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RESEARCH ARTICLE

Feasibility of the Naphtha Hydrogenation and Gasoline Improvement Unit Project

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ABSTRACT

The research aims to address an economically viable project for the investor at its minimum level, and it can achieve higher feasibility if the production capacity is doubled. The project has high economic feasibility for the Iraqi government, as it reduces financial waste resulting from purchasing improved gasoline from the Iraqi market. Additionally, after comparing several scenarios and conducting a comparative analysis with the government's losses due to importing improved gasoline, and the second scenario of establishing a naphtha hydrogenation unit and improving gasoline, it is clear that the second scenario is more likely. However, it must be conditional on greater government support for the private sector. The most important recommendations included the necessity for the Iraqi government to pay attention to such a project as it reduces financial waste, by granting multiple licenses to enhance the reality of the oil industries, giving greater opportunities to investors, and easing restrictions on them, especially regarding the duration of the investment license and increasing the profit margin to achieve economic feasibility. Additionally, drafting a memorandum of understanding between the companies applying for investment and the Iraqi Ministry of Oil that allows the investor greater freedom than before in bringing in technology and increasing the production of improved gasoline.

INTRODUCTION

Problem statement

Research problem is related to the amount of financial waste achieved by the Iraqi government's import of improved gasoline and its resale at subsidized prices to citizens. From this logic, the problem of the study revolves around two aspects:

A productivity problem: The production system in Iraq related to the manufacture of gasoline and its derivatives in economic units is based on the old traditional systems, as the economic value is not determined through them, but most of the machines and equipment used in the production of gasoline and its derivatives have become dilapidated and have not kept pace with production developments, so there is There is a severe need and shortage of investment in the gasoline improvement sector, in terms of the number of investors and the annual production quantities of improved gasoline.

Financial problem: The Iraqi government imports improved gasoline at international prices, in exchange for bartering with crude oil, and with a large financial difference between the two prices, in addition to the Iraqi government reselling improved gasoline at subsidized prices to consumers in Iraq, which constitutes a large financial burden and waste.

Hypotheses

Granting the Iraqi government an investment license to companies operating in the field of petroleum derivatives is considered economically feasible for the Iraqi government, and achieves economic feasibility for investors in the field of improving gasoline.

Objectives

Research has several objectives, including shedding light on the feasibility of petroleum derivative projects, especially those related to the financial waste incurred by the Iraqi government, such as in gasoline improvement projects, waste gas projects, and others. The other objective is to conduct a comparison between several scenarios and a comparative analysis with the government's losses as a result of importing improved gasoline/scenario. The first (consequences and losses of the Iraqi government importing gasoline from abroad), the second scenario (creating a naphtha hydrogenation and gasoline improvement unit project for the investor Fox Oil Company), analyzing the results for the two scenarios. The comparative analysis is preceded by estimating the investment, operational and sales costs and then extracting the financial ratios for the naphtha improvement unit project. necessary for comparison.

THEORETICAL FRAMEWORK

Concept of continuous improvement in companies

Interest in the concept of continuous improvement began by the General Company for Automotive Production (TOYOTA) since the beginning of the fifties of the last century, and more specifically in the Japanese principle "Kaizen", which means "change for the better" at lower cost and better quality through measuring and analyzing production activities that do not add Value and work to improve it and delete and exclude production activities that do not add value compared to competitors. From this logic, the philosophy of the concept of continuous improvement seeks to develop production process activities related to machines, materials, individuals and production methods on an ongoing basis (Yacoub, 2018: 38). Continuous improvement is defined as Continuous and ongoing striving towards developing performance and improving quality with the aim of maximizing the benefit obtained by the consumer and reducing costs to the extent possible without compromising quality. Thus, continuous improvement aims to reduce costs in the short term, which is consistent with shortening the product's life cycle, with the aim of increasing the facility's market share and achieving a competitive advantage and meeting Customer desires and satisfaction (Saleh, 2014: 70) through the difference between results and future results through the use of tools that would bring about change in the work environment (Stevenson, 2007: 43). On this basis, hidden improvement in companies in the general sense includes the following: (Al-Akhdar, 2018: 89):

Removing damage and impurities in the product: It means distinguishing between necessary and unnecessary things and getting rid of the latter. Its goal is to prevent waste, ensure security and safety, and improve the environment.

