THE UNIVERSITY OF LATVIA FACULTY OF BUSINESS, MANAGEMET AND ECONOMICS

(Global Economics Interdisciplinary Studies Department)

Production costs and factors affecting them mostly in Oil and Gas companies in Uzbekistan

Ražošanas izmaksas un faktori, kas tās ietekmē, galvenokārt naftas un gāzes uzņēmumos Uzbekistānā

BACHELOR'S THESIS

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ANNOTATION

In the chain of product price formation, the most important and fundamental role is played by the cost of production, it is a start point where the formation of the product price begins, which goes through further stages in pricing until it falls into the hands of a client or consumer. As such, the importance attached to production costs and factors affecting them cannot be emphasized. Companies use different models for calculating production costs depending on the industry, company size, inputs, and desired outcomes. As the oil and gas industry is highly specialized and rarely correlates with other industries, this study set itself the aim of examining the way of formation of production costs by using the example of one of oil and gas companies. A qualitative research on case study of Ltd. "Shurtan Gas-Chemical Complex" located in the Republic of Uzbekistan was conducted in this thesis. Research results demonstrated that that the main factor affecting the cost of oil and gas products is material costs, which account for more than 50% of all production costs. Also, the study revealed that large oil and gas companies do not use a single model for calculating the cost of production, but a set of approaches that are developed by specialists in this field and then implemented into the software used by the company. As a solution to decrease material costs it was proposed to implement gas turbine unit SOLAR MARS 100.

Keywords: production costs, oil and gas industry, energy industry, Uzbekistan, material costs, strategy, reduction of costs.

ANOTACIJA

Produkta cenu veidošanās ķēdē vissvarīgākā un būtiskākā loma ir ražošanas izmaksām, tas ir sākumpunkts, kur sākas produkta cenas veidošanās, kas cenu noteikšanā iet cauri tālākiem posmiem, līdz nonāk nonācēju rokās. klients vai patērētājs. Kā tādu nevar uzsvērt nozīmi, kāda ir ražošanas izmaksām un faktoriem, kas tās ietekmē. Uzņēmumi ražošanas izmaksu aprēķināšanai izmanto dažādus modeļus atkarībā no nozares, uzņēmuma lieluma, ieguldījumiem un vēlamajiem rezultātiem. Tā kā naftas un gāzes nozare ir ļoti specializēta un reti korelē ar citām nozarēm, šis pētījums izvirzīja mērķi izpētīt ražošanas izmaksu veidošanas veidu, izmantojot vienu no naftas un gāzes uzņēmumiem. Šajā darbā tika veikts kvalitatīvs pētījums par SIA "Shurtan Gas-Chemical Complex", kas atrodas Uzbekistānas Republikā, gadījumu izpēti. Pētījumu rezultāti parādīja, ka galvenais faktors, kas ietekmē naftas un gāzes produktu izmaksas, ir materiālu izmaksas, kas veido vairāk nekā 50% no visām ražošanas izmaksām. Tāpat pētījums atklāja, ka lielās naftas un gāzes kompānijas ražošanas izmaksu aprēķināšanai izmanto nevis vienu modeli, bet gan pieeju kopumu, ko izstrādā šīs jomas speciālisti un pēc tam ievieš uzņēmuma izmantotajā programmatūrā. Kā risinājums materiālu izmaksu samazināšanai tika ierosināts ieviest gāzes turbīnu bloku SOLAR MARS 100.

Atslēgvārdi: ražošanas izmaksas, naftas un gāzes rūpniecība, enerģētika, Uzbekistāna, materiālu izmaksas, stratēģija, izmaksu samazināšana.

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LIST OF ABBREVIATIONS

APR – Asia-Pacific Region

CIS – Commonwealth of Independent States

EU – European Union

GTP – Gas turbine plant

JSC – Joint Stock Company

LNG – Liquefied Natural Gas

LPG – Liquefied Petroleum Gases

MJ – Mega Joule

Mtoe – Million Tons of Oil Equivalent

MW – Mega watt

OECD – The Organisation for Economic Co-operation and Development

OPEC – Organization of the Petroleum Exporting Countries

VAT – Value added tax

INTRODUCTION

The oil refining industry is the most important link in the oil complex, which determines the efficiency of the use of hydrocarbon raw materials. The main goal of any enterprise, and oil refining one is no exception, in market conditions is to maximize profits. The possibility of realizing this goal in all cases is limited by the demand for manufactured products and production costs. The costs of the enterprise are made up of the entire amount of the organization's expenses for the production of products and their sale. These costs, which are expressed in monetary terms, are called cost price and are part of the value of the product. It includes the cost of raw materials, fuel, electricity and other items of labor, as well as depreciation, wages of production personnel and other monetary costs.

Each market enterprise aims to save production costs. To this end, it is necessary to take measures to reduce the cost of production, as it is one of the most important factors for increasing production efficiency, as well as for the growth of savings. Due to the large volume of production and its growth, the importance of the cost indicator is greatly enhanced. Therefore, each enterprise or production unit must know what is the cost of producing products (works, services). Getting the maximum profit at the lowest cost, saving the amount of used materials, labor and financial resources depend on how the company is taking measures to reduce the cost of production.

The search for reserves for reducing the cost should be based on a comprehensive technical and economic analysis of the enterprise, namely, on the study of the technical and organizational level of production, the use of production capacities and fixed assets, raw materials and labor units.

Thus, the cost of production is one of the most important indicators of economic efficiency of company’s production. It reflects all aspects of economic activity and accumulates the results of the use of all production resources. The formation of the cost of products (works, services) is the sum of the enterprise's costs associated with the production process and related to a specific reporting period. The cost price shows all the successes and failures of the enterprise in organizing the production of a particular product.

Research problem of the bachelor thesis is what should be researched and clarified in order to understand how to reduce production costs in sphere of oil and gas in Uzbekistan. Hypothesis: the structure of the costs must be researched on the example of one of the national oil and gas companies in Uzbekistan in order to understand which factors affect production costs mostly and consequently how these factors can be reduced.

The relevance of the chosen topic is explained by the fact that in the context of the country's transition to market economy from planned economy, reducing the cost of production is the most important factor in the development of the country's and enterprise's economic strategy.

The aim of this thesis is to analyze factors that mostly affect production costs in companies of oil and gas in Uzbekistan and introduce the way to reduce them.

Achieving this goal involves performing the following **tasks:**

1. to give theoretical aspects of the concept "production cost";
2. to explore calculation methods of production costs;
3. to research trends in sphere of oil and gas globally;
4. to examine challenges facing oil and gas industry today worldwide and in Uzbekistan;
5. to analyze the structure of costs of the enterprise Ltd. "Shurtan Gas-Chemical Complex" as an example of oil and gas company located in Uzbekistan;
6. to investigate which factors affect mostly to production costs in Ltd. "Shurtan Gas-Chemical Complex";
7. to conduct an interview with expert from Ministry of Energy of the Republic of Uzbekistan and management representative of Ltd. "Shurtan Gas-Chemical Complex";
8. to introduce solution for reduction of production costs on the example of Ltd. "Shurtan Gas-Chemical Complex";

The **methodology** used for research include:

1. Case study;
2. Expert interview with representative from Ministry of Energy of The Republic of Uzbekistan and Management representative from Ltd. "Shurtan Gas-Chemical Complex";

The research started in March 2021 and was finished in May 2021.

The structure of the course work is as follows: the first chapter reveals theoretical basis of production cost, types of production costs, the methods and ways to calculate it, the second chapter examines the global trends and challenges in the field of oil and gas for and also in Uzbekistan, including digitalization of the industry, ecologic problems and influence of COVID-19 to the industry, the third chapter presents the results of the interviews and analyzes structure of production costs and factors affecting them at the Ltd. "Shurtan Gas Chemical Complex" as an example of oil and gas company located in Uzbekistan, and after conclusion

the recommendations will come for reduction of production costs at oil and gas companies at the territory of the Republic of Uzbekistan.

CHAPTER 1. THEORETICAL FOUNDATIONS OF THE CONCEPT OF PRODUCTION COSTS

1.1. The concept and essence of the production costs

In the process of economic activity, each enterprise incurs costs (labor, material and financial). The costs of the organization are made up of the entire cost of production and sales of products. These costs, which are expressed in monetary terms, are called costs and are included in the cost of the product. Cost is one of the most significant indicators of business performance. It represents the costs of the firm for production and circulation, serves as the basis for comparing income and expenses, in other words, self-sufficiency. If the cost is not known, then it is almost impossible to determine the profit. And for the formation of the selling price, one cannot do without the cost price.[1] The cost price shows how much it costs an enterprise to produce its products, how much it can earn selling these products, or what "markup" it can make in excess of the cost, that is, it is the basis of pricing. If the cost of goods sold exceeds the cost price, then expanded production takes place. If in the process of sale the products are less than the prime cost, then even simple reproduction is not ensured.[2]

The cost price is the current costs of the enterprise, expressed in value terms, for the production and sale of products (works, services).

Conventionally, the cost of production of an enterprise can be considered from an economic and legal point of view. From an economic point of view, the cost of production is the value of any costs of its production and sale. From a legal point of view, the cost of expenses incurred by an enterprise should be recorded only when permitted by law.[3]

As an economic category, the cost of production performs a number of important functions:

- accounting and control of all costs for the production and sale of products;
- the basis for the formation of the wholesale price for the products of the enterprise and the determination of profit and profitability;
- economic substantiation of the feasibility of investing real investments in the reconstruction, technical re-equipment and expansion of the existing enterprise;

[1] Khan M.Y., Jain P.K. (2008), *Cost accounting and financial management, Third edition*, New Delhi, Tata McGraw-Hill Publishing company limited, 1320 p.;
[2] Ткаченко А.Ю., Скабелина В.В., Кубанцева О.В., (2019), Анализ затрат и себестоимости продукции, *Sciff. Questions of Students Science/Sciff. Voprosy Studencheskoi Nauki*, 40 (2), стр. 33-39;
[3] Barbu C., (2013), The Price Policy of the Strategic Planning of the Enterprise, *Romanian Statistical Review,* pp. 185-19;

- determination of the optimal size of the enterprise;
- economic justification and the adoption of any management decisions, etc.[4]

The cost of production is not only the most important economic category, but also a qualitative indicator, since it characterizes the level of use of all resources (variable and constant capital) that are at the disposal of the organization. The cost price includes the costs associated with:

- directly with production (materials, raw materials, purchased semi-finished products and products, energy and fuel, and so on);
- with maintenance and management of the production process;
- with wages and contributions to the social protection fund, as well as payments for property insurance;
- expenses for the repair of fixed assets;
- with depreciation deductions for the full restoration (renovation) of fixed assets;
- with the costs of selling products.[5]

In theory and practice, depending on the object for which the costs are determined, the following types of cost are distinguished:[6]

Figure 1.1 Types of cost

Source: Сигидов, Ю. И., Бабалыкова, И. А., Баранников, А. А. (2013), Классификация затрат при исчислении себестоимости продукции в управленческом учете, Политематический сетевой электронный научный журнал Кубанского государственного аграрного университета, (91);

The cost of all products, which is understood as the total cost of its production and sale. At the same time, a distinction is made between the full production cost and the full (commercial) production cost.

[4] Shephard R.W., (1970), *Theory of Cost and Production Functions*, New Jersey, Princeton University Press, 306 p.;
[5] Петров А. М., Мельникова Л. А., (2013), Теоретические аспекты учета калькулирования себестоимости продукции, *Экономические науки*, (102), стр.145-148;
6 Сигидов, Ю. И., Бабалыкова, И. А., Баранников, А. А. (2013), Классификация затрат при исчислении себестоимости продукции в управленческом учете, *Политематический сетевой электронный научный журнал Кубанского государственного аграрного университета*, (91), стр. 1312-1322;

a) the total production cost is the total amount of direct and indirect costs of producing goods or services.

b) the total (commercial) cost includes the full production cost, as well as the amount of non-production (commercial) costs.

Individual cost, that is, the cost of a specific unit of production. It is determined exclusively in the case of a one-off production, for example, during the construction of a ship or in the manufacture of unique equipment.

Average cost - this indicator can be calculated for individual enterprises and for industries is determined as a weighted average and characterizes the average cost per unit of production.[7]

Costs are part of the costs of an enterprise associated with the production of products, the performance of work and the provision of services. The composition of production costs is formed by direct costs that are associated with the release of products, in addition, the costs of auxiliary production, indirect costs associated with the management and maintenance of the main production, and losses from marriage. All production costs are ultimately included in the cost of certain types of products.

The main types of costs included in the cost of production:[8]

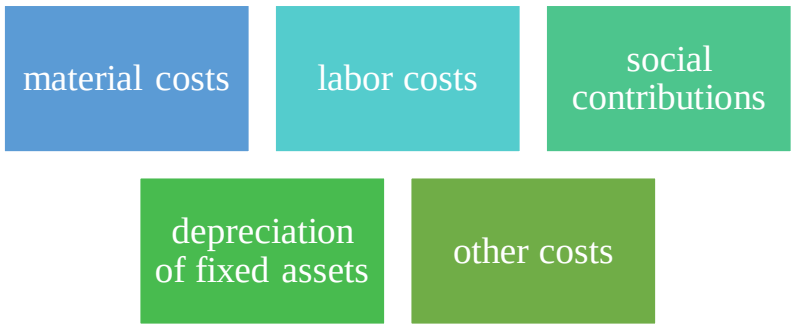


Figure 1.2 The main types of costs included in the cost of production

Source: Weetman P., (2006), Management Accounting, Harlow, Pearson Education Limited, 553 p.;

Their structure is formed under the influence of various factors:

- the nature of the products produced and the consumed material and raw materials;
- technical and economic features of production, forms of its organization and location;

[7] Буянов Е., Груздева Е, Антропов М., (2017), *Основы предпринимательства,* Москва, Проспект, стр. 336;
[8] Weetman P., (2006), *Management Accounting*, Harlow, Pearson Education Limited, 553 p.;

- conditions of supply and sale of products, and so on.[9]

For internal analysis and identification of reserves in order to reduce the cost of production, it is necessary to know not only the total cost of each enterprise for a specific economic element, but also the amount of costs depending on the place of their origin. This capability is provided by the classification of costs by costing items, which can be represented as follows:

1. raw materials and supplies;
2. component parts, semi-finished products and production services purchased from other enterprises;
3. fuel and energy of all kinds for technological purposes;
4. returnable (used in production) waste (deducted from the cost price and accounted for at the price of possible use, which the company determines independently);
5. losses from marriage;
6. wages (basic and additional) of production workers;
7. deductions for social needs (to compulsory insurance funds);
8. the cost of maintaining and operating equipment;
9. general production (shop) costs (overhead costs);
10. general business (general or general plant) costs;
11. non-production (commercial) costs for the sale of products.

As a result of the sequential summation of the listed costing items, the following system of cost indicators is obtained:

- production cost (PC) = 1 + 2 + 3-4 + 5 + 6 + 7;
- workshop cost (WC) = PC + 8 + 9;
- full production or factory cost price (FCP) = WC + 10;
- full (commercial) cost (FC) = FZS + 11. [10]

Thus, the production cost is obtained by summing up the costs of raw materials and materials, components purchased from other enterprises, fuel and energy, recyclable waste, losses from marriage, wages of production workers and deductions for social needs.

[9] Morrison C.J.M., (1999), *Cost Structure and the Measurement of Economic Performance*, Norwell, Kluwe Academic Publishers, 365 p.;
[10] Сергушина, Е. С., Солдатова, Н. Ю. (2016), Учет и анализ затрат и их связь с калькулированием себестоимости продукции промышленного предприятия, *Новая наука: Стратегии и векторы развития*, 2 (1), стр. 151-153.;

The next indicator, the workshop cost, is obtained by summing up the production cost, the cost of maintaining and operating equipment and general production costs.

