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Public acceptance of energy technologies

SUMMARY OF DOCTORAL DISSERTATION

Social sciences,
Ekonomics (S 004)

VILNIUS 2020

This dissertation was written between 2016 and 2020 at Vilnius University, Kaunas Faculty, Institute of Social Sciences and Applied Informatics.

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Chairman – **Prof. Dr. Rasa Kanapickienė** (Vilnius University, Social sciences, Economics – S 004).
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Energetikos technologijų visuomeninio priimtinumo vertinimas

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Relevance of the study. XXI age life without the usual technologies already used acceptably, such as computer, telephone, car, etc., is unimaginable. The introduction of new technologies is very important for human evolutionary development together with technology. Every new technological discovery is fundamentally important for anyone whose lifestyle can change from it - both to make it easier and harder. The further quality of life of society depends on what technologies are implemented and how they are accepted by society.

General acceptance of energy technologies is a person's ability to absorb information about an existing or new energy technology, to superficially understand its operation, benefits or harms, and other properties of new technologies.

In addition to the general acceptability of energy technologies, there is the economic acceptability of all energy technologies, which may or may not economically allow the adoption of a new technology, regardless of whether it brings benefits or harms. It can be assumed that many people would adopt all technologies that bring tangible benefits, but this requires very large financial resources, which are often lacking. In addition to the economic acceptability of energy technologies, the social and environmental aspects of technology acceptability are taken into account. According to this principle, the acceptability of energy technologies is multi-criteria, which is not determined solely from one side, but through the prism of sustainable development. Sustainable development in energy is one of the most important emphases, which says that energy diversity must be balanced in all three dimensions of sustainable development - economic, social and environmental.

As energy technologies often affect more than one group of individuals and their finances and quality of life, the question inevitably arises as to how society accepts energy technologies. With more than one opinion emerging, such acceptability of energy technologies is called the acceptability of public energy technologies.

In this way, there is a need for the organized adoption of necessary and cost-effective energy technologies, preventing financial waste and the introduction of harmful energy technologies.

Energy development plans are still drawn up with too little focus on public opinion and the level of technological acceptability, public needs and attitudes. The focus is on the lowest cost, which is not always the case. It is very important to understand how and why society accepts new energy technologies and what is public benefit caused by the introduction of such technologies.

Scientific problem and the extent of its investigation. With rapid technological development, many unanswered questions remain about the technologies we are constantly using and the technologies we will be using in the near future. These questions form problems - how much will it cost us, whether it is worth it, why it is worth it, what the consequences will be, and so on. Therefore, scientists from various fields make hypotheses, conduct research and calculations in order to investigate the level of problems caused by the introduction of energy technologies.

Authors F. Beck, E. Martinot (2004) and M. Dupuy, W. Xuan (2016) singled out the main obstacles to the development of the energy sector - high cost and initial investment, low rate of return, environmental factors that strongly hinder large projects, energy uncertainty in the development of the energy sector, uncontrolled market and political changes. McFarland et al. (2004) argued that these barriers are different for renewable and non-renewable energy technologies.

These researchers write about different energy technologies and their similarities, and differences: Ferry, Monoian (2012), Qiblawey, Banat (2007), Kim et al. (2007), Fernando et al. (2000), Zhu et al. (2006), Yoo et al. (2004), Ragheb (2013), Bukała et al. (2015), Ahrens, Diehl, Schmehl (2013), Balagaru (2013), Razak et al. (2009), Tytell (2006), Myers, Bahaj (2007), Pino et al. (2003), Yaman (2004), Chaudhuri, Lovley (2003), Zhu, Beeby (2011), Raju, Grazier (2008),

Chen et al. (2009), Kuravi et al. (2013), Wade et al. (2010). The researchers singled out the main areas of renewable energy technologies - bioenergy, direct solar energy, geothermal energy, hydropower and wind energy. All key technologies have one thing in common: they are fully renewable and do not have a negative impact on the environment or have very little impact on the environment. The authors reveal that each technology is unique in its own way and differs in the principle of operation, complexity of construction and installation, very strongly depends on geographical conditions, so it cannot be said that the same technologies can be applied in all geographical areas.

An important segment in assessing the acceptability of energy technologies is the consumer. Different users of energy technologies will adopt new technologies differently. According to Accenture (2015) and Wolsink (2012), the characteristics of users of new energy technologies are distinguished - promising, comprehensive, specific, individual, socially centered, high-quality consumer, technical, joint, advance and versatile. Each consumer is characterized by a certain combination of these characteristics, which determines how much the consumer is ready and how he adopts new energy technologies. According to Labay, Kinnear (1981), Molin (2005), O'Garra, Mourato (2007), O'Garra, Mourato, Pearson (2008), Ellis et al. (2007), Siegrist, Cvetkovich (2000), Martin et al. (2009), Shaheen et al. (2008), Saxe et al. (2007), Venkatesh et al. (2003), the characteristics of energy technology users and consumers can be supplemented by demographic characteristics, skills perceptions, knowledge and experience.

When assessing the feasibility of technologies, much attention needs to be paid to the time it takes to select, coordinate, inform and implement users and consumers. How long can it take from the idea to introduce a new technology to the realization of that idea and whether that time will not eliminate the novelty of the technology? Researchers Wustenhagen et al. (2007), Simon, Wustenhagen (2006), Bell et al. (2005), Toke et al. (2008) demonstrated in their work that

too little attention is paid to social acceptability and that it is directly dependent on the time component.

