

Analysis of Obstacles and Youth Proposals in the Context of Improving Energy Efficiency and Renewable Energy Sources

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Abstract

The paper presents an analysis of current obstacles in the adoption of energy efficiency measures, and presents concrete proposals for measures for the development of energy efficiency and renewable energy sources. Students from the 1st cycle of study at the Faculty of Economics, University of Tuzla participated in the research. The methodology used in the paper is based on the use of primary (survey questionnaire) and secondary (desk research) data sources. The results of the research showed that the biggest obstacles to the adoption of energy efficiency measures are the following, respectively: lack of information and promotional activities, lack of interest in environmental issues and energy consumption, underdeveloped consumer awareness of potential energy savings, and financial obstacles. Potential proposals for energy efficiency measures generally go towards the proper design of laws and regulations for energy efficiency standards, then the labeling of energy efficiency of products, and finally, the results of the study showed that financial incentive measures have a significant (positive) effect on increasing energy efficiency. The results of this paper can assist policy makers in creating economic and energy policies and strategies.

Keywords: energy efficiency, youth, obstacles, proposals for measures, renewable energy.

1. Theoretical background

We are aware of the increasing climate change caused by, among other things, human activities and the production and consumption of energy from fossil fuels. At the same time, economic development and rising living standards entail growing energy needs. This is precisely in the last decade the greatest motive for experts in the development of new products and energy systems, and for governments, around the world - to inform and educate them on energy efficiency and renewable energy sources, and to encourage and apply them in all sectors of consumption.

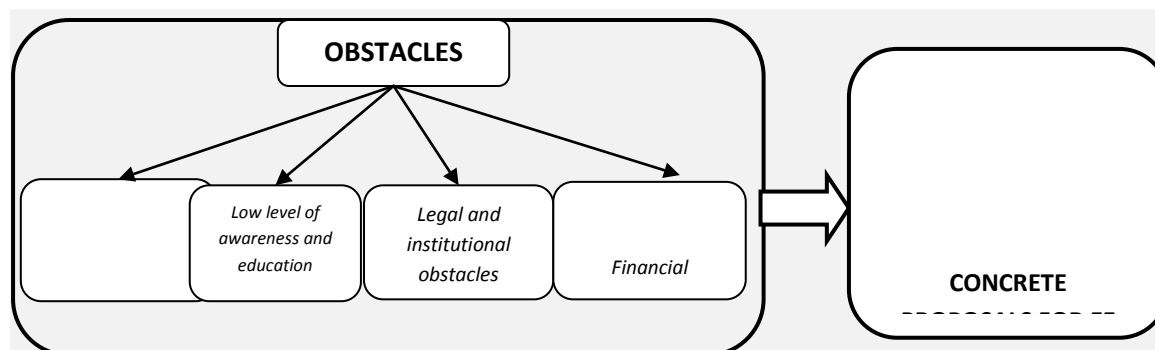
Increasing the efficiency of the use of renewable energy sources are inevitable topics of today's scientific work, and such topics are also contained in various strategies for solving the problem of securing energy needs.

Applying the principle of energy efficiency, does not only mean higher costs or renunciation, but also an opportunity to achieve better results with the resources we have, while reducing the environmental impact. Our society is becoming more and more aware of the importance of protecting the environment, and at the same time, so-called "Green jobs" have become part of potential solutions to today's economic, financial and environmental problems. In this context, it is necessary to constantly work on creating the conditions for involving not only the general public (public opinion), but also the youth in creating and adopting better quality legislative frameworks regarding the energy economy and allowing them space to express their views and proposes stated issues.

Extending the foregoing idea, a presentation on "Youth and Energy Efficiency" was held in the Parliament of the Federation of Bosnia and Herzegovina in 2014.¹ The presentation is primarily organized for students, interested in energy efficiency and renewable energy. The aim of the presentation was to explain the general procedures for the adoption of laws in FBiH, the requirements of the draft Law on Energy Efficiency in FBiH, and the experience gained so far during the implementation of energy efficiency projects across BiH and work on capacity building of local experts and activities to raise public awareness of energy efficiency.