The total production cost is determined by adding the workshop cost and general operating costs.[11]

As a result, the total (commercial) cost is equal to the sum of all the above costs and non-production (commercial) costs of selling products.

The first three indicators characterize production, and the fourth includes costs that are associated not only with the production of products (as indicated in the name of this indicator), but also with the process of its implementation. These costs are included in selling costs and include: costs of packaging and containers; costs of transportation of products (costs of delivering products to the station or pier of departure, loading on ships, in wagons or cars, etc.); commission fees and deductions that are paid to sales companies and organizations in accordance with contracts; advertising costs, other sales costs (storage and sorting).

General production and general expenses are classified as overheads. General production overhead is the cost of maintaining and managing production. The general production overhead costs include:[12]

Figure 1.3 Composition of general production overhead costs

Source: Assaf S. A., Bubshait A. A., Atiyah S., Al-Shahri, M., (2001), The management of construction company overhead costs, International Journal of Project Management, 19(5), pp. 295-303;

Each of these groups of overhead costs has its own specifics - they are planned and accounted for by their places of origin, that is, by production units, and not by product type. Both of these groups are complex costs, indirectly distributed between specific types of products and between finished products and work in progress.

[11] Tamulevičienė D., Tvaronavičienė M., Mackevičius J., (2020), Methodology of complex analysis for production costs at manufacturing enterprises, *Journal of International Studies*, 13(4), pp. 128-142;
[12] Assaf S. A., Bubshait A. A., Atiyah S., Al-Shahri, M., (2001), The management of construction company overhead costs, *International Journal of Project Management*, 19(5), pp. 295-303;

General overhead costs associated with the function of leadership, management, which are carried out within the enterprise, company, firm as a whole. These expenses include several groups: general business administrative and management, taxes, mandatory payments, deductions and others.

The content and meaning of the remaining articles follow from their title. In addition to item-by-item, costs are classified according to other criteria.

Grouping by costing items, moreover, allows the following division of costs into direct and indirect.[13]

Direct (technological) costs are characterized by a direct relationship with the production process and can be fairly easily distributed between specific types of products.

There are three groups of direct costs (Figure 1.4).

Thus, direct costs are the following items:

- labor costs,
- raw materials and supplies,
- purchased products and semi-finished products,
- losses from marriage,
- fuel and energy for technological purposes.[14]

These costs can be attributed directly to the type of product for the manufacture of which these raw materials, materials, and so on, were spent.

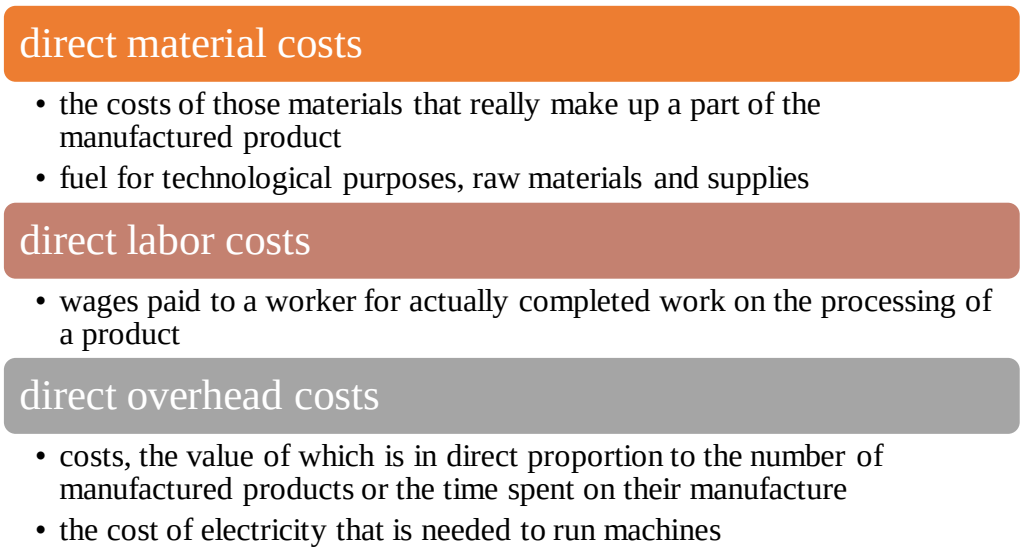


Figure 1.4 - Groups of direct costs

[13] Weetman P., (2006), *Management Accounting*, Harlow, Pearson Education Limited, 553 p.;
[14] Backer M., Jacobsen L.E., (1964), *Cost Accounting, a Managerial Approach*, Michigan, McGraw-Hill, 678 p.;

Source: Backer M., Jacobsen L.E., (1964), Cost Accounting, a Managerial Approach, Michigan, McGraw-Hill, 678 p.;

Indirect costs cannot be directly attributed to the specific type of product or service being produced. The corresponding calculation items are complex. In particular, these are administrative and management expenses, property insurance expenses, and so on.

Indirect costs are also divided into three groups (Figure 1.5).

Thus, indirect costs are general production and general business expenses and expenses for the repair and maintenance of machinery and equipment. As mentioned above, such costs are included in the cost of the product only indirectly, using conditional calculations, for example, in proportion to the remuneration of production workers.[15]

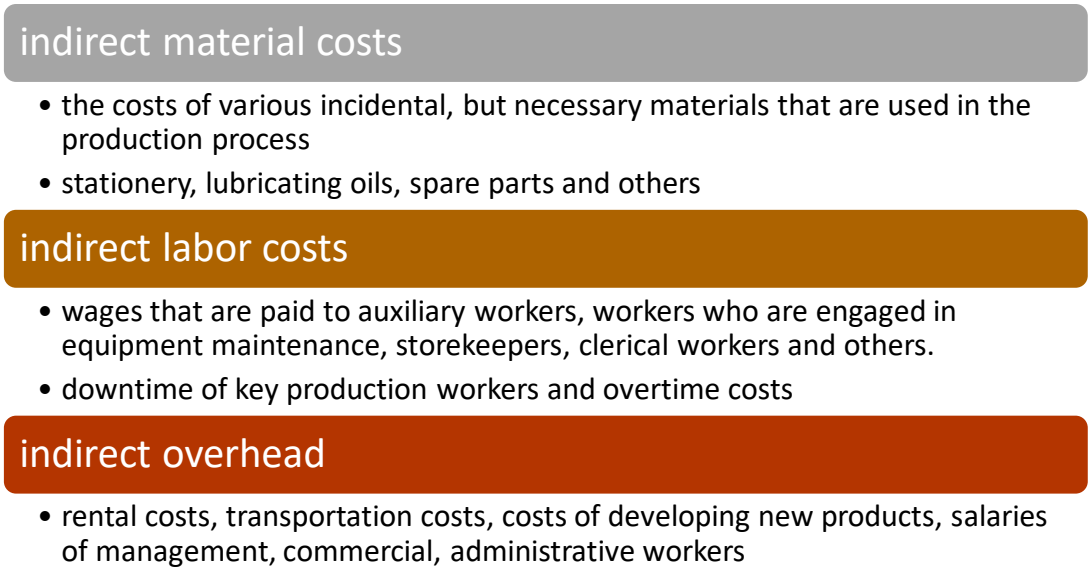


Figure 1.5 - Groups of indirect costs

A source: Backer M., Jacobsen L.E., (1964), Cost Accounting, a Managerial Approach, Michigan, McGraw-Hill, 678 p.;

Such a division into direct and indirect costs occurs in the case of the production of a wide range of goods; in simple production, all costs are considered as direct.

The classification of costs into variables and constants reflects a direct proportional dependence of the volume of output and, accordingly, the cost of its production on the degree of utilization of production capacities.

Variable costs are those costs, the value of which is a derivative of the level of utilization of production facilities. These are, for example, the cost of labor or raw materials and supplies.

[15] Backer M., Jacobsen L.E., (1964), *Cost Accounting, a Managerial Approach*, Michigan, McGraw-Hill, 678 p.;

Costs are considered constant, the size of which is not tied to the volume of production and the level of utilization of production facilities. These include rent of industrial premises, equipment costs, payment of the management staff.[16]

Also, the classification of costs into conditionally fixed and conditionally variable is of great importance for the analysis and management of production costs in an organization in order to reduce them.

Conventionally fixed costs are those costs that do not change at all or change insignificantly depending on the change in the volume of production. These include rent, depreciation of buildings and structures, the cost of managing production and the enterprise as a whole, and others.

Provisionally variable costs are those costs that change in direct proportion to the change in production. These include: the cost of raw materials, materials, components, process fuel and energy, piecework wages of workers and others.[17]

Obtaining the greatest effect with the lowest costs, saving labor, material and financial resources depend on how the company decides to reduce the cost of production.

Reducing the cost of products (works, services) is necessary for:

- increase in profits from the sale of products, due to which an entrepreneur can develop his own production, to a greater extent to stimulate individual employees, pay more income (dividend) to shareholders and solve social problems;
- increasing the competitiveness of manufactured products due to the possibility of setting a lower contract price in comparison with its competitors;
- production of new products and introduction of advanced technologies. [18]

Reducing production costs is a unity of two sides: economic relations and factors of production. The main directions of cost reduction in the field of production are (Figure 1.6):[19]

[16] Lewis W.A., (1946), Fixed costs, *Economica. New Series*, 13 (52), pp. 231-258;
[17] Прищенко Е.А., Низовкина Н.Г, (2018), Совершенствование системы учета затрат и калькулирования себестоимости, *Мир экономики и управления*, 18(2) стр 121-131;
[18] Dhar U., Dhar S., Chauhan V.S., (2006), *Strategies of Winning Organizations*, Excel Books, 587 p.;
[19] Bragg M.S., (2010), *Cost Reduction Analysis: Tools and Strategies*, New Jersey, John Wiley & Sons, 416 p.;

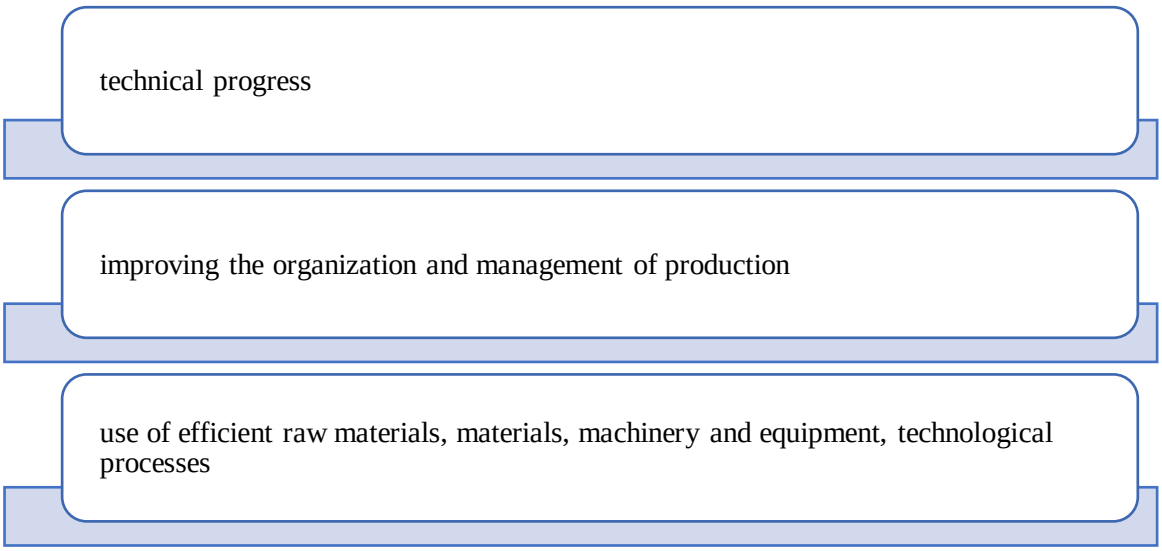


Figure 1.6 Main directions of cost reduction

Source: Bragg M.S., (2010), Cost Reduction Analysis: Tools and Strategies, New Jersey, John Wiley & Sons, 416 p.;

Reducing the cost of products, works, services depends on several groups of factors (Figure 1.7):[20]

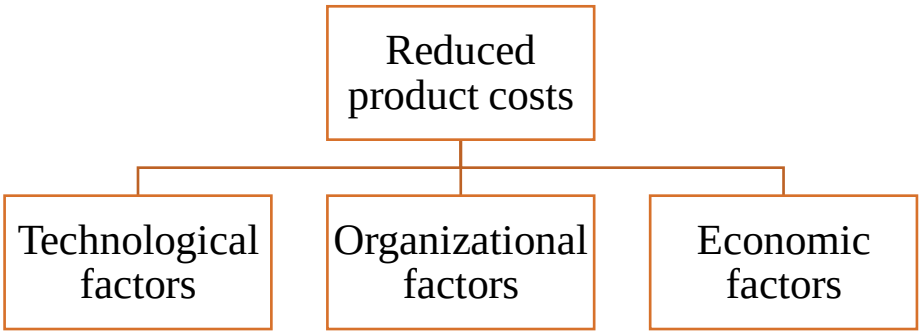


Figure 1.7 - Factors affecting the reduction of product costs

Source: Bragg M.S., (2010), Cost Reduction Analysis: Tools and Strategies, New Jersey, John Wiley & Sons, 416 p.;

Technological factors are associated with technology. They provide:

- increasing the progressiveness and quality of products, works, services;
- the use of more modern and high-performance equipment and technology (machines and mechanisms);
- increasing the degree of mechanization and automation of production;

[20] Bragg M.S., (2010), Cost Reduction Analysis: Tools and Strategies, New Jersey, John Wiley & Sons, 416 p.;

- application of resource and energy saving technologies;
- increasing the level of technical and energy equipment of labor;
- accelerating the implementation of the achievements of new technology and tools;
- the use of highly effective materials.

Organizational factors are related to the organization of production and labor and their management and include:

- increasing the level of concentration, cooperation and specialization;
- reduction of the duration of the production cycle;
- ensuring the rhythm of production;
- complete elimination or reduction of defects in production, downtime of equipment and workers;
- advanced training of employees and selection of personnel according to the technical level of production.

Economic factors are to improve the level of management and methods of management. They include:

- improvement of the production structure of the enterprise;
- increasing the level of planning, analytical and accounting and control work;
- improving the social living conditions of the company's employees;
- improving the culture of production and the state of industrial aesthetics;
- increasing the competence of the administrative and managerial personnel (managers) of the organization.[21]

All factors affecting the level of cost reduction are also subdivided according to the scale of their action: national, intra-industry and intra-production.

National ones are associated with government policy in the field of economic relations.

Intra-industry factors in the context of economic reform play an insignificant role and can be represented by the process of improving the standards of the product price system and in the planning of production activities, the adoption of price and tariff, labor (sectoral) agreements regulating certain types of costs. The issues of specialization and cooperation are decided by the enterprise itself.

[21] Bragg M.S., (2010), *Cost Reduction Analysis: Tools and Strategies*, New Jersey, John Wiley & Sons, 416 p.;

Intra-production factors are associated with the improvement of the use of all the material, technical, labor and financial resources available to the enterprise. They mainly depend on the results of the enterprise's activity, they can also be independent of them. [22]

In addition to the listed groupings, the factors are subdivided into promising and current ones according to the signs of use, and, according to the methods of identification, explicit and hidden.

Planned and sudden factors are distinguished according to the time of occurrence.

An enterprise can plan the following activities:

- commissioning and development of new shops;
- preparation and development of new types of products;
- preparation and development of new technological processes;
- optimal placement of certain types of products in the enterprise.

Sudden (unplanned) factors include:

- changes in the composition and quality of raw materials;
- changes in natural conditions;
- deviations from the established norms of production;
- production losses, etc.

According to the place of origin, factors are divided into external (independent of the enterprise) and internal (depending on the enterprise).

The cost of production, regardless of the enterprise, can be influenced by such external factors as:

- the economic situation in the country;
- inflation;
- natural and climatic conditions;
- technical and technological progress;
- changes in tax legislation, etc.