Another, no less important segment in assessing the acceptability of energy technologies, is the market. Market acceptance is another separate component of technology acceptance and is singled out by the authors Rogers (1995), Bird et al. (2002), Ek (2005), Maruyama et al. (2007), who point out that the market must be prepared for new players and the challenges that new energy technologies will create, changes in existing energy technologies. This means that the rules of the old market will change, new opportunities will appear, new markets will open up, which will be able to provide and offer new technologies. At the same time, energy technologies must be introduced in those countries that are at a lower technological level than others.

Energy technology acceptance models were developed by Davis (1989), Davis et al. (1989), Venkatesh, Davis (2000), Venkatesh (2000), Venkatesh et al. (2003), Venkatesh, Bala (2008), Huijts et al. (2012). These models have been developed using empirical research, but have received criticism for the unsustainability of the models themselves. There are no acceptable and validated models that allow a comprehensive and holistic assessment of the global acceptability of energy technologies. As a result, one of the biggest scientific challenges remains to develop a model for a full assessment of the societal acceptability of energy technologies.

Studies based on energy technology acceptance models have been written by Slovic (1987), Davis (1989), Mathieson (1991), Taylor and Todd (1995), Davis and Venkatesh (1996), Venkatesh and Davis (2000), Siegrist and Cvetkovich (2000), Golay (2001), Bronfman and Cifuentes (2003), Poortinga and Pidgeon (2003), Bronfman et al. (2008), Huijts and Midden (2007), Bronfman and Lopez-Vazquez (2009), Bronfman et al. (2012). During the research, the most important components of the research construction were clarified - the natural location of the research, the accuracy of the prepared

questionnaire, the validity of the connections between the questions. Following the research, the level of technology acceptability is explained through the perceived benefits, simplicity, and other variables of the technology acceptance methods examined.

The method of contingent valuation is described by Gordon and Knetsch (1979), Bishop et al. (1983), Bergstrom et al. (1985), Gerking et al. (1988), Mitchell and Carson (1989), Ehrenberg and Mills (1990), Langford et al. (1996), Hansen (1997), Wen (1998), Bianchi et al. (1998), Carson et al. (2001), Olsen and Smith (2001), Vatn (2004), Protière et al. (2004), Carson and Hanemann (2005), Knetsch (2005), Spash (2006). The contingent valuation method is a direct valuation method for determining the value of undervalued resources. The contingent valuation method directly assesses people's willingness to pay for non-market goods or services. The authors argue that the contingent valuation method is reasonable and widely used to value environmental benefits, real estate, health care services, cultural property, and other public goods and services.

The authors Scarpa and Willis (2010), Gracia et al. (2012), Kosenius and Ollikainen (2013), Heinzle et al. (2010), Mozumder et al. (2011), Kim et al. (2005) emphasize that the population has a positive attitude towards technologies that use renewable energy sources. One way to determine the acceptability of renewable energy technologies is to be able to assess the unacceptability of non-renewable energy technologies. About the willingness to pay for energy technologies, both renewable and non-renewable, writes these authors: Lee and Heo (2016), Oerlemans et al. (2016), Sundt and Rehdanz (2015), Yang et al. (2017), Jones et al. (2017), Ntanos et al. (2018), Lee et al. (2017) and Cheng et al. (2017). Research by all the authors agrees that the population tends to pay for energy produced from renewable energy sources. The extent to which the population tends to pay for renewable energy technologies is determined by the level and demographic characteristics of the state and population.

Scientific problem - The market penetration of new technologies is hampered by their low public acceptance. It is therefore necessary to assess its factors and barriers and propose measures to increase public acceptance. In Lithuania, such research has not been carried out, there is a lack of reasonable methodologies for assessing the public awareness of energy technologies, based on economic assessment methods.

Object - public assessment of the acceptability of energy technologies.

The aim of the scientific research - to prepare a model for assessing the public acceptability of energy technologies and, after applying it, to determine the level of acceptability of energy technologies in Lithuania.

The research aim is to be attained by reaching the following five-fold research **objectives**:

1. To analyze the theoretical assumptions and evaluation methods of public acceptance of energy technologies being implemented and planned to be implemented, to systematize and substantiate evaluation criteria.
2. Based on the criteria of energy technology assessments, to develop a conceptual model for the assessment of public acceptance of energy technologies.
3. To perform the analysis of the principles of the methods of public acceptance assessment of the revealed and indicated priorities of energy technologies and to prepare the methodology of public acceptance assessment of energy technologies and its implementation tools and to determine the reliability and application limits of the assessment method.
4. To apply the prepared methodology of public acceptance assessment of energy technologies and to perform empirical research in Lithuania.
5. On the basis of the study on the assessment of public acceptance of energy technologies in Lithuania, to provide

recommendations on increasing the public acceptance of new energy technologies.

Methods of the research include:

1. Analysis of scientific literature, synthesis, comparison, deduction, generalization, abstraction to apply, analyzing theoretical assumptions of energy technology acceptance assessment and performing conceptualization analysis of energy technology public acceptance, forming conceptual model of energy technology social acceptance assessment.