Safety and security: means keeping things in a way that is available for use and the goal is to improve efficiency and ensure security and safety.

Review: means finding small defects and fixing them.

Purity: means improving the environment surrounding production facilities to reduce damage and waste, and the goal is to maintain and improve quality.

System: means obeying what is decided and the goal is to standardize activities and procedures.

Importance of continuous improvement

Principles of continuous improvement in industrial and transformational units are based on the policy of reducing production costs, improving and preserving the value and quality of the product, and thus achieving consumer satisfaction, which leads to increasing the profits of the economic unit and continuing its sustainability. This is achieved through the following:

Planning: In this stage, what must be done is planned, meaning setting the goals, specifications, and necessary operations.

Implementation: In this stage, what has been planned is implemented.

Evaluation and examination: In this stage, the results obtained from the process are evaluated and examined by comparing them with the goals and specifications.

Improvement: In this stage, based on the evaluation results, improvements and modifications are made to the process or product, and we return to the first stage, and so on.

Principles of continuous improvement

The continuous improvement system is based on a policy of reducing costs and improving value through the manufacturing process by introducing improvements to the production process gradually and continuously to reduce costs that are difficult to introduce significant improvements in production as well as to ensure fulfillment of customer requirements Yes in terms of prices and quality, through the following (Drury, 2008: 334):

Reducing resources used: Operations that use more resources than planned are considered wasteful. For example, reports distributed to individuals who will not use them result in wasted copies and wasted time in distribution and reading.

Meeting or exceeding consumer expectations: By meeting or exceeding consumer expectations, operations can be improved.

Making operations safer: A safer workplace is more productive and efficient, as it experiences fewer accidents and requires less compensation and fewer demands from employees.

Increasing satisfaction of those involved in operations: Achieving satisfaction among those involved in operations is crucial, even though it can be challenging to determine who is a satisfied and happy worker. Numerous studies have shown that a happy, satisfied worker is more productive and has a more positive attitude towards work.

Stages of applying continuous improvement methods

The stages of applying continuous improvement methods can be detailed as follows: (Abdul Rahman & Ahmed, 2013: 234)

Developing a process map to identify each activity.

Determining the cost of each activity.

Identifying lost opportunities for improvement through (reengineering processes to identify the needs of non-value-adding activities and continuously improving the performance of value-adding ones).

Establishing the priorities required for making improvements.

Presenting action plans for process reengineering.

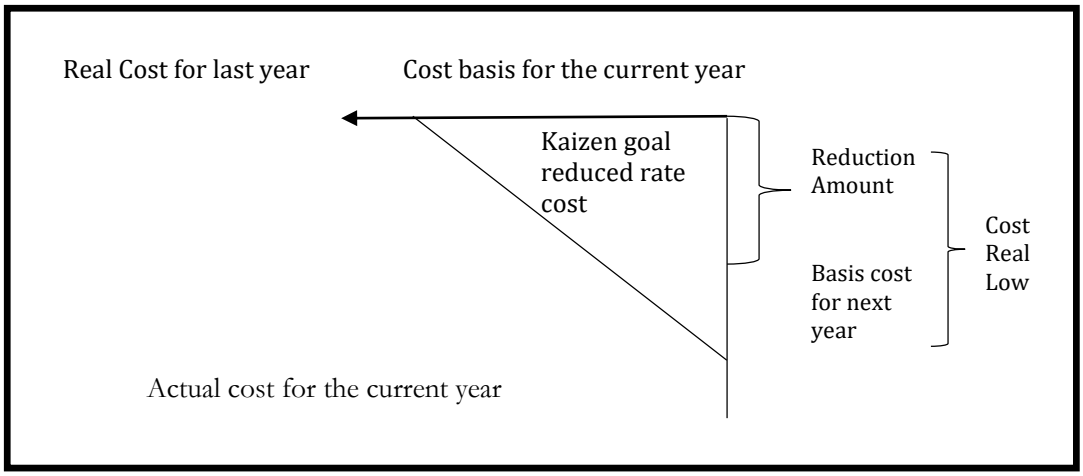
Identifying what can be eliminated to reduce activity costs.

Implementing the required changes.

Comparing the achieved benefits with the manufacturing costs.

