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ON SOME ISSUES OF MANAGING GEORGIA'S HYDROPOWER POTENTIAL

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Abstract

Georgia's pursuit of energy security and sustainable development is intrinsically linked to its significant hydropower potential. This article examines the role of hydropower in Georgia's energy landscape, exploring its contribution to national energy security and its alignment with sustainable development goals. Georgia, strategically located in a geopolitically complex region, faces unique energy challenges. While actively participating in regional energy initiatives and facilitating energy transit to neighboring countries, Georgia also prioritizes diversifying its own energy sources. Hydropower, derived from the country's abundant river systems, offers a promising pathway towards achieving these objectives. With an estimated annual potential capacity of 15,000 MW and a production potential of 50 TWh, Georgia's hydropower resources remain significantly underutilized, currently supplying only 22.5% of its potential. Despite hydropower representing 80.5% of Georgia's electricity production, substantial opportunities exist for expanding its contribution to the national energy mix. However, harnessing this potential requires careful consideration of environmental and societal impacts. This article also presents findings from a survey of 1220 Georgian residents, revealing broad public support (80.1%) for increased utilization of hydropower resources. By exploring the interplay between Georgia's hydropower potential, energy security goals, and public perception, this article contributes to a deeper understanding of the country's sustainable energy future. It also highlights the importance of integrating modern technologies and sustainable practices to maximize the benefits of hydropower while mitigating potential environmental concerns.

Keywords: hydropower, energy security, sustainable development, Georgia.

I. INTRODUCTION

Energy security and sustainable development are critical priorities for Georgia, a country situated in the Caucasus region [1]. As a nation with limited fossil fuel reserves, Georgia has increasingly turned to its abundant renewable energy resources, particularly hydropower, to meet its growing energy demands [3].

Hydropower plays a pivotal role in Georgia's energy landscape, accounting for approximately 80.5% of its total electricity generation [4]. However, Georgia's hydropower potential remains significantly underutilized, with only 22.5% of its estimated annual capacity of 15,000 MW currently harnessed.

The development of Georgia's hydropower sector is not only crucial for ensuring national energy security but also aligns with the country's sustainable development agenda. Exploring Georgia's hydropower potential, its contribution to energy security, and the public's perception of its utilization is essential for understanding the country's energy future [8].

This article examines the role of hydropower in Georgia's energy landscape, its potential for expanding the country's energy security, and the public's perspectives on the development of hydropower resources.

II. METHODOLOGY

The methodology used in this study included a literature review of relevant academic and policy documents, as well as a survey of 1,220 Georgian residents to assess public perceptions of hydropower development. The literature review focused on analyzing the current status of Georgia's hydropower sector, its potential for expansion, and the challenges and opportunities associated with its development.

The survey questionnaire was designed to gather information on the public's attitudes towards hydropower, their perceived benefits and concerns, and their preferences for the future development of the sector.

The survey respondents were selected through a random sampling method, ensuring a representative distribution across different regions and demographic groups within Georgia. The survey data was then analyzed using statistical methods to identify trends and patterns in public opinion. The survey results were used to develop a comprehensive understanding of the role of hydropower in Georgia's energy landscape, the public's perspectives on its development, and the key factors that should be considered in shaping the country's energy strategy.

III. GEORGIA'S ENERGY LANDSCAPE: LEVERAGING HYDROPOWER

Georgia's energy landscape is characterized by a significant reliance on hydropower, which accounts for the majority of its electricity generation. The country's abundant river systems, particularly the Mtkvari, Rioni, and Enguri rivers, offer a substantial hydropower potential [7].

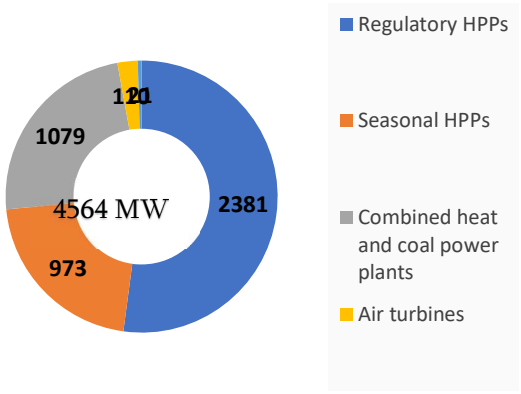

Fig 1. Existing capacities of power plants
source: https://energy.ec.europa.eu/data-and-analysis/energy-prices-and-costs-europe_en