Internal include:

- production structure of the enterprise;
- management structure;
- the level of concentration and specialization of production;
- duration of the production cycle [23]

[22] Прищенко Е.А., Низовкина Н.Г, (2018), Совершенствование системы учета затрат и калькулирования себестоимости, *Мир экономики и управления*, 18(2) стр 121-131;
[23] Семенов В.М., (2016), *Экономика предприятия*, Санкт-Петербург, Питер Пресс, 416 стр.;

By appointment, the main and secondary factors are distinguished. This group of factors depends on the specialization of the enterprise. If it's consider material-intensive production, then the following factors can be attributed to the main factors:

- prices for material resources and consumption of raw materials and other materials;
- technical equipment of labor;
- technological level of production;
- production rate;
- nomenclature and product range;
- organization of production and labor.

To a lesser extent, the following factors will affect the cost of production:

- management structure;
- natural and climatic conditions;
- wages of production workers;
- structure of other costs, etc.[24]

The classification of factors that determine economic categories and indicators of cost reduction for products (works, services) is the basis for the classification of production reserves. Reserves should be understood as unused opportunities to reduce costs at a given level of production and economic relations. Elimination of all kinds of losses and waste is the main way to use production reserves. Another way is associated with great opportunities for accelerating scientific and technological progress and using the achievements of science and technology as the main lever for increasing production efficiency.

The reserves also affect the final results of the production activity of the enterprise due to changes in the nature of production and the transition from extensive methods to intensive methods. Cost reduction factors affect the reserves while providing an increase in the volume of products (works, services), improving their quality, improving the structure and range of products. They also create conditions for increasing the profitability of the enterprise, increasing its level of profitability and strengthening the financial position. Their action is determined by many factors of production, economic and organizational nature.[25]

[24] Chary S.N., (2019), *Production and operations management,* New Delhi, Tata McGraw-Hill Education, 972 p.;
[25] Chary S.N., (2019), *Production and operations management,* New Delhi, Tata McGraw-Hill Education, 972 p.;

1.2. Methodology for analyzing the cost of production

The method of accounting for production costs and the calculation of the cost of production is usually understood as a set of techniques for documenting and reflecting production costs, which provide the determination of the actual cost of production and provide the necessary information to control this process.

Costing should be understood as not only calculating the actual cost of a unit of manufactured products, but also other works on calculating the cost:

- products, works, services of auxiliary industries consumed by the main production;
- intermediate products (semi-finished products) of the main production units used at subsequent stages of production;
- products of divisions of the enterprise to identify the results of their activities;
- the entire product output of the enterprise;
- production and, accordingly, a unit of the type of finished products and semi-finished products of own production, sold to the outside. [26]

There are the following main methods of calculating production costs, depending on the object (Figure 1.8):[27]

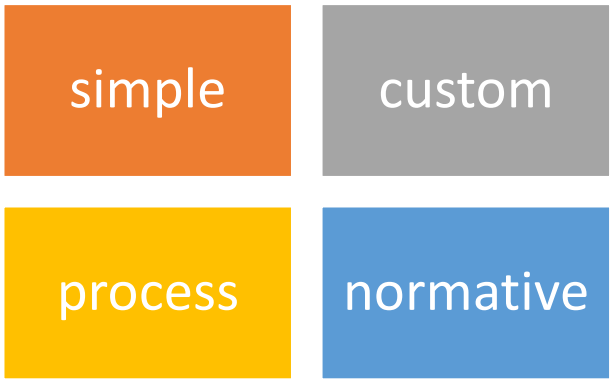


Figure 1.8 Main methods of costing and accounting for production costs

Source: Dutta M., (2004), Cost Accounting: Principles And Practice, Delhi, Pearson Education, 880 p.;

A simple method of calculating the cost of production is used in enterprises that produce homogeneous products that do not have semi-finished products and work in progress. All production costs per month are the cost of all manufactured products. The unit cost is calculated by dividing the amount of production costs by the number of units.

[26] Иванов Н.Н., (1961), *Учет затрат на производство и калькулирование себестоимости продукции,* Москва, Госфиниздат, 94 стр.;
[27] Dutta M., (2004), *Cost Accounting: Principles And Practice,* Delhi, Pearson Education, 880 p.;

The custom-made method of calculating the cost of production is used in individual and small-scale production, where the production process lasts more than one reporting period, or in repair shops and services, where information is needed on the costs of individual work to calculate their cost. Direct costs are accounted for separately for each order for a product (a group of similar products). Overhead costs are included in the cost price in proportion to the corresponding distribution base.

The process method of calculating the cost of production is used in mass production, where the technological process consists of a number of successive redistributions (textile, glass and other industries) or when different types of products (metallurgical and other industries) are obtained from the same raw materials in one technological process. The actual cost of goods produced during the month is calculated based on the production costs identified in the redistribution, taking into account the change in the balance of work in progress at the beginning and end of the month, minus the cost of by-products at the planned cost.[28]

The normative method of calculating the cost price provides efficiency and the possibility of preliminary control of production costs.

The normative method assumes compliance with the following principles:

1. preliminary compilation of a calculation (calculation) of the standard cost for each product;
2. Maintaining, within a month, accounting of changes in existing norms to adjust the standard cost;
3. Accounting for actual costs during the month with their subdivision into costs according to norms and deviations from norms;
4. Establishing the reasons for deviations from the norms in the places of their occurrence;
5. Determination of the actual cost of production as the sum of the standard cost, deviations from the norms and changes in the norms;

Cost rates are set based on data analysis, actual costs of materials and labor based on the results of previous periods. The essence of the analysis is the study of operations based on the accounting of materials, labor, materials, and then a control survey of operations. This method is used in enterprises with serial and mass production. The aim of the normative method is to prevent irrational use of resources. Its basis is the technically justified calculated values of the costs of material, labor and financial resources per unit of production, work, and services. Cost

[28] Dutta M., (2004), *Cost Accounting: Principles And Practice*, Delhi, Pearson Education, 880 p.;

rates show the technical and organizational level of development of the enterprise, affect its economy and the result of its activities.

This method assumes constant identification of deviations from the norms at the end of the month in the current order. The identified deviations show how the enterprise adheres to the production technology of products, the consumption rates of raw materials, materials, labor costs. They can be positive meaning savings in costs, and negative, causing their increase.[29]

Also, there are four other methodologies for determining cost of production. The index method consists in calculating the generalizing relative indicators for comparing two populations consisting of elements that cannot be summed up directly. The method of chain substitutions allows you to determine the influence of individual factors on the result by successively replacing their basic values with actual ones. The integral method and the logarithm method involve the use of appropriate mathematical techniques for cost analysis. The factorial method of analysis allows you to establish and analyze the relationship between various phenomena. The heuristic method of analysis is based on the experience and intuition of the researcher.[30]

The "standard costing" method is widely used in Western countries with developed market economies. This method is usually used in industries where resource prices are relatively stable and the products themselves do not change for a long time. The method is a cost accounting and costing system using standard costs. Standard - the amount of costs required to produce a unit of product; costing is their monetary expression. The system appeared in America in the early 30s of the XX century, when the United States was going through an economic crisis. The method is based on the following principles:

1. preliminary rationing of costs by their elements and items;
2. drawing up normative calculations for the product and its parts. 3. Separate accounting of standard costs and deviations;
3. analysis of deviations;
4. refinement of calculations when the norms are changed.[31]

Cost rationing is carried out in advance (before the beginning of the reporting period) by items of expenditure: basic materials, wages of production workers, general production costs (depreciation of equipment, rent payments, wages of auxiliary workers, auxiliary materials and

[29] Завьялова Е.С., (2015), Методы учета затрат на производство продукции, Научно-исследовательские публикации, 12(32), стр. 13-20;
[30] Сагитов М.И, (2019), Методики анализа затрат на производство продукции предприятия, *Аллея науки*, 1(4), стр. 432-434;
[31] Hallbauer R. C., (1978), Standard costing and scientific management, *Accounting Historians Journal*, 5(2), pp. 37-49;

others), commercial costs (costs of selling products). Target costs are based on the expected cost of the resources required for production. Resource consumption rates are determined per one product. General production costs consist of various items, and for them the norms are drawn up for a certain period in monetary terms and based on the production volume planned by the enterprise. During the reporting period, deviations of actual costs from standardized costs are taken into account. The amount of deviations is taken into account in special accounts, and at the end of the reporting period they are written off to financial results. Next, an analysis of deviations is carried out, and the enterprise decides the issue of adjusting the established standards.

The "direct costing" method is used in enterprises where there is no high level of fixed costs and the result of the work can be easily identified and measured. Its key concepts are margin income and margin costing. Profit margin is the difference between revenue and variable costs. Includes operating income and fixed costs. The direct costing system offers the following accounting options:

- simple direct costing, in which only direct variable costs are taken into account in the cost price;
- method "direct costing", in which the cost includes direct variables and indirect variable general business expenses.[32]

Cost accounting is carried out in the context of variable costs, fixed costs are accounted for as a whole for the enterprise and are attributed to a decrease in operating profit. In the process of applying this method, the margin income and net profit are determined. The change in the amount of profit margin shows the effect of sales prices and variable costs on the unit cost. The amount of profit depends on the amount of fixed costs. The interrelation of indicators allows you to influence the amount of profit by adjusting prices and volume of production. 26 "Direct costing" defines the critical production volume at which the proceeds will cover all production costs without making a profit.[33]

As can be seen from theoretical chapter there are several factors influencing cost of production and for this research it is crucial to figure out which factor or factors affect companies in oil and gas industry.

[32] Don E. J., (1958), This New Costing Concept-Direct Costing?, *Accounting Review*, pp. 561-567;
[33] Ştefea P., Pelin A., Brindescu D., (2008), Cost analysis methodology in a "standard cost" costing environment, *Annals of the University of Craiova, Economic Sciences Series*, 5 (36), pp 2159-2166;

CHAPTER 2. THE ANALYSIS OF OIL AND GAS INDUSTRY

This chapter examines trends in oil and gas sphere industry worldwide: energy consumption and production levels, the leaders of oil and gas production and consumption, challenges facing the industry today, the impact of COVID-19 to the industry and challenges facing the Republic of Uzbekistan while developing and running the sphere.

2.1 Oil and gas industry trends

Digitalization

According to Accenture company, one of the leaders of IT solution services provider, oil and gas industry will be transformed digitally. They indicated five main changes that will face the industry.

The first trend is the use of technologies from the DARQ group, which includes a distributed ledger (D - Distributed ledger technologies), artificial intelligence (A - Artificial intelligence), extended reality (R - Extended reality), quantum computing (Q - Quantum). In the next three years, according to Accenture, organizations will be most affected by artificial intelligence. Next comes quantum computing, the third place belongs to augmented reality, the fourth place belongs to the distributed ledger technology. At the same time, 80% of the top mining companies and 76% of the processing enterprises agree that the greatest changes in business will come from the integrated use of DARQ. 80% of managers from upstream companies and 90% from downstream companies are already experimenting with one or more DARQ technologies.

Trend number two is the use of technology to identify the unique needs of each customer, search for new demands from consumers and new market opportunities. This approach helps not only to better understand the new generation of customers, but also to build individual relationships with them, taking into account all the previous interaction experience.

According to Accenture experts, the third trend is the intensification of employees' skills using technological tools. It has been noted that the need for the oil and gas industry to apply the Human + concept, in which each employee will use a combination of their own skills and knowledge, along with an ever-changing combination of technologies, from artificial intelligence to training platforms. For the link to work, oil and gas companies will have to pay great attention to continuous training of personnel.

The fourth trend is the strengthening of cyber defense. By building ecosystems around themselves, oil and gas companies will strengthen cyberspace security in a way that protects themselves and all partners. 91% of executives from mining companies and 85% of processing

companies agree that only companies that rethink their approaches to information security can be truly sustainable.

As the fifth trend, analysts named the willingness to work with the "instant market". Direct digital access to customers, combined with sophisticated backend technologies, is enabling business reorientation and bringing new products and services to market faster than ever. Thanks to technology, companies can not only create proposals for specific customers, but meet their needs at any given time. [34]

Moreover, ss oil reserves are gradually depleted, companies have to touch deep layers of the Earth to generate stable profits. This complicates the process of exploration and development of the field using traditional methods. Smart wells come to the rescue. Smart well is a generic name for new digital technologies that can be used in mining.

Such installations are equipped with automated internal equipment. This allows information on production parameters to be continuously collected and transmitted to the surface. For this, a complex system of underground sensors and control valves is organized. Thanks to this, it is possible to control parameters such as temperature, pressure, fluid flow from a distance.

New technologies make it possible to more accurately determine the seismic state of the zone in which the field is located. Today, scientists are developing cableless technologies that will help not only reduce energy consumption, but also make the entire data collection and transmission system more perfect.[35]

The listed processes organically fit into the course of production and allow achieving a higher level of customer focus. In addition, they greatly simplify the process of drilling and producing oil and gas, which helps to increase supply and strengthen the company's position in the market.

New technologies are also being used to improve working conditions. The installation of cameras, the use of robots and software with the use of artificial intelligence make it possible to get rid of the need to endanger the lives of workers and help in creating voluminous layouts and plans that previously had to be drawn manually on a computer. This time savings will improve overall production efficiency.[36]

Global energy consumption

[34] Technology vision 2019, (2019), *Accenture*, 37 p.;
[35] Glandt, C. A., (2005), Reservoir management employing smart wells: A review. *SPE Drilling & Completion*, 20 (04), p. 281-288;
[36] Carvajal G., Maucec M., Cullick S., (2017), *Intelligent digital oil and gas fields: concepts, collaboration, and right-time decisions*. Gulf Professional Publishing, 374 p.;

Global energy (coal, gas, oil, electricity, heat, biomass) consumption growth slowed down in 2019 and increased only +0.6% compared to an average 2%/year during years 2000-2018, in a context of slower economic growth.

Energy consumption increased at a slower pace than in previous years in China (+3.2%), the world's largest consumer since 2009, in Russia (+1.8%) and in India (+0.8% only). It declined in almost all OECD countries, for example, for the USA it decreased by 1%, for the EU -1.9%, and for Japan -1.6%. Australia was the only exception, posting a 6.3% growth (caused by soaring gas consumption from LNG plants) well above the historical average. Consumption remained dynamic in Indonesia and Algeria, continued to increase in Saudi Arabia, Nigeria and South Africa but declined in Latin America (stable in Brazil and slight decrease in Mexico). US sanctions contributed to reduce Venezuela's and Iran's consumption.[37]

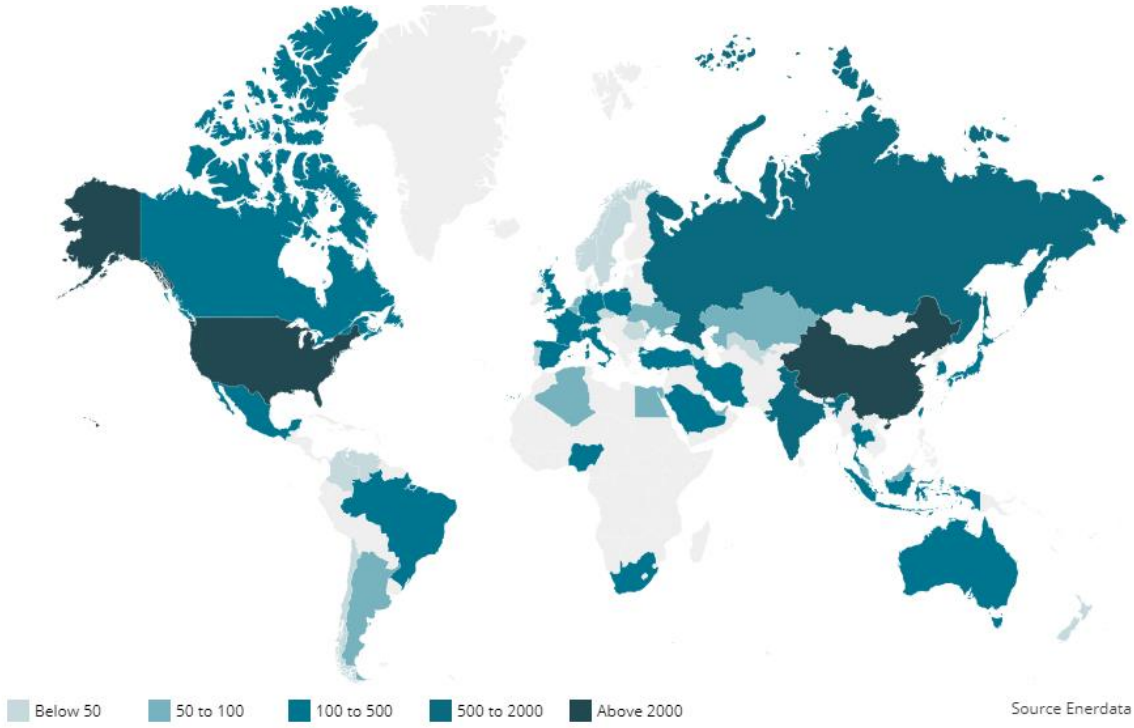


Figure 2.1 Total energy consumption by countries worldwide in 2019 in Mtoe.