The stages of implementing continuous improvement steps can be represented as follows:

Figure 1: Stages of applying the continuous improvement method



Source (Hilton, 2005:235)

While this technology primarily focuses on production processes and cost reduction, which translates into increased productivity efficiency, it takes various forms, including increased training of workers and encouraging them to identify variables that could contribute to cost reduction and quality improvement

The importance of improving the quality of gasoline

Improving the quality of gasoline is of great significance environmentally and economically. Let's take a look at some important aspects:

Environment and health: Improving the quality of gasoline reduces emissions of environmental pollutants, thereby improving air quality and reducing the public health impacts associated with air pollution. This contributes to environmental preservation and helps mitigate climate change.

Economy: Enhancing the quality of gasoline increases fuel efficiency for vehicles, reducing fuel costs for consumers and businesses. It also promotes reliance on local fuel sources and reduces dependence on imports, which can enhance economic stability and security.

Industrial development: Improving the quality of gasoline supports the petrochemical sector and industries related to oil, contributing to infrastructure development and job creation. It's worth noting that enhancing the quality of gasoline represents a sustainable investment for the future, combining both environmental and economic benefits.[1]

Improving the quality of gasoline also provides many benefits, including reducing financial waste, through:

Fuel efficiency: When gasoline is of high quality, it burns more efficiently in car engines. This means vehicles consume less fuel to achieve the same performance. Result: Financial savings for consumers and businesses.

[1] Adjusting gasoline prices in the Kingdom of Saudi Arabia, General Authority for Statistics, 2021.

Vehicle maintenance: High-quality gasoline reduces the buildup of deposits in car engines, leading to decreased wear and tear, thus saving on maintenance costs.

Sustainability: Improving gasoline contributes to environmental preservation and conservation of natural resources. It reduces pollutant emissions and protects the environment for future generations.

Feasibility study

Feasibility study is one of the scientific methods aimed at estimating the success opportunities of an investment idea before its implementation. This includes studying the feasibility of the hydrocracker unit and improving

General project description

The project involves the Hydrocracking Unit and Gasoline Improvement, operating solely on a trial basis. It will obtain 6,500 barrels of naphtha per day from the Iraqi government, based on refining, where each barrel is sold to the Iraqi government at a price of $20. The total project area is 35 dunums, with 335 productive workdays per year and the remaining days allocated for holidays and maintenance. Production operates 24 hours a day. The project serves a large segment of society and covers a vast geographical area. It will be implemented using the latest design technologies by globally renowned companies known for their good reputation, adhering to the latest international design and execution standards practiced to produce high-quality gasoline to supply the Iraqi local market.

Project objectives

The effective contribution to supporting the oil industries and their derivatives sector aims to achieve overall development, becoming a significant source and creating distinctive job opportunities within society. It also aims to provide consumers with the best services and products.

Among the objectives is contributing to supporting the current investment environment in Iraq following the qualitative leap achieved in terms of security. Additionally, it aims to increase the exchange of expertise with countries equipped with refineries and to introduce unique technologies in Iraq, which will have economic returns for the city and the investor.

One of the investor's priorities will be to establish a well-organized refinery entity in Iraq and to produce and deliver products of excellent quality and specifications. This includes providing gasoline to the Iraqi market, which is currently underserved.

Environmental Impact of the Project

The environmental impact assessment process for the Hydrocracking Unit and Gasoline Improvement project is subject to the nature of the activity, which inevitably involves environmental pollution. However, the operational cost allocation will include a specific item for periodic environmental impact mitigation, as determined by specialized engineers. Generally, the costs of environmental impact mitigation for the project are acceptable and accounted for within the initial estimates of operational costs. They will undoubtedly adhere to international standards and Iraqi Republic standards, and are subject to global environmental specifications such as ISO 15000 and ISO 9009.