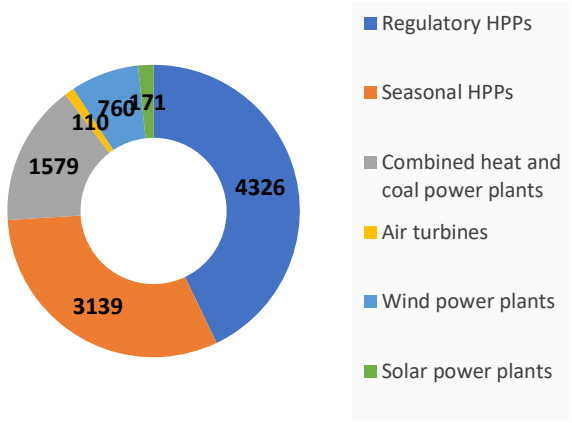

Fig 2. Expected capacities of power plants by 2032
source: https://energy.ec.europa.eu/data-and-analysis/energy-prices-and-costs-europe_en

According to official estimates (see. Figure 3), Georgia's annual hydropower potential is approximately 15,000 MW, with a production potential of 50 TWh. However, despite this significant potential, only 22.5% of the country's hydropower resources are currently being utilized.

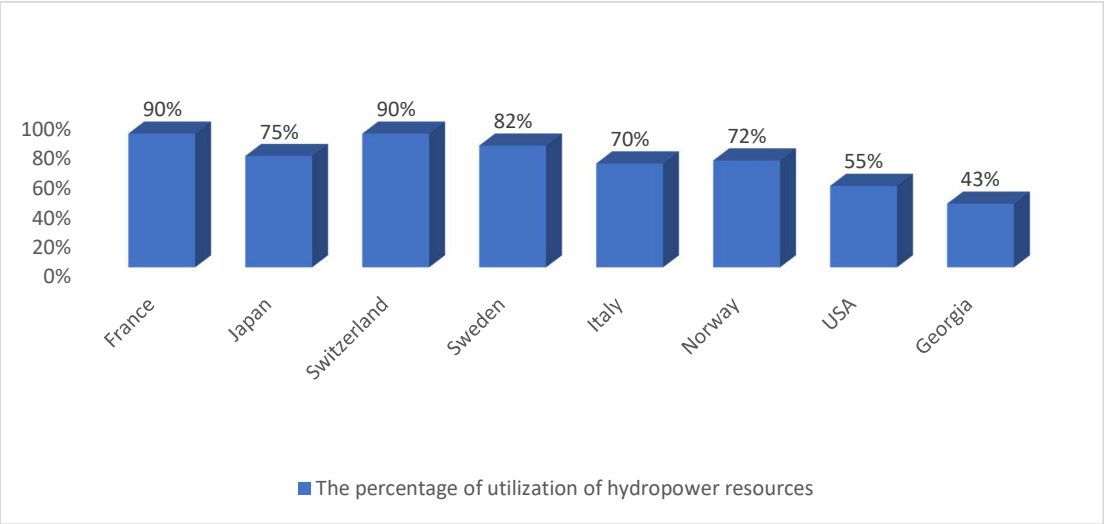

Fig 3. The percentage of utilization of hydropower resources.
Source: https://energy.ec.europa.eu/data-and-analysis/energy-prices-and-costs-europe_en

This underutilization of Georgia's hydropower resources can be attributed to a combination of factors, including limited financial resources, infrastructure challenges, and environmental concerns [9]. Despite these challenges, the Georgian government has made efforts to develop its hydropower sector, recognizing its importance for ensuring national energy security and promoting sustainable economic growth.

IV. HYDROPOWER AND ENERGY SECURITY IN GEORGIA

Georgia's energy security is heavily dependent on its ability to meet its growing energy demands. Hydropower plays a crucial role in this regard, as it provides a reliable and renewable source of electricity that can help reduce the country's reliance on imported fossil fuels [5, 6].

By leveraging its hydropower resources, Georgia can enhance its energy independence and reduce its vulnerability to external energy supply disruptions. Additionally, the development of hydropower infrastructure can contribute to regional energy cooperation and facilitate energy trade with neighboring countries, further strengthening Georgia's energy security.