2. The methods of statistical data analysis will be applied by processing the results of the questionnaire survey conducted in an experimental manner, and the statistical data in assessing the level of public acceptance of energy technologies. Experimental analysis will include documentation, transcription, coding, and categorization. It is planned to apply the MS Excel program, SPSS (Statistical Package for the Social Sciences) - a package of statistical information processing programs.

3. Mathematical modeling, economic analysis, will be applied in the analysis of the reasons for the acceptability of energy technologies and the variables that determine the level of acceptability of an individual's energy technologies.

Scientific novelty of the research:

1. Theoretical assumptions of public acceptance of energy technologies are systematized and generalized and their evaluation methods and evaluation criteria are substantiated.

2. Based on the established criteria of energy technology assessments, an original theoretical model of energy technology public acceptance assessment based on holistic principles has been developed.

3. A detailed analysis of the methods of public acceptance assessment of the revealed and indicated priorities of energy technologies has been performed and a unique methodology of public acceptance assessment of energy technologies and a computer model

of its implementation have been prepared. The computer model is created using the MS Excel programming language by summarizing the values required for the computer model.

4. For the first time, an empirical assessment of the acceptability of energy technologies in Lithuania is performed, the main factors and barriers of public acceptance of energy technologies are identified, which allow to prepare recommendations on increasing the public acceptance of new energy technologies and improving and promoting them.

Limitations of the research. The study period is limited and covers the period from 27/02/2019 to 01/06/2019. Due to the lack of physical, financial and time resources, only 10 residents of Lithuanian municipalities were interviewed in writing when researching the public acceptability of energy technologies, while the population of Lithuania as a whole was surveyed online, but this resulted in a small number of respondents from less populated municipalities.

Too little information was provided when the questions were asked, which led to a lot of questions for the residents during the written survey, and it took an extra longer time to answer all of them than was originally planned. According to the methodology of contingent evaluation and the peculiarities of compiling the questionnaire, it is mandatory to explain the questions to the respondents so that they can answer the questions completely and accurately.

Work structure. The structure of the dissertation work is determined by the formed goal and the planned tasks to achieve it, the solution of which is reflected in three parts of the work:

In the first part of the work, the conceptualization of energy technology acceptance in society is systematized and summarized, its analysis is performed. The energy technologies being implemented and planned to be implemented are analyzed, their evaluation methods are described, and evaluation criteria are systematized. Separate models of energy technology public acceptance assessment have been

examined and described, according to which a conceptual technology acceptance application model has been developed for use in Lithuania, and with appropriate corrections, it can be applied globally.

In the second part of the work, based on the theoretical provisions, the methodology for assessing the public acceptability of energy technologies, the principles of the methods for assessing the acceptability of revealed and indicated (contingent) preferences are analyzed. The integration of the conceptual model of public acceptance assessment of energy technologies with the methodology of public acceptance assessment of energy technologies is explained.

In the third part of the work, based on the conceptual model of public acceptance of energy technologies, the aim of the research is formed, the hypotheses of the research are raised, the empirical evaluation of the acceptability of energy technologies in Lithuania is constructed. The conclusions summarize the results of the dissertation. The logical structure of the work is presented in the first diagram below.

