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 DEPARTMENT OF INTERNATIONAL ECONOMY

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_____ Serhii VOITKO
 «___» December 2022 p.

MASTER THESIS
 for a master's degree
 according to the educational program
 "International Economics"
 specialty 051 "Economics"

on the theme: "**IMPLEMENTATION OF INTERNATIONAL
 COOPERATION IN GAS AND HYDROGEN ENERGY BETWEEN
 QATAR AND UKRAINE**"

Completed:
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I certify that in this
 master's dissertation
 there are no borrowings
 from the works of other
 authors without proper
 references

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Head of the Department

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«___» _____ 2022

OBJECTIVE

for a master's thesis of a student

Al-Ghaffari Aisha Mohamed I.Y.

1. The theme is “IMPLEMENTATION OF INTERNATIONAL COOPERATION IN GAS AND HYDROGEN ENERGY BETWEEN QATAR AND UKRAINE”, scientific supervisor – Voitko Serhii Vasyliovych, head of Department of International Economics, Doctor of Economics, Professor, approved by the order of the University from "___" _____2022
№ _____
2. The deadline for students to submit a dissertation is December 24, 2022.

3. The Objective of research is process of development of international scientific and technical cooperation for enterprises of the gas complex and hydrogen technologies.
4. Initial data: provisions of economic theory, periodicals and monograph publications, legal framework, materials of international scientific and practical conferences, as well as statistical materials of the Data World Bank.
5. List of tasks to be developed: Determine the economic essence and basic principles of international cooperation. To study the content and types of export and import strategies in the energy sector. Select methods for assessing the level of efficiency and productivity of energy enterprises. To study the trends in the development of the energy sector in the world, in Qatar and in Ukraine. Assess the efficiency and productivity of investment projects. Analyze strategies for the development of hydrogen energy in the global economy. Determine directions for improving international cooperation between Qatar and Ukraine in the energy sector. Propose diversification of energy sources in international cooperation. Make an economic justification for international energy projects.
6. Approximate list of graphic (illustrative) material: not less than 5 tables and not less than 10 figures.
7. Approximate list of publications: 0 publications
8. Dissertation section consultants *

Section	Surname, initials and position consultant	Signature, date	
		task issued	task accepted

9. Date of issuance of the task: November 01 2022

Calendar plan

№	Name of stages	Term of implementation	Note
1	Get the list of research area, make up the mind of research topic	September 01, 2022	done
2	Assignment of students to supervisors of master's dissertations;	September 05, 2022	done
3	Selection of topics for master's theses (with supervisors) and their approval at the meeting of the department;	September 05, 2022	done
4	Development of the content (plan) of the master's dissertation and issuance of the task by the supervisor;	September 12, 2022	done
5	Selection of literature on the research topic and its analysis;	October 10, 2022	done
6	Preparation of the theoretical section and coordination of its content with the supervisor;	October 17 2022	done
7	General research on carbon economy	October 17, 2022	done
8	Conducting a comprehensive analysis on the point of view of carbon trade	October 17, 2022	done
9	Conducting a comprehensive analysis on the point of view of energy market	October 20, 2022	done
10	Final completion of the second section of the thesis, master's thesis;	November 07, 2022	done
11	Development of improvements and innovations, which are the basis of the third recommendation section;	November 10, 2022	done
12	Prepare the materials of market mechanisms the third section;	November 16, 2022	done
13	Generalization of the received scientific results, use the materials of world published data and experience for further analysis and preparation of the general conclusions;	November 28, 2022	done
14	Registration of the master's dissertation and its submission for check to the scientific adviser;	December 09, 2022	done
15	Elimination of the shortcomings revealed by the head and the reviewer, preparation of a report and visual materials for defense;	December 19, 2022	done
16	Defense of the master's dissertation before the EC according to the approved schedule.	December 24, 2022	

Student _____

Al-Ghaffari Aisha Mohamed I.Y.

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Serhii VOITKO

ABSTRACT

Pages 83	Drawings 3	Tables 8	Applications 0
Research by example:			
The aim of the study:	The purpose of this study is to reveal the origin and basic logic of international cooperation in gas and hydrogen energy, to investigate the theoretical foundations of international cooperation in energy, to analyze the efficiency of energy enterprises, to analyze the strategy for the development of hydrogen energy in the global economy, to propose directions for the implementation of the main provisions of international cooperation between Qatar and Ukraine.		
Objectives of the study	<ul style="list-style-type: none"> – Work out the theoretical foundations of international cooperation in energy. – Identify the economic essence and basic principles of international cooperation. – To study the content and types of export and import strategies in energy. – To evaluate the levels of efficiency and productivity of energy enterprises. – To carry out a system-structural analysis of the efficiency of energy enterprises in the process of implementing international cooperation. – To study trends in the development of the energy sector in the world, in Qatar and in Ukraine. – Assess the efficiency and productivity of investment projects. – To analyze the strategy for the development of hydrogen energy in the global economy. – Identify directions for the implementation of the main provisions of international cooperation in the field of gas and hydrogen energy. To propose improvement of international cooperation between Qatar and Ukraine in the energy sector. – To propose diversification of energy sources in international cooperation. – To make an economic justification of energy international projects. – Form conclusions on the topic of the master's thesis. 		
Subject of study:	theoretical, methodological and applied foundations of the functioning of international scientific and technical cooperation between countries and enterprises of the oil and gas complex and hydrogen technologies in the conditions of the post-crisis stage of economic development		
Object of study:	is the process of development of international scientific and technical cooperation for enterprises of the gas complex and hydrogen technologies.		

Scientific novelty	The scientific novelty of the work is the further development of the methodological foundations of the transformation of the energy system of the world economy on the basis of the Paris Agreement in the conditions of the post-crisis stage based on the gradual transition from traditional energy to hydrogen energy in order to improve the planet's ecology and develop international scientific and technical cooperation.
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Key words: international cooperation, energy, Qatar, Ukraine, gas, hydrogen.

Annotation

Al-Ghaffari Aisha Mohamed I.Y. Implementation of international cooperation in gas and hydrogen energy between Qatar and Ukraine. – Manuscript.

Master's dissertation in the field of study 051 "Economics", educational and professional program "International Economics". - National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute". - 2022.

The work defines the economic essence and basic principles of international cooperation in the energy sector. The author studied the content and types of export-import strategies in energy. The main methods of assessing the level of efficiency and productivity of energy enterprises have been determined. The trends in the development of the energy sector in the world, as well as countries such as Qatar and Ukraine, are analyzed. The efficiency and productivity of investment projects in the energy sector were evaluated. Strategies for the development of hydrogen energy in the world economy are also analyzed. The directions for improvement of the international cooperation between Qatar and Ukraine in the energy sector have been duly determined. Diversification of energy sources in international cooperation is proposed. The economic justification of international energy projects has been formed.

Subject of study: theoretical, methodological and applied foundations of the functioning of international scientific and technical cooperation between countries and enterprises of the oil and gas complex and hydrogen technologies in the conditions of the post-crisis stage of economic development.

The scientific novelty of the work is the further development of the methodological foundations of the transformation of the energy system of the world economy on the basis of the Paris Agreement in the conditions of the post-crisis stage based on the gradual transition from traditional energy to hydrogen energy in order to improve the planet's ecology and develop international scientific and technical cooperation.

Key words: international cooperation, energy, Qatar, Ukraine, gas, hydrogen.

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INTRODUCTION

Actuality of theme. The topicality of the topic is determined by the current state of the world economic system, the possibility of armed conflicts in many countries of the world, and the special conditions of the functioning of the gas industry in conditions of uncertainty. The energy sector in the 21st century is key to ensuring the economic stability of countries. The Paris Climate Agreement deserves special attention. Stable energy supply contributes to the normal functioning of all spheres of the world economy. The significant transformation of the European natural gas market made it necessary to change approaches to the regulation of this market by sanctioning mechanisms, as well as to introduce alternatives in the energy market, such as hydrogen energy. The above should be implemented in parallel in order to preserve the energy balance and energy security. Quarantine restrictions of COVID-19 started transformational processes in the energy market precisely from the position of using alternative types of energy. Hostilities on the European continent continued this trend.

The well-established mechanism of the functioning of the energy industry ensures a comfortable life, stable operation of industries, as well as the development of the economy as a whole. To minimize the negative economic consequences of transformational effects, it is necessary to provide a list of stages of gradual transformation based on forecasting. Based on the forecasting results, balanced management decisions will be made in conditions of limited resources.

Analysis of the latest research. Abe J., Gielen D., Gorini R., Wagner N., Mottaeva A., Cetkovic J., Hongfang dealt with the issue of energy supply by products of the gas industry.

Also, such scientists as: Voitko S., Peng Y. Chandler J, Alfred D., Kosov M., Fragiacomio P., Piraino F., Genovese M., Zakari A. were engaged in the research of this problem and made a significant contribution.

There is already a scientific development in science, but many issues have not yet been sufficiently investigated. This concerns the structure of the natural gas market, as well as the promising market of hydrogen energy technologies. The issue of technological changes in the energy sector and evaluation of the effectiveness of the latest energy technologies is important.

All this determined the choice of the topic of the master's thesis, justification of its purpose, tasks, as well as the logic of the research.

The purpose of this study is to reveal the origin and basic logic of international cooperation in gas and hydrogen energy, to investigate the theoretical foundations of international cooperation in energy, to analyze the efficiency of energy enterprises, to analyze the strategy for the development of hydrogen energy in the global economy, to propose directions for the implementation of the main provisions of international cooperation between Qatar and Ukraine.

In accordance with the set goal, the following **tasks were defined and solved in the dissertation:**

- Work out the theoretical foundations of international cooperation in energy.
- Identify the economic essence and basic principles of international cooperation.
- To study the content and types of export and import strategies in energy.
- To evaluate the levels of efficiency and productivity of energy enterprises.
- To carry out a system-structural analysis of the efficiency of energy enterprises in the process of implementing international cooperation.
- To study trends in the development of the energy sector in the world, in Qatar and in Ukraine.
- Assess the efficiency and productivity of investment projects.
- To analyze the strategy for the development of hydrogen energy in the global economy.
- Identify directions for the implementation of the main provisions of international cooperation in the field of gas and hydrogen energy.

- To propose improvement of international cooperation between Qatar and Ukraine in the energy sector.
- To propose diversification of energy sources in international cooperation.
- To make an economic justification of energy international projects.
- Form conclusions on the topic of the master's thesis.

The object of the study is the process of development of international scientific and technical cooperation for enterprises of the gas complex and hydrogen technologies.

Subject of study: theoretical, methodological and applied foundations of the functioning of international scientific and technical cooperation between countries and enterprises of the oil and gas complex and hydrogen technologies in the conditions of the post-crisis stage of economic development.

Research methods. Commonly known research methods were used to achieve the goal and solve the tasks of the master's thesis. The main general scientific methods of research include: the dialectical method of cognition; formal-logical method; method of comparison; generalization method; systematization method; classification method; synthesis method; methods of grouping; statistical and mathematical methods; graphical analysis; systematic approach; integrated approach; forecasting method, factor analysis, comparative analysis, analogy method.

Scientific novelty. The scientific novelty of the work is the further development of the methodological foundations of the transformation of the energy system of the world economy on the basis of the Paris Agreement in the conditions of the post-crisis stage based on the gradual transition from traditional energy to hydrogen energy in order to improve the planet's ecology and develop international scientific and technical cooperation.

Practical significance of the obtained results. The measures formulated by the author and substantiated in the master's thesis can be used by Qatari, Ukrainian and enterprises of other countries that carry out industrial and commercial activities in the gas sector and in the field of hydrogen energy technologies in

order to develop international scientific and technical cooperation and increase the economic efficiency of these enterprises.

Structure and scope of the master's thesis. The work consists of an introduction, three chapters, conclusions, a list of used literary sources and appendices. The volume of work includes *** pages of printed text, including: ** tables, ** figures, a list of used sources - ** titles on ** pages.

CHAPTER 1.

THEORETICAL FOUNDATIONS OF INTERNATIONAL COOPERATION IN ENERGY

1.1. Economic essence and basic principles of international cooperation

In the context of the decline in industrial production due to COVID-19, the introduction of energy-saving technologies due to the energy crisis, the fact that the world economy is at the stage of an unstable economic and political situation, and the instability of the external operating environment, it is necessary to improve the mechanism of international cooperation [1].

The stability of the functioning of the modern post-crisis oil and gas complex is largely achieved through the planning and organization of an effective system of strategic management and planning of strategic changes.

The strategy becomes the main tool for the long-term development of the industry. The term “Strategy” (ancient Greek “the art of the commander”) is a general, non-detailed plan of any activity covering a long period of time, a way to achieve a complex goal that is uncertain and main for the manager at the moment, further adjusted to change conditions for the existence of a manager-strategist [2].

Strategy, as a way of acting in international cooperation, becomes necessary in a situation where the resources of one country are not enough to directly achieve the main goal of the industry. The objective of the strategy is the effective use of international relations to achieve the main goals.

From a strategic perspective, the economic component plays an important role. At the enterprise, the strategy is supported by economic indicators. It is possible to achieve the strategic goal if economic and financial resources are available. In this case, it is necessary to take into account possible competitors and their resources.

In the history of the development of society, there have been many economic crises. For example, the economic crisis of 1929-1933 was a test for the world economy [3]. Also in history, the "invisible hand" of Adam Smith played an important role. The Hand is based on the economic crisis of overproduction. Also important for elucidating our problem is the theory of John Keynes. This theory is based on the study of employment, interest and money.

Thus, the economic strategy is faced with the task of preventing the crisis phenomenon. At the same time, economic indicators and a sequence of actions are determined.

Economic indicators include many generally accepted indices. These include finance, cash flows, personnel, resources, and others.

The sequence of actions includes a set of steps that must be followed by all structural divisions of the enterprise. These actions should be consistent with the overall direction to achieve the overall strategic goals of the enterprise. At the same time, there should be coordination of these actions and control over the passage of the path to the goal. The main thing is the resource support of the enterprise. The sequence of actions should be comprehensive, systematic, balanced. Long actions should be divided into many short actions. Short actions should also be described properly. In general, the implementation of the economic strategy of an enterprise is carried out by combining long stages of the strategy with a list of short stages [4].

In the process of entrepreneurship development, several types of economic strategies of the enterprise have been formed. The first type is the decision-level approach. At the same time, the corporate, business and functional components of the strategy are singled out.