However, the country's reliance on hydropower also exposes it to potential risks, such as fluctuations in precipitation patterns and the impacts of climate change [11]. To mitigate these risks, Georgia is exploring ways to diversify its energy mix, including the development of other renewable energy sources, such as solar and wind power.

In this region, hydropower production is projected to be reduced by approximately 40% on average by the end of the century under a high emissions scenario. According to recent projections, hydropower production in the region is expected to decline by approximately 40% on average by the end of the century under a high emissions scenario. This underscores the need for Georgia to adopt a comprehensive energy strategy that incorporates measures to adapt to the potential impacts of climate change on its hydropower resources.

V. PUBLIC PERCEPTION OF HYDROPOWER DEVELOPMENT IN GEORGIA

To better understand the public's perspectives on the development of hydropower resources in Georgia, a survey was conducted with 1,220 residents across the country.

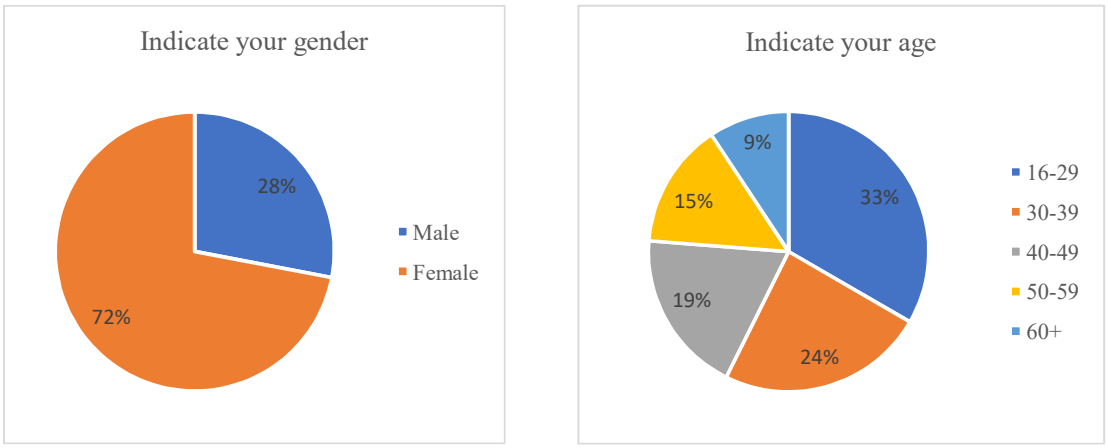

Fig 3. Distribution of respondents by gender and age

Source: Authors

According to the interviewees, the assessment of the importance of utilizing hydro resources to ensure the country's energy security is represented below (1- the lowest rating, 5 - the highest rating).

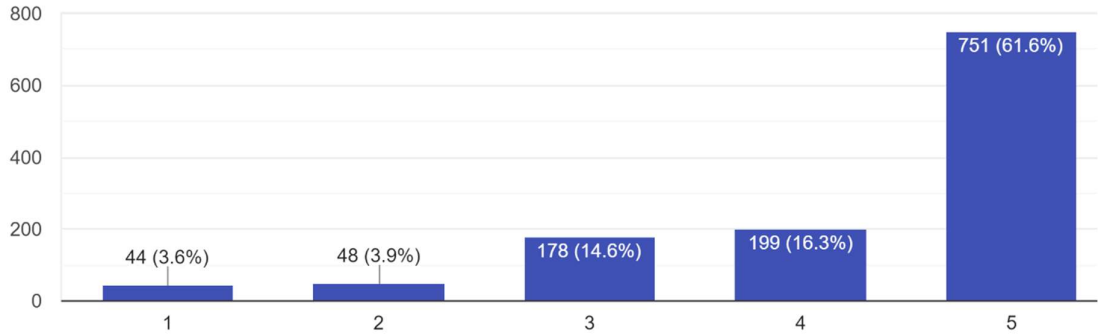

Fig 4. The assessment of the importance of utilizing hydro resources to ensure the country's energy security

Source: Authors

The survey results revealed a generally positive public attitude towards hydropower development, with the majority of respondents (72%) expressing support for increased utilization of hydropower resources. Approximately 68% of respondents indicated that they were in favor of expanding hydropower capacity in Georgia, citing benefits such as reduced reliance on imported fossil fuels, job creation, and environmental sustainability.