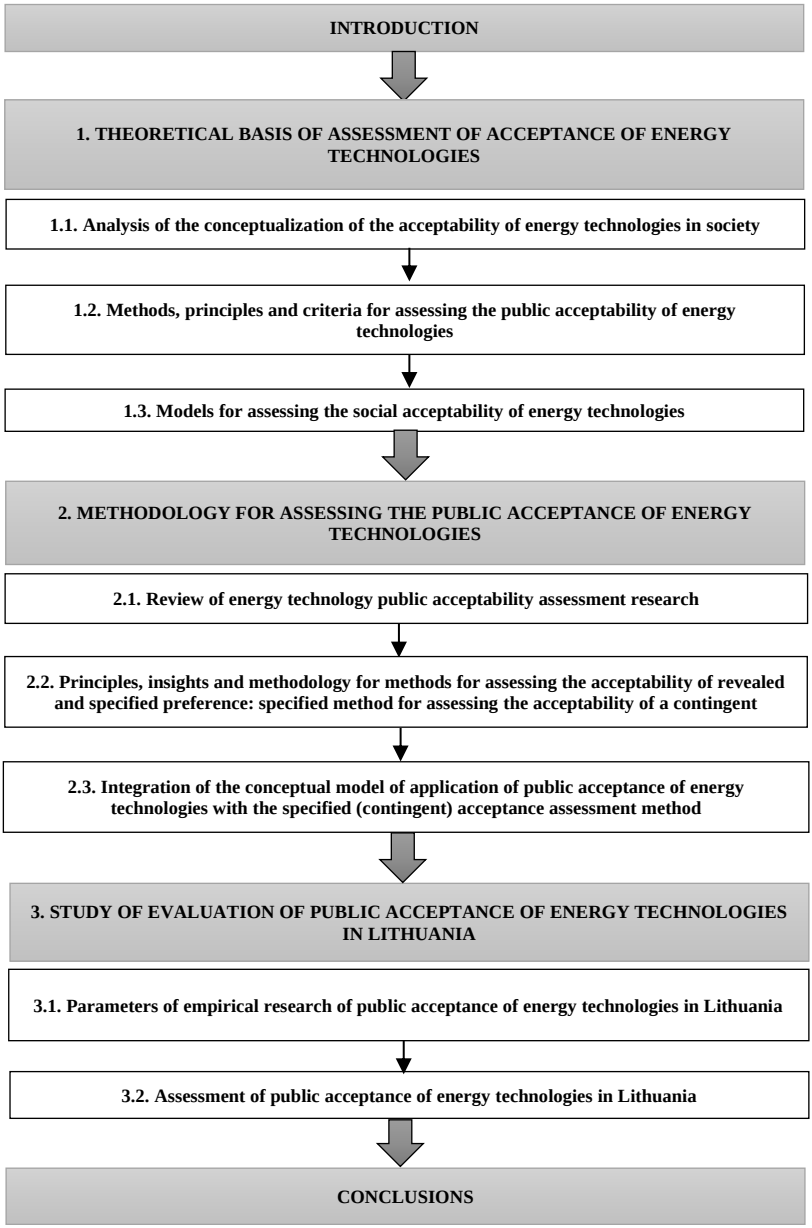

Fig. 1 Work structure scheme

Scope of the thesis. The thesis consists of 153 pages, 13 tables, 13 figures, 8 appendices. 191 references are applied in the study from Lithuanian and foreign resources.

1. THEORETICAL BASIS FOR ASSESSING THE PUBLIC ACCEPTANCE OF ENERGY TECHNOLOGIES

The first part of the dissertation establishes precise scientific definitions and concepts of the topic, highlighting the prevailing attitude of energy technologies and their acceptability worldwide. Existing research in the energy and technology sectors is analyzed, including all dimensions of sustainable development - social, economic and environmental.

The collected information is structured and the initial conceptual model of public acceptance of energy technologies is prepared accordingly, covering and reflecting the current situation in the energy sector and explaining the means by which the public acceptance of energy technologies can be assessed.

1.1 Analysis of the conceptualization of the acceptability of energy technologies in society

Explaining the general concept of energy, it can be said that energy is an energy management policy, as well as an economic activity covering all energy sectors that are exclusively involved in energy resources, production, distribution, energy systems and their operation.

After examining the concept of energy, it is analyzed what future technologies are and can be. In general, energy technologies are defined as any type of technology that interacts with one or more of the segments in the energy sector. Specific energy technologies and their definitions, general concept and principle of operation are named and grouped as follows: electricity, hydropower, nuclear or nuclear energy, thermal energy, renewable energy, hydrogen energy. Renewable energy is divided into these groups: biomass, solar thermal collectors, geothermal power generation, hydroelectricity, horizontal axis wind turbine onshore/offshore.

The characteristics of energy technology users are presented (energy perspective, omnipresent, individualized, social centric, prosumer, tech savvy, interconnected, pay it forward, energy diverse), according to which consumers who use the above-mentioned energy technologies are divided, new energy technology users are identified who face the challenges posed by new energy technologies, adaptation, acquaintance with benefits, conveniences, satisfaction of needs.

1.2 Methods, principles and criteria for assessing the public acceptability of energy technologies

Assessing the social acceptability of energy technologies is closely linked to sustainable development. Public acceptability can be analyzed and assessed through all the prisms of sustainable development - economic, social and environmental. The criteria and assessment principles used to assess the challenges of sustainable development are also reflected in the analysis of energy technologies and their societal acceptance.

According to Barbier (1987), Hamilton and Clemens (1999), Akubue (2000), Le Kama (2001), Dyllick and Hockerts (2002), Stavins, Wagner and Wagner (2003), Young and Tilley (2006), Buehler and Pucher (2011), Zelenika and Pearce (2014), Farah (2015), Fankhauser and Jotzo (2018), Eder, Filimonova, Nemov and Provornaya (2018), Sachs, Woo, Yoshino and Taghizadeh-Hesary (2019), Uribe Toril, Ruiz-Real, Milan-Garcia and de Pablo Valenciano (2019), Schroeder, Anggraeni and Weber (2019), Razmjoo, Sumper and Davarpanah (2019), Sarkodie and Strezov (2019), Vasylieva, Lyulyuov, Bilan and Streimikiene (2019), the economy, in the concept of sustainable development, takes into account the following main criteria:

1. Economic growth.
2. Energy efficiency and effectiveness.

3. Energy technologies.
4. Flexibility and stability.
5. Transportation, production and consumption.
6. Recruitment and earnings.
7. Business, competitiveness and international trade.

Economic growth is a term used when production is increased, and such growth is measured by an increase in gross domestic product. At the same time, the real and earned income of companies and individuals is increasing. With the introduction of new energy technologies, it is worth mentioning that in the long run, most of the technologies examined bring economic benefits, which in turn means economic growth, as both the technology supplier and the recipient earn from energy technologies. In an unfair and uncompetitive economy where the recipient of the technology is exposed to external influences and is deceived, or where the economy is uncompetitive and dominated by a single technology or technology service provider, there is a likelihood of economic disadvantage to the recipient but economic benefit to the energy technology provider. benefits that will result in overall economic growth.

Energy efficiency and effectiveness are related to how users are able to use energy technologies more efficiently in both the business environment and in households. The main criteria for the efficiency and effectiveness of the use of energy technologies are described in the European Commission's directives.