In the process of determining the national interests of countries in the energy sector, it is necessary to carry out an analysis of influencing factors. The expansion of the boundaries of cooperation in the energy sector takes place within the framework of current regulatory documents. For example, this is the "Ukraine-

EU Action Plan" [5] dated February 21, 2005. According to the documents, the goals and priorities are determined:

1. Approval of energy policy.
2. Formation of energy policy goals.
3. Development of sub-sectoral documents.
4. Determination of funding sources.
5. Proposals regarding various energy programs.
6. Mechanisms of functioning of internal markets.
7. Planning measures to modernize energy systems.
8. Determination of price policy for the long term.
9. Development of energy sector reconstruction plans.
10. Determination of diversification of energy supply routes.
11. Carrying out a technical and economic analysis of the energy infrastructure.

Progress in international cooperation is achieved to a greater extent in the field of natural gas and oil transit. Improvement of this cooperation is possible by improving the operation of technological equipment for transporting the energy carrier. Ensuring the safety of transportation systems is also important [6].

The development of cooperation in the newest areas - the field of hydrogen energy - is very promising. The latest developments require significant scientific research and technical and economic justification. It should be noted that it is impossible to accurately determine the economic efficiency at the initial stages of the introduction of the latest technologies [7].

It is also necessary to decide on sales markets. Markets are characterized by many parameters. The main ones are market capacity and growth rates.

Renewable energy sources compete with hydrogen technologies. Therefore, we have to take into account the competitive advantage of a specific energy source. Competitive advantage can be developed. Environmental, social, economic, and technological parameters can be limitations of development [8].

International cooperation can be deepened by developing and adopting international standards [9]. Standards can limit or support the development of certain technologies. It is important to take into account the following principles: priority; strategic focus; social responsibility; economic efficiency. We would like to consider the following:

- availability of a common vision in energy policy;
- ensuring safety of obtaining, storing, transporting and using energy;
- diversification of sources of supply and ways of transportation of energy carriers;
- formation of the energy market in accordance with the energy policy;
- development of energy infrastructure;
- increasing the level of energy efficiency;
- implementation of research works in the field of the latest energy technologies and energy sources.

International cooperation should focus on financial, personnel, and technical issues. This cooperation involves precisely agreeing on these issues on mutually beneficial terms. Of course, there are also obligations in cooperation. The results of agreement on issues should increase the level of cooperation.

The deepening of cooperation in the energy sphere between Ukraine and Qatar can take place within the framework of extending the already agreed provisions of international cooperation. Collective emotions and national identity are also important in times of crisis [10]. This applies to the general principles of the signed contracts. Of course, the spectrum of principles of contracts is much wider than energy. However, established provisions can be used to develop new provisions.

Within the framework of the principles of the activities of enterprises, we single out a set of classic goals of enterprises:

1. Receiving income and profit.
2. Expansion, growth, development of the business structure.
3. Reputation and social responsibility.

4. Creation of reserves and resource provision.

The value orientations of the enterprise are reflected in the formation of the company's goals.

The strategic goal is determined by what result should be achieved in the implementation of the strategy. The goal of international cooperation is the basis for motivating joint actions, which are the basis of the strategy. The strategic goals of a corporation describe the various intentions in determining its place in the international business environment [11].

For goals, you can define SMART characteristics [12]:

- Specific - precise and carefully formulated goals;
- Measurable - goals that have a measure definition, measurable;
- Achievable – achieved goals;
- Related – corresponding to the goals of the company's strategy and policy;
- Time-bound – active targets during a certain time period.

Contracts on the international management of corporations and international cooperation differ in how they define the purpose of cooperation. Some seek to radically limit opportunities for further cooperation by specifying what the organization can and cannot do. Others want flexibility. The main goal of international cooperation management is the management of a wide range of objects. Subjects may cooperate under various circumstances that they cannot foresee. An alternative is to define a goal by collaborating more fully around a particular problem in order to minimize costs and reduce uncertainty [13, p. 7].

1.2. Content and types of export and import strategies in the energy sector

In the context of the decline in industrial production due to COVID, the introduction of energy-saving technologies, the fact that the world economy is at the stage of the political situation and the instability of the external environment as a whole is one of the important aspects of the functioning of the energy sector [14].

The stability of the functioning of modern energy is largely achieved through the organization of an effective management and planning system at enterprises. The Paris Climate Agreement deserves special attention.

Analyzing the scientific achievements of scientists, we affirm that the strategy successfully copes with economic and political tasks. The economic strategy at that time was tasked with creating a clear sequence of actions, the result of which is to overcome the consequences of crises. Determining the vector of an enterprise's strategy, regardless of the business area of the concept of "strategy", should come from the goals and mission [15]. On the one hand, the application of the strategy is based on the development and stabilization of the enterprise. On the other hand, it is important to determine the financial potential of the enterprise and its use.

The strategy is the implementation of an integrated, systematic approach that ensures balance, the general direction of movement and the success of the introduction of business. The implementation of the organization's strategy is carried out by combining the main long-term strategy with a set of short-term strategies focused not only on achieving current goals, but also on solving unforeseen tasks and problems [16].

A. Chandler's and Alfred D. theory define strategy as the definition of long-term goals and objectives of the enterprise, the definition of a course of action and the allocation of resources necessary to achieve them [17; 18]. B. Karlof defines strategies before perceiving it as a generalizing model of actions necessary to achieve established goals by coordinating and distributing company resources.

Also, the strategy is considered as a set of long-term goals and a plan for the effective allocation of resources to achieve them [19].

Kunz G. and Grace I. define strategy as a general program of action that identifies the priorities of problems and resources to achieve the main goal [20]. It forms the main goals (mission) and the main ways to achieve them in such a way that the organization receives a single direction of action. Ansoff I. and McDonnell E. in their work "New Corporate Strategy" positions the strategy as a list of rules for decision-making that the organization uses in its activities [21]. Ansoff I. and McDonnell E. argue that strategy is one of several sets of decision rules regarding the behaviour of an organization.

There are such levels of strategy: corporate, functional and individual. The corporate level of strategy is the overall strategy of the enterprise [22]. Functional refers to the functional departments of the enterprise: finance, logistics, marketing, production. Single refers to a greater measure to goods or assortment.

Corporate strategy is the overall plan for managing a company. The business strategy defines the stages and measures as components of the development of professionalism in the main areas of activity. Business strategy focuses on the unification of strategic efforts in various functional units. Portfolio strategy reveals the features of planning strategic changes. A portfolio strategy also combines several product lines or activities of a company. Richard L. Daft drew an analogy with a personal investment portfolio and identified the opportunity and need to make changes to this portfolio [23]. Marketing strategy determines the promotion of goods on the market in a competitive environment. A good marketing strategy determines the success of an enterprise in the market. We argue that all functional strategies are important for every department. they must be consistent with the policies, goals, mission and strategies of the enterprise. The production strategy forms the main areas of the internal environment of the enterprise. The essence of the production strategy lies in the optimal organization of production in order to achieve maximum profitability. The production strategy include the following:

- type of production (small-batch, medium-batch, large-batch);
- the form of organization of production (a combination in time and space of elements of the production process);
- method of organizing production (methods, techniques and rules for the rational combination of the main elements of the production process);
- regulation and design of labor processes (a set of norms and standards for the use of material, labor and financial resources).

The financial strategy in the main part determines the budgeting, accounting automation and planning of the financial system. The staff strategy determines the staffing of the enterprise. The marketing strategy includes building distribution channels and ensuring uninterrupted and timely deliveries, and also includes managing distribution channels, direct and indirect marketing, organizing effective relationships with partners, and sales promotion. Marketing strategy mainly determines the sale and advertising

Currently, world energy is aimed at the maximum effective use of natural fuel and energy resources. The global energy sphere today determines the following trends [24]:

- 1) restructuring of the natural gas market based on competition with developed distribution and spot prices;
- 2) the growth of environmental requirements for energy;
- 3) the development of innovations and technological progress involves more efficient and economical use of energy;
- 4) formation of new business structures for effective investment with lower "entry thresholds";
- 5) change in the nature of demand and the status of the energy consumer in the market: digitalization of the energy market;
- 6) integration of the latest technological solutions, new consumers and new suppliers according to the requirements of the Smart Grid concept;
- 7) restructuring of business processes based on the distributed nature of new energy.

In general, the energy industry is defined as a set of business sectors that use energy resources for the purpose of producing, transforming, transmitting and distributing energy [25]. The goal of the industry is to ensure the process of energy production by processing primary (natural) energy into secondary energy - electrical or thermal energy. Here it is worth adding that hydrogen energy is based on the processing of resources or energy into a chemical compound from which secondary energy can be produced.

Primary energy resources are divided into renewable and non-renewable [26]. Renewable resources include those that can recover over a certain period of time. These include hydrogen energy, wind energy, solar energy, biomass energy, hydrogen energy, geothermal energy and others. Non-renewable resources include those that are exhaustible and cannot be reproduced in sufficient quantities over a long period of time. These include oil, natural gas, coal, shale, and nuclear energy. Therefore, enterprises of the fuel and energy complex produce, process, and transport energy resources (Fig. 1.1).

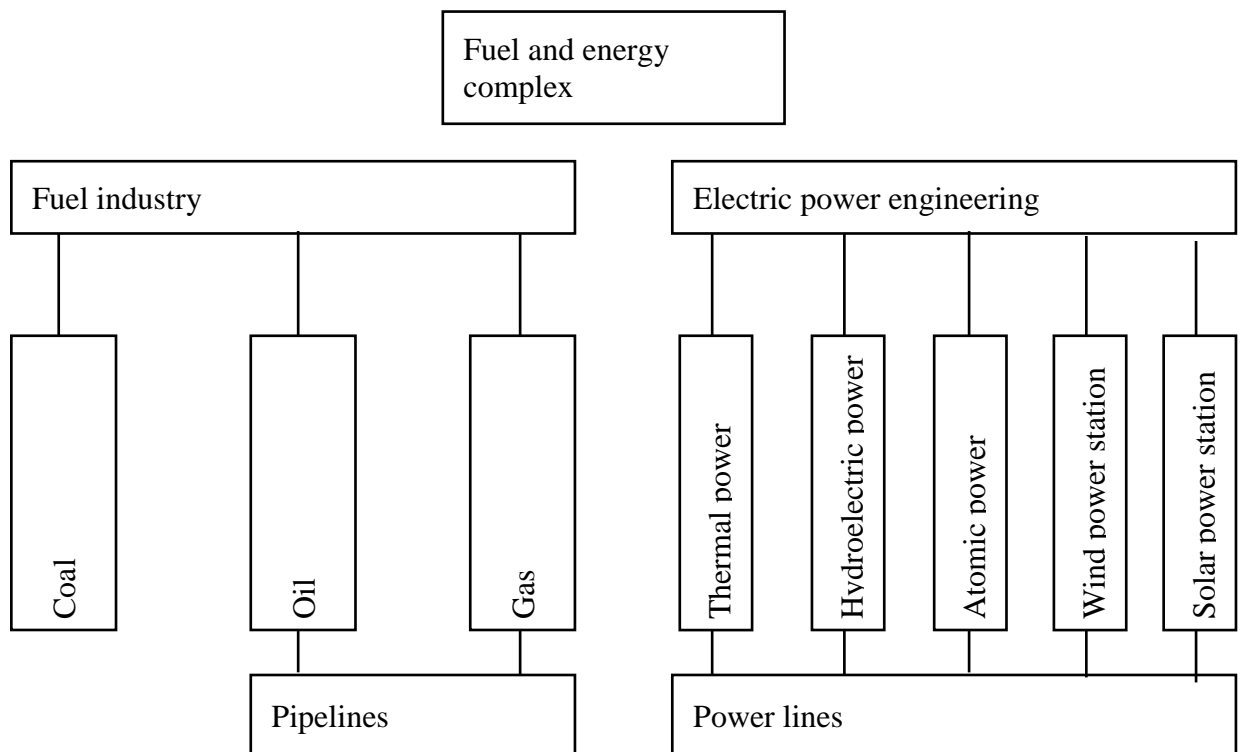


Fig. 1.1. Structure of the Fuel and Energy Complex of Fuel Power Complex [27]

The main components of the fuel and energy complex are the electric power industry, oil refining, gas industry and coal industry.

The fuel industry is a collection of enterprises that extract and process various types of fuel. The fuel industry includes the coal, oil and gas industry.

The coal industry is the oldest branch of the fuel and energy complex. The oil and gas industry, as part of the fuel and energy complex, plays an important role in shaping the economies of countries. This industry carries out exploration and development of oil and gas deposits, as well as their transportation, processing, storage and sale of oil and gas. It should be added that oil and gas processing products are important. Regarding hydrogen energy, there are technologies for adding hydrogen to natural gas during its transportation to increase the energy value of the final product [28].

In general, the oil and gas industry has played an important role in creating an industrial society in Industry 2.0 and Industry 3.0. In Industry 1.0, the coal industry developed to a greater extent. And in Industry 4.0, the development of hydrogen energy is possible [29].

Until recently, it was believed that modern types of fuel have no alternative. These are the following types of fuel: gas, gasoline, diesel fuel, lubricants. Yes, significant reserves of natural gas and oil support this. Basic concepts related to oil, gas and the oil and gas industry are given in the table.

Table 1.1. Definition of the main concepts related to the oil and gas industry

Concept	Definition
Oil	is a useful mineral, a mixture of hydrocarbons and components dissolved in them, which are in a liquid state and are marketable products of the industry;
Gas	is a useful mineral, a mixture of hydrocarbons and non-hydrocarbon components that are in a gaseous state and are marketable products of the industry
The oil and gas industry	is a branch of the economy that provides exploration and development of oil and gas fields, their transportation, processing, storage of oil, gas and their processing products

Compiled by the author based on [30]

States can be conditionally divided into energy-deficient and energy-rich. Ukraine is an energy-deficient country, and Qatar is an energy-rich country. Accordingly, Ukraine imports a significant amount of energy carriers (about 50%), and Qatar exports a significant amount of energy carriers. This refers to classic energy carriers - oil and natural gas. Qatar and Ukraine can produce energy from alternative energy sources. This requires scientific research. In general, energy enterprises play a significant role in the creation of the GDP of countries and the development of their economies.

1.3. Methods for assessing the level of efficiency and productivity of energy enterprises

The main task of the enterprise of any kind is to increase the level of its economic efficiency. Economic efficiency is one of the categories of economics. It is characterized by criteria for determining the level and its evaluation. The criteria differ depending on the form of the enterprise, its type, type, direction of activity, and the purpose of its operation. Every enterprise seeks to minimize costs and maximize profits. We will give several basic principles of economic efficiency [31]. The relationship between the obtained financial results of the production process and the costs of labor and means of production. [32] Economic efficiency is the achievement of the greatest results at the lowest costs [33]. Production of the optimal combination of products based on the use of the most efficient combination of resources. There are a number of other approaches to determining efficiency. For example, a combination of resources that make it possible to achieve the maximum output with the lowest costs.