Based on the findings presented, relatively few scientific papers have been published so far, dealing with the analysis of obstacles in the development of energy efficiency, as well as the use of renewable energy sources. The research aims to (general) aim to identify current obstacles to the development of energy efficiency and renewable energy sources in order to identify concrete proposals for mitigation measures based on the results of the research.

Starting from the existing scientific knowledge about the importance of energy efficiency and renewable energy sources, explained in the second part of the paper, the theoretical concept of this research is presented in the following figure:



Source: Author Creation

Figure 1. Theoretical background of research

The paper is organized as follows: After the theoretical concept of the research, which is also the first chapter of the paper, the second part gives a brief overview of the significant research results that deal with the problem of energy efficiency and renewable energy sources, in general. The third part deals with the methodology of the conducted research and the fourth part with the results and discussion. The concluding observations summarize the main findings of the study.

2. Literature review

Policy makers in Bosnia and Herzegovina (BiH) will be obliged, already in the process of accession to the European Union (EU), to base plans for the development of the energy economy on EU energy policies. This means that BiH will have to implement the EU *acquis* in the energy and environmental sectors consistently into domestic law.

With its strategic documents, the EU has identified options, opened discussions and initiated processes of adopting action plans at national, regional and local levels, industry and individual consumers, in order to exploit all the potential for energy-efficient savings. According to EU legislation, all its members should, by the end of 2020, implement the 20-20-20 strategic plan, (ie achieve 20% energy savings, reduce greenhouse gas emissions by at least 20% compared to 1990, and allow at least 20% of energy needs come from renewable energy sources). Furthermore, the EU is currently aligning its energy and climate policies with the commitments it has made to accession to the Paris Climate Agreement. Even in its strategic planning documents, the Union committed itself to decarbonising the economy and society by 2050, with well-defined country-specific targets.

During 2017, a “Framework Energy Strategy of Bosnia and Herzegovina until 2035” was drafted in BiH. Working groups nominated in front of entity governments in BiH participated in the development of strategies coordinated by a consultant (*Price water house Coopers - PwC*). Therefore, the views expressed by these working groups during the drafting of the Strategy, which are contained in individual development scenarios in the proposal for the final document, can be considered as the official positions of key energy efficiency decision makers in BiH. An insight into the Strategy, it can be concluded that the current commitments (visions, strategies and plans) of key actors in BiH are not based on EU energy policies.

The Republic of Srpska and the Federation of BiH also worked on the analysis and recommendations for removing obstacles to investing in the energy sector at the BiH level and implementing energy efficiency measures (2018). In fact, this Report was the initial basis for preparing a detailed analysis of the legal framework, the identification of legal and other recommendations for removing obstacles to the implementation of energy efficiency measures and the use of renewable energy in both Entities.

According to these available studies, the obstacles specifically relate to: 1) research and technological development, 2) better use of tax measures, 3) public procurement and purchases, 4) building, 5) household appliances, 6) limiting fuel consumption of vehicles, and optimization of traffic management.

In order to identify current obstacles and potential measures for the development of energy efficiency and renewable energy sources, Kusljagic (2019) has undertaken research into the "Energy Transition in BiH". Namely, the main objective of this document was to initiate a systematic dealing with the topic (trends, opportunities and challenges) of the energy transition in BiH, which is a precondition for the development of future quality strategic documents regarding energy efficiency and renewable energy sources.