Energy technologies are defined as any type of technology that interacts with one or more of the segments in the energy sector. An important component of energy technology is the economy, which acts as an economic engine to expand new technologies, remove old ones, and the energy sector involves huge amounts of monetary capital that is invested and returns can be as low as 3 or more in 30 years. This means that, from an economic point of view, energy technologies have a huge impact on the development of a national or continental economy.

Sustainable development in the economy must also be flexed with flexibility and stability. Both users and consumers must have the flexibility to purchase and use energy technologies without interruption. Economically, this requires a competitive environment in which all users and consumers can have a level playing field. If such conditions are not met, the economy in the state may be distorted and it may be assumed that corruption will occur, where one or another user or consumer of energy technology may seek personal gain.

Other criteria may be used to assess the societal acceptability of energy technologies. Authors Labay and Kinnear (1981) single out and describe the following key demographic characteristics, skills perceptions:

1) Demographic characteristics:

• gender; • age; • education; • professional status; • family life cycle.

2) Skills perception:

• relative advantage; • complexity; • compatibility; • financial risk; • social risk; • observability;

• trialability.

Of particular importance is the existing or potential knowledge of existing and new energy technologies: what are the direct benefits, what are the harms, what is the principle of energy technology. Available knowledge can change a person's perception of the affordable price of energy technologies, the risks involved, and so on. Such assimilation of knowledge has a direct impact on a person's decision whether or not to accept energy technologies. With more knowledge and additional information about hazardous energy technologies (eg potentially harmful to the environment), people can decide to abandon certain energy technologies without knowing the economic benefits of such energy technologies. It is important to assess the relationship between all the different factors that determine the public acceptance of energy technologies (Molin, 2005; O'Garra, Mourato, 2007; O'Garra, Mourato, Pearson, 2008; Ellis et al., 2007).

1.3 Models for assessing the social acceptability of energy technologies

This section presents the models, understandings, and concepts of various scholars that recommend the evaluation of energy technologies or one of the energy technologies segments. Based on the analysis of the literature and the already developed models for various energy technology segments, a conceptual model for the assessment of public acceptance of energy technologies is created. This conceptual model will be used in the research part of the work as the main model according to which the energy technology assessment will be performed.

The subsection examines the following basic and primary developed author models:

1. TAM - technology acceptance model, (Davis, 1989; Davis et al., 1989);
2. TAM 2 - technology acceptance model 2 (Venkatesh, Davis, 2000; Venkatesh, 2000);
3. UTAUT - unified technology acceptance and use theory, (Venkatesh et al., 2003);
4. TAM 3 - technology acceptance model 3, (Venkatesh, Bala, 2008);
5. Huijts-Molin-Steg - a theoretical model of energy technology acceptability (Huijts et al., 2012).

To understand the peculiarities of each of these models, a brief overview of the models is made, indicating the most important aspects and how these models are applied in theory and practice, if any.

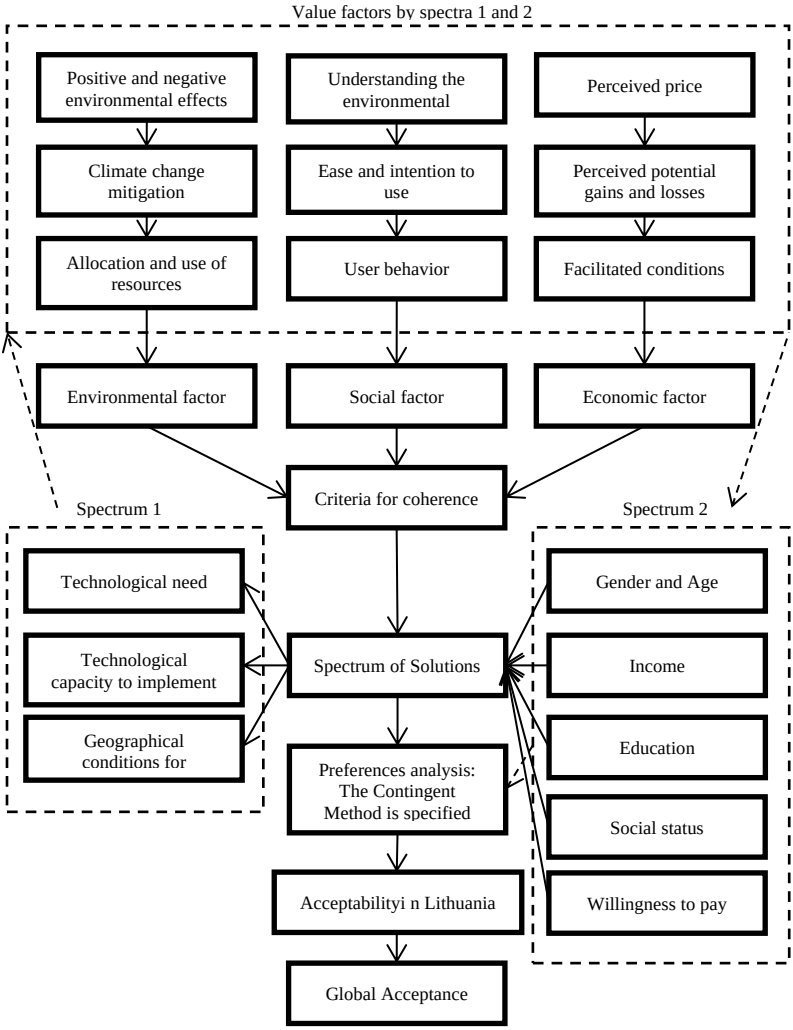

Fig. 2 Conceptual model of application of energy technology acceptability in Lithuania

Taking into account the above-mentioned technology acceptance models, the main criteria were selected, which are also closely related to the economic, social and environmental policy pursued in Lithuania, as well as the main demographic trends, geographical opportunities and indicators of technological progress development,

understanding and education. Taking all factors into account, an initial hypothetical global application model of technology acceptability is constructed, as shown in Figure 2.