The basis of the concept of "energy efficiency" is considered from the standpoint of the characteristics of the equipment, the technology used, the available means of production, methods of obtaining energy, the state of the economy, and the level of costs in the country [34].

In practice, "energy efficiency" is considered as the following indicator: degree of energy use; the ratio between the amount of received energy and the amount of spent energy; energy consumption at all stages of the life cycle; specific energy density; specific energy consumption; man-made impact on the environment. Generalized indicators can be the following: parameters of extensive and intensive processes of consumption of primary and secondary sources of energy; the profitability of the country's economic sectors from the reduction of energy costs; the ratio of the results of the use of energy resources to the volume

of their consumption; balance between energy consumption and achieved production capacity.

The methodological component of the master's work is important due to the fact that we have to analyze the existing methods of analysis, development of the forecast and propose our own in order to achieve the tasks.

To perform the theoretical part of the master's thesis, the following methods were used to formulate definitions of concepts and build a model of the functioning of the energy sphere: generalization, deduction and induction.

Induction is used to form general conclusions from individual facts, deduction when forming a conclusion about a separate element of the system on the basis of the entire system [35].

Generalization is the ability to draw a conclusion, reflect the main results of the conducted research, derive the generalized meaning of an object or phenomenon [36].

To carry out analytical research and analysis of dynamics, the method of analysis, the method of rating evaluation, graphic, comparison was used.

Among the general scientific methods used during scientific research, the methods of comparison, analysis and synthesis are common. Analysis is the derivation of smaller components from a larger whole, and synthesis is the joining of small parts into a larger whole [37].

We used the comparison method in the analytical part of the work to compare the development of the energy sector of different countries.

Comparison is the process of finding similarities or differences of phenomena or objects, searching for common and common features inherent in phenomena [38].

The rating evaluation method consists in comparing systems of indicators that characterize a certain object in comparison with a conditional "ideal" object. The rating reveals the value of a certain indicator that characterizes the activity of the research object. The received ratings of the countries are ranked and the place of the enterprises of each country's industry in the overall rating is determined.

The graphic method is used to visualize the analyzed data. This method makes it possible to visually monitor the main trends and regularities.

The analysis method, data forecast and foresight were used in developing the forecast.

The use of the above-mentioned methodological approaches to the study of the economy of the energy sector makes it possible to develop a relevant forecast and proposals for the further development of the industry.

Conclusions on Chapter 1

1. Based on scientific research, a drop in industrial production due to COVID-19 and an increase in the number of energy-saving technologies introduced due to the energy crisis have been identified. It was found that the stability of the functioning of the modern post-crisis oil and gas complex is largely achieved through the implementation of a number of measures. The following are the main tools for successful energy development: "strategy", "strategic plan", "international cooperation",

2. To study the development of the conceptual apparatus, the retrospective of economic crises should be studied. Crises are measured by economic indicators. With proper theoretical preparation, the study of indicators makes it possible to prevent future crises.

3. The study of the patterns of energy development made it possible to draw conclusions about the importance of this field of activity for the economy of the countries of the world. An important aspect is the strategy and its implementation at the corporate, functional and individual levels. And the corporate strategy has become important for the enterprises of the oil and gas complex. Together with the production strategy, the main directions of development are formed.

4. Industry research revealed a significant range of fuel types. Each variety has its own characteristics. The coal industry is the oldest branch of the fuel and energy complex. The oil and gas industry, as part of the fuel and energy complex, plays an important role in shaping the economy of countries. This industry carries out exploration and development of oil and gas deposits, as well as their transportation, processing, storage and sale of oil and gas. It should be added that oil and gas processing products are important. As for hydrogen energy, there are technologies for adding hydrogen to natural gas during its transportation to increase the energy value of the final product.

5. In general, the oil and gas industry has played an important role in creating an industrial society in Industry 2.0 and Industry 3.0. In Industry 1.0, the

coal industry has gained greater development. And in Industry 4.0, the development of hydrogen energy is possible.

6. Based on the study of best practices, the importance of increasing the level of economic efficiency according to a number of criteria was studied. These criteria are classified according to the type of enterprise, the direction of activity, the purpose of operation, as well as cost minimization and profit maximization.

7. According to literary sources, the concept of "energy efficiency" is generalized, which we consider from the standpoint of the characteristics of the equipment, the technology used, the available means of production, methods of obtaining energy, the state of the economy and the level of costs in the country. Indicators are singled out: degree of energy use; the ratio between the amount of received energy and the amount of spent energy; energy consumption at all stages of the life cycle; specific energy density; specific energy consumption; man-made impact on the environment.

8. The methodological component of the master's thesis consists of generalization, deduction, induction, comparison, analysis, synthesis, rating evaluation, graphic method, forecast, foresight.

CHAPTER 2

SYSTEM-STRUCTURAL ANALYSIS OF THE EFFICIENCY OF ACTIVITIES OF ENERGY ENTERPRISES IN THE PROCESS OF IMPLEMENTATION OF INTERNATIONAL COOPERATION

2.1. Studying trends in the development of the energy sector in the world, in Qatar and in Ukraine

Currently, several countries envisage the transition to hydrogen technologies in the energy and transport sectors. Individual countries can carry out international cooperation. These can be energy-saturated countries and high-tech countries. It is also useful for countries that are energy dependent. It is also useful for countries that have great opportunities in the use of renewable energy sources.

The country's transition to hydrogen technology requires new technological solutions and financial support. Special attention should be paid to engineering support. By the way, hydrogen technologies are not yet economically viable. Therefore, these technologies require a deep economic analysis.

Note that in March 2020, the European Commission presented the New EU Industrial Strategy [39]. One of the priorities of this Strategy is the transformation of Europe into a climate-neutral territory by 2050. Today, Ukraine cannot fully engage in the development of energy technologies in connection with the war. Qatar is now more involved in providing many countries with hydrocarbon energy carriers. Given the priorities of the new industrial strategy of the EU, it is expedient to determine the main economic principles of using oil, gas and hydrogen technologies in various spheres of industry. The Paris Climate Agreement deserves special attention [40].

At the stage of development of Industry 4.0 [41], energy saving measures are implemented and hydrogen production is developed. This hydrogen can play an important role in the economy of a significant number of countries.

It is worth noting that hydrogen, as an energy carrier, has the highest specific mass energy density among all types of fuel (120 MJ/kg). That is why this

energy carrier is considered an ideal environment for storing, transmitting and using energy. Here we note that for oil and natural gas the conditions for storage, transmission and use of these types of energy have already been created.

There are many technologies for obtaining hydrogen. They can be divided into two types. These are classic and "green". Classic technologies include the following: steam methane reformer; coal gasification; autothermal reforming, etc.

"Green" technologies use renewable sources and hydrogen:

- biological splitting of hydrogen;
- photoelectrochemical splitting of hydrogen;
- fermentation of substances;
- biomass and waste conversion;
- solar thermal splitting of hydrogen;
- electrolysis of hydrogen due to the energy of renewable sources.

Hydrogen is slowly replacing oil and natural gas. Hydrogen production must ensure environmental friendliness. This should be a competitive advantage. There are studies of the environmental impact of various methods of hydrogen production. Technologies that use renewable energy sources are more environmentally friendly. For classic technologies, the disadvantages are CO₂ emissions. Electrolysis is considered the only process that is not accompanied by CO₂ emissions [42].

The following indicators are used for qualitative assessment of economic costs for each method of hydrogen production: 1) energy source; 2) cost of raw materials; 3) capital investments; 4) cost of hydrogen production. Regarding the cost of hydrogen, the price has not yet been established. The price is formed on the basis of supply and demand. The scale of production is still small. Demand can be significant. The amount of demand will be determined by the amount of replacement of classical energy sources. It will take a long time to form.

Of course, the cost of hydrogen significantly depends on the level of development of production technology, on the availability of infrastructure for storage and transmission of energy raw materials. Cost is a component of price.

The difference between price and cost is profit. One of the goals of the corporation is to make a profit. Therefore, there should be a profit during the activity. It is the choice of technology that will determine the level of profit. That is, the company can choose the technology that is currently more profitable.

Currently, the following are the financially profitable ways to obtain hydrogen:

- 1) steam conversion of methane;
- 2) biomass gasification.

A promising technology is the nuclear thermochemical cycle (CuCl and SeI).

Electrolysis technology for wind or solar generation is more expensive [43]. It may be appropriate for local placement of electrolyzers. And it is also profitable for small volumes for local consumption.

SMR – steam methane reformer;

CCS – carbon capture and storage;

GS – gasification of coal;

ATR – auto thermal reforming;

PEM – polymer electrolyte membrane;

SOE – solid oxide electrolyzers;

CAPEX – capital expenses;

OPEX – operational costs;

WACC – weighted average capital costs;

WE – water electrolysis;

FCV – vehicle on fuel cells.

We will list all technologies.

- Steam methane reformer with carbon capture and storage.
- Steam methane reformer without carbon capture and storage.
- Coal gasification with carbon capture and storage
- Coal gasification without carbon capture and storage.
- Auto thermal reforming methanol with carbon capture and storage.

- Methane pyrolysis.
- Biomass pyrolysis.
- Gasification of biomass.
- Direct biophotolysis.
- Indirect biophotolysis.
- Dark fermentation.
- Photo-fermentation.
- Solar PV electrolysis.
- Solar thermal electrolysis.
- Wind electrolysis.
- Nuclear electrolysis.
- Nuclear thermolysis.
- Solar thermolysis.
- Photoelectrolysis.

The sources of energy for these technologies are: fossil fuels; internally generated steam; solar energy; wind energy. The raw materials for these technologies are the following resources: natural gas; coal; natural gas; wood biomass; algae; organic biomass; hydrogen.

Note that the cost of hydrogen depends significantly on the scale of production. This should be taken into account when implementing the transition of the energy system to hydrogen technologies. It is possible to reduce the cost through international scientific and technical cooperation. Bringing two or more countries together to implement hydrogen technologies can have a synergistic effect. Each country has different resources. Combining these resources can reduce the cost of hydrogen production. Countries can be conditionally divided into capital-saturated, labor-saturated, and energy-saturated. It is the combination of capital, highly qualified specialists and energy resources that can increase the efficiency of hydrogen production and reduce its cost.

We will consider cooperation according to the principles of production: centralized and distributed. Centralized is more appropriate for international

scientific and technical cooperation. This is explained by the large scale of hydrogen production. For this principle, there is a problem of delivering hydrogen to consumers over a considerable distance.

Distributed production is local. This production is less expensive in terms of shipping. This is due to the fact that hydrogen is produced directly near the point of hydrogen consumption. There is no delivery in this case. The scale of production in this case is insignificant. Installations are also small. However, the number of such installations may be significant. This is beneficial for the manufacturer. Producing many units will give the manufacturer more profit.

It is not yet known what principle the society will choose for the creation of hydrogen generation stations. Economic efficiency and ecology will play a decisive role.

Every country wants to increase the economic efficiency of enterprises that do business on their territory. Also, the leadership of the countries wants to raise environmental standards to improve the quality of life of the population of these countries. As a rule, economic efficiency is an internal matter of countries. Ecology is the business of all mankind. It is expedient to carry out international cooperation, including for the purpose of improving ecology in the countries that carry out cooperation.

A more ecological and less costly equipment for the production of hydrogen is a distributed production infrastructure. These can be natural gas reforming equipment or electrolyzers. It is advisable to install such equipment in places where hydrogen is used. It can be a filling station for electric cars or electric buses using fuel cells. And it is also profitable to install in areas of stationary electricity generation for a small number of consumers. It is advisable to use natural gas if it is technically possible to deliver the energy resource to the place of installation of the technological equipment that generates hydrogen.

The ecological component of cooperation is based on the principle that fossil fuels on planet Earth are diminishing and climate change as a result of the anthropogenic greenhouse effect is becoming a problem. Therefore, cooperation in

the fields of renewable technologies will be beneficial for energy-rich countries and countries that consume significant amounts of energy resources in the near future. Hydrogen production provides great opportunities for expanding existing cooperation and establishing new areas of cooperation.

Experts forecast the total production and consumption of hydrogen in 2030 at 4.4 million tons, which is equivalent to 173 TWh•h, which is 25% of the total demand for hydrogen in the EU (665 TWh•h). This is indicated in the "Hydrogen Roadmap of Europe" [44].

It should be noted that the implementation of the concept of transition from classical energy to the use of "green" hydrogen depends on a number of factors. such factors include the following:

- availability of energy potential of renewable sources in a given region or country;
- the cost level of the main and auxiliary equipment for hydrogen production;
- availability of sufficient amount of necessary water resources;
- availability and affordable price for land plots for installation of equipment.

These factors directly or indirectly affect the cost of produced hydrogen. Hydrogen can be produced from renewable sources or using electricity. According to European researchers from renewable sources, hydrogen can become competitive by 2025. Its price is possible at the level of 1.5 to 2.0 euros/kg.

The prerequisites for the development of hydrogen technologies within the framework of international cooperation are the following problems:

- there must be a peaceful state in Ukraine;
- economic stability must be ensured by sovereignty and territorial integrity;
- choose the most stable and dangerous technologies for implementation;
- agree on parameters of economic efficiency;
- decide on equipment suppliers;

- develop and coordinate infrastructure for transportation of resources and hydrogen;
- develop investment and financing plans;
- ensure compliance with technical standards and regulations.

In order to implement international cooperation, it is expedient to approve strategies for the development of regional energy supply.

It should be noted that the advancement of hydrogen technologies reduces CO₂ emissions. According to the forecast, in 2050, the most populated regions of Europe, North America, China, India and Japan will become the main markets for the sale of energetic hydrogen [45]. This can reach 60% of the world market. Now it is expedient to develop cooperation with these regions. The strategies of such countries as Japan and Germany are described in the most detail. The European Union has also made significant improvements.

Regarding bilateral relations between the Qatar and Ukraine. Diplomatic relations between Qatar and Ukraine began on April 13, 1993, when ambassadors were exchanged [46]. Also, permanent ambassadors were exchanged in November 2000 and in 2013. In March 2009, the first political consultations between the Ministries of Foreign Affairs of the two countries took place in Kyiv. In 2013, the Qatar embassy was inaugurated in Kyiv, the capital of Ukraine. Subsequently, an air route was opened for the Qatar Airways company between the capital Kyiv and Doha in August 2017. Additionally, we inform you: the Ukrainian community living in Qatar is 1,771 people (according to the Embassy of Ukraine in Doha), and the number of students.