Agić *et.al.* (2013), point out in their paper that there are valid indicators to suggest that decisive efforts and perseverance in implementing energy efficiency and energy saving measures could become one of the promising avenues leading to a stable economy over the longer term, reducing energy costs, and thus production, and increasing employment. This could be an important factor in creating a better and more sustainable BiH economy. Thus, these authors state that the greatest obstacles to increasing energy efficiency in BiH are: a) lack of information (on prices and availability of new technologies, costs of their own energy consumption, lack of information on the customers themselves); b) a problem with financial investments (investments are often long-term and sometimes uncertain); c) technical obstacles (non-standardization of equipment and components in energy infrastructure); and d) regulatory failures (problems in tariff structures, criteria and standards related to the eligibility or privilege of electricity producers from renewable energy sources).

Brstilo & Nekić (2014) in their own research, through 6 chapters, presented measures related to promoting energy efficiency and use of renewable energy sources in almost all economic sectors in the Republic of Croatia, with the aim of removing barriers and implementing measures for their implementation as soon as possible.

Soluiz (2013) analyzed the key parameters that indicate the need to improve energy efficiency in the Republic of Serbia, namely: 1) the energy intensity of primary energy is questionable (Serbia consumes several times more energy than EU countries to create the same amount of newly created energy) values); 2) the high share of households in electricity consumption, which is largely the result of its use for heating during the winter months, which indicates that electricity is used very inefficiently; 3) the efficiency of transformation of primary to final energy is low; 4) dependence on imported energy; and 5) large greenhouse gas emissions from the energy sector.

3. Research methodology

Within the desk research, available secondary sources of data (ie books, study articles, publications and websites addressing the field of energy efficiency and renewable energy) were processed, all with respect to the principles of reference and current literature.

Primary data sources are collected to investigate current obstacles and propose measures for the development of energy efficiency and renewables, based on a survey questionnaire. The research units are students of the 1st cycle of studies at the Faculty of Economics, University of Tuzla. The examination was conducted on a sample of 70 students over four years of study. This part of the population has a great capacity to absorb new information and knowledge. However, it is noted that the existing formal education channels do not offer sufficient theoretical and practical knowledge in the field of energy efficiency and the use of renewable energy sources.

Therefore, the target group of education is students between 20-24 years, in whose structure gender representation is equal (1: 1).

The data collected were subjected to descriptive statistical analysis.

4. Results and discussion

Most of the students have completed General High School or one of the Secondary Technical Schools (Economic School, Electrical Engineering School, Commercial School). Of these, 50 students (71.5%) come from the "urban" environment, and 28.5% (20 students) come from the "rural" environment.

In this regard, Table 1. presents some of the basic characteristics of the sample.

Table 1. The basic characteristics of the sample

<i>The basic characteristics</i>					<i>Total</i>
<i>High school graduation</i>	<i>General high</i>	<i>Electrical Engineering</i>	<i>Economic</i>	<i>Tourist -catering</i>	
	15	3	35	17	70 (n)
	21,43	4,29	50	24,29	100 (%)
<i>Sex</i>					
<i>Mail</i>	5	3	15	10	33 (n)
	15,15	9,09	45,45	30,30	100 (%)
<i>Femail</i>	10	-	20	7	37 (n)
	27,02	0	54,05	18,92	100 (%)
<i>The environment in which you live</i>					
<i>Urban</i>	5	3	25	17	50 (n)
	10	6	50	34	100 (%)
<i>Rural</i>	10	-	10	-	20 (n)
	50	0	50	0	100 (%)

Source: Author Creation

We divided the results and discussion of the research into two parts, namely:

1. In the first part of the research, the discussion deals with a set of questions concerning the **obstacles** to the adoption of energy efficiency development measures.
2. In the second part of the research, the discussion deals with **concrete proposals** for measures for the development of energy efficiency and renewable energy sources.

4.1 Obstacles to the adoption of energy efficiency measures

In relation to the subject of the research, the following operational goals are set in the paper:

G1: Determine the intensity of the obstacles related to the role of energy efficiency in purchasing decisions;

G2: Determine the intensity of the obstacles related to the lack of awareness of energy efficiency on many end-user products;

G3: Identify the intensity of the obstacles related to lack of awareness of potential energy savings;

G4: Determine the intensity of the obstacles regarding investment in energy efficiency; and

G5: Determine the intensity of the obstacle related to financial obstacles.