Table 1: Summary of the feasibility study

Fixed Capital		108,490,125
Working Capital		11,966,208
Investment Costs		120,456,333
Fixed Costs		35,200
Variable Costs		35,863,425
Operational Costs		35,898,625
Sales		43,550,000
Average net profits		8,804,361
Opportunity Cost	0.04	4,818,253
Depreciation		0
Financial Indicators		
Return on Investment	%	0.07
Payback Period	Year	13.68
Operational Cost Coverage Rate	Once	1.21
Interest Coverage Ratio	Once	54
Breakeven	%	0.5
Liquidity Ratio	More then 1	0.00
Turnover Ratio	More then 1	3.34
Asset Turnover Rate	More then 1	0.40
Working Capital Turnover Rate	More then 1	3.64

Source: Prepared by Researchers

Table 2: Estimation of fixed capital

Description	**Total Amount**
Establishment Expenses	176,000
Land	503,125
Buildings, Facilities and Services	3,100,000
Other Service Facilities	1,957,250
Cars and Diesel Engines	2,258,000
Office Furniture and Equipment	325,000
Basic Machines and Equipment	100,000,000
Secondary Equipment and Supplies	170,750
Total Fixed Capital	**108,490,125**

Source: Prepared by Researchers

Table 3: Estimating working capital for an operating cycle

Cash	**Amount**	
Bank Deposits	10,325	
Cash in Hand	1,173	
		11,499
Inventory	**Amount**	
Raw Materials and Raw Materials	11,954,475	
Fuel and Spare Parts Activity	235	
		11,954,710
Total Working Capital		**11,966,208**
Total Investment Costs		

Source: Prepared by Researchers

Table 4: Summary of Production Costs

Summary of Production Costs (Monthly/Barrel)			
No.	**Material**	**Monthly Cost ($)**	**Cost – Barrel ($)**
1	Diesel for Generators	331,370	1.7
2	Castalyst	104,166	0.53
3	Chemical Materials	3,301	0.02
4	Lubricants	1,706	0.01
5	Water	11,520	0.06
6	Spare Parts	11,800	0.06
7	Depreciation	375,000	1.92
8	Various Consumables	15,000	0.08
9	Operation & Maintenance team Salaries	300,000	1.54
10	Meals	112,500	0.58
11	Staff Housing Cost	243,000	1.25
12	Loan Interest	806,666	4.14
13	Loan Insurance	201,666	1.03
14	Cash transaction Expenses	50,416	0.26
15	Refinery Insurance	201,666	1.03
16	Electricity	41,756	0.21
17	Transportation Cost	304,054	1.56

18	Product lost During Transportation	74,000	0.38
19	Government Taxes	21,312	0.11
		3,210,899	**16.47**

The two tables (5-6) illustrate the income statement and cash flows, outlining the project's net profit for the next five years, considering an annual sales growth rate of (5%) annually, which relies on market research and estimation of market share. Additionally, the cash flow statement is one of the most important financial statements that assist users in understanding the financial position of the enterprise. The importance of cash flows lies in demonstrating the cash impact of all activities undertaken by the company during the financial period, along with stating the nature of this impact as either a cash inflow or outflow for the project.

Table 5: Preparing the Income Statement for the Project

	First Year	**Second Year**	**Third Year**	**Fourth Year**	**Fifth Year**
Growth Rate %	**1.00**	**1.05**	**1.10**	**1.15**	**1.20**
Sales	43,550,000	45,727,500	47,905,000	50,082,500	52,260,000
Sales Returns	0	0	0	0	0
Net Sales	43,550,000	45,727,500	47,905,000	50,082,500	52,260,000
Cost of Sales	35,863,425	37,656,596	39,449,768	41,242,939	43,036,110
Total Operating Income	7,686,575	8,070,904	8,455,233	8,839,561	9,223,890
Operating Expenses	35,200	35,200	35,200	35,200	35,200
Net Operating Income	7,651,375	8,035,704	8,420,033	8,804,361	9,188,690
All Other Revenues	0	0	0	0	0
Net Income before Tax	7,651,375	8,035,704	8,420,033	8,804,361	9,188,690
Tax	0	0	0	0	0

Source: Prepared by Researchers

Table 6: Preparing the project's cash flow schedule

	First Year	Second Year	Third Year	Fourth Year	Fifth Year
Sales	43,550,000	45,727,500	47,905,000	50,082,500	52,260,000
Cost of Sales	35,863,425	37,656,596	39,449,768	41,242,939	43,036,110
Total Operating Income	7,686,575	8,070,904	8,455,233	8,839,561	9,223,890
Depreciation	0	0	0	0	0
Earnings before Interest and Taxes	7,686,575	8,070,904	8,455,233	8,839,561	9,223,890
Benefits	800,000	800,000	800,000	800,000	800,000
Taxable Profit	6,886,575	7,270,904	7,655,233	8,039,561	8,423,890
Tax	0	0	0	0	0
Profit after Tax	6,886,575	7,270,904	7,655,233	8,039,561	8,423,890
صافي التدفق النقدي	**7,686,575**	**8,070,904**	**8,455,233**	**8,839,561**	**9,223,890**