The total volume of foreign trade exchange of goods and services between Ukraine and the Qatar in 2021, \$94.178 million (\$69.146 million in 2020), which is currently the largest indicator in the history of Ukrainian-Qatar diplomatic relations. Thus, the volume of trade in goods with Qatar increased in 2021 by 8.19% to \$75.166 million (\$15.139 million in 2020, (the volume of trade in services between Ukraine and Qatar in 2021 amounted to \$19.12 million.

Regarding national aid to Ukraine. During the pandemic, the Qatar, on behalf of His Highness the Emir, sent a plane loaded with 9 tons of emergency medical aid through the Qatar Development Fund. The Qatar facilitated the evacuation of citizens of Ukraine to return to the country during the coronavirus pandemic. The Qatar facilitated the evacuation of Ukrainian citizens from Afghanistan. The Qatar provided state aid to Ukraine in the amount of 1,820,000 Qatari riyals for the period between 2010 and 2017, which is equivalent to approximately half a million dollars. The Qatar also provided assistance to non-governmental organizations of Ukraine in the amount of 1,879 thousand Qatar rials for the period between 2010 and 2017, which is also equivalent to approximately half a million dollars. Development aid came in the field of education, in addition to humanitarian food aid, and in the field of social welfare.

It should be noted that the Qatar announced the allocation of \$5 million in humanitarian aid for Ukrainian refugees and displaced persons through the Qatar Development Fund. This is connected with moral responsibility and emphasizes the difficult humanitarian situation that Ukraine is facing. In addition, Qatar calls for the solidarity of the international community to develop contingency plans for millions of refugees in light of the ongoing escalation of the Russian-Ukrainian war to meet its basic needs. In this regard, an amount of USD 5 million was transferred to the bank account of the fund-raising platform for the Government of Ukraine. The Government of Ukraine transferred this amount to the Ministry of Health to cover urgent health care needs.

Quantitative indicators of cooperation. The number of interstate agreements: 38 bilateral agreements have entered into force, 11 are being processed. Agreements that are considered and studied require special attention:

1. The draft protocol on amending some provisions of the Agreement on the release of holders of diplomatic passports - a special entry visa, in addition to Ukrainian service passports.

2. Draft Agreement on maritime and commercial transportation between the Cabinet of Ministers of Ukraine and the Government of Qatar.

3. Intergovernmental agreement on mutual recognition and exchange of national driver's licenses.

4. Draft memorandum of understanding on cooperation in the field of tourism between the Cabinet of Ministers of Ukraine and the Government of the Qatar.

5. Draft Agreement on cooperation between the Government of the Qatar and the Council of Ministers of Ukraine in the field of culture.

6. Agreement on mutual recognition of documents on higher education between the Cabinet of Ministers of Ukraine and the Government of the Qatar.

7. Draft memorandum of understanding between the Ukrainian Immigration Service and the competent body of the Qatar regarding cooperation in the field of immigration.

8. Draft agreement between the Cabinet of Ministers of Ukraine and the Government of the Qatar on joint information protection.

9. Memorandum of Understanding regarding the authorization of the practice of fifth freedom for passenger and cargo flights at or outside any intermediate points.

10. Draft memorandum of understanding between the Ministry of Economy of Ukraine and the Ministry of Trade and Industry of the Qatar for emergency cooperation in bilateral trade.

11. Draft memorandum of understanding on cooperation in the fields of standardization, metrology and conformity assessment between the Qatar General Directorate for Standardization and Standardization (QS) in the Qatar and the Ministry of Economic, Commercial and Agrarian Development of Ukraine.

Qatar's efforts in connection with the Russian-Ukrainian war should be noted. Thus, the Qatar continues to show interest in the Ukrainian crisis and its development within the framework of multilateral international cooperation and work with international and regional partners to advance efforts in dialogue, restoration of sovereignty and territorial integrity of Ukraine. Here is a list of the

most important steps and statements of Qatar regarding the Russian-Ukrainian war:

His Highness the Emir, at the opening of the 20th Political and Security Forum in Doha, noted that he regretfully observes the narrowing of the political and diplomatic space to stop military aggression, and the armed expansion has begun to increase, reaching one of the most difficult peaks in the war. His Majesty supports the firm position of the Qatar regarding the rejection of violence, intimidation of the civilian population, attacks on the sovereignty of states and everything that would be a violation of human values and international laws. The country stands in solidarity with the millions of innocent people and refugees who have become victims of this unjust war.

Qatar-Ukrainian political consultations are held at a high level between the Ministry of Foreign Affairs of the Qatar and the Ministry of Foreign Affairs of Ukraine, led by the Secretary General of the Ministry of Foreign Affairs of Qatar, His Excellency Ahmed bin Hassan Al-Hammadi and Mr. Serhiy Kislitsy, Deputy Minister of Foreign Affairs of Ukraine. There was an agreement on the need to increase cooperation between the two countries and coordinate positions on regional and international issues.

Political consultations were held under the chairmanship of His Excellency Ahmed bin Hassan Al Hammadi, Secretary General of the Ministry of Foreign Affairs, and the Ukrainian side was headed by His Excellency Mr. Serhiy Kyslytsia Olegovych, Deputy Minister of Foreign Affairs of Ukraine.

Important communications, meetings and negotiations should be noted:

– On October 10, 2022, His Highness the Emir and President Zelensky discussed Ukrainian events and the crisis with Russia.

– A telephone conversation took place between His Highness the Emir Sheikh Tamim bin Hamad Al Thani and the President of Ukraine Volodymyr Zelenskyi, during which the latest events in the Ukrainian arena were discussed, especially in connection with the escalation of hostilities. It was noted the inadmissibility of prolonged military operations and the need to stop the military

crisis through dialogue and diplomatic means. Qatar firmly supports the sovereignty and territorial integrity of Ukraine. At the level of cooperation, further joint steps in joint action on other international platforms were discussed.

From the recent actions of Qatar. On October 10, 2022, His Majesty the Emir and President Zelenskyi discussed Ukrainian events and military operations. His Majesty called for respect for the sovereignty and territorial integrity of Ukraine within its internationally recognized borders. The Qatar called for compliance with the Charter of the United Nations and international law, including the Charter's obligation to settle international disputes by peaceful means. Also, the Qatar called on the parties to exercise restraint, to resolve the dispute through dialogue and diplomatic means, and to settle disputes peacefully and without escalation. It should be noted that at the UN General Assembly, the Qatar voted for UN Resolution 141 condemning Russia's attack on Ukraine.

Back in 2014, the Qatar supported the draft resolution of the General Assembly No. 262/68 "Territorial integrity of Ukraine" [47]. Subsequently, in 2016, the Qatar supported the draft resolution of the General Assembly No. 205/71 regarding the human rights situation in the Autonomous Republic of Crimea and the city of Sevastopol in Ukraine. Then in 2017, the Qatar supported the draft resolution of the General Assembly No. 190/72 "On the situation with human rights in the Autonomous Republic of Crimea and the city of Sevastopol in Ukraine. In 2018, the Qatar abstained from voting in favor of General Assembly resolution No. 263/73 on "The problem of militarization of the Autonomous Republic of Crimea and the city of Sevastopol in Ukraine and parts of the Black Sea region and the Sea of Azov" The Qatar supported General Assembly Resolution No. 263/73 "Situation with human rights in the Republic of Crimea." Recently, in 2021, the Qatar abstained from voting to include the item "Situation in the temporarily occupied territories of Ukraine" on the agenda of the UN General Assembly. It should be noted that Ukraine supported the Qatar in its candidacy for membership in the Council of the International Civil Aviation Organization (ICAO) for the period 2022-2025.

On October 3, 2022, the Ministry of Foreign Affairs of Qatar published a statement emphasizing the need to respect the sovereignty of Ukraine and its territorial integrity within internationally recognized borders, as well as the adoption of dialogue as a way to resolve the Ukrainian crisis. The statement was made after Russia announced the annexation of Ukrainian lands.

The figure 2.1 shows the location of the Persian Gulf countries in terms of Export of goods and services and Import of goods and services.

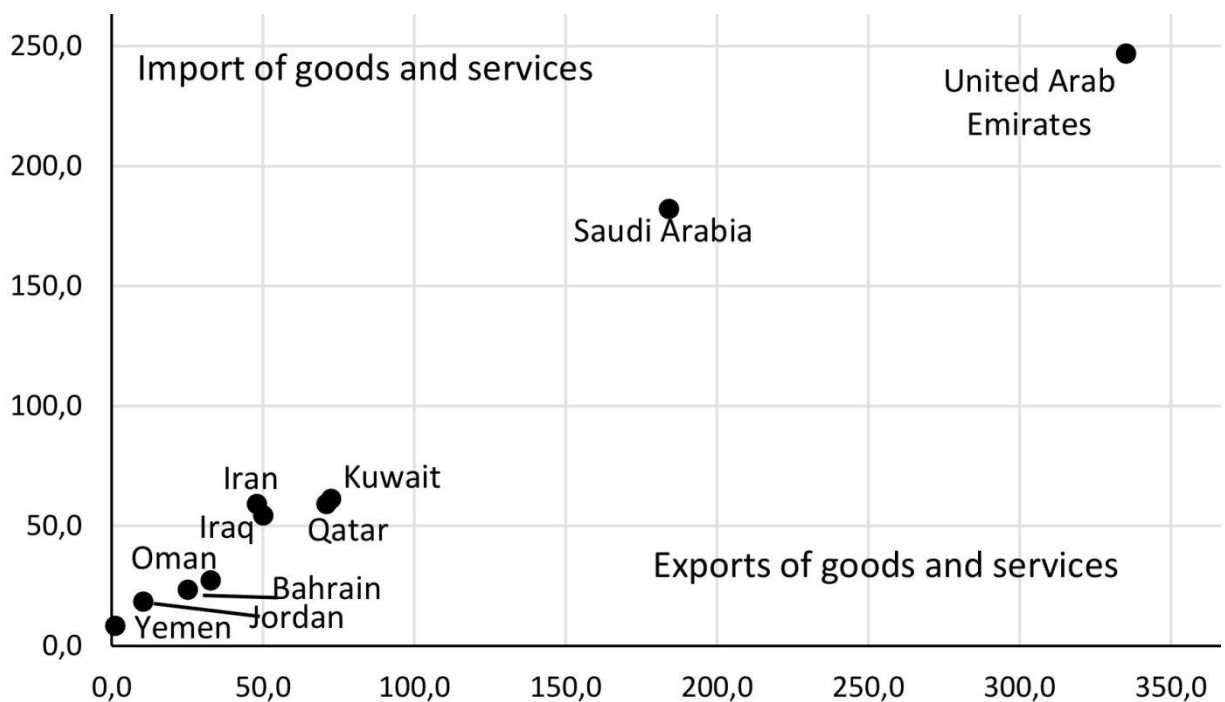


Figure 2.1. Ratio of Persian Gulf countries in terms of Export of goods and services and Import of goods and services for 2020. [48]

Based on the obtained data processing results, we state that Qatar occupies the fourth position in this ratio among the countries of the Persian Gulf. This is an important place considering the area and population. Also, this chart shows the special places of Saudi Arabia and the United Arab Emirates.

It is important to study the dynamics of changes in these indicators: Export of goods and services and Import of goods and services. Figure 2.2 shows the

dynamics of Export of goods and services and Import of goods and services from 2001 to 2020.

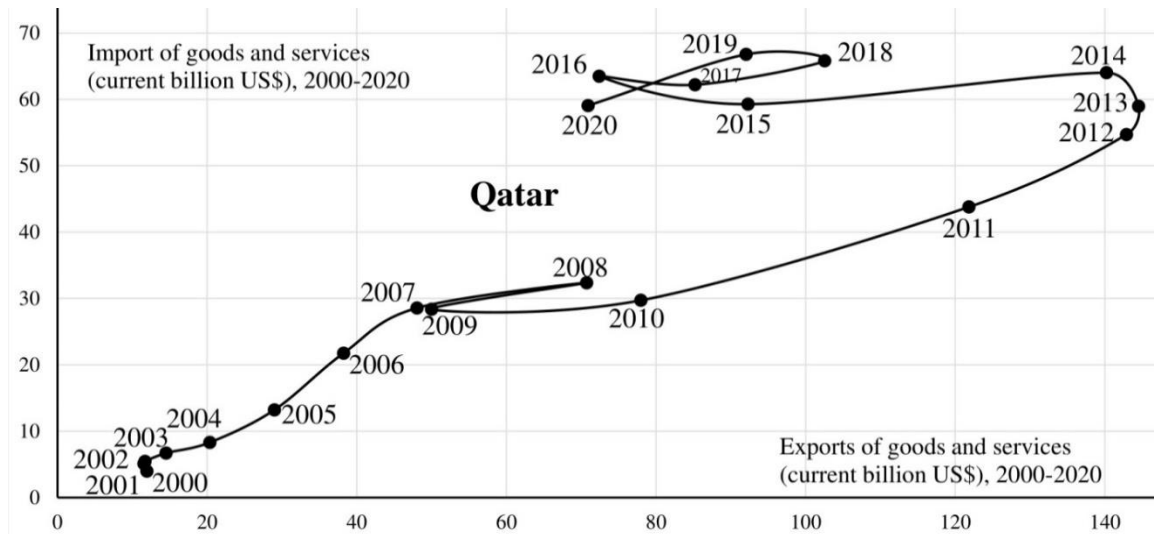


Figure 2.2. Dynamics of Export of goods and services and Import of goods and services from 2001 to 2020 for the Qatar [48].

Several stages of changes in the ratio of Export and Import of goods and services are distinguished on this dependence.

The first stage. Growth from 2001 to 2008. This phase is characterized by stable growth between the two global economic crises of 1998 and 2008.

The second stage. A slight decrease in imports and a significant decrease in exports in 2008-2009. The impact of the global economic crisis of 2008 is clearly reflected here. By the way, it is worth noting that exports decreased significantly. Imports changed little. This is explained by the fact that the country's financial resources are sufficient. To ensure an adequate level of quality of life through the import of goods and services. However, the export of products of the oil and gas industry decreased due to the decrease in demand for these products.

The third stage. From 2009 to 2012, we have significant growth rates of these two indicators. Exports grew about 3 times, and imports increased almost 2 times.

The fourth stage. The period from 2012 to 2014 was characterized by the stabilization of these two indicators, which became an indicator of the future decrease of the indicator.