The second figure shows the conceptual model of application of energy technology acceptability, which includes potentially implemented technologies both in Lithuania and globally, as the factors to be solved and analyzed are possibly interpreted in Lithuania and foreign countries according to their essential commonality.

The purpose of the model is to measure the technological acceptability of each possible energy technology by asking questions under the first spectrum, evaluating all the factors raised, and obtaining an answer through the second spectrum. This is followed by a testing and evaluation using the contingent method, which shows whether the responses received are sufficient leverage to positively evaluate the utility function. It is these responses that are obtained during the first and second spectra after the contingent evaluation using the contingent method in general to answer the question of whether this technology is acceptable. The answers depend directly on the question raised, i.e. if we ask about technology in one geographic area, it means that the answer is valid only in that particular geographical area.

The first set of questions contains the following core values:

1. Technological need.
2. Technological capacity to implement.
3. Geographical conditions for the technology.

The technological need must answer the question of whether this technology is fundamentally necessary i.e. whether this is the best option for such technologies and not others. Possible solutions are presented through all three dimensions of sustainable development, where the interplay between environmental and economic values is crucial. The answer is obtained from the second spectrum before, under normal conditions, at the end of asking all the questions of the first spectrum.

Technological capacity to implement determines whether there are technical capabilities and capabilities that would allow the implementation of the chosen technology. Additional factors may also affect. Such factors are referred to as the global economic situation - whether the global economy is capable of taking risks, taking risks and allowing such technology to be developed, produced and deployed. It is also important to note that each technology requires different materials for its production, development, and deployment. If such access to materials is not available, then the technological capacity is assessed negatively.

Geographical conditions answer the question of whether a technology can be implemented in a given geographical plane. In this case, wind farms will be surveyed in a geographical plane with potentially higher wind speeds, geothermal power plants will be surveyed in areas with geothermal energy, and light collectors will be surveyed in regions where there is enough light to enable and operate the technology.

The second set of questions is analyzed according to the following key values:

1. Age and gender.
2. Income.
3. Education.
4. Social situation.
5. Willingness to pay.

Gender and age show whether the use of technology affects a person's maturity, the extent to which he is able to adapt to new technologies, adaptation as well as gender differences, where perhaps the use of one technology is more accessible to men than women or vice versa.

Revenue essentially reflects whether a user can directly and at his own expense acquire and use or acquire the right to use a particular technology. A low level of income means that technology will be more difficult for the user to access and that he will allocate his funds

accordingly to other things that he will prioritize as a commodity. Meanwhile, middle- and high-income users will have more opportunities to allocate their available income to energy technologies. In addition, higher income levels also allow for a more flexible relationship with sponsors, companies, or banks that may have an interest in financing the technology when the user pledges part of their capital or signs another type of contract. At the global level, meanwhile, only individual states or communities can introduce tax incentives, additional funding, funds, or other economic control regimes that allow technology to be available to citizens with lower incomes.

Education is directly related to a person's ability to use technology. Understandably, the more complex the system of using technology, the more difficult it is to use. In any case, a minimum general educational level of understanding of how the technology used works is required to avoid misuse, i.e. used when unnecessary. Such a use would be considered unacceptable as it reflects the exact opposite result. Vocational education is also included in general education. This is the case when a person does not have a general education, but is acquainted with and has worked with various technologies during the prism of his age and, according to this principle, has delved into the operation or other principles of the technology level.

Social or societal status is a degree of assessment according to a varying number of individual assessment criteria. This includes a person's general level of education, level of professional education, job title and what kind of work is done or its nature. Also important are policy approaches that can contribute to one or another targeted way of evaluating with many, as can specific family relationships. Religion makes a big difference in this case, but only in certain areas and is difficult to analyze on a large scale.

The willingness to pay is a separate spectral question that directly asks and answers what is the maximum price at which the user will certainly be inclined to purchase and use at least one energy

technology. This reflects a standard understanding of consumer prices prevailing in the economy. This price can also be used not only as a maximum size but also as a price range. This means that prices in the range are affordable and understandable for the user of energy technology.

The three main sustainability criteria - the environmental, the social and, most importantly, the economic - are the basic part of the test of the whole model. Assessment according to sustainability criteria is often integrated and often one or two different criteria are assessed together because they are very closely related.

2. METHODOLOGY FOR ASSESSING THE PUBLIC ACCEPTANCE OF ENERGY TECHNOLOGIES

In order to determine the public acceptability of energy technologies, two popular methodologies for assessing the acceptability of technologies are selected - revealed preferences and stated preferences or contingent valuation. These two methodologies in principle reveal how the assessment of the public acceptability of energy technologies can be performed, so it is necessary to assess the main features and aspects of both methodologies.

