GREEN ENERGY DEVELOPMENT POLICY IN GEORGIA

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Abstract

The purpose of the article is to analyze the green energy development policy in Georgia and study citizens' awareness of the need to use renewable energy sources to stop climate change. The article examines Georgia's integrated national energy and climate plan, which covers the period 2021-2030, and outlines the country's commitment to achieving the 2030 goals. The paper also analyzes policies to achieve the long-term goals of the 2050 plan, ensuring compliance with the long-term political goals of the EU, the UN Framework Convention on Climate Change and the Energy Union. The article characterizes the factors that promote and hinder the convergence of Georgia's energy policy with the requirements of the EU and international policy for the development of green energy. The study provides an analysis of the general legal framework conditions for the production, transmission, distribution, supply and trading of electricity produced from renewable energy sources. Based on a survey of respondents on social networks and processing the results using the IBM SPSS Statistics computer program, information was revealed about insufficient awareness and understanding among respondents of the need to develop green energy and the lack of training programs in the field of education. In conclusion, the authors of the scientific article, summing up the economic policy for the development of green energy, proposed the introduction of a low symbolic municipal tax on environmental management in the regions and cities of Georgia, as well as the need to introduce new curricula for the study of green energy and climate change in educational institutions.

Keywords: green energy, renewable energy sources, energy policy, survey of population awareness on green energy issues

JEL classification codes: Q28, Q42, Q48, Q48, P18

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Introduction

Climate change is a very visible and dangerous challenge to sustainable and inclusive economic development in the world.
And the main character causing this is a person with his own economic interests and actions.

Prevention of risks affecting the limitation of the area of human habitation involves the introduction of such technologies and behavioral mechanisms that will have less impact on environmental conditions. Green energy - etymologically refers to such an energy system, in which the negative impact on the environment will be minimized. Scientific research has long focused on finding alternatives to traditional carbonate energy sources. In this sense, there are many interesting ideas, but in the process of introducing nano-bio-computer technologies, the world community cannot ignore the opportunities offered by nature itself, which are given to us with minimal effort and maximum benefit. Among the existing alternatives (the number of which is increasing every day), renewable energy sources occupy a particularly important place. At this level of technological progress, renewable energy sources are not equally available to all countries. Nevertheless, the consequences of the anthropogenic impact on the Earth have become so serious that the use of any opportunity to stop the process of increasing the temperature on Earth to 1.5^0C will save humanity (and not only humanity). Scientists suggest and prove that an increase in the Earth's temperature to 2^0 C will cause irreversible destructive processes, so humanity is faced with the task of stopping the impact of climate change (up to 1.5^0C) and preventing further temperature rise. The practical implementation of the task is associated with very complex processes, which, in turn, require both material and human resources, as well as scientific discussion and high-level consensus.

The purpose of our work is to analyze the green energy development policy in Georgia and to investigate the awareness of citizens about the need to use renewable energy sources. To do this, we set the following tasks:

- Analysis of the factors contributing to and hindering the convergence of Georgia's energy policy with the requirements of the European Union and international green energy development policy;
- Analysis of the general legal framework conditions for the production, transmission, distribution, supply and trade of electricity derived from renewable energy sources; and
- A study of the awareness of Georgian citizens about the need to develop green energy.

Methodology

The study of environmental issues that contribute to the development of green energy and other activities is relevant today. Scientists believe that both fixed and accelerated dissemination of innovations, as well as the development of green energy, in turn, require not only efforts from the government of the country, but also direct and wide participation of the population in their design and development (Sandra Brozzait, Ursula

Fritsch, Holger Görg and Marie-Christine Laible, 2016). It turns out that any timely and wise decisions and actions are aimless and impossible without the presence of social capital accumulated in society. Such capital is mainly created by the education system and the provision of correct information to the population (the function of the media). In this article, we conducted a study on the awareness of the state policy for the development of green energy as a policy for the dissemination of innovations in social networks in Georgia. For this purpose, in the study we rely on the theory of innovation diffusion. Innovation diffusion is a theory that attempts to explain how, why, and at what rate new ideas and technologies spread. The theory was popularized by Everett Rogers in his book Diffusion of Innovations, first published in 1962. Rogers, Everett M. (1983). In the case of policy dissemination, the focus is on how institutional innovations are adopted by other institutions at the local, local, or country level. An alternative term is "political transmission" where the focus is on dissemination agents and dissemination of political knowledge, such as in Stone, Diana (2012: 483-499). In particular, the use of innovation policy can be defined as knowledge of how the goals and instruments of policy in one political environment (past, present or future) are used to develop policy in another political context. Marsh, D., Sharman, J. K. (2009: 269–288).