The results of the research are presented in Table 2.

Table 2. Summary statistical data processing

Statistics

		Energy efficiency of the product plays a small role in the purchase process	There is not enough information on energy efficiency on end-user products	Consumer awareness in BiH of potential energy savings has not been developed	Energy efficiency investment decision makers are not end users who pay energy bills	Financial obstacles are the biggest obstacle to adopting energy efficiency measures
N	Valid	70	70	70		70
	Missing	0	0	0	0	0
Mean		3.5000	4.8857	4.9286	4.0143	4.6143
Std. Error of Mean		.09269	.03830	.03100	.11051	.12089
Median		3.0000	5.0000	5.0000	4.0000	5.0000
Mode		3.00	5.00	5.00	5.00	5.00
Std. Deviation		.77553	.32046	.25940	.92459	1.01143
Variance		.601	.103	.067	.855	1.023
Minimum		1.00	4.00	4.00	3.00	2.00
Maximum		5.00	5.00	5.00	5.00	5.00
Sum		245.00	342.00	345.00	281.00	323.00
Percentiles	25	3.0000	5.0000	5.0000	3.0000	5.0000
	50	3.0000	5.0000	5.0000	4.0000	5.0000
	75	4.0000	5.0000	5.0000	5.0000	5.0000

Source: Author Creation

The results of the research showed that the biggest obstacles to the adoption of energy efficiency measures are the following, respectively:

- BiH consumers' awareness of potential energy savings not developed (4,92)
- Lack of sufficient energy efficiency information on end-user products (4,88)
- Financial obstacles (4.61)
- Energy efficiency investment decision makers are not end users paying energy bills (4.01) and
- Product energy efficiency plays a small role in purchasing (3,5)

An overview of frequencies on the Likert scale by individual operational research objectives is given in the tables below:

Table 3. The energy efficiency of a product plays a small role in the purchase process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I totally disagree	1	1.4	1.4	1.4
	Neither agree nor disagree	41	58.6	58.6	60.0
	I agree	19	27.1	27.1	87.1
	I totally agree	9	12.9	12.9	100.0
	Total	70	100.0	100.0	

Source: Author Creation

Table 4. There is not enough information on energy efficiency on end-user products

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid I agree	8	11.4	11.4	11.4
I totally agree	62	88.6	88.6	100.0
Total	70	100.0	100.0	

Source: Author Creation

Table 5. Consumer awareness in BiH of potential energy savings has not been developed

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid I agree	5	7.1	7.1	7.1
I totally agree	65	92.9	92.9	100.0
Total	70	100.0	100.0	

Source: Author Creation

Table 6. Energy efficiency investment decision makers are not end users who pay energy bills

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Neither agree nor disagree	29	41.4	41.4	41.4
I agree	11	15.7	15.7	57.1
I totally agree	30	42.9	42.9	100.0
Total	70	100.0	100.0	

Source: Author Creation

Table 7. Financial obstacles are the biggest obstacle to adopting energy efficiency measures

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid I do not agree	9	12.9	12.9	12.9
I totally agree	61	87.1	87.1	100.0
Total	70	100.0	100.0	

Source: Author Creation

The research results showed the following:

- Of the 70 students surveyed, more than half (41) or 58.6% have no idea at all whether the energy efficiency of the product plays a role in purchasing;
 - Unfortunately, very little attention is paid to the promotion and sufficient awareness of the importance of extending energy efficiency and renewable energy. Specifically, 88.6% of students in all years of the first cycle of graduate study believe that there is insufficient information on energy efficiency on end-user products;
 - Consumer awareness in BiH of potential energy savings has not been developed. 65 students or 92.9% agreed with this view.
 - The relevant government institutions are under-working on public awareness-raising activities on the issue of energy waste and the benefits of implementing energy efficiency and renewable energy resources and environmental protection, and education programs in this area.
- All this, causally, indicates that there is also insufficient public participation of young people in the decision-making process, in terms of energy economics, in general.