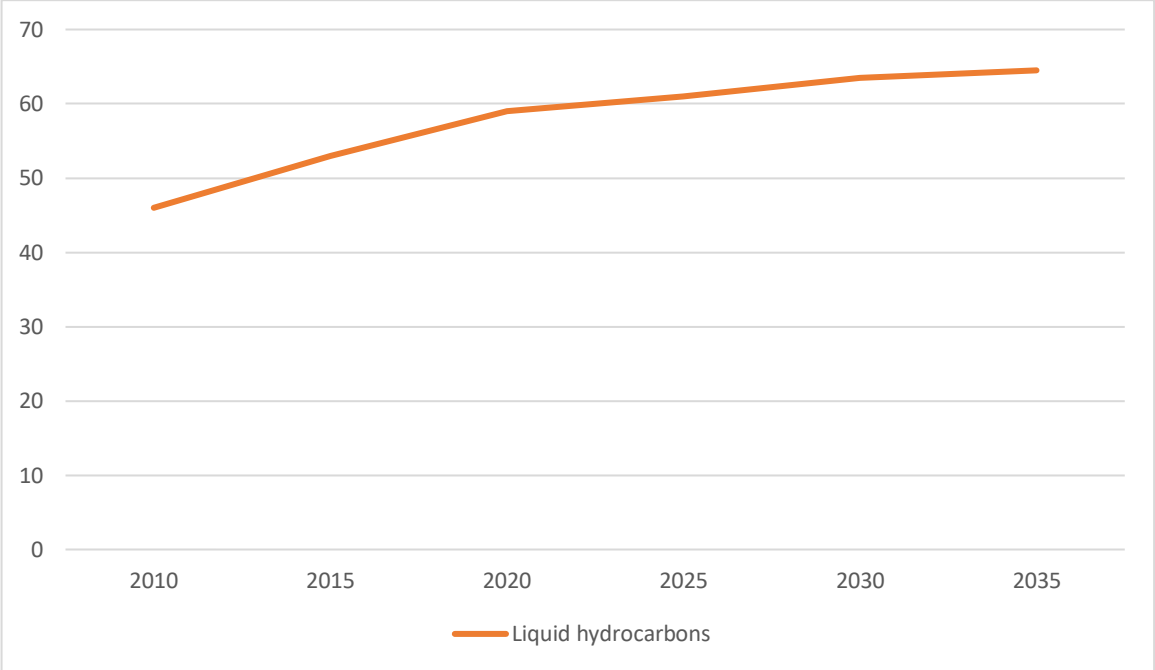
Source: Enerdata, (2020), Global Energy statistical yearbook;

The global population is projected to grow from 7.7 billion in 2019 to 8.9 billion in 2035, according to UN forecasts. The largest population growth will occur in Africa and Asia, where 78% of the world's population will live by 2035. The population of African countries is expected to grow by 40% by 2035 compared to the 2019 level. In Asian countries, population growth

[37] Enerdata, (2020), Global Energy statistical yearbook;

over the same period will be 10%. The growth of the world population is accompanied by an increase in the proportion of people living in cities. It's expected that over the period 2018-2035, the share of the urban population will increase from 55% to 63%. Asian countries will account for about 90% of the urban population growth. At the same time, the upward trend in the size of the middle class will continue: people belonging to the middle class will exceed 5 billion in 2025–2030. Due to such changes, the demand for transport will also grow. In nearest 20 years 90% of personal cars will use petrol from oil as fuel, as a consequence, the demand to oil products will grow worldwide, especially in Asia and Africa, while Europe and North America will slowly shift to alternative fuel. [38][39][40]

Consumption of petroleum products in sectors such as sea transport, air transport, river and rail transport will grow faster than in the road transport sector. The highest growth rates (over 60%) are expected in the air transportation sector. A growing middle class in developing countries will boost demand for air travel. At the same time, it is not expected that alternative fuels will be able to seriously compete with aviation kerosene in the future 10-15 years. The growth in international trade will contribute to an increase in the consumption of petroleum products in the shipping sector. The share of liquefied natural gas as fuel for ships will gradually increase. However, this process will proceed rather slowly, as the fleet of ships is renewed and international trade in liquefied natural gas increases. [41]



[38] Main trends in the development of the global liquid hydrocarbons market until 2035, (2019), LUKOIL, 110 p;
[39] 2020 oil and gas industry outlook, (2020), Deloitte, 11 p;
[40] Global Energy Perspective 2021, (2021), McKinsey&Company, 9 p.;
[41] Main trends in the development of the global liquid hydrocarbons market until 2035, (2019), LUKOIL, 110 p;

Figure 2.2 Forecasts of consumption of liquid hydrocarbons in the transport sector, mln barrel/day from 2010 to 2035 worldwide.

Source: Compiled by author based on publication "Main trends in the development of the global liquid hydrocarbons market until 2035", (2019), LUKOIL;

Refined products such as naphtha and liquefied gases are traditional feedstock for the production of petrochemical products. The consumption of liquid hydrocarbons in the petrochemical industry will grow faster than in other sectors. The traditional regions with a predominance of naphtha consumption in pyrolysis plants are the countries of the APR. North America and the Middle East mainly use liquefied gases as feedstock for pyrolysis. The rapid development of the petrochemical industry in the APR countries is a key driver of the growth in the consumption of petroleum products in the petrochemical industry. China will be the leader in monomer production growth over the next five years.

Industrial development and urbanization in developing countries are key drivers of increased consumption of petroleum products in the industrial sector. Consumption growth is expected in sectors such as metallurgy, cement production, building construction and road construction. In developed countries, the consumption of petroleum products by the industrial sector will gradually decline due to increased energy efficiency. Households are major consumers of petroleum products. LPG and heating oil are used in many countries for cooking and heating. Unlike natural gas, the use of propane-butane does not require significant investments in infrastructure; therefore, one can expect an increase in demand for LPG in developing countries due to the transition from burning firewood to using LPG for the same purposes. Gas oil consumption for heating is likely to decline as it is replaced by natural gas and electricity. The growth of the world population will lead to an increase in demand for agricultural products, which in turn will drive an increase in demand for diesel fuel, the main source of energy for agricultural machinery.[42][43]

When combining the results of the analysis of the structure of world demand by industry and the analysis of global macroeconomic trends, it can be concluded that the global demand for liquid hydrocarbons is likely to grow until 2035.

[42] Oil market report, (2021), IEA (International Energy Agency);
[43] Main trends in the development of the global liquid hydrocarbons market until 2035, (2019), LUKOIL; 110 p;

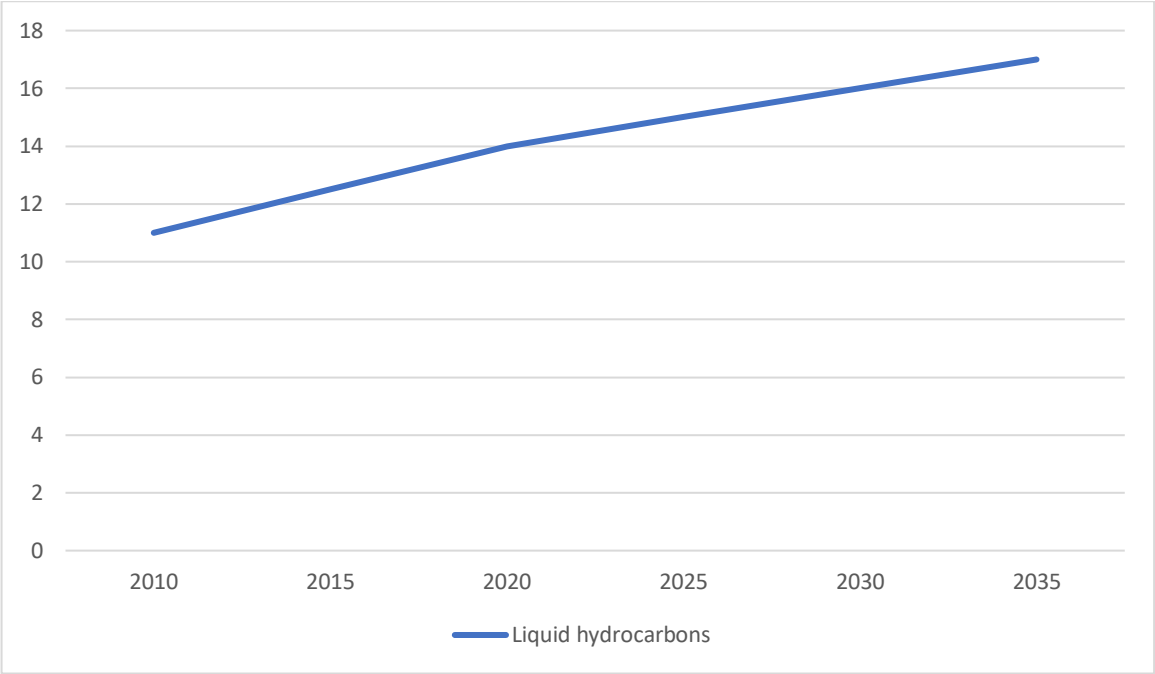


Figure 2.3 Forecast of global demand for liquid hydrocarbons for petrochemicals, mln barrel/day from 2010 to 2035 worldwide.

Source: Compiled by author based on publication "Main trends in the development of the global liquid hydrocarbons market until 2035", (2019), LUKOIL;

Global energy production

World energy production continued growing in 2019 and increased by 1.5%, but stayed below its historical trend (2%/year). The USA and China were the main contributors to the increase in global energy production in 2019, posting a significant growth in crude oil production and coal production, respectively. [44]

2019 Key data for energy production are as follows:

- Crude oil: -0.7% driven by the fall in production in the Middle East (vs. +1.2%/year over 2000-2018)
- Gas: +4% propelled by the USA, Russia and Australia (vs. +2.5%/year over 2000-2018)
- Coal: 0%, with growth in China (+4%) offset by drops in India, the USA and the EU (compared with +3%/year over 2000-2018)
- Electricity: +1%, spurred by China, with declines in Europe, the USA and Japan (down from +3.1%/year over 2000-2018)

Energy production also grew in Russia and Australia due to new LNG projects coming on stream, in Brazil as oil production rise, in South Africa thanks to higher coal production and

[44] Enerdata, (2020), Global Energy statistical yearbook;

in Turkey due to surge in hydropower generation. On the contrary, energy production continued to decline in Europe (especially coal production in Germany and Poland, and crude oil production in Norway and the Netherlands, where oil and gas resources tend to decrease). In the Middle East, US sanctions cut Iran's energy production by nearly 15%, while Saudi Arabia reduced its crude oil production in line with the OPEC+ agreement.[45]

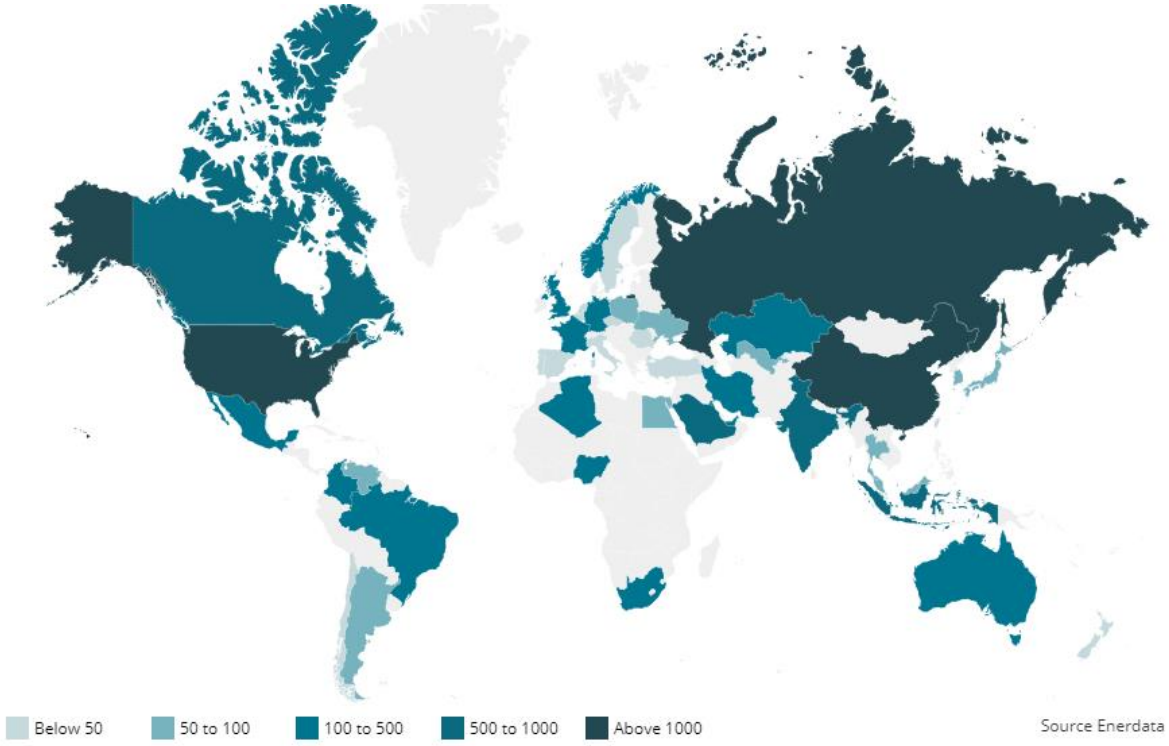


Figure 2.4 Total energy production by countries worldwide in 2019 in Mtoe.