More recently, interest in policy dissemination with purpose and objectives has shifted towards mechanisms (perception, imitation, learning, and enforcement), (Simmons, B. A.; Elkins, Z. (2004: 171-189), (Fabrizio Gilardi (2010: 650 -667), or distribution channels. From this position, the researchers decided that the creation of an international regulatory center for economic policy is transmitted through the channels of countries and sectors. At the national level, the study of options for effective popular policies makes it possible to find patterns in their distribution by examining levels of public awareness (Shipan , C., Volden, C., (2008: 840-857) At the international level, economic policy is transferred between countries in dependence with international and regional organizations beyond mandates established by global economic and financial centers Way, Christopher (2005: 125- 144) According to the scientist, when a group of countries achieves high results in the implementation of a set of policies, others can follow it and achieve success. This can be seen, for example, as lessons learned from China's successful growth (albeit somewhat of a moot point), (Meseguer, Covadonga 2005: 67-82). This can be seen, for example, as lessons learned from China's successful growth (Meseguer, Covadonga 2005: 67-82). However, here lies a catch that is not considered by scientists. Not always and not everywhere are the conditions that lead to success even when countries are transferred new technologies. The process of learning and introducing new energy-saving technologies corresponds to the stages of obtaining knowledge and making decisions. But this is not enough, because if the population of the country is not aware of national and global problems, it does not seek to participate in the process of generating new ideas, and after a certain time the development process will slow down.

Our survey of public awareness of green energy as an innovation was conducted for three months, from March 5 to May 5, 2023. The survey was conducted mainly in the professional social network https://www.linkedin.com/. The survey questionnaire was sent to more than 600 respondents, the questionnaire was filled out by 276 people, or 46%. The questionnaire consisted of 29 questions, 15 of which were general in nature

and 14 were related to awareness of green energy. We started the study by characterizing the composition of the respondents. Answers were received on such characteristics of respondents as: gender, age, place of residence, income, spending structure, change in income after the end of the pandemic, types of additional income, financial obligations, savings, level of education, ownership of property, employment, areas of activity, marital status and the respondent's assessment of his own standard of living.

As for the main question of the first model, we had to understand the attitude of the citizens of Georgia towards the need to replace carbonate resources with renewable energy sources, which would increase public support for the development of green energy. Using the second model, we wanted to understand how the Georgian education system educates young people about climate change and its causes. Such knowledge will have a multiplicative effect on the processes of understanding the problems associated with the use of carbonate energy resources and adverse changes in the current climate in the world. Also of interest was the connection of the remaining issues of the model, which reflects and determines the knowledge of the results of the use of carbonate energy resources.

Compliance of Georgia's energy policy with the requirements of international and European policies for the development of green energy

Compliance of Georgia's energy policy with the requirements of international and European policies for the development of green energy. Georgia is a member of the International Energy Charter, the European Energy Union, the NATO Energy Security Expert Center and other international organizations. The country is partnering with the International Monetary Fund, World Bank, USAID, KfW, EBRD, ADB and other organizations to strengthen the energy sector. Globally, the issue of climate change is being discussed/monitored by the United Nations Framework Convention on Climate Change (UNFCCC).

Since Georgia is not included in Annex 1 of the UNFCCC, it is authorized to participate in only one of the three mechanisms of the Kyoto Protocol - the Clean Development Mechanism (CDM), (United Nations Department of Economic and Social Affairs). By ratifying the Paris Agreement on June 7, 2017, Georgia joined 197 countries in committing to reach the zero emissions goal in the second half of the century by constantly updating the Nationally Determined Contribution with the main goal of limiting global temperature rise to a maximum of 2°C and, as far as possible, up to 1.5 °C.

Following the ratification of the Paris Agreement, Georgia announced that by 2021 it would submit an updated Nationally Determined Contribution document. (Georgia Updated Nationally Determined Contribution (NDC) 2021). Objectives of the updated Nationally Determined Contribution are:

1. Georgia is fully committed to achieving unconditional reductions in greenhouse gas emissions below 35% by 2030 of the 1990 total;

2. Georgia committed to achieve, subject to international support, the goal of reducing greenhouse gas emissions by 50-57% by 2030 (compared to 1990), if global greenhouse gas emissions follow the 2 or 1.5 degree Celsius scenario;
3. The updated Nationally Determined Contribution of Georgia defines climate change mitigation measures aimed at achieving the goals of unconditional and conditional mitigation measures;
4. Georgia is committed to examining the magnitude of climate change by mobilizing domestic and international resources for sectors that are particularly vulnerable to climate change as indicated in the updated Nationally Determined Contribution (NDC Georgia 2021 Update).

The Climate Change Action Plan will be updated every 2-3 years with the possibility of further adjustment/revision of the Nationally Determined Contributions (NDC). Georgia has made an unconditional commitment that by 2030 greenhouse gas emissions will not exceed 66% of the 1990 level, which is equivalent to 32.14 million tons of carbon dioxide, and with financial and technological support, this figure will decrease by 8% (4.32). million tons of carbon dioxide equivalent, and this will be the updated national goal of nationally determined contribution.

In addition to the above agreements, in April 2020, 21 Georgian self-government entities signed the Covenant of Mayors and joined the process of developing Sustainable Energy Action Plans (SEAPs). The Sustainable Energy Action Plans (SEAPs) include targets to reduce greenhouse gas emissions, as well as targets to reduce energy demand and improve energy efficiency by 2020-2030.

There are some problems and ambiguities in the activation of green energy development policy. Some Sustainable Energy Action Plans overlap/intersect with activities of the Climate Action Plan and are reflected in the sectoral positions of the Climate Action Plan, creating some gaps in action. In some cases, this is not directly relevant as the sustainable energy action plans of some municipalities are outdated and cover the period up to 2020. However, it should also be noted that current and future discussions of the Sustainable Energy Action Plans may be relevant in the process of adjusting the Climate Change Action Plan.

The European Commission, as an annex to the 2015 Energy Union Official Communication, has published guidelines for the development of integrated national energy and climate plans for EU Member States, which provide the basis for the development of national plans for 2021-2030.