2.1 Review of energy technology societal acceptance assessment research

In the first subsection, an empirical level of research into the assessment of the social acceptability of energy technologies is performed. The research already performed according to the individual evaluation methods, the obtained results and conclusions and why such obtained results are important in the further course of work are described. Research is examined regardless of what the energy technology is. Key information and knowledge already gained in the field of public acceptance assessment is collected.

2.2 Principles, insights and methodology of methods for assessing the eligibility of revealed and stated priorities: specified method for assessing contingent eligibility

The second section describes and presents information, the methodology of the essence of both methods, the revealed preferences and the stated preferences, and the evaluation principles, and presents various important aspects that describe the individual methods. A methodological review is performed, which presents the most important aspects, categorizing both methods according to their evaluation principles. A detailed and comprehensive method for

assessing the specified contingency eligibility contingency is provided. The principle of compiling a questionnaire according to the complexity of the contingent assessment method is described. Following this methodology, the following third subsection is made.

A study of high-quality contingent evaluation requires that much of the work be devoted to developing a questionnaire. To this end, research has been and is being carried out with researchers and experts, target groups are being set up and in-depth interviews with potential respondents are needed to provide a reliable and comprehensible description of the product or service being evaluated and its context. When reviewing the questionnaire, it is necessary to review and improve and edit the questionnaire more than once. Tests for fuzzy estimates, as with all primary data collection methods, require a repeat pilot test. Much effort should be made to make expert knowledge understandable and valuable to respondents. The live survey is also a feature of a well-planned survey. In essence, this means that the information provided in the survey tool should be clear, precise and sufficient to allow a decision to be made and the proposed compromise to be credible.

According to the author Carson (2000), the current practice of contingent assessment research usually consists of a questionnaire in six sections:

1. The first chapter is dedicated to the introduction of the purpose of the survey, the formation of the context.

2. Chapter 2 provides a clear and detailed description of the goods or services. This section usually also collects respondents 'prior knowledge and attitudes toward benefits.

3. The third chapter presents the contingency assessment scenario, including the current or initial status quo and the possible future situation of natural resources in case of non-compliance with the proposed policy measures, including the institutional context in which the commodity and payment instrument will be provided.

4. The fourth section states that respondents should have the maximum willingness to pay in order to obtain environmental benefits or the minimum willingness to accept it.

5. The fifth part analyzes the respondents' understanding and the veracity of the answers provided.

6. The last section deals with certain issues related to the social and demographic characteristics of the respondents.

Thus, in particular, the researcher needs to assess the amount of information needed to develop a sufficiently informative and reliable questionnaire. This may be particularly difficult in cases where prior knowledge of the product concerned varies widely among the relevant population.

Second, the contingent evaluation study is based on the evaluation scenario presented in the questionnaire. The evaluation scenario should provide clear information on the changes to be evaluated, how they will occur, who would pay for them and how, and other information related to the changes. The design of the survey tool requires a careful analysis of the baseline or status situation and the results of the proposed policy. The question part of the questionnaire provides the researcher with information to assess individuals ’preferences.

Surveys of a given contingent valuation method may obtain a monetary expression directly related to an individual change in the provision of services or goods by replacing one service or good with another or by making a slight attributive change to existing services and goods. The contingent valuation method allows to reveal a person's willingness to pay for or willingness to accept changes through a survey tool.

2.3 Integration of the conceptual model of application of public acceptance of energy technologies with the specified (contingent) acceptance assessment method

In the third subsection, the conceptual model of application of technology acceptability (Fig. 2) is applied with the specified method of assessing the acceptability of contingent preferences. The connection, the suitability of the method for integration with the conceptual model of application of energy technology acceptability in Lithuania and according to which separate criteria can be applied in other broader studies are analyzed.

The testing of the conceptual model starts from the first spectrum, where the advantage is the possibility to pre-assess which energy technologies are to be tested, which can be realistically implemented. According to the first spectrum, the technological need, technological capacity to implement and geographical conditions of the technology are distinguished.

In the generated and submitted questionnaire survey for the population, questions are formed for the Lithuanian population, which describe the technological processes existing and characteristic in the territory of Lithuania. Questions are asked about microgeneration technologies - renewable energy sources. These include wind and solar power plants, heat pumps, biofuel boilers and more. technologies that are fully justified by geographical conditions, capabilities and needs. This issue does not provide technologies that cannot be used in Lithuania or are irrational. The centralized communications network mentions water, gas and heating, and refrigeration, although a popular practice in Western and Northern Europe, is not provided due to non-existent real projects in Lithuania. The questionnaire on the need for centralized refrigeration can only be included if it is possible to implement the technological capacity.