Source: Prepared by Researchers

Table 7: Sensitivity Analysis of the Project

		Decrease	Increase	Revenues	Operational Costs	Change
First situation		0.9		39,195,000	35,898,625	3,296,375
Second situation			1.1	43,550,000	39,488,488	4,061,513
Current revenues and costs				**43,550,000**	**35,898,625**	**7,651,375**
The project is insensitive to changes in revenues with fixed operating costs.						
The project is insensitive to changes in operating costs with fixed revenues.						

Source: Prepared by Researchers

Table 8: Financial indicators of the project

Return on Investment				**0.07**	**%**
The project's profitability is measured by the total investments					
Payback Period				**13.68**	**Year**
The number of years needed to cover the amount in the project when the annual net flow is constant					
Operational Cost Coverage Rate				**1.21**	**Once**
Using revenues to cover operating costs					
Interest Coverage Rate				**54**	**Once**
Using project revenues to cover interest costs					
Breakeven				**0.5**	**%**
The point at which a project's sales revenue equals its total production costs					
Liquidity Ratio				**0.00**	**More then 1**
Measuring the rapid ability to pay obligations					
Turnover Ratio				**3.34**	**More then 1**
How much assets cover liabilities					
Asset Turnover Ratio				**0.40**	**More then 1**
The project's ability to exploit available resources					
Working Capital Turnover Rate				**3.64**	**More then 1**
Management efficiency in using working capital					

Source: Prepared by Researchers

Table 9: Comparative analysis with government losses as a result of importing improved gasoline/first scenario

First Scenario		**Consequences and losses of the Iraqi government's import of gasoline from abroad**			
The price discount currently granted by the marketing company for contracts to export naphtha from Matrouh North Refineries is $/Ton					**44**

Purchasing improved gasoline from abroad at a price premium of $20/Metric Ton		**20**
Sea and land transportation fees, plus the importing company's profit margin/Dollar per Metric Ton		**110**
Average price difference between naphtha and improved gasoline in the global bulletin / dollar per metric ton during the past nine months for the year 2022		**250**
Total price difference in gasoline import and naphtha export activity/$ per Metric Ton		**424**
The approved production capacity for comparison is FOX naphtha hydrogenation unit project capacity/Metric Ton		**740**
Total daily losses for Iraq as a result of practicing the first scenario / Dollar per Metric Ton		**313,760**
Total annual Iraqi losses as a result of practicing the first scenario / Dollar per Quantity (740 Tons)		**105,109,600**

Source: Prepared by Researchers

Table 10: Comparative analysis with government losses as a result of importing improved gasoline/second scenario

Second Scenario		Establishing a Naphtha Hydrogenation and Gasoline Improvement Unit Project for Fox Company
Activating the Naphtha Refining fees contract with Fox Company		
Net daily production of Fox's naphtha hydrogenation and gasoline improvement unit/Barrel		**6,500**
Liquidation fees paid by the state to the investing company for each barrel/Dollar per Barrel		20
The total liquidation fees paid by the state to the investing company per day / Dollar		130,000
The amount of 6,500 barrels of naphtha per day is equivalent to metric tons		**740**
The amount of losses amounts to 11% of the daily production of 740 metric tons		**81.4**
The average price of naphtha for the ninth month is $580 per metric ton, minus $44		**536.0**
The value of the losses amounted to 81.4 metric tons at a price of $536 per metric ton		**43,630.4**
The value of losses is 11% per metric ton at $536		58.96
The daily quantity supplied to the Ministry of Oil of improved gasoline is the result of a subtraction of 740 metric tons with 6% LPG of naphtha, minus losses of 81.4 metric tons.		**658.6**

The Iraqi government's loss in the second scenario results from dividing the liquidation fees paid by the state to the investor: $130,000 divided by 658.6 metric tons.		197.4
Total loss is the sum of paragraph (A) and paragraph (B)		**256.3**
Iraq's total daily savings as a result of practicing the second scenario / $		**124,062**
Iraq's total annual savings as a result of practicing the second scenario / $		**41,560,832**