The Energy Union approved recommendations for the development of the Integrated Energy and Climate Plan (NECP), which refers to cooperation with the Energy Union member countries in 5 areas. The purpose of the recommendations is to create analytical, institutional and regulatory prerequisites in the process of developing the Integrated Energy and Climate Plan (NECP). The recommendations are not legally binding and do not contain specific deadlines. In accordance with Article 5 of the Energy Union (Directive (EU) 2018/2001 (RED II), (Article 5 - Opening of support schemes for

electricity from renewable sources). By joining the Energy Union (membership ratified in April 2017), Georgia has assumed an obligation in national legislation to reflect the key EU laws in the field of energy and the environment related to energy, to develop an appropriate regulatory document and to liberalize the energy market in accordance with the legislation of the "Energy Union" and within the agreed time frame.

The former Ministry of Energy of Georgia and the European Energy Union (due to the fact that Georgia is not directly connected to the energy union and requires special approaches) agreed that the agreements signed by Georgia on oil and gas pipelines are contrary to the principles of the energy union. The EEU stated that it would not revise the agreements concluded between Georgia and Azerbaijan on the conditions for gas transit until August 31, 2026. Part of the transit agreements concluded by Georgia with Azerbaijan is also exempt from consideration of this agreement. This agreement with a neighboring state is important to us, so it will not be reviewed. And this means that until August 31, 2026, the transit conditions that we have will remain.

Under the Treaty Directives, security of supply is an important part of any energy sector. By the end of 2019, the former Ministry of Energy of Georgia was supposed to ensure the security of electricity supply, and by the end of 2020, the security of natural gas supplies. Supply chain security includes stockpiling and crisis management. Also, in order to avoid a shortage of oil products, there was an obligation to create reserves of oil supplies. Obviously, the reserves played a positive role during the pandemic, when the movement of goods for a certain period was completely limited.

The Georgia created a more competitive and liberalized market in 2018-2020 (during the COVID19 pandemic). This applies to markets and prices for both electricity and natural gas. The agreement also included the issue of rational use of renewable energy sources. By the end of 2018, Georgia was required to encourage the use of renewable energy sources and raise awareness about the resource, but this was not carried out. Environmental issues are also a priority in the agreement. The Georgian side undertook to assess the environmental damage caused by public and private projects by the end of 2017, adopt directives on air pollution by 2018, and the level of sulfur in liquid fuels by 2021. The industrial waste management policy, which Georgia must develop by 2026, is also important.

Based on the foregoing, the preparation of a national plan (report) for the period 2021-2030 has become mandatory for Georgia as a member of the Energy Union.In accordance with the “Main Directions of the State Policy in the Energy Sector”, a draft energy strategy of Georgia was created in 2020, which describes the current situation, vision, priorities and existing problems in the energy sector of Georgia, as well as ways to solve them. The strategy covers 2020-2030 (Integrated National Energy and Climate Plan of Georgia (draft).

The use of local renewable energy sources (wind, solar and geothermal energy) in the country has become the main aspect of the development of the energy sector in Georgia (National Integrated Energy and Climate Plan of Georgia 2022...). The Integrated

National Energy and Climate Plan covers the period 2021-2030 and defines the way to achieve the goals set for 2030, and is also based on the implementation measures associated with the policies of each Contracting Party of the Energy Union for 2020 (as a starting point). It should include a long-term perspective up to 2050 to ensure coherence and alignment with the respective long-term political goals of the EU, the United Nations Framework Convention on Climate Change and the Energy Union.

The Integrated National Energy and Climate Plan of Georgia until 2022 is based on the existing national energy and climate policy strategy developed by the contracting party, which reflects in a comprehensive (holistic) approach the five main areas of the energy connection, such as: decarbonization, energy efficiency, energy security, domestic energy market and research, innovation and competitiveness.

The National Integrated Energy and Climate Plan specifically focuses on achieving the goals by 2030, which include reduction of greenhouse gas emissions, energy production from renewable sources, energy efficiency and interconnected transmission lines (National Integrated Energy and Climate Plan Georgia 2022. Draft). In 2022, the document "Georgia Development Strategy Vision 2030" was developed, where the development of energy in Georgia is the seventh goal, and to achieve this seventh goal - ensuring the sustainability of the energy sector of Georgia - the following tasks were set: task 7.1 development of the energy market; Target 7.2 Development of renewable energy sources to meet consumer demand for electricity; and target 7.3 promoting energy efficiency to balance the existing energy deficit (National Integrated Energy and Climate Plan of Georgia until 2022...).

The geographic location of Georgia and its power systems create opportunities for electricity trade with neighboring power systems. Based on the foregoing, the concept of "Georgia - an electric power hub" remains a priority. In response to direct access to the European electricity market and the challenges of the country's power grid, work on the Georgia-EU submarine transmission line project will continue. The project involves the construction of an underwater transmission line from Poti across the Black Sea and thus will connect the Georgian power system to the systems of the ENTSO-E (ENTSO-E Recommendations on Net-Zero Industry Act member countries bordering the Black Sea). Given its strategic importance for the region, Armenia, Azerbaijan and Romania are included in the project along with Georgia. In the coming years, the units of obsolete thermal power plants will be gradually replaced with modern technologies, as a result of which at least 600 million m3 of additional imported gas will be saved annually.

