economy initiative in Iraq requires building a production base that relies on renewable energy sources as a solution to reducing pollution levels, working to support environmentally friendly projects, reducing dependence on fossil fuels in industry, increasing green spaces, and good water management to preserve the environment (Al-Janabi: 2023) <sup>[13]</sup>.

**The challenges facing Iraq for the green economy transition:** There are a number of challenges that hinder the



implementation of the transition to the green economy for oil refining operations in Iraq, the most important of which are political and economic concerns, represented by the failure to provide the necessary funding in the oil sector, which are represented by the following: (The International Labor Organization: How to work in the green economy in Iraq: A guide for young people and job seekers and who will support them in 2023 (First Edition, p. 13) <sup>[19]</sup>.

1. Lack of diversification of the economic base and requires diversification of the Iraqi economy towards a diversified social market economy that generates decent job opportunities and provides a high level of prosperity with joint management between the private and buyer sectors.
2. Water scarcity and pollution. This problem has been around since the seventies of the last century as a result of industrial development, as many of the existing industries at that time lacked the conditions for environmental pollution in terms of their locations and methods of discharging their waste. However, at the present time, they are characterized by many pollutants of organic water and health violations related to hospitals and wastewater.

**Environmental pollution:** The high percentage of pollution in the air is a phenomenon that threatens the achievement of a sustainable green economy in Iraq, resulting from several problems, the most important of which are business crises and increased desertification due to decreased rainfall and the lack of use of modern technology in the extraction process, which has caused air pollution to increase significantly.

1. Issues of desertification, reduced water availability, and radiation resulting from the conditions that Iraq has experienced during the past years.
2. The lack of legislation and laws that support the transition to a green economy in Iraq, the absence of national policies and plans, and the weakness of the accountability system.
3. The absence of long-term planning, institutional and community awareness, and not making environmental issues a national priority.
4. The skills gap is one of the important reasons that could hinder the growth processes of the green economy in Iraq if it is worked on quickly and in line with the transformation processes.

## Conclusions and Recommendations

### First - Conclusion

1. Applying the green economy in oil refining operations protects people from environmental risks resulting from industries that cause environmental pollution.
2. The oil refining sector is one of the most important pillars of the Iraqi economy, which is carried out through the production and provision of all types of fuel to all economic sectors.
3. The oil refining sector provides large financial returns that support the Iraqi economy by increasing production, which contributes directly to covering the requirements of the economy.
4. The green economy works to reshape and correct economic activities that are considered more supportive of the environment and humans.
5. The green economy contributes to the search for the

best means and techniques to reduce the percentage of pollutants in the oil refining industry in the environment and treat them at the lowest costs.

6. Transitioning to a green economy means relying on green sectors that do not harm the environment and developing clean environmental innovations.
7. Improving environmental performance, reducing health risks to the maximum possible extent, and treating waste in an environmentally sound manner.

### Second - Recommendations

1. Intensifying capacity-building programs in the public and private sectors in the field of the green economy, with an emphasis on the role of United Nations organizations and non-governmental organizations.
2. The green economy is not limited to industrial policies or low-carbon activities, but rather it must cover a wide range of policies that include the productive and environmental sectors in Iraq, including the regulations and reforms required for the transition to the green economy.
3. Encouraging the Iraqi government to adapt green economy concepts and create an investment climate to attract projects and technologies.
4. Efforts must be made to restore full compliance with the Transparency Initiative in the field of petroleum refining and extractive operations.
5. The necessity of developing Iraqi refineries in order to be able to produce high-quality oil derivatives capable of meeting the needs of internal demand and then exporting the surplus abroad on the one hand and consistent with the environmental requirements associated with protecting the environment from pollution on the other hand.
6. Arranging priorities in the process of preparing national programs to reduce emissions according to their size and their impact on citizens' health and environmental safety.
7. Strengthening national capabilities to enable them to develop policies and programs to stimulate and develop green productive sectors through developing and preparing relevant policies and programmes, and enhancing and facilitating access to information and expertise related to green production options.
8. Continuing current refinery projects in order to increase the rate of conversion and treatment operations, on condition in accordance with the Environmental Protection Law.

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