However, the survey also highlighted some concerns among the public, particularly regarding the potential environmental impacts of hydropower projects. Approximately 40% of respondents expressed worries about the environmental consequences of hydropower development, including

concerns about the disruption of natural ecosystems, displacement of local communities, and the impact on biodiversity.

VI. CONCLUSION

Georgia's hydropower sector plays a crucial role in the country's energy security and sustainable development. Leveraging its vast hydropower potential can help reduce Georgia's reliance on imported fossil fuels, enhance energy independence, and contribute to the country's efforts to transition to a low-carbon economy.

However, the development of hydropower resources must be balanced with environmental concerns and the potential impacts of climate change. By adopting a comprehensive energy strategy that incorporates measures to adapt to the challenges posed by climate change, Georgia can ensure the long-term viability of its hydropower sector and strengthen its energy security.

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საქართველოს ჰიდროენერგეტიკული პოტენციალის მართვის ზოგიერთ საკითხის შესახებ

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აბსტრაქტი

საქართველოს ენერგოუსაფრთხოების სწრაფვა და მდგრადი განვითარება არსებითად არის დაკავშირებული მის მნიშვნელოვან ჰიდროენერგეტიკულ პოტენციალთან. წინამდებარე სტატია განიხილავს ჰიდროენერგეტიკის როლს საქართველოს ენერგეტიკულ ლანდშაფტში, იკვლევს მის წვლილს ეროვნულ ენერგეტიკულ უსაფრთხოებაში და მის შესაბამისობაში მოყვანის მდგრადი განვითარების მიზნებთან. საქართველო, რომელიც სტრატეგიულად მდებარეობს გეოპოლიტიკურად რთულ რეგიონში, უნიკალური ენერგეტიკული გამოწვევების წინაშე დგას. რეგიონულ ენერგეტიკულ ინიციატივებში აქტიური მონაწილეობისა და მეზობელ ქვეყნებში ენერგიის ტრანზიტის ხელშეწყობისას, საქართველო პრიორიტეტულად ანიჭებს საკუთარი ენერგიის წყაროების დივერსიფიკაციას. ჰიდროენერგეტიკა, რომელიც მიღებულია ქვეყნის უხვი მდინარის სისტემებიდან, გვთავაზობს პერსპექტიულ გზას ამ მიზნების მისაღწევად. სავარაუდო წლიური პოტენციური სიმძლავრით 15,000 მეგავატი და საწარმოო პოტენციალი 50 ტვტ.სთ, საქართველოს ჰიდროენერგეტიკული რესურსები მნიშვნელოვნად არასაკმარისად გამოიყენება და ამჟამად ამარაგებს მისი პოტენციალის მხოლოდ 22.5%-ს. იმისდა მიუხედავად, რომ ჰიდროენერგეტიკა წარმოადგენს საქართველოს ელექტროენერგიის წარმოების 80.5%-ს, არსებობს მნიშვნელოვანი შესაძლებლობები ეროვნული ენერგეტიკული მიქსში მისი წვლილის გასაფართოებლად. თუმცა, ამ პოტენციალის ათვისება მოითხოვს გარემოზე და სოციალურ ზემოქმედების ფრთხილად განხილვას. ამ სტატიაში ასევე წარმოდგენილია 1220 საქართველოს მაცხოვრებლის გამოკითხვის დასკვნები, რომლებიც ავლენს საზოგადოების ფართო

მხარდაჭერას (80.1%) ჰიდროენერგეტიკული რესურსების გაზრდილი გამოყენების მიმართ. საქართველოს ჰიდროენერგეტიკული პოტენციალის, ენერგეტიკული უსაფრთხოების მიზნებისა და საზოგადოების აღქმის ურთიერთქმედების შესწავლით, ეს სტატია ხელს უწყობს ქვეყნის მდგრადი ენერგეტიკული მომავლის უფრო ღრმა გაგებას. იგი ასევე ხაზს უსვამს თანამედროვე ტექნოლოგიებისა და მდგრადი პრაქტიკის ინტეგრირების მნიშვნელობას ჰიდროენერგეტიკის სარგებლობის მაქსიმალურად გაზრდის მიზნით, ხოლო შერბილების პოტენციური გარემოსდაცვითი პრობლემები.

საკვანძო სიტყვები: ჰიდროენერგეტიკა, ენერგეტიკული უსაფრთხოება, მდგრადი განვითარება, საქართველო.