Legal Framework for the Production, Transmission, Distribution, Supply and Trade of Electricity from Renewable Energy Sources

The policy of the electricity sector is determined by **the Ministry of Economy and Sustainable Development.** (Ministry of Economy and Sustainable Development). The objectives of its activities are: development of state policy and strategy in the field of electric power industry (after approval by the competent authorities) and their

implementation; promoting the development of the industry and attracting investments; approval of acts referred by law to its competence.

The Georgian National Energy and Water Supply Regulatory Commission (GNERC) is responsible for regulating the sector. Functions of GNERC: issuance of licenses for production, dispatching, transmission and distribution of electricity; tariff regulation; Discussing, resolving disputes and approving acts within its competence (Georgian National Energy and Water Supply Regulatory Commission (GNERC).

Dispatching Licensee. In Georgia, only one dispatching license has been issued and the dispatching licensee is State Electricity System of Georgia JSC, whose functions include: managing the electric power system, ensuring its stability, safety and reliable operation; Development of a 10-year plan for the development of the transmission network and forecast of the balance of electricity (capacity), etc. (dispatch licensee...) .

Transfer Licensees. The transmission licensee is **Georgian State Electric System (GSES)**, which owns most of the 220/110/35 kV transmission lines and 500/220/110/35 kV substations included in the transmission network.
Another owner of high-voltage transmission lines is ,,Sakrusenergo", which has leased out its transmission lines (part of the 220/330/500 kV transmission lines that are part of the transmission network).

The functions of the GSES JSC are: provision of services for the transmission of electrical energy through its own power transmission network; consideration of applications for connection to transmission networks and coordination with the dispatching licensee; Preparation of the transmission network investment plan within the framework of the 10-year transmission network development plan.
Electricity market operator. JSC "**Commercial Electricity System Operator" (CESO)** is the operator of the electricity market. Its functions are: registration of relevant persons as wholesalers; purchase and sale of balancing electricity and guaranteed capacity; Creation and production of a single base for wholesale purchase and sale, including a single accounting register (Commercial operator of the electric power system (CESO).

Electricity producers are production licensees and low-capacity power plants with a design capacity of not more than 15 MW, which are regulated (operate without a license and tariff). Georgia's power supply network includes 5 thermal power plants, 1 wind power plant and more than 100 hydroelectric power plants.

Policy instruments for the electricity sector.

JSC Georgian Energy Exchange (GENEX) is a trading platform for electricity not only for supplies to the Georgian market, but also a regional hub used by participants in adjacent markets for cross-border trading.
Currently, the exchange operates in a simulation mode (Georgian Energy Exchange OJSC (GENEX).
Distribution Licensees. There are 2 distribution licenses in Georgia: JSC "Telasi" and JSC “Energo-Pro Georgia”.

Georgia is rich in renewable energy sources, among which hydro resources are especially noteworthy. The economically justified potential of the country's hydropower resource is about 40 billion kWh, of which only 30% is used. In addition to hydro resources, Georgia has great potential to use other renewable energy sources such as wind, solar, geothermal energy, bioenergy, etc. According to current estimates, the wind energy resource in Georgia is 4 billion kWh, of which only 2% is used. According to optimistic estimates, the solar energy resource is about 1 billion kWh, the load of which is less than 1%. Georgia is rich in resources of high-temperature thermal waters, but out of 250 known deposits, only 44 wells with geothermal water with a temperature of 30 to 112 degrees Celsius have been registered. The use of underground thermal energy in the cities and regions of Georgia, where there are large reserves of high-temperature thermal waters, is accompanied by a limiting factor in the form of hydrogen sulfide (H2S). It should be noted here that Georgian scientists Lali Akhalbedashvili and Tsira Beruashvili developed a method for purifying geothermal water using physicochemical sorption methods. (Anano Mchedlishvili (2020).

In the process of understanding the idea of sustainable development, the Constitution of Georgia provides a really important explanation in this regard and says that the state is obliged to protect the interests of new and future generations through the rational use of natural resources and environmental protection. (Constitution of Georgia).

In 2019, the Law "**On Promotion of the Production and Use of Energy from Renewable Sources"** was adopted, the purpose of which is to create a legal framework for the promotion, stimulation and use of energy from renewable sources. It should be noted that the said law was prepared on the basis of the relevant directive of the European Union (Directive 2009/28/EC). The ministry is currently implementing a revised directive that will help introduce new market-oriented support schemes, encourage the use of biofuels, bioliquids and biomass, and provide consumers with more opportunities to develop renewable energy for their own consumption. Table 1 shows consumption and production of electricity, with a separate mention of electricity generated from renewable energy sources.