Source: Enerdata, (2020), Global Energy statistical yearbook;

Saudi Arabia is the country with the largest proven oil reserves in the world. In 2018, the first independent audit of Saudi Aramco's reserves was carried out, which showed that the state-owned company has more than 200 billion barrels. proved reserves. Due to the geological features of the fields and the low cost of delivering oil to the main consumers, the total cost of oil production in Saudi Arabia is one of the lowest in the world at about $ 20/barrel. Saudi Arabia seeks to maximize the value of its reserves by gradually involving them in development in order to extend the life of oil reservoirs.[46]

[45] Enerdata, (2020), Global Energy statistical yearbook;
[46] Oil market report, (2021), IEA (International Energy Agency);

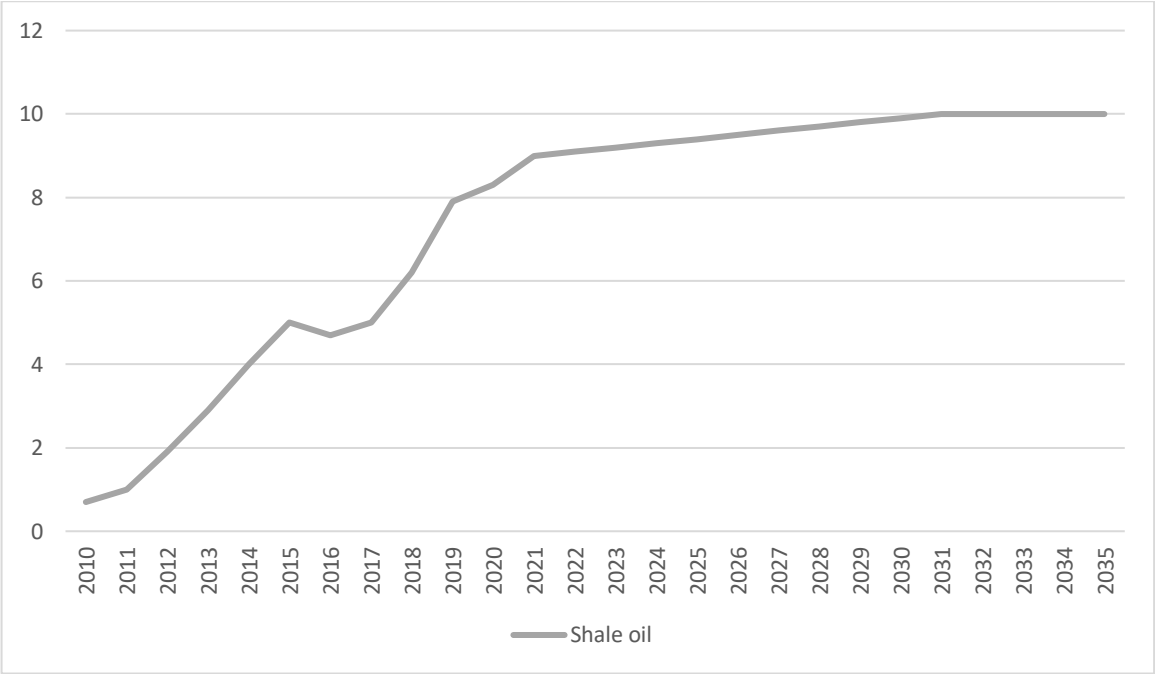


Figure 2.5 US shale oil production forecast, mln barrel/day from 2010 to 2035 worldwide.

Source: Compiled by author based on publication "Main trends in the development of the global liquid hydrocarbons market until 2035", (2019), LUKOIL;

In recent years, the growth in oil production in the United States has surpassed all the most daring forecasts. Since the beginning of 2016, oil production in the country has grown by more than 3 million barrels per day and reached 12 million barrels per day at the beginning of 2019, updating the historical record of 1970. The main source of production growth in the United States continues to be tight oil production, often referred to as "shale oil". Since the beginning of 2016, oil production in this formation has increased by more than 2.5 times, reaching 4 million barrels per day in the second half of 2019.The sharp increase in oil and gas production in the United States has led to an increase in the supply of gas feedstock for the petrochemical industry. As a result, the United States plans to significantly increase the production of ethylene. In the next five years, a number of large petrochemical complexes for the production of ethylene with a total capacity of 12 million tones are expected to be commissioned in the United States. Despite the expected growth in global polymer production capacity, certain factors will contribute to a slowdown in the growth rate of demand for liquid hydrocarbons from the petrochemical industry. These factors include the development of polymer recycling and restrictions on the use of disposable plastic products in a number of countries. At present, in addition to the USA, commercial oil production from low-permeability

reservoirs is carried out mainly by Canada and Argentina. It is these countries that will provide the main growth in shale oil production outside the United States until 2025.[47]

2.2 Challenges facing oil and gas industry worldwide and in Uzbekistan.

Ecological problems.

Having started the exploitation of oil and gas fields, a people did not think about the consequences of intensive extraction of these natural resources. The great danger is fraught with the use of oil and gas as fuel. When these products are burned in the atmosphere, large quantities of carbon dioxide, various sulfur compounds, nitrogen oxide, etc. are released. A decrease in oxygen and an increase in carbon dioxide, in turn, will affect climate change. Molecules of carbon dioxide allow solar shortwave radiation to penetrate the Earth's atmosphere and trap infrared radiation emitted from the earth's surface. Pollution of the atmosphere is fraught with another danger: it reduces the amount of solar radiation reaching the Earth's surface.

A large role in the pollution of the atmosphere belongs to jet planes and cars. To cross the Atlantic Ocean, a modern jetliner absorbs 35 tons of oxygen and leaves contrails that increase cloud cover. Cars, of which there are already more than 500 million, also significantly pollute the atmosphere. Various projects for the creation of engines operating on other types of fuel are emerging. Various factories, heat and power plants make a significant contribution to the poisoning of the atmosphere. An average power plant operating on fuel oil emits 500 tons of sulfur daily into the environment in the form of sulphurous anhydride, which, combining with water, immediately gives sulfurous acid, which falls out in the form of acid rains with high chemical activity. Air pollution with various harmful gases and particulate matter leads to the fact that the air of large cities becomes dangerous for human life. Deadly fogs that descend on large cities are especially dangerous.[48]

Recklessly pollutes man and the world's water bodies. Annually, from 2 to 10 million tons of oil is dumped into the World Ocean for one reason or another. Aerial photography from satellites recorded that almost 30% of the ocean's surface is covered with an oil film. The waters of the Mediterranean Sea, the Atlantic Ocean and their shores are especially polluted.

A liter of oil deprives oxygen of 40 thousand liters of seawater. A ton of oil pollutes 12 sq. km of ocean surface. When it is concentrated in seawater in an amount of 0.1-0.001 ml / l,

[47] Main trends in the development of the global liquid hydrocarbons market until 2035, (2019), LUKOIL; 110 p;
[48] Jiang S., Hue, R., Wu J. (2019), Research on oil and gas ecological compensation mechanism, *Chemistry and Technology of Fuels and Oils*, 55(1), pp 85-92:

fish eggs die in a few days. More than 100 million fish larvae can die per hectare of the sea surface if there is an oil film. There are many sources of oil entering the seas and oceans. These are accidents of tankers and drilling platforms, discharge of ballast and treatment water, bringing polluting components by rivers.[49]

A threatening question arises: what to do with these black oceans? How to save their inhabitants from death?

Swedish and British experts suggest using old newspapers, pieces of wrapper, scrap from paper mills to cleanse sea waters from oil. Thrown into water and crushed, they are able to absorb 28 times the amount of oil compared to their own weight. Then the fuel is easily extracted from them by pressing. Such strips of paper, placed in large nylon shopping bags, are proposed to be used to collect oil at sea at the site of a tanker disaster. Good results are obtained with the use of dispersants, special substances that bind oil; processing oil films with iron powder, followed by collecting sawdust with a magnet. Great hopes are pinned on biological protection.

For various reasons, during the extraction and transportation of oil, part of the raw material is poured onto the earth's surface and into water bodies.

One of the most promising ways of protecting the environment from pollution is the creation of a comprehensive automation of the processes of oil production, transportation and storage. Careless handling of oil can be a big disaster. The use of oil and oil products should be very careful, thoughtful and dosed. Oil requires careful attention. This must be remembered not only by every oilman, but also by everyone who deals with petrochemical products.[50]

Impact of COVID-19 on oil and gas industry.

Against the backdrop of the spread of the coronavirus, worldwide demand for electricity decreased by 7% in 2020. Recovery to 2019 values is possible in 1–4 years. Such forecasts are cited in a study by the consulting company McKinsey. The authors of the report "World Energy Outlook 2021" recall that the reduction in demand for electricity has led to a sharp decline in prices for key energy resources. In particular, by the end of March 2020, oil prices for the first time in 20 years dropped to $ 20 per barrel. After the restrictions were lifted, the level of energy consumption began to recover. For example, in China, by the end of the third quarter of 2020,

[49] Vilchek G. E., Bykova O. Y., (1992), The origin of regional ecological problems within the northern Tyumen Oblast, Russia, *Arctic and Alpine Research*, 24(2), pp 99-107;

[50] Алчинова, А. А. (2014), Современные методы борьбы с экологическими загрязнениями в нефтегазовой отрасли, *Материалы Всероссийской 41-й научно-технической конференции молодых ученых, аспирантов и студентов*, стр. 127-130;

electricity demand returned to pre-crisis levels in Europe and North America, recovered by 50%, the document says.[51]

Analysts have studied the impact of the coronavirus pandemic on economic growth and developed several scenarios for the development of the global energy sector. They believe that demand for fossil fuels will peak in 2029 and then begin to decline. Coal demand has decreased by 40% by 2050 compared to the 2019 growth rate. Gas will remain the only fossil fuel that will grow over the next 10-15 years and will peak around 2037. Nevertheless, they will continue to occupy important places in the global energy balance, including due to the development of the chemical industry and aviation. The growth of energy in dangerous countries will also play a role. The study authors expect that reducing electricity consumption during a pandemic will not interfere with renewable energy. Industrial renewable energy sources (RES) are already competing with the fossil costs of electricity generation. Moreover, generation from them will become cheaper within a decade. As a result, the total capacity of renewable energy sources will reach 5 TW by 2035. Taking into account hydroelectric power plants, renewable energy sources will supply more than 50% of energy; by the middle of the century they will outstrip in terms of the volume of generation of energy sources. According to the forecasts of the International Energy Agency, by 2025 renewable energy sources will account for 30% of the generation. More than half of the energy will come from hydroelectric power plants, the rest from wind and solar installations.[52]

McKinsey predicts that by 2050, the transition to new energy sources and energy efficiency improvements due to technological progress will reduce the energy intensity of global GDP by 40% (the ratio between gross domestic energy consumption and GDP). Light electric vehicles are cited as the action, the number of which has increased in recent years in many countries. These cars consume 3-4 times less energy than cars with an internal combustion engine. The state of the energy sector will be affected by the massive shift of people to remote work, in addition to the reduction in the number of air travel. These factors reduce oil consumption by 2 million barrels per day by 2035. The amount of energy consumed per capita by the middle of the century will fall by 5%. The study authors note that the COVID-19 outbreak is leading to a 7 percent reduction in carbon dioxide (CO2). By 2023, energy-related CO2 emissions peaked at 33 Gt. By 2050, it will be reduced by about 25% compared to 1990 levels. However, this will not help slow the rise in global temperatures. To keep the rise in global temperature at 1.5 ° C, achieve cerebral neutrality by 2050. This means that the amount

[51] World Energy Outlook 2021, (2021), McKinsey&Company, 9 p;
[52] World Energy Outlook 2021, (2021), McKinsey&Company, 9 p;

of CO2 released into the atmosphere will not exceed the amount that is removed from it. Annually over the next 30 years, it is said to decline in the same way as during the pandemic. "There is a long way to go to reverse significant climate change," concluded senior partner at McKinsey Christer Triggestad.[53]

Oil and gas industry challenges in Uzbekistan.

The oil and gas industry ranks first in the republic in terms of export earnings and accounts for 7% of the total GDP. Today, there are 243 hydrocarbon deposits on the territory of the republic, of which 111 have been discovered over the past 20 years, of which 15 have been by foreign investors. Out of 243 hydrocarbon deposits, 194 have free gas, 121 - oil and 157 - condensate. Of the total number of fields, 104 are in development, 60 are prepared for development, and 69 are in the process of being studied. Geological oil reserves of the republic are 5 billion tons, and proven oil reserves - 530 million tons. In terms of gas production, the republic ranks second in the CIS, and in oil production as of December 2019 it was 50th among the countries of the world.[54]

Along with the positive results of the oil and gas industry in recent years, problems and negative trends have arisen associated with objective and subjective reasons, and their consequence was a decrease in the production of oil and gas condensate, as well as natural gas. oil production in the republic began to decline since 2002, while consumption only grew. During the 90s of the 20th century, oil production increased sharply from 2.8 million tons in 1991 to 8.1 million tons by 2002. But subsequently, the volume of oil production steadily decreased, and if in 2003 the daily volume of oil production was 171 thousand barrels, then in 2009 it was 107 thousand barrels, and in December 2014 it reached 65 thousand barrels. According to experts, the objective reasons for the steady decline in oil and gas condensate production can be attributed to the depletion of reserves of existing fields, and the current volume of recoverable reserves of liquid hydrocarbons does not exceed 0.1 billion tons (the ratio of reserves to current production is 18,9). In addition, the reason is also considered to be the limited resource base and the unsuccessful exploitation of existing reserves in the early years of independence.[55]

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[53] World Energy Outlook 2021, (2021), McKinsey&Company, 9 p;

[54] Сайфутдинова Н. Ф., (2020), Современное состояние нефтегазовой отрасли Узбекистана на мировом уровне, Научно-аналитический журнал "Наука и практика" Российского экономического университета им. ГВ Плеханова,, Ташкент, 12 (3), стр. 86-96;

[55] Шадыбаев Т., Мирзамахмудов Ж., Рахматуллаев Х., Норматов Б., Шек Е., Турсунова Р.,(2013), Совершенствование системы управления в нефтегазовом секторе Республики Узбекистан. *Доклад Центра экономических исследований при содействии проектов Программы развития Организации Объединенных Наций (ПРООН) «Содействие модернизации, ускорению реформ и трансформации»*, Ташкент, 14 стр.;

There are also problems associated with the technology of development of flooded objects, of which it is necessary to single out the unevenness of oil displacement by the injected water from the reservoirs, the formation of flooded areas. This raises the problem of extracting residual oil from the increase in oil recovery ratio. The decrease in oil and gas condensate production affected the decline in oil refining and production of oil products. The level of utilization of the existing production capacities of refineries decreased from 73.7% in 1998 to 50-55% in 2019. Due to the need to load oil refineries and the resumption of the export of petroleum products, the import of oil has almost doubled. In addition to the low utilization of the production capacities of oil refineries, the activity of the refinery becomes unprofitable due to the high cost of imported raw materials, since the processing and sale of finished products is carried out at fixed prices. Considering that all processes in the oil and gas industry are interconnected, the decline in oil and gas condensate production has also become the reason for the insufficient working financial resources of the industry, which were directed, first of all, for the purchase of imported raw materials. Lack of financial resources has become a limitation of the ability to meet current needs in the chain of exploration - drilling - production. And underfinancing, in turn, is a consequence of a decrease in the volume of reserves and production of natural gas. Also, the problems of the oil and gas industry include the high value of the coefficient of unit costs per unit of manufactured products.[56]

The activity of service enterprises of Uzbekneftegaz JSC is limited and requires fundamental changes, as well as reforming. The specifics of the activities of the service enterprises of the JSC Uzbekneftegaz are associated with the need to perform work on the order of the holding itself. In addition, service enterprises do not have the authority to independently organize the procurement of raw materials and materials that may be required if they win a tender for servicing third-party companies. In the development of foreign economic cooperation in Uzbekistan, one of the main problems is limited transport communications, in particular, lack of access to seaports. In addition, Uzbekistan is surrounded by countries that also do not have access to seaports. The subjective reasons that had a negative impact on the development of the oil and gas industry include:

- an ineffective system of management of the industry, which does not allow quick re -shat arise problems;

[56] Шермухамедов А. К., (2019), Устойчивое развитие нефтегазовой отрасли Узбекистана и её инвестиционная привлекательность, *Международный научный сельскохозяйственный журнал*, Ташкент, 4, стр. 16-17;

- insufficiently high level of qualification of personnel, as well as low level of management at all levels of management;
- a high level of tax burden on the industry, which does not stimulate its development.