The fifth stage. From 2014 to 2016, with stable imports, there was almost a 2-fold decrease in the volume of exports from Qatar.

The sixth stage. From 2016 to 2018, the country emerged from a crisis situation. At the same time, the values of the indicator of Import of goods and services remained practically unchanged.

The seventh stage. From 2018 to 2020, the Qatar again has a decrease in the volume of exports of goods and services. This can be explained by the growth of international competition.

Static and dynamic analysis makes it possible to identify peculiarities and regularities in the country's development by individual indicators.

The main exports of the Qatar are oil and natural gas. These are energy resources. These resources are classic. Perhaps because of this, crisis phenomena occur. To reduce the dependence of exports on the price of oil and natural gas, as well as on the volume of demand for these resources on the world market, it is proposed to engage in the production of energetic hydrogen. This can stabilize the markets.

Knowledge about foreign economic activity is an important factor in international cooperation. We need to know the volume of exports and imports of goods and services for many countries. Table 2.1 shows the volume of Exports and Imports of goods and services in current billion US\$. Appendix A.1 contains complete data. The data are for 2021. For comparison, the table shows data for these indicators at the same time. This is important for comparison. Country codes are also provided for reference.

Table 2.1. Exports and Imports of goods and services (current billion US\$)

	Country Name	Country Code	Exports of goods and services (current US\$)	Imports of goods and services (current US\$)
1	China	CHN	3549	3090
2	United States	USA	2123	2775
3	Germany	DEU	2004	1771
4	France	FRA	880	941
5	United Kingdom	GBR	860	900
6	Netherlands	NLD	851	739
7	Japan	JPN	784	796
8	Hong Kong SAR, China	HKG	751	733
9	Korea, Rep.	KOR	750	684
10	Singapore	SGP	734	609
11	Italy	ITA	687	637
12	Ireland	IRL	672	471
13	India	IND	660	726
14	Canada	CAN	611	608
15	Switzerland	CHE	569	448
16	Russian Federation	RUS	548	378
17	Mexico	MEX	523	542
18	Belgium	BEL	512	504
19	Spain	ESP	498	476
20	Poland	POL	411	382
21	Australia	AUS	342	275
22	United Arab Emirates	ARE	335	247
23	Brazil	BRA	323	307
24	Thailand	THA	295	296
25	Sweden	SWE	290	263
26	Saudi Arabia	SAU	290	203
27	Turkiye	TUR	289	292
28	Austria	AUT	267	263
29	Malaysia	MYS	257	230
30	Indonesia	IDN	256	224
...
40	Slovak Republic	SVK	108	109
41	Portugal	PRT	105	113
42	Philippines	PHL	101	149
43	Chile	CHL	101	103
44	Argentina	ARG	90	74
45	Greece	GRC	88	105
46	Ukraine	UKR	82	84
47	Qatar	QAT	71	59

The top ten countries according to the indicator "Exports of goods and services" are occupied by the following countries: China; USA; Germany; France; United Kingdom; Netherlands; Japan; Hong Kong; China; Korea; Singapore. When ranking according to the "Imports of goods and services" indicator, we have the TOP-10 countries: China; United States; Germany; France; United Kingdom; Japan; Netherlands; Hong Kong; China; India; Korea. We have a similar rating. This means that the countries are similar in terms of imports and exports.

It is interesting that Qatar and Ukraine are next to each other according to the "Exports of goods and services" indicator. This is the 46th and 47th position in the rating. The situation is similar for the "Imports of goods and services" indicator. These are the 47th and 45th positions in the rating.

Yes, these countries differ significantly in terms of economic, political and energy development. Also, the area of the territory and the number of the population differ in these countries. However, these countries are similar in terms of exports and imports.

The above shows that international cooperation is possible between the countries both in various fields, and in energy in particular.

2.2. Evaluation of the efficiency and productivity of Qatar's investment projects in Ukraine

Relations between the Qatar and Ukraine have been going on for many decades. Trade and economic relations are also of significant importance for the Qatar and Ukrainian sides. This is important in such vital sectors as energy, agriculture and others. Over the past few years, the Qatar has become the main economic partner of Ukraine in the Persian Gulf region, and one of the most interested in investing in the Ukrainian market in various fields.

Mutual visits of high-ranking officials reflected the extent of bilateral interest in bringing relations to a more advanced level. This was noted during the visits. Dozens of agreements were signed by the leaders in various spheres, especially in the economic sphere.

The signing of a series of agreements between the two countries was important to strengthen the vision of both sides. Among the most important agreements in the economic, trade and financial spheres are the agreement on the establishment of a joint committee on economic and technical cooperation, the agreement to encourage and protect mutual investments, as well as the agreement on the avoidance of double taxation and the prevention of financial evasion.

The rapprochement between the Qatar and Ukraine has boosted bilateral relations in recent years. This applies to political and economic levels. Trade and investment exchanges between the two countries have grown to record levels in the history of bilateral relations. Investments have diversified into various areas, including ports, energy and others.

Qatari investments in energy. In recent years, the Qatar has paid great attention to investing in the energy sector of Ukraine, and Ukraine, for its part, has been and continues to be interested in the issue of obtaining Qatari gas.

Regarding Qatari investments in the Ukrainian economy and energy in particular. The most significant investment was made by the Qatari energy company Nebras. This investment was made in the Ukrainian energy sector in

2021 on the basis of the "Partnership Agreement" in 6 projects for the production of electricity using solar energy. The Qatari company has a majority stake in this project.

Ukrainian UDP Renewables and the Qatari energy investment company "Nebras Power" as part of the "Strategic Partnership Agreement" are implementing a number of agreements regarding the acquisition of a controlling stake in six solar energy assets in Ukraine. The Ukrainian economy received large investments and a new strategic investor.

This example clearly shows that "green" generation is a promising direction for the development of the domestic and world market.

The Qatar through Nebras acquires a controlling stake in solar energy projects:

1. "Scythia 1"
2. "Scythia 2"
3. Free Energy.
4. "Port solar"
5. "Tir Slave"
6. "Sun Power Perfumesc".

Qatar and Ukraine also cooperate in the field of energy efficiency. Ukraine and Qatar signed the "Protocol on cooperation in the energy sector". The main thing in this protocol concerns activities in the field of energy efficiency and renewable energy. The protocol was signed following the results of the second meeting of the joint committee on economic, trade and technical cooperation between the government of Ukraine and the government of the Qatar during 2021.

Over the past few years, the Qatar has succeeded in creating a stimulating business environment. Qatar has become one of the most important business centers and the main investment destination for many foreign companies from around the world. There is a desire among local Ukrainian companies and Qatari business owners to explore investment opportunities. This applies to available

areas for investment in all countries of the world. Ukraine has been in the center of interest of Qatari investors for the past few years.

In the period preceding the Russian war against Ukraine, Valery Bezos, head of the State Energy Efficiency Agency, presented opportunities for mutually beneficial cooperation between Ukraine and Qatar in such important areas as energy efficiency and carbon emissions. These areas remain among the most important investment opportunities between Qatar and Ukraine.

Qatar, due to its investment potential and extensive experience in investment operations, can expand investment. Thanks to its huge potential for energy efficiency, Ukraine has great opportunities. These opportunities are different in different sectors. It can become an important platform for mutually beneficial joint projects, for investments, for the introduction of technologies and for the exchange of experiences.

Важливим для наукового дослідження є вивчення прямих іноземних інвестицій. Table 2.2 shows foreign direct investment of different countries for 2020-2021.

Table 2.2. Foreign direct investment, net (BoP, current million US\$)

№	Country Name	Country Code	Max of 2020-2021
1	2	3	4
1.	Switzerland	CHE	124078
2.	Japan	JPN	122537
3.	Germany	DEU	120035
4.	Netherlands	NLD	110425
5.	United States	USA	100394
6.	Luxembourg	LUX	94046
7.	United Kingdom	GBR	78998
8.	Ireland	IRL	46480
9.	Korea, Rep.	KOR	44000
10.	France	FRA	40314
11.	Canada	CAN	30271
12.	Russian Federation	RUS	25362

Continuation of table 2.3

1	2	3	4
13.	Thailand	THA	23847
14.	Spain	ESP	22345
15.	Italy	ITA	22014
16.	Belgium	BEL	20285
17.	Denmark	DNK	18016
18.	Norway	NOR	10240
19.	Austria	AUT	9964
20.	Macao SAR, China	MAC	8832
21.	Finland	FIN	7299
22.	Qatar	QAT	5164
23.	Sweden	SWE	4795
24.	Saudi Arabia	SAU	4574
25.	Kuwait	KWT	3712
26.	Iraq	IRQ	3295
27.	Chile	CHL	3196
28.	Angola	AGO	3092
29.	Slovak Republic	SVK	2191
30.	Azerbaijan	AZE	1784
31.	Bolivia	BOL	1018
32.	Peru	PER	899,4
33.	Kyrgyz Republic	KGZ	582,4
34.	Iceland	ISL	542,3
35.	Estonia	EST	453,4
36.	Slovenia	SVN	327,8
37.	Namibia	NAM	210,7
38.	Zambia	ZMB	208,2
39.	Trinidad and Tobago	TTO	206,4
40.	Burkina Faso	BFA	91,6
41.	Ukraine	UKR	58,0
42.	Afghanistan	AFG	24,3
43.	Bhutan	BTN	2,8

According to the results of the analysis of this table, we observe that Qatar is on the 22nd position in the rating, and Ukraine is on the 41st position. This is quite a significant difference in investment volumes. This requires additional scientific research to identify the root causes.

Table 2.3 shows Portfolio investment of different countries for 2021.

Table 2.3. Portfolio investment, net (BoP, current million US\$)

№	Country Name	Country Code	2021
1.	Germany	DEU	299915
2.	Italy	ITA	144869
3.	Hong Kong SAR, China	HKG	105089
4.	Australia	AUS	65338
5.	Singapore	SGP	57003
6.	South Africa	ZAF	55187
7.	Sweden	SWE	44575
8.	Norway	NOR	41583
9.	Mexico	MEX	41557
10.	Saudi Arabia	SAU	38533
11.	Switzerland	CHE	37859
12.	Spain	ESP	35200
13.	Russian Federation	RUS	32087
14.	Greece	GRC	26810
15.	Finland	FIN	23934
16.	United States	USA	20897
17.	Korea, Rep.	KOR	19607
18.	Portugal	PRT	15055
19.	Ireland	IRL	12624
20.	Qatar	QAT	12160
21.	Austria	AUT	11755
22.	Poland	POL	11453
23.	Thailand	THA	11284
24.	Denmark	DNK	9170
25.	Malta	MLT	8311
26.	Philippines	PHL	8046
27.	Belgium	BEL	6857
28.	Slovak Republic	SVK	5866
29.	Argentina	ARG	4928
30.	Panama	PAN	4127

Qatar ranks 20th in this ranking. Ukraine is not in the rating.

2.3. Analysis of the strategy for the development of hydrogen energy in the global economy

Hydrogen is a unique chemical element. It is used in various industries. Now it is used to a greater extent in transport, heating, electricity production, and energy storage.

Scientists believe that the use of hydrogen is promising. This is a low-carbon technological solution.

The international agency Bloomberg NEF predicts that "green" hydrogen can provide a quarter of the final energy consumption on Earth by 2050 [49]. Another prediction is that by 2050, hydrogen will be produced in many countries around the world. Its cost can be 0.8–1.6 dollars. US per kg (at 2022 prices).

Hydrogen fuel cell systems have been implemented for a long time. They are used in electric vehicles on fuel cells (FCV – (Fuel cell vehicle)). They are also used as combined thermal and energy devices. Other options of use are also possible.

The use of hydrogen for a large power system requires solving a number of problems: safety; production; storage; distribution; using. Currently, the realization of the potential of hydrogen use is largely possible due to the following two driving forces:

- 1) proactive state support;
- 2) international cooperation of energy corporations.

Renewable energy sources include solar radiation, wind energy, biomass energy, hydropower and geothermal energy. The use of these energy sources significantly reduces greenhouse gas emissions. The disadvantages of these sources are instability in the time interval. There are daily and seasonal fluctuations in energy output. This violates the principle of continuous supply of energy to consumers.

Wind power plants and solar photovoltaic sources are characterized by fluctuations in production volumes. This does not allow balancing the supply and demand of electricity in real time. It could be that these power plants are producing too much energy. It also happens that these power plants produce not enough electricity. It is necessary to smooth out the maxima and minima of production.

This problem can be solved if there are effective means of energy storage. Accumulation can be carried out using mechanical, thermal, electrochemical energy. Each type of accumulation has its advantages and disadvantages. The classification of advantages and disadvantages is carried out according to the following indicators: energy density, battery capacity, specific cost, potential for scaling.

The battery can also be hydrogen. The chemical element hydrogen can be produced by electrolysis of water during periods when renewable energy power plants produce excess energy. When there is a need for electricity, this hydrogen is converted into electricity in the fuel cell.

Conclusions on Chapter 2

1. Based on the study of trends in the development of the energy sector in the world, Qatar and Ukraine, it was found that there is now a gradual transition to hydrogen technologies in energy and transport. It should be noted that individual countries can carry out international cooperation in this area. It has been proven that the transition of countries to hydrogen technologies requires new technological solutions, financial support, and engineering support. In the world, there is support for the development of hydrogen technologies in the documents "New Industrial Strategy of the European Union" and "Paris Climate Agreement".

2. The study of hydrogen production technologies made it possible to form a list of technologies. Classic technologies include: steam methane reformer; coal gasification; autothermal reforming, etc. "Green" technologies use renewable sources and hydrogen: biological splitting of hydrogen; photoelectrochemical splitting of hydrogen; fermentation of substances; conversion of biomass and waste; solar thermal splitting of water; electrolysis of water due to the energy of renewable sources.

3. The analysis of the economic component showed that the cost of hydrogen significantly depends on the scale of production. This should be taken into account when transitioning the energy system to hydrogen technologies. It is possible to reduce the cost price due to international scientific and technical cooperation. Bringing two or more countries together to implement hydrogen technologies can have a synergistic effect. The unification of countries will reduce the cost of hydrogen production.

4. Studies of bilateral relations between the Qatar and Ukraine show that since April 13, 1993 (the exchange of ambassadors took place) the air route between the capitals, the total volume of foreign trade exchange of goods and services in 2021 amounted to \$94.178 million, the volume of trade in goods

increased to \$75.166 million, the volume trade in services amounted to \$19.12 million. Aid is provided in the field of education, food aid and social security.