Table 1. 2019-2022 Electricity consumption data in Georgia in billion kWh

Electricity consumption and generation	2019	2020	2021	2022	2023 6 months
Domestic consumption	13,24	12,62	14,26	14,8	6,9
export	0,243	0,154	0,391	0.971	0,7565
import	1,628	1,61	2,006	1,53	0,6
Total amount of electrical energy generated	11,856	11,16	12,645	14,24	7,06
Electric energy generated from renewable energy sources	9,02	8,34	10,265	10.85	5,38

Source: The table is based on the materials of the National Statistical Service. National Statistical Office of Georgia. National Statistics Office of Georgia. https://www.geostat.ge/en

At the present stage, the energy system includes power plants with a total capacity of up to 4,600 MW, of which up to 3,400 MW are renewable energy sources, including more than 100 hydroelectric power plants and one wind power plant (with a capacity of 20.7 MW). Last year, the country's electricity production amounted to 14.26 billion kWh, and consumption - 14.8 billion kWh, while it should be emphasized that in 2022, 1.5 billion kWh were imported, which means that the country is still import-dependent . The situation can be corrected mainly through the construction of new generation facilities, if we take into account the fact that consumption in the country is increasing every year. In 2021, about 85% of all generation was hydro generation, and in 2022 this figure was 76%. From 2022 to the present, 14 HPPs have been built with a total installed capacity of 32.7 MW, and in 2013-2023. 60 hydroelectric power plants with a total installed capacity of 745 MW were put into operation. Currently, more than 200 memorandums have been signed (work is underway on the construction of 4 high-capacity hydroelectric power plants). As part of the already signed memorandums, the estimated total installed capacity of power plants is more than 3,000 MW, the estimated generation is more than 13 billion kWh. More specifically, from 2022 to the present, 89 memorandums have been signed, the distribution of which is presented in table 2.

Table 2. Distribution of Memorandums of Understanding signed from 2022 to present

Renewable energy power plants	The number of memos	Capacity in MW	Generation in million kWh	Investment in million US dollars
Hydroelectric power stations	48	265	1313.68	423.5
Wind power plants	10	366	1546	757
Solar power plants	31	87.2	128	55

Source: The table was compiled based on the data of the Ministry of Economy and Sustainable Development of Georgia (http://www.economy.ge/)

It should be noted that the possibility of developing the use of renewable energy sources (solar and wind) is limited by the technical parameters of power transmission networks. According to the State Electricity System of Georgia JSC, by 2030 the Georgian electricity grid will be able to combine only 1,332 MW of wind and 520 MW of solar power plants. To expand opportunities, it is important to introduce technologies such as batteries, which is a problematic issue for Georgia.

Within the framework of the Association Agreement with the European Union (DCFTA) and commitments to the Energy Union, the implementation of the provisions of EU directives and the transposition of energy legislation continues. In this regard, in 2019, Georgia adopted a new **law on energy and water supply** (https://www.matsne.gov.ge/), which is a key policy tool in this area. The document covers the main directions of the country and all aspects of the energy industry.

In 2019, the **Law of Georgia "On Energy Labeling"** was adopted, which has been amended to date (in order to delay the operation of certain articles of the law), and the final date of their entry into force is January 1, 2025 (https://matsne.gov.ge/ka/).
It is important that the effect of individual paragraphs of the articles of this law cannot yet be fully implemented, which leads to such decelerating events as: out of 16 technical regulations that the action plan provides for approval (in connection with the changes made to the EU regulation), one provision – regarding the energy efficiency labeling rule for vacuum cleaners – has been completely removed. 15 draft regulations have been prepared and they reflect changes in accordance with the updated EU regulations. However, the adoption of this law did not entail the process of developing the necessary equipment scheme, standards and labels, and the rule was not approved. This activity was supported by the Danish International Development Agency (DANIDA) (results not yet published).
Establishment of schemes for improving the energy efficiency of household appliances in accordance with Euro Directive 2010/30/EU has not been started. Consequently, no progress has been made in increasing the share of labeled products to 100% in the market. Also, programs to raise public awareness about energy efficiency, such as the information campaign on the „Varvara" lamps and information campaigns on solar water heating, have not been initiated.

As for the current changes in the education system, among them it is worth noting the developed short-term qualification programs for the training of installers of renewable energy technologies. From 2023, it is planned to retrain 100 people a year .

In addition, a regulation on certification and accreditation of energy auditors has been developed. The training programs defined in Article 14 of the Energy Efficiency Law were developed, discussed and agreed with stakeholders. Educational and training programs for energy consultants have also been developed, which means the development of training materials and concepts for the preparation of training programs. After the approval and implementation of the above rules and programs, the registration of graduates and certified specialists will begin. However, this activity is not only insufficient, but also does not take into account the sectoral changes taking place in Georgia, which are associated with the strengthening of the functions of the educational system of Georgia (V. Vesperi and I. Gagnidze (2023).

On May 28, 2020, Georgia adopted the **Law on Energy Efficiency** (https://matsne.gov.ge/ka/) and the Law of Georgia on Energy Efficiency in Buildings (https://www.matsne.gov.ge/) based on EU Directive 2010/31 /EU on the energy efficiency of buildings. In order to improve energy efficiency and introduce energy efficiency standards based on international best practices, work is underway on by-laws. Of these, in 2022-2023, 17 by-laws were approved, defined by the laws "On Energy Efficiency" and "On Energy Efficiency of Buildings". Also, 11 draft by-laws defined by these laws have been prepared. It should be noted that from July 1, 2023, the minimum requirements for the energy efficiency of buildings came into force. The updated Directive of the European Union on Renewable Energy Sources (Directive (EU) 2018/2001, (RED II)) on the promotion of the production and use of energy from

renewable sources is being transferred to the legislation of Georgia. In the fall, the bill will be submitted to parliament for approval.