Today, the subjective main problem for the further development of the oil and gas industry of the republic is a cumbersome and ineffective system of industry management. This system duplicates functions, is wasteful in the use of financial resources and does not correspond to the tasks aimed at eliminating the tendencies of reducing reserves and production of hydrocarbon resources.[57]

[57] Бобохужаев Ш. И., (2016), Научный обзор: Постнезависимый период развития нефтегазовой отрасли Узбекистана: успехи, проблемы и перспективы, *Научное обозрение. Экономические науки*, Ташкент, стр. 35-50;

CHAPTER 3. EMPIRICAL RESEARCH ON STRUCTURE OF PRODUCTION COSTS AND FACTORS THAT MOSTLY AFFECT THEM IN OIL AND GAS COMPANY LOCATED IN UZBEKISTAN

This chapter analyzes research methodology, i.e., interview with representative from Ministry of Energy of the Republic of Uzbekistan and Ltd. “Shurtan Gas-Chemical Complex” as an example of oil and gas company located in Uzbekistan. Also, it examines data regarding production costs structure and factors affecting them at the company “Shurtan Gas-Chemical Complex”.

3.1Research Methodology.

Empirical research has been conducted in order to answer to the questions raised in this work. A case study of one of the biggest national “oil and gas” companies was carried out, which provides an opportunity to investigate the cost structure of companies operating in this field. The research method in this study is mix of qualitative and quantitative ones, as it provides insights of the sphere and the more exact data can be obtained regarding company operations and information, also, opinions of expert and company representatives allow to draw more exact and clear picture of the industry, company and research related figures.

A research has been done by the in-depth interviews with the representative from Ministry of Energy of the Republic of Uzbekistan, Abdurasulov Nurmuhammad, who is specialist in the implementation of energy efficient and energy saving technologies in buildings and structures and with management representative from Ltd. “Shurtan Gas-Chemical Complex”, Kamolov Musa, whose position is Acting Deputy General Director for Investment and Innovation. The interviewers answered the questions prepared by the author of the thesis. The interview took place in April only once with each interviewer due to their tight work schedule via online call on Zoom, also the data regarding cost structure of the Ltd. “Shurtan Gas-Chemical Complex” was sent separately by secretary of Kamolov Musa. Not all the questions of the author got the answers as this sphere is top secret on government level, but most of them were answered, also it was required to use the data only for research purposes. List of the questions can be found in Annex 1. After the interview it was asked by the author whether recommendations after research will be useful for the enterprise and the answer of the representative was positive. The results of bachelor thesis will be sent to the company after defense.

Interview Analysis

Respondent Abdurasulov Nurmuhammad was asked 4 questions regarding oil and gas industry in the Republic of Uzbekistan.

As of his answers, strategies in this field are implemented by JSC “Uzbekneftegaz”, which engaged in the production, storage, processing and sale of oil and gas In Uzbekistan and it’s the largest state-owned company in the country. The company ranks 11th in the world in terms of natural gas production. It was implemented strategic development of JSC “Uzbekneftegaz” for years 2020-2030 with four main tasks in order to implement dynamic development of the fuel and energy industry of the Republic of Uzbekistan, ensuring balanced and sustainable activities at all stages of its reform and technical and technological modernization, taking into account the strategic interests of the state, providing for further economic growth, improving the quality of life of the population and strengthening the country's energy security; meeting the growing needs of consumers in the fuel and energy industry at affordable competitive prices that ensure a return on investment, providing for the modernization and reconstruction of existing enterprises in the fuel and energy industry, the construction of new facilities based on highly efficient technologies for the production and processing of energy resources, improving and automating the system of accounting and control of electricity and natural gas at all stages of gas supply, diversification of fuel and energy resources with the development of the use of renewable energy sources, implementation of appropriate geological and technical measures (aimed at increasing the reserves of hydrocarbons in the subsurface and increasing their production).

According to the expert, several steps have been taken in order to execute four above tasks. The first one is the launch of the “Uzbekneftegaz GTL” plant, which is being built on the initiative and order of the President of the Republic of Uzbekistan Shavkat Mirziyoyev and which will become the largest production project in Central Asia. As a result of the developed effective measures, the construction work carried out in the complex was not stopped even during the coronavirus pandemic. At the “Uzbekneftegaz GTL” plant, work is currently underway to launch. During the implementation of these processes, industrial and environmental safety, health protection and labor safety are strictly controlled. The working group headed by the Chairman of the Management Board of JSC “Uzbekneftegaz” Mehriddin Abdullayev is systematically studying the progress of the investment project, the state of completion of construction and installation works, construction of external infrastructure facilities, as well as the processes of pre-design and commissioning of the “Uzbekneftegaz GTL” plant. At the present time, at the plant, the General Contractors of the project - Korean companies Hyundai Engineering, Hyundai Engineering & Construction and Enter Engineering (Singapore) - are actively working to launch the equipment for “Uzbekneftegaz GTL”. With the commissioning of the complex for the production of synthetic liquid fuel "GTL", 3.6 billion

cubic meters of gas will be processed per year, from which 1.5 million tons of high-quality synthetic liquid fuel will be produced, more than 307 thousand tons of jet fuel, 724 thousand tons of diesel fuel, 437 thousand tons of naphtha, 53 thousand tons of liquefied gas. Also, 1,321 new jobs have been created, products worth 7.8 trillion soums (approximately 610.000.000 euro) will be produced per year. The next important step is repair of equipment for the production of 40 thousand tons of liquefied gas per year. In “Shurtan Gas-Chemical Complex”, the 1st stage of the propane-butane mixture production unit was stopped for a preventive scheduled complete overhaul. In accordance with the decree of the President of the Republic of Uzbekistan "On measures to implement the investment program of the Republic of Uzbekistan for 2020-2022", a number of works are planned in the “Shurtan Gas-Chemical Complex” within the framework of the project for the modernization of the 1st stage of the existing plant for obtaining propane-butane mixture with the purpose of increasing the production of liquefied gas. As a result of the repair work, the stable operation of the equipment in the autumn winter season and the fulfillment of the indicators of the planned plan were achieved.

In addition to these steps and several other projects being implemented by JSC “Uzbekneftegaz”, the respondent noted cooperation between the Ministry of Energy of the Republic of Uzbekistan and the company "Assystem Engineering and Operation Services" (France), which on May 10, 2021 signed a Memorandum of Understanding (for the development of alternative energy sources). The purpose of the conclusion of the Memorandum is to study the implementation of joint projects and the potential for expanding strategic partnership in the territory of the Republic of Uzbekistan. Cooperation of the parties includes the following areas: project management, engineering design and consulting on renewable energy sources, including solar, wind and hydrogen; supporting the development of energy storage systems. The cooperation is aimed at supporting the energy sector of Uzbekistan in new areas of energy use and the transition to decarbonization.

The expert from the Ministry of Energy of the Republic of Uzbekistan didn’t agreed that most of the equipment used in oil and gas sphere in country are “worn out, they have been used from USSR period” arguing that several new plants, equipment and being implemented last several years in cooperation with foreign companies, such as Lukoil, Hyundai Engineering & Construction, Enter Engineering and several other ones.

Respondent Kamolov Musa was asked 5 questions regarding production costs in “Shurtan Gas-Chemical Complex”.

According to him several methods combined are used for calculation of production costs of finished and semi-finished products. The basics of Process method is taken for calculations

where is the actual cost of goods produced during the month is calculated based on the production costs identified in the redistribution, taking into account the change in the balance of work in progress at the beginning and end of the month, minus the cost of by-products at the planned cost. The method used in “Shurtan Gas-Chemical Complex” is programmed in their software and was developed by several experts, scientists from Uzbekistan and foreign countries in order to fit the features of exactly this company.

As mentioned in the interview, the most capital-intensive material in “Shurtan Gas-Chemical Complex” is polyethylene, which consumes more than 50% of production costs among other produced products. The reason is machine participating in the production and ethylene, so polyethylene is not made from raw material, but from semi-finished ones. Also this product is highly energy consumer, besides high pressure, which is needed on the first steps of the production, granules of the resulting polyethylene are steamed at a temperature above the melting point of polyethylene.

Respondent state that despite the fact that polyethylene is capital-intensive material, the margin for this product is also high. The supply rates are increasing year by year mostly from developing countries, even year 2020 was successful for sales of this product. USA, Russia and Netherlands are competing in this market to be the largest producer of polyethylene, as this is highly attractive market. Consequently, Ltd. “Shurtan Gas-Chemical Complex” will not reduce the pace of production of polyethylene.

According to the respondents, several events are planned and already implemented for reduction of production costs. Among recent ones are installation of high-precision equipment for measuring gas flow, modernization of installations that have been in use for more than 20 years, advanced training of technicians. Being more detailed, currently, within the framework of the investment project “Expansion of production capacities of the “Shurtan Gas Chemical Complex”, the complex is actively working to provide the “Uzbekneftegaz GTL” plant with raw materials and fuel gases. Gas supply facilities are one of the main among these facilities and serve to provide the newly built plant with raw materials and fuel gases. Within the framework of the gas supply facilities project, it is planned to lay two gas pipelines and install gas flow metering devices. At present, gas pipelines have been laid, the “Uzbekneftegaz GTL” plant has been successfully connected to the existing gas pipelines, gas flow meters have been installed. Gas flow meters have been specially prepared by “Emerson” for this project and are equipped with ultrasonic flow meters that are highly accurate in measuring gas flow rates. These new generation devices for metering gas consumption were the first in the republic to be installed at the “Shurtan Gas Chemical Complex”. In May of this year, “Shurtan Gas Chemical

Complex" installed new flow metering equipment on pipeline which transfer gas to "Uztransgaz". Modern equipment of this new type has a special computer that determines the composition, density and temperature of the gas online and brings the gas volume to standard conditions based on international requirements. The analyzer provides real-time gas chemistry data and calculates the gas flow rate. Installation of this equipment will make it possible to measure with high accuracy the amount of purified natural gas transferred to "Uztransgaz".

3.1 Analysis of production costs and factors affecting them at Ltd. "Shurtan Gas-Chemical Complex" as an example of oil and gas company located in Uzbekistan.

Shurtan Gas-Chemical Complex is a Limited Liability Company which is a part of Uzbekneftegaz Joint Stock Company. Products of Shurtan Gas Chemical Complex are as shown below. The works on putting into operation the Shurtan Gas Chemical Complex were started in 2001, and in August 2002 the production of polyethylene produced in Uzbekistan was launched. The construction of such a complex in this region is due to the fact that in Uzbekistan 88% of natural gas and 92% of oil are produced in the Kashkadarya region.

The gas chemical complex is specialized in processing natural gas and obtaining a wide range of polyethylene raw materials (granules). In addition to obtaining polyethylene raw materials, it is planned to obtain the following commercial products: combustible natural gas, liquefied hydrocarbon gas, stable gas condensate, technical gas sulfur (Figure 3.1).

The main goal of the Shurtan Gas Chemical Complex is the production of competitive and high-quality products, in-depth processing of natural gas for a gradual transition from the sale of raw materials (natural gas) to the sale of finished products with high added value (organic synthesis products, polymers), as well as the development of gas chemistry in the country as a science-intensive production and at the same time a new industry for the economy of our country. In addition, the important aspects in the functioning of the Complex are the observance of the rules of safety and health protection of people, the prevention of environmental pollution.[58]

[58] Official website of "Shurtan Gas Chemical Complex";

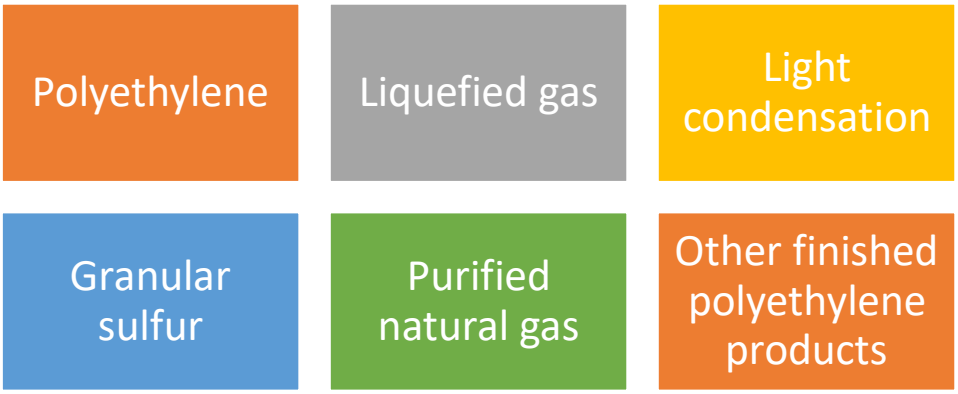

Figure 3.1. Products produced in Shurtan Gas Chemical Complex in Uzbekistan.

Source: Compiled by author based on data from official website of Ltd. "Shurtan Gas-Chemical Complex"

Table 3.1 shows the cost of the above-mentioned types of products of Ltd. Shurtan Gas-Chemical Complex by cost elements.

Table 3.1

Cost of products produced in Ltd. Shurtan Gas-Chemical Complex in 2017-2019 in Uzbek sum

	Indicators	**2017**	**2018**	**2019**
Polyethylene (t)	**The volume of production of products (t)**	**131 800**	**125 471,9**	**130 130**
	Production cost (in thousand sums)	**117 982 882**	**121 424 143**	**144 801 196**
	Material costs	80 429 052	78 625 197	94 184 126
	Remuneration	12 679 835	16 965 776	18 482 438
	Social insurance	3 167 511	42 579 381	4 599 882
	Overheads	21 706 484	21 579 381	27 534 750
	Unit cost (in sums)	**895 166**	**967 740**	**1 112 743**
Liquefied gas (t)	**The volume of production of products (t)**	**110 847,5**	**112 602,6**	**103 411,9**
	Production cost (in thousand sums)	**25 474 530**	**35 175 701**	**23 009 809**
	Material costs	17 366 013	22 777 154	14 966 442
	Remuneration	2 737 794	4 914 863	2 936 974
	Social insurance	683 920	1 232 292	730 950
	Overheads	4 686 803	6 251 392	4 375 443

	Indicators	2017	2018	2019
	Unit cost (in sums)	**229 816**	**312 388**	**222 506**
Commercial gas (thousand m^3)	**The volume of production of products (t)**	**3 703 820**	**3 632 897**	**3 580 065**
	Production cost (in thousand sums)	**29 321 446**	**37 948 159**	**38 340 982**
	Material costs	19 988 460	24 572 391	24 938 412
	Remuneration	3 151 229	5 302 240	4 893 846
	Social insurance	787 199	1 329 418	1 217 973
	Overheads	5 394 558	6 744 110	7 290 750
	Unit cost (in sums)	**7 917**	**10 446**	**10 710**
Light condensate (t)	**The volume of production of products (t)**	**101 671,3**	**112 737,9**	**104 582,1**
	Production cost (in thousand sums)	**4 130 888**	**6 018 978**	**4 288 252**
	Material costs	2 816 031	3 897 440	2 789 240
	Remuneration	443 954	840 991	547 353
	Social insurance	110 903	210 860	136 224
	Overheads	760 001	1 069 687	815 435
	Unit cost (in sums)	**40 630**	**53 389**	**41 004**
Granular sulfur (t)	**The volume of production of products (t)**	**1 790,4**	**1 518,3**	**1 402,2**
	Production cost (in thousand sums)	**33 596,9**	**32 834,1**	**23 267,6**
	Material costs	22 903,03	21 260,91	15 134,15
	Remuneration	3 610,72	4 587,69	2 969,88
	Social insurance	901,98	1 150,26	739,14
	Overheads	6 181,15	5 835,25	4 424,47
	Unit cost (in sums)	**18 765**	**21 626**	**16 594**

Source: Compiled by author based on internal statistics of Ltd. "Shurtan Gas-Chemical Complex"

According to Table 3.1, it can be seen that polyethylene occupies the leading position in terms of the volume of production (130 130 tons in 2019), and sulfur – the minimum volume (1 402,2 tons in 2019). The cost per unit of product has a maximum value for polyethylene (1 112 743 sums in 2019), and minimum for commercial gas (10,710 soums in 2019).