5. Based on the results of statistical data, it is proven that the Qatar has become the main economic partner of Ukraine in the Persian Gulf region and one of the most interested in investing in the Ukrainian market in various areas, including energy, and in the future in hydrogen technologies. In recent years, the Qatar has paid considerable attention to investing in the energy sector of Ukraine, in particular, the Qatari energy company Nebras made the largest investment. This investment was made in the Ukrainian energy industry in 2021 on the basis of the "Partnership Agreement" in 6 projects for the production of electricity using solar energy.

6. Analysis of the strategy for the development of hydrogen energy in the world economy made it possible to assert that the use of hydrogen is promising. It is a low-carbon technological solution and it is good for the environment. It is appropriate to use hydrogen as hydrogen fuel cells in electric vehicles and in combined heat and power devices. The use of hydrogen for a large power system requires solving a number of problems related to the safety, production, storage, distribution and use of hydrogen.

CHAPTER 3.
DIRECTIONS FOR THE IMPLEMENTATION OF THE MAIN
PROVISIONS OF INTERNATIONAL COOPERATION IN THE SPHERE
OF GAS AND HYDROGEN ENERGY

3.1. Improving international cooperation between Qatar and Ukraine in the energy sector

A characteristic feature of the 21st century is the formation of a new mission of the world energy sector, which consists in increasing the level of efficiency in the use of fuel and energy resources and the potential of the energy sector in order to increase the economic indicators of the world economy and improve the quality of life of the population. A significant increase in energy efficiency can only be achieved if the governments of the states develop and implement an energy-efficient policy that covers all levels of the national economy. The development of international cooperation in this area is important.

The important role of energy as a factor of production determines the need to study the efficiency of its use in order to increase this level and, as a result, to solve the issue of energy shortage at the expense of energy saving.

Limited resources create the need for their optimal distribution among the various needs of society and increasing the efficiency of their use.

The concept of "energy conservation" should be developed in the state economic policy of countries. This must be coordinated with environmental friendliness and competitiveness. We note that it is possible to solve the problem of increasing the effective use of fuel and energy resources by introducing the latest energy-efficient technologies and equipment. We also emphasize the use of hydrogen as an energy carrier. For this, it is necessary to use a comprehensive approach. Implementation of an effective policy of increasing energy efficiency and development of the field of hydrogen production from renewable energy sources will provide countries with the opportunity to create conditions for reducing the level of energy dependence. The complex should include measures to

reduce the energy intensity of the gross domestic product, to optimize the structure of the energy balance, to increase the use of renewable energy sources, and to use secondary energy resources.

Today, between Qatar and Ukraine, there are such regulatory documents:

- Sphere of investment and energy: "Agreement on additional contributions of shareholders of "Qterminals"";
- Memorandum on the mutual understanding of cooperation in the field of energy;
- Memorandum on mutual understanding between the Qatar Investment Authority and the Fund of the Sovereign Main of Ukraine;
- Memorandum on the mutual understanding of how best to obtain and support investments;
- Agreement on legal practice.
- Food safety: "Memorandum on the mutual understanding of spivpratsi in the sphere of the agricultural state and food safety";
- Sea spivrobotniitstvo: "Memorandum on the mutual understanding of portiv".
- Health and sports: “Memorandum on the mutual understanding of good health care in the field of health care”;
- Memorandum on the mutual understanding of the promotion of youth and sports.

International trade is important for international cooperation. The main indicators for this are the volumes of exports and imports. Based on these indicators, it is possible to assess the state, dynamics and trends in the development of the country's foreign economic activity. Let's consider the indicators of export and import between Qatar and Ukraine in the pre-crisis years (before the start of COVID restrictions), table. 3.1. Such a period does not take into account the impact of the crisis phenomenon. This is necessary for qualitative analysis.

Table 3.1. Export and import of goods between Qatar and Ukraine in the pre-crisis years (2016–2019*) (thousands of US dollars)

Years	Country	Export		Import		
		Destination country	Trading country	Country of origin	Country of departure	Trading country
2016	Ukraine	36361711,2	36361513,3	39249797,2	39224507,1	39225132,9
	Qatar	12433,4	1031,9	26268,8	19256,5	243,2
2017	Ukraine	43264736,0	43264516,2	49607173,9	49574442,4	49566980,0
	Qatar	42325,2	1793,7	11200,5	6157,0	466,5
2018	Ukraine	47334987,0	47334813,3	57187578,0	57150319,9	57137626,8
	Qatar	59931,8	7296,1	8369,3	7531,1	1091,0
2019	Ukraine	50054605,8	50054495,8	60800173,1	60755674,4	60744235,7
	Qatar	74908,6	18515,5	7346,4	6519,7	955,9

*According to the State Statistics Service of Ukraine [50]

We will analyze the foreign economic activity between Qatar and Ukraine. Exports to Qatar are not significant – from 12.4 million dollars. USA up to 74.9 million dollars. USA during this period. Imports from Qatar during this period change from 6.1 million USD to 19.2 million USD. USA. In general, these are not significant volumes. When analyzing these data in percentages, we will get the following results. Exports to Qatar are from 0.034% to 0.15% of Ukraine's total exports. Imports from Qatar during this period change from 0.015% to 0.067%. These are generally insignificant indicators. This shows very great opportunities for the rapid development of international cooperation in the future, starting from 2023.

3.2. Diversification of energy sources in international cooperation

The energy sector will be central to the reconstruction of Ukraine in the post-war period. The main tasks will be the production of own natural gas and the development of alternative energy sources. Special attention will be paid to "green" hydrogen. According to the "European Green Deal" document, hydrogen energy should be the main component of the EU energy system from 2025-2030. In the future, this may be relevant until 2050 [51]. The installed capacity of electrolysis plants (the main technological plants for the production of hydrogen) should increase to 30 GW.

As already mentioned, Ukraine can become the main exporter of "green" hydrogen to EU countries. The amount of revenue can reach about 10 billion dollars. USA in one year. Ukraine can become a strategically important partner of the EU in the development of hydrogen energy. Investors can be Qatari investors.

For the implementation of investment projects, it is advisable to build about 20 plants for the production of hydrogen. This task should be achieved in 10 years. That is, 2 factories should be built for one year. Estimated capacity of one plant is 10.0 GW. Then the total potential of the average annual production of "green" hydrogen may amount to about 400 billion cubic meters.

Siemens Gamesa experts have calculated that for the production of 42.3 million tons of "green" hydrogen per year, almost 1,000 GW of solar power plant capacity is needed. and about 500 GW of wind power plants.

Many countries of the world are implementing "green" investments. There is another name - eco-investment. The main principle is activities that do not harm the environment due to the development and implementation of advanced technologies. The "green" tariff should become a guarantee for the investor regarding the return of invested funds. For this, it is necessary to outline ecologically useful projects to attract investment.

The International Capital Market Association (ICMA) [52] developed the "Principles of "green" bonds". This is a road map for the issuance of "green" bonds,

which is recognized as a standard in the world. "Green" bonds have a high level of transparency. This is confirmed by the following principles: 1) the rules of permissible directions of use of funds; 2) project evaluation and selection process; 3) funds management; 4) reporting.

"Green" bonds are recognized as a tool for attracting capital. Investors from the private and public sectors of the economy can use this investment mechanism.

Cash proceeds from the placement of such bonds are spent only on "green" projects. Project bonds can be with or without recourse to the issuer and are aimed at financing one or more "green" projects. The main source of repayment of bonds is cash proceeds from assets.

Therefore, "green" bonds can play a significant role in the development of hydrogen energy.

3.3. Economic justification for international energy projects

The principles of implementing strategies for increasing the level of competitiveness are based on the use of competitive advantages, which for the energy industry consist of technological improvements, energy innovations, and sufficient financing of scientific and technical developments in the energy sector. Hydrogen energy is now a promising "market niche".

Each corporation chooses its own development strategy. Now in the strategies there are points about hydrogen energy. Such a strategy should correspond to the mission with the concept of hydrogen energy. The successful operation of TNC will depend on the success of hydrogen energy in the world in general. This is a new paradigm that is gradually spreading in the world.

The strategies of TNCs can be divided into the following types:

1. Strategies based on low-cost production (General Motors, Nokia);
2. Imitation of differentiation strategy (Nestle, Procter & Gamble, Unilever);
3. Increasing the volume of national production (ING Group, Hyundai).
4. Focusing strategies (Apple, Coca Cola).
5. Strategies for transferring the right to use their technologies, trademarks for the production or sale of goods by foreign enterprises (McDonalds, KFC).

For energy corporations with a focus on hydrogen energy, the following strategies are more common: 1) Strategies based on low-cost production; 2) Following the strategy of differentiation.

To achieve its goals and implement the corporation's mission for the development of hydrogen technologies, a number of possible alternatives can be used:

1. Opening of subsidiaries of the corporation.
2. Outsourcing of certain functions.

3. Using franchising to provide access to intangible resources from the franchisor.
4. Creation of joint ventures with locations in two or more countries.
5. Implementation of offshore production in case of geographical remoteness.

In general, an international corporation should develop development strategies taking into account the above in order to strengthen its competitive position. Special attention should be paid to the following strategies: competitive; marketing; financial. After choosing a strategy, it is necessary to create a mechanism for their implementation. The activities of enterprises at the international level must adapt to the global market.

Taking into account the results of the study, let's generalize the concept of "energy efficiency" according to the following components:

- 1) socio-economic aspect: the efficiency of the economic system to improve the quality of human life;
- 2) technical aspect: the efficiency of energy conversion according to the stages of transformation and delivery.

For the most part, "energy efficiency" is a quantitative indicator, the main parameters of which can be calculated. A qualitative assessment should be made on the basis of social indicators, for example, the level of quality of the provision of communal services for heating premises. Yes, this indicator can be evaluated quantitatively, as the number of kilocalories spent on heating. However, under different conditions, the same number of expended kilocalories can provide services with different levels of quality. This also applies to the use of such energy carriers as oil, natural gas and hydrogen.

In a broad sense, "energy efficiency" can be evaluated as an ecological, social, and economic system. Therefore, such "energy efficiency" means obtaining the most useful and minimally harmful effect from the use of energy resources, taking into account their limitations. Thus, energy efficiency can be divided into economic, social, environmental and technical aspects.

The economic aspect of energy efficiency should reflect the most useful economic result from the use of classical and renewable energy resources. The energy efficiency of the economy must take into account the exhaustion of non-renewable energy resources and the possibility of replacing resources with more environmentally safe and less energy-intensive ones.

In connection with political and military instability in the regions of energy resource extraction, tension in the global energy resource markets, military actions in the territories of energy resource transit and the increase in energy prices, the above factors are gaining significant importance.

Energy efficiency of Ukraine's economy has been ensured for a long time. A significant number of normative legal acts of various levels have been adopted in the country. The country also has signed documents on international scientific and technical cooperation. Ukraine is engaged in reducing the specific consumption of energy resources. Qatar is engaged in a significant number of projects in Ukraine, including energy saving projects.

The ecological aspect of energy efficiency is determined by obtaining a minimally harmful ecological result from the use of fuel and energy. To reduce environmental threats, it is necessary to expand scientific and technical knowledge at the global level. Regarding the level of countries, the following components are distinguished:

- inventory of natural energy resources;
- identifying the potential of alternative energy sources;
- assessment of environmental reliability of business structures;
- implementation of scientific research programs on current environmental problems
- implementation of resource and energy saving programs and projects;
- forecasting and forecasting of phenomena and processes when applied in energy-saving technologies.

The environmental aspect at the international level involves the implementation of the "green economy" provisions. This is a very versatile

program. "Green" energy is an important component in a "green" economy. Therefore, ecology and "green" economy are interconnected.

In terms of international cooperation between Qatar and Ukraine, it is important to implement the energy management system ISO 50001:2011 "Energy management systems – Requirements with guidance for use".

The social aspect of energy efficiency involves the possibility of providing the population's energy needs for an appropriate level of quality and safety of life. State regulatory measures are in the first place here.

The technical aspect involves providing the energy system with the latest, high-tech equipment to ensure a high level of energy efficiency. It is in this aspect that expanded cooperation between Qatar and Ukraine is possible. These two countries already have a long experience of successful cooperation. This cooperation should be expanded.

In general, a wide range of cooperation is defined in terms of economic, social, ecological and technical aspects. The results of cooperation can be as follows:

- improvement of living standards;
- coordinated interstate activity;
- forming in society the understanding of the need to maintain the optimal level of energy efficiency;
- increasing the level of energy efficiency of economic entities;
- optimization of the energy consumption system;
- consideration of geopolitical conditions and security of international industrial and commercial activities;
- prevention of energy threats to society;
- creation of economic conditions for efficient use of fuel and energy resources;
- ensuring energy efficiency locally in industrial sectors;
- joint development of science-intensive industries;
- creation of joint ventures for the production of high-tech products;

- forecasting and forecasting of processes in energy spheres in countries;
- optimization of energy use.

Therefore, the development of cooperation between countries in the energy sector, taking into account economic, social, ecological and technical aspects, will be effective with constant monitoring of specific energy efficiency indicators. Yes, energy efficiency can vary within different limits. Many factors affect this. Changes in energy consumption should be especially taken into account. At the same time, it is necessary to observe disproportionate changes in environmental, social, economic, and technical indicators.

Conclusions on Chapter 3

1. Based on the conducted research, we note that a characteristic feature of the 21st century. is the formation of a new mission of the global energy industry, which consists in increasing the level of efficiency in the use of fuel and energy resources and the potential of energy in order to increase the economic indicators of the world economy and improve the quality of life of the population. We discovered that the limited resources create the need for their optimal distribution among the various needs of society and increasing the efficiency of their use.

2. The author declares that the concept of "energy conservation" should be developed in the state economic policy of countries in order to ensure environmental friendliness and competitiveness within the framework of international scientific and technical cooperation. Solving the problem of increasing the efficiency of the use of fuel and energy resources is possible through the introduction of the latest energy-efficient technologies and equipment.

3. An analysis of the regulatory framework signed between Qatar and Ukraine makes it possible to assert that the following areas should be further developed: the sphere of investments and energy; receiving and supporting investments; cooperation in the field of agricultural safety and food safety; medical care and health care.

4. According to the analysis of foreign economic activity statistics, we note that between Qatar and Ukraine, exports to Qatar are insignificant - from 12.4 million dollars. USA up to 74.9 million dollars. USA, and imports from Qatar changed from 6.1 million dollars. USA up to 19.2 million dollars. USA. In general, these are not significant volumes. This demonstrates very large opportunities for the rapid development of international cooperation in the future, starting from 2023.