It should be noted that at different times there were different schemes for supporting the development of power plants. Previously, the country had a mechanism for guaranteed purchases (PPA), in which tariffs for power plants were determined in advance. Since 2020, a mechanism to **support „green tariffs"** has been introduced as part of government decree N403 of July 2, 2020 "On approval of a scheme to support the production and use of energy from renewable sources (RES)". A new renewable energy support scheme is currently in place, which involves auctions of renewable energy capacity. The new scheme introduces the concept of a contract for difference - CfD, which will compensate for the difference between the market price and the contract price. The purpose of the scheme is to expand the use of renewable energy sources in Georgia and attract investment.

Support period - within 15 years after commissioning is: for HPPs - 8 months (September - April); for a wind farm - 9 months (August - April); For a solar power plant - 12 months and for other power plants using renewable energy sources - 12 months (On the approval of the support scheme ...). At the same time, it is desirable that those family farms and firms that do not try to at least partially replace the energy of carbonate resources with green energy in their activities pay small (symbolic) taxes (Irina Gogorishvili, Irakle Zarandia (2021), Üllas Ehrlich (2022), Tea Nõmmann, Üllas Ehrlich, Sirje Pädam (2020). This approach will create an additional source of income for regional municipalities. It is also important that each municipality will be interested in promoting and advertising the use of renewable energy sources (Seturidze R. (2021). In the context of the development of the energy market, the first auction for a capacity of 300 MW was held. It was announced where the activity of investors was quite high: 78 applications were submitted , with a total installed capacity of more than 900 MW plants.According to the results of the auction, 27 winning projects were selected, among them: 15 hydroelectric power plants with a total installed capacity of 153 MW, 2 wind farms with a total installed capacity of 77 MW and 10 solar projects with a total installed capacity of 77 MW. MW The average tariff per kWh was 6.85 US cents for hydro, 6.82 US cents for wind power, and about 6.37 US cents for solar.

In addition to the winning projects of the capacity auction, other power plants operating on renewable energy sources will be added to the network. At the same time, it is very important to apply digital technologies to the management of renewable energy equipment (Sepashvili, Eka (2017)), which will make the energy they produce cheaper and more competitive. In order to develop the transit direction of the state electric power system of Georgia, a 10-year plan for the development of the transmission network of Georgia has been developed.

Green hydrogen is the main energy resource of the future.While hydrogen has been a staple in the energy and chemical sectors for decades, it is attracting unprecedented attention from policymakers and businesses worldwide. As an example of this extraordinary momentum, in July 2021, McKinsey & Co. estimated that at least 359

large-scale hydrogen projects have been announced globally to date, amounting to 500 billion USD of associated investments through 2030 (McKinsey and Co. Council (2021). The Strategic Vision for a Climate Neutral EU, published in November 2018, predicts that the share of hydrogen in Europe's energy mix will increase from less than 2% to 13-14% by 2050. In addition, hydrogen can replace fossil fuels in some carbon-intensive industrial processes such as the steel and chemical industries, reducing greenhouse gas emissions and increasing the global competitiveness of these industries. This can solve the problems of those parts of the transport system that are difficult to get rid of today (https://eur-lex.europa.eu....)

In 2020, the Georgian government signed an agreement with the European Bank for Reconstruction and Development (EBRD) that provides for a technical study to assess the country's need for cleaner hydrogen production. In 2021, the Ministry of Economy and Sustainable Development of Georgia and the German Development Bank (KfW) signed a declaration to explore the potential of green hydrogen in Georgia. The main goal of the declaration is to assess the potential and usefulness of green hydrogen in Georgia, to implement the first pilot project that will benefit the economy and, therefore, help attract investment in the country in the development of clean and renewable energy sources. At the same time, this process will affect the sectoral development of the Georgian industry (Eka Lekashvili and Revaz Gvelesiani, 2023: 167-174), (Giorgi Kraveishvili, Irina Gogorishvili, 2022: 150-171). The declaration also aims to increase the pace of development of renewable energy projects, reduce carbon emissions and create export opportunities for the country.

It is important that the regulatory framework is ready for the development of the hydrogen industry. Preparatory work has already begun in GNERC, which will become a kind of basis for the creation of draft documents supporting the development of green hydrogen (David Narmania, 2022).

Scientists believe that both the acceleration of innovation and the development of green energy, in turn, require not only the efforts of the country's government, but also the direct and wide participation of the population in their design and development (Sandra Brosite, Ursula Fritsch, Holger Görg and Marie-Christine Label, 2016). It turns out that any timely and wise decisions and actions are aimless and impossible without the presence of social capital accumulated in society. Such capital is mainly created through the education system. In this regard, the systems of vocational and higher education are of particular importance, where the age of students plays a decisive positive role.

Green Energy Awareness Survey

In this work, we conducted a study on the awareness of the state policy for the development of green energy as a policy for the dissemination of innovations in Georgia. Everett Rogers, like other researchers, believes that the main lever for the dissemination of political information and influence on society is the media. The results of a survey of journalists conducted in 2022 by researcher Norberto Pignatti and a team of economists at the ISET Policy Institute in Tbilisi showed that (mtsvane-economykaze-gadasvla-aris-

tu-ara-kartuli-media-mzad) the level of reporting by journalists on green economy issues unsatisfactory. For many reasons, the Georgian media do not work properly on the green agenda and are not an effective means of providing citizens with information about green energy. Thus, raising the level of awareness and due awareness of the population about renewable energy sources and changes in the environment should be carried out mainly through the education system.