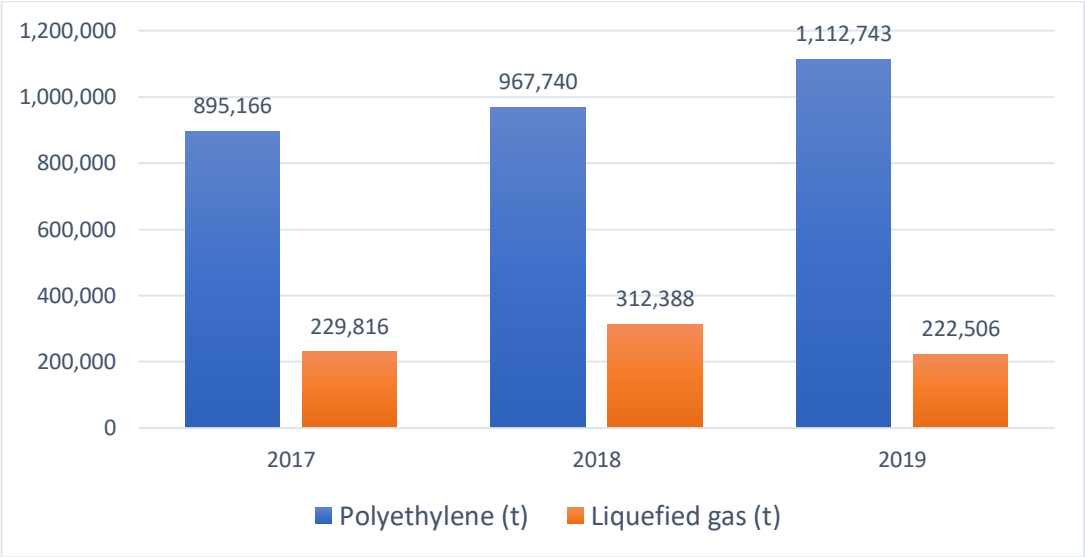

Figure 3.2. Unit costs of Polyethylene and Liquefied gas over years 2017-2019 in Uzbek sum in Shurtan Gas Chemical Complex in Uzbekistan.

Source: Compiled by author based on data from Table 3.1

It is also worth noting that according to Table 3.1 and Figures 3.2 and 3.3, it can be concluded that over the past 2 years, the cost of liquefied gas, light condensate and sulfur has been falling. While the cost of polyethylene and commercial gas, on the contrary, were increasing.

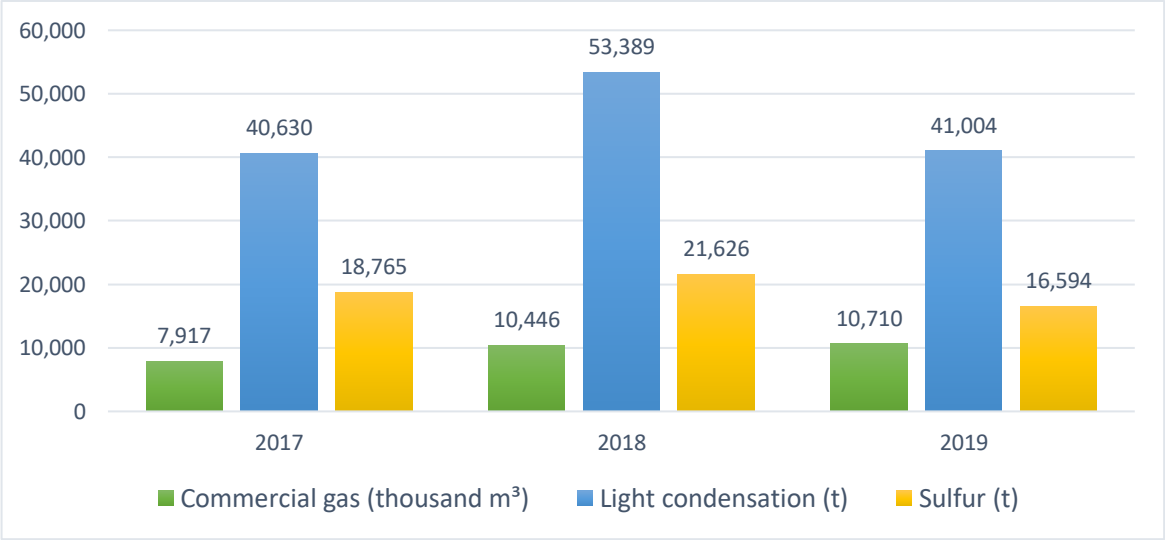

Figure 3.3. Unit costs of Commercial gas, Light condensate and sulfur over years 2017-2019 in Uzbek sum in Shurtan Gas Chemical Complex in Uzbekistan.

Source: Compiled by author based on data from Table 3.1

Since the costs for the production of polyethylene and commercial gas account for the largest specific gravity (63% and 17%, respectively, in 2019) and only the volume of

polyethylene production has been growing over the past 2 years, production costs are growing from year to year. The growth dynamics can be seen in Figure 3.4.

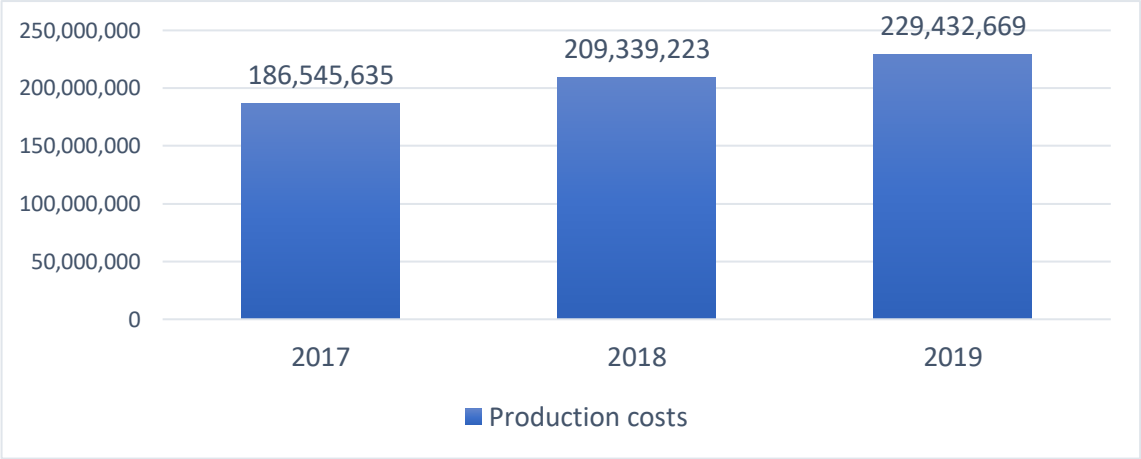

Figure 3.4. Production costs over years 2017-2019 in thousand Uzbek sum in Shurtan Gas Chemical Complex in Uzbekistan.

Source: Compiled by author based on data from Table 3.1

That is why we focus on the analysis of the cost of polyethylene. Below is information from the report on the cost of polyethylene produced by Shurtan Gas Chemical Complex Ltd for 2017-2019.

As can be seen from Table 3.1, the cost of production is growing from year to year, which is ineffective for the enterprise. This is primarily due to the cumulative change in costs each year.

In 2017, the volume of polyethylene production in physical terms amounted to 131 800 tons, which exceeds the indicators of 2018 and 2019 by 5% and 1%, respectively, but in value terms in 2019 there was the greatest growth by 402 889 245 thousand soums, which exceeded the indicators the previous two years by 10% and 18%, respectively. This is due to a significant increase in resource prices in 2019. The growth dynamics of this element can be seen in Figure 3.5.

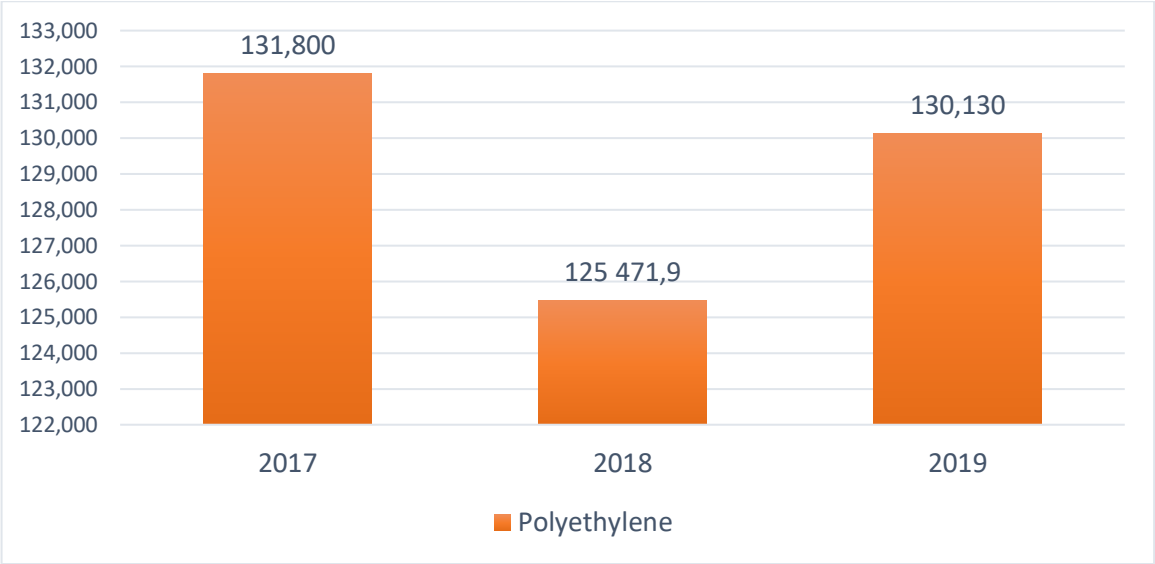

Figure 3.5. Production volume of polyethylene over years 2017-2019 in tons in Shurtan Gas Chemical Complex in Uzbekistan.

Source: Compiled by author based on data from Table 3.1

Analyzing the data in Table 3.1, it can be noted that in 2019 the volume of products sold was higher than in 2017, although in terms of production volume, in 2017 more products were produced than in 2019. This is due to the fact that the demand for production in 2019 was more than in 2017.

Table 3.2

Report on the cost of polyethylene in Ltd "Shurtan Gas Chemical Complex" for 2017-2019

№	Indicators		Polyethylene		
			2017	2018	2019
1	Production volumes				
	A	In kind (in tons)	131 800	125 471,9	130 130
	B	In value terms (in thousand sums)	362 364 143,8	330 233 478	402 889 245
1	Sales volume of commercial products				
	A	In kind (in tons)	126 396	121 548	128 333
	B	In value terms (in thousand sums)	365 424 149,6	329 929 638	392 094 541
2	Share of costs (%)		63,246	58,004	63,11
3	Production cost (in thousand sums)		117 982 882	121 424 143	14 480 119

	A	Material costs	80 429 052	78 625 197	94 184 126
	-	Raw materials (low-sulfur gas)	52 395 839	52 557 422	53 979 306
	-	Supporting materials	18 988 845	17 186 809	21 789 447
	-	Consumption of mater. own production	3 260 285	2 895 287	4 248 262
	-	Fuel and energy, energy resources	5 784 084	5 985 679	7 083 555
	*	electricity	4 848 958	5 025 597	6 326 195
	*	fuel gas	247 186	341 503	120 636
	*	Fuels and lubricants for production	516 630	484 699	456 263
	*	Purchased water	171 580	133 879	180 462
	B	Remuneration	12 679 835	16 965 776	18 482 438
	C	Social insurance	3 167 511	4 253 789	4 599 882
	D	Overheads	21 706 484	21 579 381	27 534 750
	-	Depreciation deductions	15 226 084	15 765 134	20 016 944
	-	External services (transport)	114 692	71 274	25 638
	-	Outside services (various)	5 666 079	4 899 306	6 186 865
	-	Other production costs	699 629	843 667	1 305 302
4	Period expenses (in thousand soums)		110 270 736	94 892 042	122 192 558
	1	Implementation costs	3 015 098	3 504 364	4 309 914
	2	Administrative expenses	2 640 538	3 064 540	3 852 442
	3	Other operating expenses	104 615 100	88 323 138	114 030 202
		3.1 taxes to the budget	570 882	7 827 015	9 707 827

		3.2.	payments to extrabudgetary funds	11 071 346	9 655 907	12 232 586
		3.3	others	87 834 930	70 840 216	92 089 789
5	Financial expenses (in thousand soums)			12 616 127	13 264 082	927 689
6	Full costs (in thousand soums)			240 869 745	229 580 266	267 921 443
7	Unit cost (per ton)					
	A	At production costs (in soums)		895 166	967 740	1 112 743
	B	At full cost (in soums)		1 827 540	1 829 735	2 058 875

Source: Compiled by author based on internal statistics of Ltd. "Shurtan Gas-Chemical Complex"

In Ltd. "Shurtan Gas Chemical Complex" the share of costs for the production of products, one of which is polyethylene, is calculated separately for each type every year. For example, from Figure 3.6 it can be seen that the share of costs for polyethylene production was the highest in 2017 and amounted to 63.25%. This indicates that the company paid great attention to the production of polyethylene this year. The reason for this is that polyethylene is known to be a semi-finished product for many enterprises and, therefore, the demand for it is always high. Further, in 2018, there was a decrease in costs by 5% (58%). This is due to the fact that, firstly, the company took measures to reduce the cost of producing this product, and secondly, in 2018 the least amount of the product was produced due to a drop in demand. However, further, the share of costs increased again and reached 63.11%. This was facilitated by a sharp rise in product output due to increased demand.

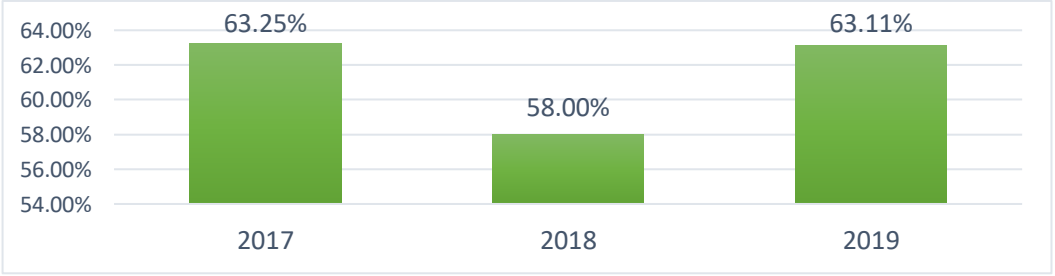

Figure 3.6. The share of costs in % attributable to the production of polyethylene over years 2017-2019 in Shurtan Gas Chemical Complex in Uzbekistan.

Source: Compiled by author based on data from Table 3.2

As mentioned earlier, the cost of polyethylene is growing every year. In 2016, the production cost amounted to 117 982 882 thousand sums, and in 2017 this indicator increased by 2.9% and amounted to 121 424 143 thousand sums. Further, in 2018, the cost was already 144 801 196 thousand sums, which is 19.3% higher than in 2017. This is accompanied, as can be seen from Figure 3.7, a colossal increase in payroll charges, which amounted to 34.9% and 46.9% in 2017 and 2018, respectively, in relation to 2016 and as can be seen from Figure 3.8, for social insurance: 34.3% (2017) and 45.2% (2018).