Therefore, it is not surprising that students' attitudes towards the decision makers about investing in energy efficiency are not the end users paying energy bills. In simplified terms, the costs are paid by end users, individuals and their households. Thus, 43% support this view.

4.2 Proposed measures for the development of energy efficiency and renewable energy

Sources

In relation to the subject of the research, the following operational goals are set in the paper:

- G1: Determine the intensity of the measures relating to the promotion of energy efficiency investments on a legal basis;
- G2: Determine the intensity of the labeling measure for energy efficient products;
- G3: Determine the intensity of the measure for possible ways of defining requirements for new products;
- G4: Determine the intensity of the measure to build the certification system; te
- G5: Determine the intensity of the potential financial incentive measure.

The summary results of the descriptive statistical analysis are given in Table 8.

Table 8. Summary statistical data processing Statistics

		The most effective way to encourage investment in energy efficiency is to have well designed and implemented laws and regulations for efficiency standards, paired with appropriate customer prices.	Labeling the energy efficiency of products has a positive impact on the purchase of efficient products	Defining energy requirements for new products has a positive impact on increasing energy efficiency	The certification system has a positive impact on increasing energy efficiency	Financial incentives have a positive impact on increasing energy efficiency
N	Valid	70	70	70	70	70
	Missing	0	0	0	0	0
	Mean	4.2143	3.2857	2.4571	2.5429	5.0000
	Std. Error of Mean	.08364	.10602	.10707	.09692	.00000
	Median	4.0000	4.0000	2.0000	2.0000	5.0000
	Mode	4.00	4.00	2.00	2.00	5.00
	Std. Deviation	.69975	.88699	.89581	.81090	.00000
	Variance	.490	.787	.802	.658	.000
	Minimum	3.00	2.00	2.00	2.00	5.00
	Maximum	5.00	4.00	5.00	4.00	5.00
	Sum	295.00	230.00	172.00	178.00	350.00
	Percentiles					
	25	4.0000	2.0000	2.0000	2.0000	5.0000
	50	4.0000	4.0000	2.0000	2.0000	5.0000
	75	5.0000	4.0000	3.0000	3.0000	5.0000

Source: Author Creation

The results of the research show that according to the respondents' opinion, the best measures for increasing energy efficiency are:

- Financial incentive measures (5,00)
- Well-enforced laws and regulations for efficiency standards, paired with appropriate customer prices (4.21)
- Product energy labeling (3.28)
- Certification system (2.54) i
- Defining energy requirements for new products (2.45)

An overview of frequencies on the Likert scale by individual operational research objectives is given in the tables below:

Table 9. The most effective way to encourage investment in energy efficiency is to have well designed and implemented laws and regulations for efficiency standards, paired with appropriate customer prices

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Neither I agree nor I disagree	11	15.7	15.7	15.7
I agree	33	47.1	47.1	62.9
I totally agree	26	37.1	37.1	100.0
Total	70	100.0	100.0	

Source: Author Creation

Table 10. Labeling the energy efficiency of products has a positive impact on the purchase of energy efficient products

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid I do not agree	20	28.6	28.6	28.6
Neither I agree nor I disagree	10	14.3	14.3	42.9
I agree	40	57.1	57.1	100.0
Total	70	100.0	100.0	

Source: Author Creation

Table 11. Defining energy requirements for new products has a positive impact on increasing energy efficiency

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid I do not agree	51	72.9	72.9	72.9
Neither I agree nor I disagree	12	17.1	17.1	90.0
I agree	1	1.4	1.4	91.4
I totally agree	6	8.6	8.6	100.0
Total	70	100.0	100.0	