On the main question of the first model (question 1.1.), we had to find out the attitude of the citizens of Georgia to the replacement of carbonate resources with renewable energy sources, which would increase public support for the development of green energy. With the help of the second model, we wanted to find out how the respondents perceive the results of the green energy development policy to preserve their living space. In addition, what kind of knowledge does the Georgian education system give young people about global climate change and its causes. Such knowledge will have a multiplier effect on the processes of understanding the problems associated with the use of carbonate energy resources and limiting adverse changes in the global climate. Also of interest was the connection of other questions with the main question of the model, which reflects and determines knowledge about the consequences of using carbon-containing energy resources. As a result of processing the program using SPSS in both models, we obtained the following results:

Model I

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,752	,767	7

Model Summary

Model I	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.747a	.558	.550	.531

ANOVA[a]

Model I		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	96, 212	5	19,242	68,277	.000b
	Residual	76, 093	270	,282		
	Total	172,304	275			

Model II

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,806	,820	7

Model Summary

Model II	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.803a	.644	.638	,524

ANOVA[a]

Model II		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	134,181	5	26,836	97,753	.000b
	Residual	74,124	270	,275		
	Total	208.304	275			

Model I is relatively consistent and robust in the estimates given, as Cronbach's alpha is 0.752 and ANOVA Sig is 0.000b with an R squared of 0.558 (median), which, together with Cronbach's alpha and regression analysis, partially determines the need to replace carbonate energy resources with renewable energy resources. The R-squared regression score indicates that the relationship of questions (respectively, and answers) of the first model with the main 1.1. Question 0.558 has a 56% impact on the research objective, indicating that less than half of the respondents, but still a significant proportion, are not enthusiastic about the complete and widespread replacement of carbonate resources with renewable energy sources. Here we are clearly dealing with a lack of information, propaganda and knowledge. At the same time, if we take into account the fact that we are dealing with the opinions of people, the results are still positive and acceptable.

Model II (compared to Model I) is more consistent and reliable because Cronbach's alpha is 0.806 and ANOVA Sig is 0.000b. At the same time, the level of influence of model questions on the main question (question 2.3.) R Square is 0.669 or almost 70%. This indicates that the level of education has a significant impact on the importance of the mandatory replacement of carbonate energy resources with renewable energy resources in relation to the preservation of our living space (see questions and answers of respondents in the appendix). Respondents' dissatisfaction with obtaining knowledge about green energy in the educational space is due to the fact that students study these specialties only at the Technical University of Georgia.

Conclusion

After the conclusion of the DCFTA agreement with the European Union, since 2014 the government and society of Georgia have been trying to accept and implement the basic requirements of the energy policy of the European Union. At the same time, there are important limiting factors, such as: financial deficit, lack of own energy resources, problems associated with technology transfer and risks associated with geopolitics from neighboring countries;

In many developing markets, including Georgia, the media are busy collecting sensational facts. This situation does not help get rid of the "trouble at the door" (caused by global climate change). Today, media efforts should be directed at discussing information (terrifying and alarming facts and disasters) related to the changing nature of the world. Perhaps this will influence a large part of the Georgian society and they will completely change their opinion (about carbonate resources) and behavior;

Based on the position of protecting fairness, the electricity tax rate should be differentiated depending on the amount of energy consumed. Energy consumed above the established level must be paid at a progressive tariff, and electricity consumption below the established level must also be compensated at a regressive tariff. In Georgia, a partially but still similar tariff was in effect during the COVID-19 pandemic and quite effectively. It is desirable to encourage the population to save electricity by differentiating tariffs;

Outdated technologies for the construction of large hydroelectric power plants in Georgia, which need to be significantly replaced. Recent observed changes in nature (increased rainfall, floods, sea level changes, terrorist activities and poor qualifications of dam builders) combine to pose a threat of significantly higher levels of risks that developing and poor countries (including Georgia) cannot prevent on their own. It is also necessary to take into account the protests of the Georgian population regarding the construction of a large hydroelectric power station;

In parallel with the development of transmission lines and stations, it is necessary to develop a significant expansion of existing incentive mechanisms for those firms and family businesses that are trying to independently install wind, solar and thermal energy facilities. To achieve this, it is also necessary to strengthen the dissemination of information among the population about the latest technologies for the use of renewable energy sources;

The end result of the study is that today in Georgian society there is an unsatisfactory level of perception of the extremely high risks associated with climate change, which prevents people from recognizing the urgent need to replace carbonate energy resources with renewable energy sources. It should also be noted that after the outbreak of the Russian-Ukrainian war, more and more Georgian citizens understand that relying on constant imports of energy resources will call into question the country's development;

Secondary and higher education systems, together with the media, must participate in the dissemination of truthful and transparent information about the Earth's climate change and the need to replace carbonate energy resources. Curricula to stop climate change in the world and in Georgia in secondary and higher educational institutions must be completely updated. These should include Georgia's non-contingent and contingent commitments as outlined in Georgia's Integrated National Energy and Climate Plan.