5. Current events make it possible to assert that the energy sector will occupy a central place in the reconstruction of Ukraine in the post-war period. The

main tasks will be the production of own natural gas and the development of alternative energy sources. Special attention will be paid to "green" hydrogen. The installed capacity of electrolysis plants (the main technological plants for the production of hydrogen) should increase to 30 GW. The amount of income can reach about 10 billion dollars. USA in one year.

6. Therefore, the implementation of strategies to increase the level of competitiveness is based on the use of competitive advantages, which for the energy industry consist of technological improvements, energy innovations and sufficient financing of scientific and technical developments in the energy industry, in particular in hydrogen energy, on the basis of successful international scientific and technical cooperation. Taking into account the results of the study, we will distinguish energy efficiency according to the following components: 1) socio-economic aspect; 2) technical aspect. Thus, Ukraine is engaged in reducing the specific consumption of energy resources. Qatar participates in a significant number of projects in Ukraine, including energy-saving projects.

General conclusions

1. Based on scientific research, a drop in industrial production due to COVID-19 and an increase in the number of energy-saving technologies introduced due to the energy crisis have been identified. It was found that the stability of the functioning of the modern post-crisis oil and gas complex is largely achieved through the implementation of a number of measures. The following are the main tools for successful energy development: "strategy", "strategic plan", "international cooperation",

2. To study the development of the conceptual apparatus, the retrospective of economic crises should be studied. Crises are measured by economic indicators. With proper theoretical preparation, the study of indicators makes it possible to prevent future crises.

3. The study of the patterns of energy development made it possible to draw conclusions about the importance of this field of activity for the economy of the countries of the world. An important aspect is the strategy and its implementation at the corporate, functional and individual levels. And the corporate strategy has become important for the enterprises of the oil and gas complex. Together with the production strategy, the main directions of development are formed.

4. Industry research revealed a significant range of fuel types. Each variety has its own characteristics. The coal industry is the oldest branch of the fuel and energy complex. The oil and gas industry, as part of the fuel and energy complex, plays an important role in shaping the economy of countries. This industry carries out exploration and development of oil and gas deposits, as well as their transportation, processing, storage and sale of oil and gas. It should be added that oil and gas processing products are important. As for hydrogen energy, there are technologies for adding hydrogen to natural gas during its transportation to increase the energy value of the final product.

5. In general, the oil and gas industry has played an important role in creating an industrial society in Industry 2.0 and Industry 3.0. In Industry 1.0, the

coal industry has gained greater development. And in Industry 4.0, the development of hydrogen energy is possible.

6. Based on the study of best practices, the importance of increasing the level of economic efficiency according to a number of criteria was studied. These criteria are classified according to the type of enterprise, the direction of activity, the purpose of operation, as well as cost minimization and profit maximization.

7. According to literary sources, the concept of "energy efficiency" is generalized, which we consider from the standpoint of the characteristics of the equipment, the technology used, the available means of production, methods of obtaining energy, the state of the economy and the level of costs in the country. Indicators are singled out: degree of energy use; the ratio between the amount of received energy and the amount of spent energy; energy consumption at all stages of the life cycle; specific energy density; specific energy consumption; man-made impact on the environment.

8. The methodological component of the master's thesis consists of generalization, deduction, induction, comparison, analysis, synthesis, rating evaluation, graphic method, forecast, foresight.

9. Based on the study of trends in the development of the energy sector in the world, Qatar and Ukraine, it was found that there is now a gradual transition to hydrogen technologies in energy and transport. It should be noted that individual countries can carry out international cooperation in this area. It has been proven that the transition of countries to hydrogen technologies requires new technological solutions, financial support, and engineering support. In the world, there is support for the development of hydrogen technologies in the documents "New Industrial Strategy of the European Union" and "Paris Climate Agreement".

10. The study of hydrogen production technologies made it possible to form a list of technologies. Classic technologies include: steam methane reformer; coal gasification; autothermal reforming, etc. "Green" technologies use renewable sources and hydrogen: biological splitting of water; photoelectrochemical splitting of water; fermentation of substances; conversion of biomass and waste; solar

thermal splitting of water; electrolysis of water due to the energy of renewable sources.

11. The analysis of the economic component showed that the cost of hydrogen significantly depends on the scale of production. This should be taken into account when transitioning the energy system to hydrogen technologies. It is possible to reduce the cost price due to international scientific and technical cooperation. Bringing two or more countries together to implement hydrogen technologies can have a synergistic effect. The unification of countries will reduce the cost of hydrogen production.

12. Studies of bilateral relations between the Qatar and Ukraine show that since April 13, 1993 (the exchange of ambassadors took place) the air route between the capitals, the total volume of foreign trade exchange of goods and services in 2021 amounted to \$94.178 million, the volume of trade in goods increased to \$75.166 million, the volume trade in services amounted to \$19.12 million. Aid is provided in the field of education, food aid and social security.

13. Based on the results of statistical data, it is proven that the Qatar has become the main economic partner of Ukraine in the Persian Gulf region and one of the most interested in investing in the Ukrainian market in various areas, including energy, and in the future in hydrogen technologies. In recent years, the Qatar has paid considerable attention to investing in the energy sector of Ukraine, in particular, the Qatari energy company Nebras made the largest investment. This investment was made in the Ukrainian energy industry in 2021 on the basis of the "Partnership Agreement" in 6 projects for the production of electricity using solar energy.

14. Analysis of the strategy for the development of hydrogen energy in the world economy made it possible to assert that the use of hydrogen is promising. It is a low-carbon technological solution and it is good for the environment. It is appropriate to use hydrogen as hydrogen fuel cells in electric vehicles and in combined heat and power devices. The use of hydrogen for a large power system

requires solving a number of problems related to the safety, production, storage, distribution and use of hydrogen.

15. Based on the conducted research, we note that a characteristic feature of the 21st century. is the formation of a new mission of the global energy industry, which consists in increasing the level of efficiency in the use of fuel and energy resources and the potential of energy in order to increase the economic indicators of the world economy and improve the quality of life of the population. We discovered that the limited resources create the need for their optimal distribution among the various needs of society and increasing the efficiency of their use.

16. The author declares that the concept of "energy conservation" should be developed in the state economic policy of countries in order to ensure environmental friendliness and competitiveness within the framework of international scientific and technical cooperation. Solving the problem of increasing the efficiency of the use of fuel and energy resources is possible through the introduction of the latest energy-efficient technologies and equipment.

17. An analysis of the regulatory framework signed between Qatar and Ukraine makes it possible to assert that the following areas should be further developed: the sphere of investments and energy; receiving and supporting investments; cooperation in the field of agricultural safety and food safety; medical care and health care.

18. According to the analysis of foreign economic activity statistics, we note that between Qatar and Ukraine, exports to Qatar are insignificant - from 12.4 million dollars. USA up to 74.9 million dollars. USA, and imports from Qatar changed from 6.1 million dollars. USA up to 19.2 million dollars. USA. In general, these are not significant volumes. This demonstrates very large opportunities for the rapid development of international cooperation in the future, starting from 2023.

19. Current events make it possible to assert that the energy sector will occupy a central place in the reconstruction of Ukraine in the post-war period. The main tasks will be the production of own natural gas and the development of

alternative energy sources. Special attention will be paid to "green" hydrogen. The installed capacity of electrolysis plants (the main technological plants for the production of hydrogen) should increase to 30 GW. The amount of income can reach about 10 billion dollars. USA in one year.

20. Therefore, the implementation of strategies to increase the level of competitiveness is based on the use of competitive advantages, which for the energy industry consist of technological improvements, energy innovations and sufficient financing of scientific and technical developments in the energy industry, in particular in hydrogen energy, on the basis of successful international scientific and technical cooperation. Taking into account the results of the study, we will distinguish energy efficiency according to the following components: 1) socio-economic aspect; 2) technical aspect. Thus, Ukraine is engaged in reducing the specific consumption of energy resources. Qatar participates in a significant number of projects in Ukraine, including energy-saving projects.

LITERATURE

1. Sohrabi C, Alsafi Z, O'Neill N, et al. World Health Organization declares global emergency: a review of the 2019 novel coronavirus (COVID19). *Int J Surg.* 2020; 76: pp. 71-76.
2. Gielen D., Gorini R., Wagner N. et al. *Global Energy Transformation: A Roadmap to 2050.* International Renewable Energy Agency (IRENA). 09 April 2019.
3. Eigner, Peter, and Thomas S. Umlauf. "The great depression (s) of 1929-1933 and 2007-2009? parallels, differences and policy lessons." *Parallels, Differences and Policy Lessons* (July 1, 2015). Hungarian Academy of Science MTA-ELTE Crisis History Working Paper 2 (2015).
4. Fursov, Victor Alexandrovich, et al. "Evaluation of performance of enterprise development strategy implementation." *J. Advanced Res. L. & Econ.* 6 (2015): 79.
5. Holovko S., Vodolaskova K. "EU-Ukraine relations development policy: historical background and current state" *Scientific works of National Aviation University. Series: Law Journal "Air and Space Law"* 2.63: pp. 35-41.
6. Peng Yu., et al. "Energy-efficient cooperative transmission for intelligent transportation systems." *Future Generation Computer Systems* 94 (2019): pp. 634-640.
7. Abe J. O., et al. "Hydrogen energy, economy and storage: review and recommendation." *International journal of hydrogen energy* 44.29 (2019): 15072-15086.
8. Khan, Tahir, Miao Yu, and Muhammad Waseem. "Review on recent optimization strategies for hybrid renewable energy system with hydrogen technologies: State of the art, trends and future directions." *International Journal of Hydrogen Energy* (2022).
9. Sebastian P. "International cooperation and development: A conceptual overview." *German Development Institute/Deutsches Institut für Entwicklungspolitik Discussion Paper* 13 (2014).

10. Assche V., Azzam Amin J., and Abdelrahman M. "Collective Emotions and National Identity in Times of Crisis Evidence from Qatar and Ukraine." Available at SSRN 4134106 (2022).
- 11., Chiara M, Panfilo S. and Blundo B. "Sustainable development goals and the strategic role of business: A systematic literature review." *Business Strategy and the Environment* 29.8 (2020): 3220-3245.
12. Glushchenko V. V. "Ergodesign and "Specific", " Measurable", " Achievable", " Relevant", and " Time-Bound"(SMART) Technologies as Tools for The Formation of Innovative Leadership Programs." *ASEAN Journal of Economic and Economic Education* 2.1 (2023): 23-34.
13. Liesbet H., Lenz T. and Marks Gary. "A theory of international organization". Oxford University Press, 2019. 28 p.
14. Ali, Md Jafor, et al. "The COVID-19 pandemic: Conceptual framework for the global economic impacts and recovery." *Towards a Post-Covid Global Financial System* (2022).
15. Hekkert M. P., et al. "Mission-oriented innovation systems." *Environmental Innovation and Societal Transitions* 34 (2020): p. 76-79.
16. Hitt M. A., Arregle J.-L., Holmes R. M. "Strategic management theory in a post-pandemic and non-ergodic world." *Journal of management studies* 58.1 (2021): p. 259.
17. Chandler Jr, Alfred D. *The visible hand*. Harvard university press, 1993.
18. Chandler Jr, Alfred D. *Strategy and structure: Chapters in the history of the American industrial enterprise*. Vol. 120. MIT press, 1969.
19. Karloff B. *Business strategy: a guide to concepts and models*. Springer, 1989. 243 p.
20. Kunz, Grace I. "Behavioral theory of the apparel firm: A beginning." *Clothing and Textiles Research Journal* 13.4 (1995): p. 252-261.
21. Ansoff, H. I., McDonnell E. J. *The new corporate strategy*. New York: J. Wiley, 1988. 288 p.

22. Brown S., Blackmon K. "Aligning manufacturing strategy and business-level competitive strategy in new competitive environments: the case for strategic resonance" *Journal of Management Studies* 42.4 (2005): p. 793-815.
23. Daft R. L. *Organization theory and design*. Cengage learning, 1998. 701 p.
24. International Energy Agency IEA URL: <https://www.iea.org/> (access date: 10.10.2022)
25. Kosov M. E., et al. "Energy industry: Effectiveness from innovations." *International Journal of Energy Economics and Policy* 8.4 (2018): 83 p.
26. Coccia M. "Foresight of technological determinants and primary energy resources of future economic long waves." *Int. J. Foresight and Innovation Policy* 6.4 (2010): pp. 225-232.
27. Mottaeva A., Četković J. "Influence of the Sustainable Development of the Fuel Power Complex on the Formation of Competitiveness of the Region." *Energy Management of Municipal Transportation Facilities and Transport*. Springer, Cham, 2018.
28. Abe J. O., et al. "Hydrogen energy, economy and storage: review and recommendation." *International journal of hydrogen energy* 44.29 (2019): pp. 15072-15086.
29. Fragiacomio P., Piraino F., Genovese M. "Insights for industry 4.0 applications into a hydrogen advanced mobility." *Procedia Manufacturing* 42 (2020): pp. 239-245.
30. Hongfang Lu, et al. "Oil and Gas 4.0 era: A systematic review and outlook" *Computers in Industry* 111 (2019): pp. 68-90.
31. Kornienko G., Chabanenko M., Leheza Yu. "Assessment of the economic efficiency of it application at enterprises." *Baltic Journal of Economic Studies* 4.3 (2018): pp. 123-132.
32. Mochernyi S. V., Yerokhin C. A, Kanishchenko L. O. "Osnovy ekonomichnoyi teorii" [Fundamentals of economic theory]. Kyiv: Academy (1997). 464 p.

33. Douglas M. C. "An economic case for land reform." *Land Use Policy* 17.1 (2000): pp. 49-57.
34. Zakari A. et al. "Energy efficiency and sustainable development goals (SDGs)." *Energy* 239 (2022): 122365.
35. Rothchild I. "Induction, deduction, and the scientific method." *Society for the Study of Reproduction*. 2006.
36. Woo-Young A. et al. "Comparison of decision learning models using the generalization criterion method." *Cognitive science* 32.8 (2008): 1376-1402.
37. Andersen, Ann-Louise, et al. "Towards a generic design method for reconfigurable manufacturing systems: Analysis and synthesis of current design methods and evaluation of supportive tools." *Journal of Manufacturing Systems* 42 (2017): pp. 179-195.
38. Tantardini, Mattia, et al. "Comparing methods for comparing networks." *Scientific reports* 9.1 (2019): pp. 1-19.
39. European industrial strategy URL: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en
40. The Paris Agreement URL: <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>
41. Voitko S. V. and Gaidusky I. P. "The use of fossil fuels for the production of electricity in the period 1985–2021." (2022).
42. Tashcheev Yu, et al. "Global trends in the development of hydrogen technologies in industry." *Business Informiо № 8 (511)6* (2020): pp. 103-114.
43. Nasser M., et al. "A review of water electrolysis–based systems for hydrogen production using hybrid/solar/wind energy systems." *Environmental Science and Pollution Research* (2022): pp. 1-25.
44. Hydrogen Roadmap Europe. URL: <https://www.h2haul.eu/hydrogen-roadmap-europe/>

45. Mirjat N. H., et al. "Long-term electricity demand forecast and supply side scenarios for Pakistan (2015–2050): A LEAP model application for policy analysis." *Energy* 165 (2018): pp. 512-526.