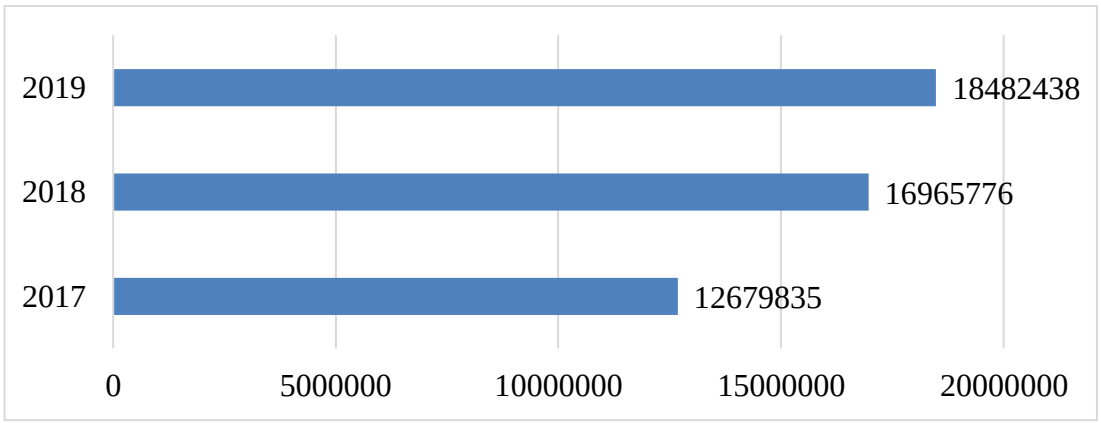

Figure 3.7. Labor remuneration for polyethylene production over years 2017-2019 in thousands of sums in Shurtan Gas Chemical Complex in Uzbekistan.

Source: Compiled by author based on data from Table 3.2

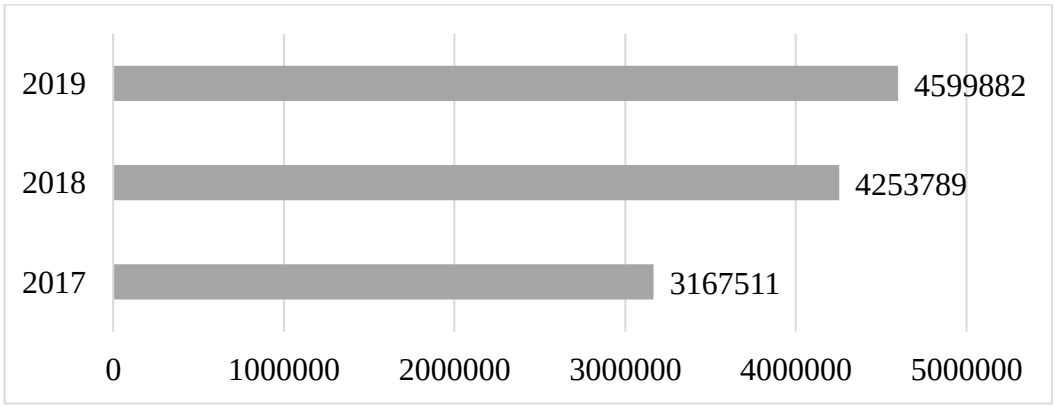

Figure 3.8. Social insurance expenses for polyethylene production over years 2017-2019 in thousands of sums in Shurtan Gas Chemical Complex in Uzbekistan.

Source: Compiled by author based on data from Table 3.2

However, most of the petrochemical industries are material intensive. Having analyzed the cost elements in the cost structure of polyethylene over years 2017-2019, it can be seen that

material costs account for the largest share (65%), labor costs - 13%, social insurance - 3%, overhead costs - 19%.

Material costs are the costs of the organization for the purchase of raw materials and materials for the creation of finished products.

Material costs include the cost of:

- purchased components and semi-finished products;
- purchased semi-finished products;
- natural raw materials;
- all types of fuel purchased from the side, consumed for technological purposes, the generation of all types of energy, heating of buildings;
- purchased energy of all types spent on technological, energy, motor and other needs.[59]

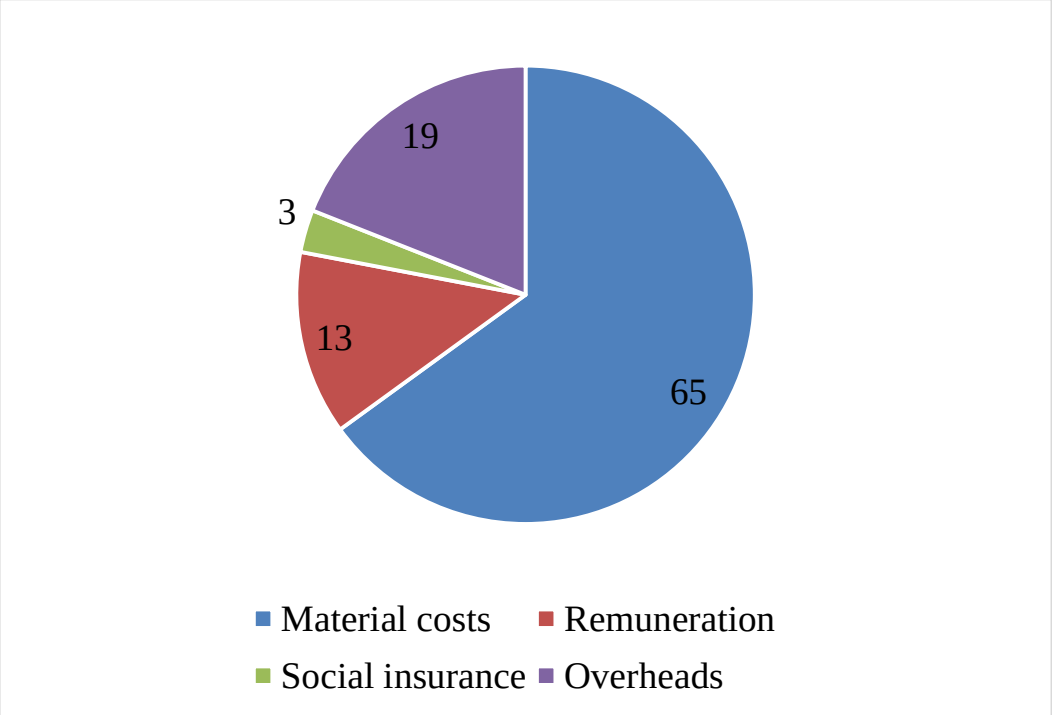

Figure 3.8. Share of component costs in the cost of polyethylene in 2018 in% in Shurtan Gas Chemical Complex in Uzbekistan.

Source: Compiled by author based on data from Table 3.2

Consequently, for the petrochemical industry, most of which are material-intensive and some are energy-intensive, the most important way to reduce costs is to save on materials and energy. Each percentage reduction in material costs leads to a decrease in the cost of chemical

[59] Thomas D. S., Gilbert S. W., (2014), Costs and cost effectiveness of additive manufacturing. *NIST special publication*, 1176, p. 89;

products by 0.6-0.8%, while a 1% decrease in the cost of wages of basic workers reduces the cost by about 0.01%, and a reduction in overhead costs by 1% gives cost reduction by 0.15-0.2%.

CONCLUSION

Production costs are the current costs of the enterprise, expressed in value terms, for the production and sale of products (works, services). The method of accounting for production costs and the calculation of the cost of production is usually understood as a set of techniques for documenting and reflecting production costs, which ensure the determination of the actual cost of production and provide the necessary information to control this process. There are several methods for calculating production costs depending on industry, the size of the company, legislation and on output of desirable results. The main methods of calculation of production costs in CIS, including Uzbekistan, are simple, process, custom and normative methods.

Global energy production and consumption is slowly increasing year by year. There is a trend among highly developed countries, most EU counties, Japan, Canada, Singapore and several others: oil and gas products, coal is being used in less quantities replacing it by alternatives such as sun, water, wind energy. While from developing countries the perspective, most Asian and Latin America countries, the consumption of all types of energy is increasing year by year, especially consumption of cheap energy materials, such as gas and coal. Oil production is also developing, mostly in OPEC countries, Russia and USA. According to experts, the sphere of oil and gas will successfully operate nearly 100 more years, slowly being replaced by alternative energy materials. This industry is being challenged by world organizations and governments in order to minimize ecologic problems which it causes and companies are moving towards zero carbon production. Also, pandemic COVID-19 brought challenges to the industry, as usage of all kinds of transport, starting from vessels and ending with personal cars, is decreased several times and it is only being restored, as this sector is one of the main consumers of oil and as products. Besides, the industry waits for new technologies to be implemented and to be digitalized, starting from personnel records and ending with smart wells technology and artificial intelligence to be used while geological exploration and well drilling. Based on previous researches, it can be stated that company representatives from biggest companies of the industry support the idea of digitalization.

As case study showed, “Shurtan Gas Chemical Complex” uses a complex of methods in order to calculate cost prices at the enterprise which was formulated by experts in this field and was further implemented into the software which is used by the company. Also, according to the representative of the Ministry of Energy of the Republic of Uzbekistan, who participated in the

interview, JSC “Uzbekneftegaz” which is the largest state company in Uzbekistan has a strategy till 2030 which aims also to hold events for reduction of cost prices with the help of introduction of new technologies.

Moreover, as research illustrated, the biggest portion of production costs in “Shurtan Gas Chemical Complex” is material costs, which makes up 65% of all costs. So, for the reduction of production costs in material-intensive and energy-intensive companies, which are most of the oil and gas companies, it is advisable to decrease the amount of used energy, fuels in the production by introducing new generation of plants and equipment.

PROPOSALS

For the petrochemical industry, most of whose enterprises are material-intensive, and some are energy-intensive, the most important way to reduce costs is to save materials and energy which participate in the process of production. Each 1% reduction in material costs leads to a decrease in the cost of chemical products by 0.6-0.8%, while a 1% decrease in the cost of wages of basic workers reduces the cost by about 0.01%, and a reduction in overhead costs by 1% gives cost reduction by 0.15-0.2%.

As mentioned earlier, in the structure of the cost of polyethylene for 2019, it can be seen that material costs account for the largest share (65%). Moreover, the calculation of the specific weights of cost elements in the total cost of all products also allowed us to conclude that material costs occupy more than 60%. That is why even an insignificant saving of raw materials, materials, fuel and energy in the production of each unit of production as a whole for the enterprise will give a large effect.

Thus, as measures to reduce material costs at the enterprise, it is proposed to reduce the cost of electricity consumption. For this, it is advisable to adopt foreign experience in this direction. Nowadays, oil and gas companies have begun using gas turbine units that generate electricity from gas. This installation is especially popular in places where there is no government power supply, such as deserts, offshore oil and gas platforms, and so on.

One of these turbine units is SOLAR MARS 100, which has the following main characteristics:

- Type - two-shaft gas turbine unit;
- Type of fuel used - natural gas;
- Electric power - 11.19 MW;
- Fuel consumption - 36 MJ / s;
- Voltage - up to 13.8 kV,
- Current frequency - 50 Hz;
- Overall dimensions (LxWxH) - 9.1 m; 2.8 m; 3.4 m;
- Compression ratio of the compressor - 17.4;
- Generator - NEMA class F;
- Control system - Turbotronic;
- Exhaust gas temperature - 485 ° C;
- Weight - 34 tons.

The MARS 100 gas turbine offers high reliability and durability as well as ease of maintenance. Like all SOLAR gas turbines, MARS gas turbines are available for mechanical drives, generators and compressors. The MARS 100 is designed for long-term industrial use and depending on the operating conditions, long repair intervals are possible. The unit has a fifteen-stage axial compressor, a SoLoNOx low-emission annular combustion chamber, two-stage high and low pressure turbines.

This power equipment, which does not require a foundation or room, is highly mobile. All of its parts are located in a soundproof housing with a silencer. The installation already includes all auxiliary elements (instrumentation, safety) Moreover, the installation is quickly assembled and put into operation. The cost of this equipment is $ 5.25 million, including installation, start-up and on-site training of personnel. However, delivery of the installation will cost 40 thousand dollars. According to the Resolution of the Ministry of Economy, Ministry of Finance, Ministry of Foreign Economic Relations, Investments and Trade, State Customs Committee of the Republic of Uzbekistan dated 15.02.2013 No. 21, GTP MARS 100 is included in the list of technological equipment that are exempted upon import into the territory of the Republic of Uzbekistan from import customs duties and VAT. Thus, the initial investment will amount to $ 5.25 million.

Today the dollar exchange rate is 10 572 sum. Consequently, initial investments: 5 250 000 * 10 572 = 55 503 000 000 sum. Next, the power consumption for 1 hour will be calculated:

Table 4

Electricity consumption for 1 hour in Ltd. "Shurtan Gas Chemical Complex" over years 2017-2019

Indicator	2017	2018	2019
Electricity consumption per year (billion soums)	7,6	8	10
Electricity consumption per year (MW)	25 901,4	26 659,3	35 544,8
Electricity tariff (sum / kWh)	296	325	282
Electricity consumption per hour (kW)	**2997,8**	**3085,5**	**4114**

Source: Compiled by author based on internal statistics of Ltd. "Shurtan Gas-Chemical Complex"

"Shurtan Gas Chemical Complex" plans to complete the expansion of the ethylene department of the enterprise this year. Thus, it is planned to increase the volume of production from 1500 thousand tons to 5000 thousand tons per year. In this case, the power consumption will increase to approximately 13 MWh, and the purchase of a selected installation that allows to obtain such an amount of electricity per hour will become expedient.

Since the fuel consumption is known to be 36 MJ / s, it can be found how many m³ of gas is needed to produce that much energy. The specific heat of combustion of natural gas is 37,000 kJ / m³.[60] This means that 36 MJ will have 0.97 m³ of gas. As a result, 11,085.7 m³ of gas is consumed to generate 11.19 MW of electricity per hour.

"Shurtan Gas Chemical Complex" processes gas produced by "Shurtanneftegaz". In 2019, the price of the supplied gas was 24 soums per 1 m³.

The GTP at full capacity produces 11 190 * 24 * 360 = 96 768 000 kW of electricity per year. If the company buys it this year, then in the remaining six months it will operate at 36.7% of its capacity, since the hourly consumption by the end of this year will be about 4MW. However, with the completion of the expansion of the ethylene plant, SOLAR MARS 100 will operate at full capacity.

[60] Бузановский, В. А. (2009). Информационно-измерительная система состава и свойств природного газа. *Технологии нефти и газа*, (2), 60-64.

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Annex

Questions to the representative from Ministry of Energy of the Republic of Uzbekistan, Abdurasulov Nurmuhammad, who is specialist in the implementation of energy efficient and energy saving technologies in buildings and structures:

- Are there any strategy in the Republic of Uzbekistan for production costs reduction in oil and gas industry?
- Within the framework of the strategic development of JSC "Uzbekneftegaz" 2020-2030 there are 4 tasks, what specific ways are supposed to solve these tasks and have steps been taken to achieve the future goal of the strategic development?
- It's known that most of the equipment used in companies of oil and gas industry in the Republic of Uzbekistan are worn out, they have been used from USSR period, when they are planned to be changed to up-to-date ones and are concrete steps planned for this?
- Does the Ministry of Energy involve experience of top oil and gas companies in order to reach high results in reduction of production costs? If yes, then which company's experience is chosen for this goal?

Questions to management representative from Ltd. "Shurtan Gas-Chemical Complex", Kamolov Musa, whose position is Acting Deputy General Director for Investment and Innovation:

- Which method is used for calculation of production costs in the company?
- Which material, semi-finished product is the most capital intensive?
- Is this material is sold with high margin?
- Are there any events, strategies implemented in order to reduce production costs in the company?
- Is it allowed to survey employees in the company in order to know their inferences regarding production costs and factors affecting them in the company?

The Bachelor's thesis **"Change Management and its Role in Business"** has been developed at the Faculty of Business, Management and Economics of the University of Latvia

With this signature, I confirm that the research has been done independently, only the stated sources of information have been used, and the electronic copy of the thesis is identical to the printed copy.

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The thesis has been submitted to the dean's designated responsible person at the Study Centre of the UL Faculty of Business Management and Economics

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The thesis has been defended at the meeting of the _____Examination Commission

on _____._____._____. (Bachelor's, Master's, State)

Secretary of the commission: _____ _____

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