Source: Author Creation

Table 12. The certification system has a positive impact on increasing energy efficiency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I do not agree	46	65.7	65.7	65.7
	Neither I agree nor I disagree	10	14.3	14.3	80.0
	I agree	14	20.0	20.0	100.0
	Total	70	100.0	100.0	

Source: Author Creation

Table 13. Financial incentives have a positive impact on increasing energy efficiency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I totally agree	70	100.0	100.0	100.0

Source: Author Creation

The students' views and statements helped formulate the following proposals for measures to develop energy efficiency and renewable energy:

1. Financial incentives have a significant impact on increasing energy efficiency. It is interesting to note that all 70 students (100%) supported this measure proposal.
2. Aquis communautaire or a specifically defined legal aspect of energy efficiency is the most effective way to encourage investment in electricity and / or RES. Approximately 47% of students agree with this, and approximately 37% of students agree.
3. Adequate and proper labeling of energy efficiency of products has a positive impact on the purchase of energy efficient products. About 57.1% of students agreed with this.

5. Conclusions and recommendations

Development Strategy of The Federation of Bosnia and Herzegovina, for the period 2010-2020, has allocated the following within the *Framework Objectives and Strategically Priority Development Goals*: (1) Sustainable growth and development, ecology and development of energy potentials, (2) Utilization of renewable and non-renewable natural resources in securing sustainable development, and thereby defining concrete measures that will contribute to increasing the level of environmental protection and energy efficiency, that is, the use of renewable energy sources. In this context, young people have been given a special role in promoting energy efficiency and the use of renewable energy sources in order to raise public awareness and strengthen the role of young people in the field.

The EU *Green Paper* identified options and opened a debate on how to achieve cost-effective savings and initiate rapid adoption of concrete action plans that would cover action at Union, national, regional, local and international levels, as well as at industry and individual levels consumers, in order to exploit the identified potential for efficient energy savings. The basic actions that can be taken in this regard are:

- Adopting annual energy efficiency action plans at Member level,
- Better information for citizens by directing public campaigns and improved product labeling, given their energy efficiency,
- Changing the tax system that will "force" polluters to introduce new, or "cleaner" technologies,
- Targeting state aid for implementing energy efficiency initiatives and projects,
- Targeting public procurement in energy efficient technologies (e.g. more energy efficient and environmentally friendly means of transport),
- Use of new or improved financial instruments to support business and household initiatives, to make energy-efficient improvements,
- Improving the energy efficiency of residential buildings to which the existing EU Directive applies, and possibly extending it to smaller buildings, in such a way as to ensure cost-effectiveness and minimal additional red tape, and

- Implementation and improvement of the EU-CARS21 (*Competitive Automotive Regulatory System for the 21st Century*) initiative to accelerate the development of a new generation of less fuel efficient vehicles.

One of the basic goals arising from the results of this research is focused, among other things, on changing the consciousness of the individual, for example, in terms of rationalizing one's energy use in everyday life and attitudes towards renewable energy sources. We can safely say that this goal is linked to the "idea of responsibility", especially the individual's or the young man's own responsibility.

Bearing in mind the above, we highlight the following conclusions of the conducted research.

Certainly, we believe that each can be a good starting point or a fundamental basis for some further (future) research.

- Financial obstacles are the biggest obstacle to adopting energy efficiency measures;
- Financial incentives have a significant impact on increasing energy efficiency.
- The most effective way to encourage investment in energy efficiency is through well designed and implemented *aquis* for efficiency standards;
- Product energy labeling has a positive impact on purchasing more energy efficient products; and
- There is insufficient information on energy efficiency on end-user products;
- Consumer awareness in BiH of potential energy savings has not been developed;

Moreover, a potential conclusion drawn from this research could be cited - the introduction of various contents in the field of energy efficiency and renewable energy sources into teaching *syllabuses* as a special form of education and training, thus facilitating the realization of clear energy education goals.

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