46. Embassy of the Qatar in Ukraine. URL: <http://www.kyiv.embassy.qa/>

47. Territorial integrity of Ukraine: Resolution adopted by the General Assembly on 27 March 2014. 68/262. <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N13/455/17/PDF/N1345517.pdf>

48. The World Bank Data and Research (2022), World Bank Statistics Database. URL: <http://data.worldbank.org>

49. Baker D. R. A Green Hydrogen Economy Depends on This Little-Known Machine URL: <https://www.bloomberg.com/news/features/2022-07-22/the-key-technology-behind-the-green-hydrogen-economy>

50. Official website of the State Statistics Service of Ukraine. URL: <http://www.ukrstat.gov.ua/>

51. A European Green Deal. Striving to be the first climate-neutral continent. URL: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

52. The International Capital Market Association (ICMA). URL: <https://www.icmagroup.org/>

Appendix

Appendix A.1.

Table A.1. Exports and Imports of goods and services (current US\$)

Country Name	Country Code	Exports of goods and services (current US\$)	Imports of goods and services (current US\$)
1	2	3	4
China	CHN	3,54855E+12	3,08962E+12
United States	USA	2,12341E+12	2,7746E+12
Germany	DEU	2,00425E+12	1,77061E+12
France	FRA	8,797E+11	9,40542E+11
United Kingdom	GBR	8,60135E+11	9,00169E+11
Netherlands	NLD	8,51087E+11	7,3897E+11
Japan	JPN	7,84168E+11	7,96345E+11
Hong Kong SAR, China	HKG	7,50713E+11	7,33256E+11
Korea, Rep.	KOR	7,50399E+11	6,84201E+11
Singapore	SGP	7,33773E+11	6,09273E+11
Italy	ITA	6,87469E+11	6,36716E+11
Ireland	IRL	6,72266E+11	4,71419E+11
India	IND	6,60499E+11	7,25551E+11
Canada	CAN	6,10975E+11	6,07882E+11
Switzerland	CHE	5,68557E+11	4,4839E+11
Russian Federation	RUS	5,47741E+11	3,78028E+11
Mexico	MEX	5,22772E+11	5,42229E+11
Belgium	BEL	5,12002E+11	5,03988E+11
Spain	ESP	4,97711E+11	4,76182E+11
IDA total	IDA	4,71132E+11	6,81857E+11
Poland	POL	4,10541E+11	3,82246E+11
Australia	AUS	3,42196E+11	2,7513E+11
United Arab Emirates	ARE	3,35238E+11	2,46886E+11
Brazil	BRA	3,23361E+11	3,06975E+11
Thailand	THA	2,94591E+11	2,958E+11
Sweden	SWE	2,90234E+11	2,62928E+11
Saudi Arabia	SAU	2,89815E+11	2,02945E+11
Turkiye	TUR	2,88571E+11	2,92007E+11
Austria	AUT	2,66922E+11	2,62607E+11
Malaysia	MYS	2,56784E+11	2,3044E+11
Indonesia	IDN	2,55731E+11	2,2372E+11
Denmark	DNK	2,3654E+11	2,09907E+11
Czechia	CZE	2,0492E+11	1,96312E+11
Norway	NOR	2,00543E+11	1,40449E+11

Continuation of Table A.1.

1	2	3	4
Luxembourg	LUX	1,83928E+11	1,53245E+11
Hungary	HUN	1,48254E+11	1,4687E+11
Israel	ISR	1,43054E+11	1,21667E+11
South Africa	ZAF	1,30636E+11	1,04833E+11
Finland	FIN	1,16469E+11	1,15768E+11
Romania	ROU	1,16047E+11	1,32127E+11
Slovak Republic	SVK	1,07816E+11	1,08552E+11
Portugal	PRT	1,05025E+11	1,12508E+11
Philippines	PHL	1,01447E+11	1,48804E+11
Chile	CHL	1,01113E+11	1,03175E+11
Argentina	ARG	89947580720	74354518317
Greece	GRC	87857673499	1,04994E+11
Ukraine	UKR	81532203092	83781068819
Qatar	QAT	70933241758	59064560440
Peru	PER	64932484667	58979023862
Lithuania	LTU	52654593275	49904047892
Kazakhstan	KAZ	51711339273	44470358513
Slovenia	SVN	51392129172	48122520463
Colombia	COL	51270596215	76276946183
Bulgaria	BGR	50597770064	49731474046
Iraq	IRQ	50188790940	54265699329
Morocco	MAR	49441809379	62011877399
Belarus	BLR	49193128989	45452683004
Iran, Islamic Rep.	IRN	48047122404	59112942613
Egypt, Arab Rep.	EGY	47872738615	81943913321
New Zealand	NZL	46404210822	47227785373
Bangladesh	BGD	44385410501	71019901847
Algeria	DZA	42040567028	42376652111
Croatia	HRV	34869139702	35518034632
Pakistan	PAK	34569034836	69042352354
Serbia	SRB	34309399080	39259668658
Oman	OMN	32728998700	27224447334
Estonia	EST	29200476815	29105207083
Ecuador	ECU	27803104000	26751297000
Angola	AGO	27475246116	10918170057
Macao SAR, China	MAC	26406095809	22691524577
Malta	MLT	25515407682	23212226752
Azerbaijan	AZE	25487647059	16336941176
Bahrain	BHR	25249202128	23296808511
Latvia	LVA	24906145450	25713463879
Costa Rica	CRI	23226248401	22161096139
Ghana	GHA	23206601901	22131745925

Continuation of Table A.1.

1	2	3	4
Myanmar	MMR	22615134490	20878696530
Cyprus	CYP	22453925488	22157972797
Congo, Dem. Rep.	COD	21651289631	21234909902
Panama	PAN	21379165200	18605504600
Dominican Republic	DOM	20500497766	29198662389
Tunisia	TUN	19443549830	23784219002
Uruguay	URY	18675039638	15021977774
Cote d'Ivoire	CIV	18145707206	17677645839
Cambodia	KHM	17417509553	18228762399
Uzbekistan	UZB	16436730538	27794836637
Guatemala	GTM	15900155254	26629316440
Sri Lanka	LKA	14991838022	21385927611
Paraguay	PRY	14210767005	13752425495
Jordan	JOR	13853239437	23339718310
Kenya	KEN	11662731889	22179806764
Zambia	ZMB	11576250154	7635370163
Bolivia	BOL	11243140347	12605111071
Brunei Darussalam	BRN	11228914277	9377986860
Honduras	HND	10957691939	17639425899
Bosnia and Herzegovina	BIH	10145797880	12713793254
Gabon	GAB	9719674348	3738834912
Tanzania	TZA	9712766572	11557280891
Iceland	ISL	9707035995	10248966625
North Macedonia	MKD	9150765794	11363959984
Mongolia	MNG	9031863638	9106679295
Cuba	CUB	8769000000	8067000000
El Salvador	SLV	8490950000	15753950000
Guinea	GIN	8456597648	5815658236
Ethiopia	ETH	8448635570	18540745791
Georgia	GEO	8056744916	10963129187
Cameroon	CMR	8037426963	8877236193
Lebanon	LBN	7291512787	15392207538
Equatorial Guinea	GNQ	6806230926	5716807023
Zimbabwe	ZWE	6715438966	7003800738
Nicaragua	NIC	6563617753	8322737483
Uganda	UGA	6342558847	10646655942
Senegal	SEN	6164686203	11312124798
Mali	MLI	5662920941	7697809993
Albania	ALB	5590528224	8016544326
Armenia	ARM	4855736546	5957470274
Botswana	BWA	4681133360	6937553464
Chad	TCD	4564757551	5210833232

Continuation of Table A.1.

1	2	3	4
Mozambique	MOZ	4189966170	10299541811
Moldova	MDA	4188570116	7932925988
Namibia	NAM	3908420040	6035645005
Jamaica	JAM	3799016239	6365841914
Djibouti	DJI	3682879345	3414846867
Bermuda	BMU	3481700000	1705200000
Mauritius	MUS	3401144339	6204005075
Cayman Islands	CYM	3372614905	2592463699
Kyrgyz Republic	KGZ	3358817497	5901762507
Madagascar	MDG	3288300799	4414708155
Kosovo	XKX	3191153400	6133170550
West Bank and Gaza	PSE	3180200000	10244900000
Mauritania	MRT	3148584916	4059731899
Benin	BEN	3110348717	3906745128
Bahamas, The	BHS	3081800000	4722500000
San Marino	SMR	2540725125	2169156167
Montenegro	MNE	2500533005	3642880368
Pacific island small states	PSS	2424505791	4525094483
Nepal	NPL	2275258178	14008213484
Rwanda	RWA	2110469007	3851166792
Togo	TGO	1961685800	2879433005
Maldives	MDV	1851697984	2560647754
Eswatini	SWZ	1788677595	1680458298
Virgin Islands (U.S.)	VIR	1621000000	3212000000
Faroe Islands	FRO	1551741005	1596511877
Niger	NER	1506855651	4123504997
Haiti	HTI	1490135681	6269037074
Aruba	ABW	1411731844	1815642458
Tajikistan	TJK	1409159166	3125471086
Barbados	BRB	1389434624	1719046120
Timor-Leste	TLS	1307550600	1792268700
Somalia	SOM	1305273950	6370044470
Fiji	FJI	1233170417	2293344924
Yemen, Rep.	YEM	1179872637	8407513091
Seychelles	SYC	1133061932	1467436948
Greenland	GRL	1118507536	1502185809
Belize	BLZ	921585469,3	963314047,1
Lesotho	LSO	911398721,7	1977735958
Sudan	SDN	772804661	643989332,3
Bhutan	BTN	689741914,9	1075563026
Sierra Leone	SLE	613193854,9	1481754390
Antigua and Barbuda	ATG	598873555,6	655278518,5

Continuation of Table A.1.

1	2	3	4
Cabo Verde	CPV	476614904,2	1123172278
Solomon Islands	SLB	429200270,3	556764506,8
American Samoa	ASM	426000000	651000000
Guam	GUM	371000000	3375000000
Central African Republic	CAF	357002527,9	799194666,1
Samoa	WSM	255051264	413447854,7
Guinea-Bissau	GNB	205987686,6	418772054,7
Gambia, The	GMB	199882863,5	944623124,7
Vanuatu	VUT	156812272,5	391688334,2
Burundi	BDI	145109996,6	691215996,8
Micronesia, Fed. Sts.	FSM	97900000	289000000
Tonga	TON	92703865,63	304418250,3
Comoros	COM	87766961,3	364545364
Marshall Islands	MHL	85530100	169836100
Nauru	NRU	54363855,74	141577729,7
World	WLD	2,79266E+13	2,69826E+13

Appendix B.

Table B.1. Foreign direct investment, net (BoP, current million US\$)

№	Country Name	Country Code	Max of 2020-2021
1	2	3	4
1.	Switzerland	CHE	124078
2.	Japan	JPN	122537
3.	Germany	DEU	120035
4.	Netherlands	NLD	110425
5.	United States	USA	100394
6.	Luxembourg	LUX	94046
7.	United Kingdom	GBR	78998
8.	Ireland	IRL	46480
9.	Korea, Rep.	KOR	44000
10.	France	FRA	40314
11.	Canada	CAN	30271
12.	Russian Federation	RUS	25362
13.	Thailand	THA	23847
14.	Spain	ESP	22345
15.	Italy	ITA	22014
16.	Belgium	BEL	20285
17.	Denmark	DNK	18016
18.	Norway	NOR	10240
19.	Austria	AUT	9964
20.	Macao SAR, China	MAC	8832
21.	Finland	FIN	7299
22.	Qatar	QAT	5164
23.	Sweden	SWE	4795
24.	Saudi Arabia	SAU	4574
25.	Kuwait	KWT	3712
26.	Iraq	IRQ	3295
27.	Chile	CHL	3196
28.	Angola	AGO	3092
29.	Slovak Republic	SVK	2191
30.	Azerbaijan	AZE	1784
31.	Bolivia	BOL	1018
32.	Peru	PER	899,4
33.	Kyrgyz Republic	KGZ	582,4

Continuation of Table B.1.

1	2	3	4
34.	Iceland	ISL	542,3
35.	Estonia	EST	453,4
36.	Slovenia	SVN	327,8
37.	Namibia	NAM	210,7
38.	Zambia	ZMB	208,2
39.	Trinidad and Tobago	TTO	206,4
40.	Burkina Faso	BFA	91,6
41.	Ukraine	UKR	58,0
42.	Afghanistan	AFG	24,3
43.	Bhutan	BTN	2,8

Appendix C.

Table C.1. Portfolio investment, net (BoP, current million US\$)

№	Country Name	Country Code	2021
1.	Germany	DEU	299915
2.	Italy	ITA	144869
3.	Hong Kong SAR, China	HKG	105089
4.	Australia	AUS	65338
5.	Singapore	SGP	57003
6.	South Africa	ZAF	55187
7.	Sweden	SWE	44575
8.	Norway	NOR	41583
9.	Mexico	MEX	41557
10.	Saudi Arabia	SAU	38533
11.	Switzerland	CHE	37859
12.	Spain	ESP	35200
13.	Russian Federation	RUS	32087
14.	Greece	GRC	26810
15.	Finland	FIN	23934
16.	United States	USA	20897
17.	Korea, Rep.	KOR	19607
18.	Portugal	PRT	15055
19.	Ireland	IRL	12624
20.	Qatar	QAT	12160
21.	Austria	AUT	11755
22.	Poland	POL	11453
23.	Thailand	THA	11284
24.	Denmark	DNK	9170
25.	Malta	MLT	8311
26.	Philippines	PHL	8046
27.	Belgium	BEL	6857
28.	Slovak Republic	SVK	5866
29.	Argentina	ARG	4928
30.	Panama	PAN	4127