Source: Prepared by Researchers

Table 11: Analysis of results for the two scenarios

Analyze the Results					
The optimal scenario presented to the Ministry of Oil for its implementation					**Second Scenario**
Supporting standards					
Providing job opportunities for youth and eliminating unemployment is achieved through:					**Second Scenario**
Improving the country's balance of payments is achieved by:					**Second Scenario**
Good job opportunities for the local transportation sector are achieved in:					**Second Scenario**
High cash savings for the Iraqi government and rationalization of financial waste achieved in:					**Second Scenario**
High effectiveness in eliminating bottlenecks and crises in the fuel sector in Iraq					**Second Scenario**
Reducing the need for hard currency is achieved by:					**Second Scenario**
Raising the scale and degree of settlement and the level of attraction and industrial interconnection in the governorate has been achieved in:					**Second Scenario**
Strengthening the internal economy, supporting the economy, and increasing oil infrastructure					**Second Scenario**
Developing local skills and expertise in the oil sector and its derivatives					**Second Scenario**
High potential to satisfy the basic needs of society, specifically improved gasoline					**Second Scenario**
Number of sectors benefiting directly and indirectly					**Second Scenario**

Source: Prepared by Researchers

Table 12: The Total added value achieved as a result of paying interest and fees, plus amortizations, salaries and wages.

The Total added value achieved as a result of paying interest and fees, plus depreciations, salaries and wages.		**Second Scenario**
Per capita rate and human development indicators		**Very Good**
The direct and indirect benefits of the project		**Very Good**
Raising the level of income and living conditions		**Very Good**
Increase the level of technical skills and training		**Excellent**
Raising the social level and developing living conditions		**Excellent**
The criterion of balancing expenditure on the project with the benefits achieved		**Excellent**
Developing technical knowledge and increasing the experience curve		**Excellent**
Support and support the current facilities of the institution		**Excellent**
Availability of infrastructure in the project area, represented by water, electricity, and sewage networks		**Very Good**

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The project's payback period was approximately thirteen and a half years. The project's ability to meet its short-term obligations was about 3.34 times what is required. The project's ability to utilize available resources was around 40% of what is required. The project management demonstrated high efficiency in using working capital, estimated at about 3.648 times more than required.

The revenue utilization standard for covering operational costs resulted in a good figure, estimated at approximately 121% of what is required. The project's profitability relative to total investments was around 7%, and this percentage is after deducting all liabilities, including the interest rate on the loan. The project is not sensitive to cost increases and revenue decreases. Overall, most of the project's standards and indicators are positive and achieve non-quantitative feasibility, represented by achieving social and environmental benefits through providing opportunities and supporting the oil derivatives sector.

Based on the economic feasibility study and quantitative analysis of the data, it is evident that the project is economically feasible for the investor, but within its minimum limits. It could achieve higher feasibility if production capacity is doubled. The project has high economic feasibility for the Iraqi government as it reduces financial waste resulting from purchasing improved gasoline from Iraqi market.

After comparing several scenarios and conducting a comparative analysis with the government's losses due to importing improved gasoline, and the second scenario of establishing a naphtha hydrogenation and gasoline improvement unit, it is clear that the second scenario is more likely. However, it should be conditional on greater government support for the private sector.

Supporting the oil derivatives sector in Iraq and fully transitioning to continuous fuel quality improvement achieves sustainability and meets environmental improvement standards. This, in turn, supports the reduction of indirect financial waste and decreases challenges for the Iraqi government.

Recommendations

The Iraqi government needs to pay attention to such a project as it reduces financial waste by granting multiple licenses to boost the oil industry.

Giving greater opportunities to investors and easing restrictions on them, especially concerning the duration of the investment license, and increasing the profit margin to achieve economic feasibility.

Preparing a draft memorandum of understanding between the companies applying for investment and the Iraqi Ministry of Oil that allows greater freedom for the investor than before in bringing in technology and increasing the production of improved gasoline.

The market is expansive enough to grant more opportunities and licenses due to the urgent need for improved gasoline and the increasing demand due to the rising number of cars in Iraq.

Supporting the private sector to invest in improving oil derivatives by increasing the quantities of raw materials involved in the production of derivatives to achieve the breakeven point and economic feasibility, and striving to protect investors and ensure their continued activity.

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