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Appendix

1.1. To what extent do you agree with the following statement: "I believe that carbonate energy resources should be completely replaced by renewable energy resources"

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I have no answer	12	4.3	4.3	4.3
I generally disagree	18	6.5	6.5	10.9
I mostly agree	102	37.0	37.0	47.8
I completely agree	144	52.2	52.2	100.0
Total	276	100.0	100.0	

1.2. To what extent do you agree with the following statement: “In a gender context, I believe that it will be more difficult for women to use installations and equipment associated with renewable energy sources than for men (meaning education and opportunities for gaining skills for women and men in using equipment)?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I have no answer	18	6.5	6.5	6.5
I generally disagree	42	15.2	15.2	21.7
I mostly agree	72	26.1	26.1	47.8
I completely agree	144	52.2	52.2	100.0
Total	276	100.0	100.0	

1.3. Do you agree with the statement that the use of carbonate energy resources is the cause of the greenhouse effect and climate change on Earth?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I totally agree	12	4.3	4.3	4.3
I don't now	24	8.7	8.7	13.0
I don't agree at all	54	19.6	19.6	32.6
I mostly agree	156	56.5	56.5	89.1
I don't agree	30	10.9	10.9	100.0
Total	276	100.0	100.0	

1.4. Do you agree with the statement that any government in Georgia should make every effort to use renewable energy sources everywhere instead of oil and gas?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I have no answer	12	4.3	4.3	4.3
I don't agree	36	13.0	13.0	17.4
I don't agree at all	210	76.1	76.1	93.5
I totally agree	18	6.5	6.5	100.0
Total	276	100.0	100.0	

1.5. Do you agree that the Namakhvani HPP, the Khudoni HPP and a number of other large HPPs should be built to produce and export large amounts of electricity?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I don't agree	126	45.7	45.7	45.7
I don't agree at all	102	37.0	37.0	82.6
I mostly agree	18	6.5	6.5	89.1
I totally agree	30	10.9	10.9	100.0
Total	276	100.0	100.0	

1.6. Do you agree or not with the opinion that when installing renewable energy sources in homes, offices and public buildings, there are more problems than opportunities to solve them?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I have no answer	12	4.3	4.3	4.3
I don't agree at all	12	4.3	4.3	8.7
I don't agree	84	30.4	30.4	39.1
I mostly agree	162	58.7	58.7	97.8
I agree	6	2.2	2.2	100.0
Total	276	100.0	100.0	

1.7. What is the quality of the work of institutions related to energy sector development policy in Georgia?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I have no answer	12	4.3	4.3	4.3
Very low	6	2.2	2.2	6.5
low	48	17.4	17.4	23.9
average	174	63.0	63.0	87.0
high	36	13.0	13.0	100.0
Total	276	100.0	100.0	

2.1. To what extent do you agree with the statement that in the education system of Georgia one can get complete knowledge about renewable energy sources, as well as about the sale and accumulation of electricity produced on their basis?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I don't know	18	6.5	6.5	6.5
I don't agree at all	78	28.3	28.3	34.8
I don't agree	120	43.5	43.5	78.3
I mostly agree	48	17.4	17.4	95.7
I totally agree	12	4.3	4.3	100.0
Total	276	100.0	100.0	

2.2. Do you agree that the current educational system in Georgia (universities, schools, advanced training courses and other educational institutions) should teach courses on renewable energy sources, and students should actively participate in the study and research of the results of their use in cities and districts?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I have now answer	6	2.2	2.2	2.2
I mostly agree	18	6.5	6.5	8.7
I agree	138	50.0	50.0	58.7
I don't agree	114	41.3	41.3	100.0
Total	276	100.0	100.0	

2.3. Do you agree with the statement that through the development and intensive use of renewable energy sources, it is possible to stop the deterioration of climatic conditions in Georgia and avoid dangers for people?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I don't now	12	4.3	4.3	4.3
I don't agree at all	12	4.3	4.3	8.7
I mostly agree	66	23.9	23.9	32.6
I don't agree	162	58.7	58.7	91.3
I totally agree	24	8.7	8.7	100.0
Total	276	100.0	100.0	

2.4. Do you share the opinion that the supply of natural gas to the population in the regions has increased significantly?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I don't now	18	6.5	6.5	6.5
I don't agree at all	6	2.2	2.2	8.7
I don't agree	24	8.7	8.7	17.4
I agree	210	76.1	76.1	93.5
I mostly agree	18	6.5	6.5	100.0
Total	276	100.0	100.0	

2.5. Are you satisfied with the expansion of opportunities for transparent and fair decision-making by government authorities on energy issues in Georgia?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I don't know	18	6.5	6.5	6.5
I'm completely dissatisfied	6	2.2	2.2	8.7
I'm mostly dissatisfied	42	15.2	15.2	23.9
I'm mostly satisfied	210	76.1	76.1	100.0
Total	276	100.0	100	

2.6. To what extent do you agree with the statement that economic agents participating in the energy market should take into account not only the receipt of benefits, but also the honesty and security of the results of transactions?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I have no answer	6	2.2	2.2	2.2
I don't agree at all	24	8.7	8.7	10.9
I don't agree	30	10.9	10.9	21.7
I agree	144	52.2	52.2	73.9
I mostly agree	72	26.1	26.1	100.0
Total	276	100.0	100.0	

2.7. To what extent do you agree with the opinion that the creation and development of an oil, gas and electricity transit hub in Georgia contains significant risks for the citizens of Georgia in terms of limiting national interests and security?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
I have no answer	18	6.5	6.5	6.5
I don't agree at all	42	15.2	15.2	21.7
I don't agree	126	45.7	45.7	67.4
I agree	60	21.7	21.7	89.1
I mostly agree	30	10.9	10.9	100.0
Total	276	100.0	100.0	