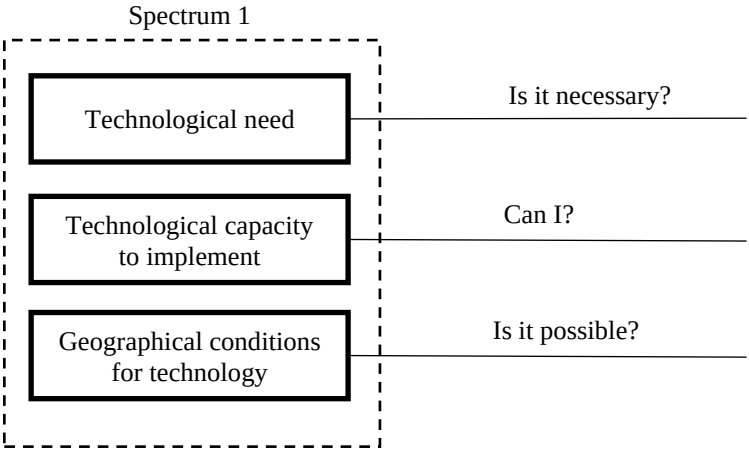

Fig. 3 The first spectrum of the conceptual technology acceptance model

The third figure shows a section of the conceptual model of technology acceptability explaining the relationship between the generated questionnaire and the model. This is one of the first stages of the evaluation, in which the further projection of the technological evaluation is decided. Part of this model can be further applied to other countries' solutions when it is desired to organize technological analysis. It is necessary to assess not only the geographical conditions but also the actual use of such geographical conditions in practice, the systematization and comparison of practical examples. Such practices are described in the first section.

The second spectrum is used to check the standard variables - gender and age, income, education and social status. A distinguishing and very important variable here is the willingness to pay. Both the complex and simple answer to the question whether the resident, the respondent wants or does not want to pay in principle, according to the methodology of revealed and indicated preferences, has a strong influence on the overall assessment of the acceptability of all energy technologies. The question according to the contingent methodology

also answers what is the level of willingness to pay or how much is the population willing to pay for one or another energy technology, what is the threshold for willingness to pay.

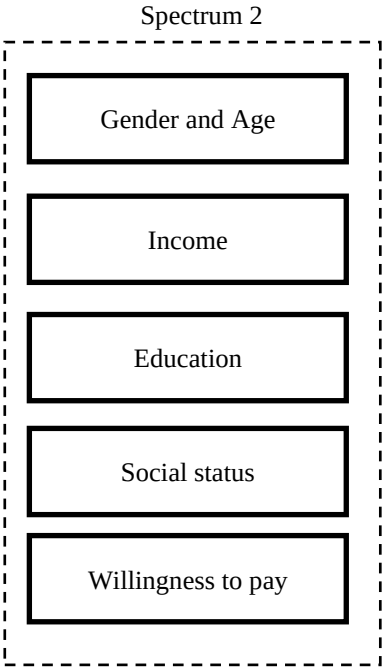

Fig. 4 The second spectrum of the conceptual technology acceptance model

The fourth figure depicts the variables of the second spectrum of the conceptual technology acceptance model listed above. These variables are generated and presented in a questionnaire survey, where gender can be either female or male (the goal is to achieve the most equal gender distribution among respondents), age from less than 25 years to more than 64 years, a total of 6 different groups (goal goal assess all age groups through both online and paper surveys to ensure that the results obtained are independent of whether the population has an Internet and a computer, which would lead to and inaccurately

reflect the overall assessment of acceptability by distorting the results). The average monthly income is divided into 5 groups, ranging from less than 500 and more than 2,500 euros. Financial data in the social field are collected on the basis of information provided by the state and must be based on the current economic situation in Lithuania. Similarly, the variables - wages and salaries are reflected in the questionnaire survey (Lietuvos Respublikos socialinės apsaugos ir darbo ministerija, 2019).

As described in Section 1.2, knowledge and education have a significant impact on the acceptability of energy technologies, and therefore education and occupation and employment issues need to be addressed. When generating questionnaire parameters on energy technologies and their public acceptability, it is mandatory to provide explanations of concepts that are rarely used in society. Such explanations of who is an active energy consumer (prosumer) should, as far as possible, be reflected in the survey itself, as well as questions reflecting knowledge and education. It must be emphasized that when conducting a survey "live", there is always the opportunity for the respondent to ask a question and get an answer to questions he or she does not know. When answering in an online survey, the most convenient option remains for the respondent to find the right answer by means of an online search. In the latter way, the possibility of obtaining inaccurate answers remains if the explanations sought are inaccurate and mislead the respondent. Such definitions should rather be provided in the questionnaire itself. Next, the social status through the marital status, the number of family members is determined. Such questions can be identically identified in questionnaires conducted in foreign countries to assess the acceptability of energy technologies.

Questions about willingness to pay should be visualized throughout the survey so as not to have a negative impact on the respondent. The questions refer to individual energy technologies. In all cases, when answering the questions, the resident can inquire and be acquainted in more detail with the information provided in the

questions. The information provided in the questions may not be arranged in such a way as to form an exclusive opinion on one principle or another and to direct the answer in one direction or another. This principle guarantees the authenticity and independence of the answers generated. The lower the level of external intervention, the more responses the population has to show the true degree of acceptability of energy technologies.

The willingness to pay is measured not only by consent or disagreement, but also by the price - ct/kWh. Such a unit of measurement is suitable for comparing energy and heat energy prices, but cannot be estimated from gas prices alone, which are expressed in eur/m^3.

The intellectual and informational basis of all questions are the value factors of the first and second spectra, which were formed in the theoretical parts of the work and which basically make a difference in how the resident, respondent will respond to one question or another, what principle the question will be asked, what questions , technological options are considered. All of this is defined through sustainability criteria.

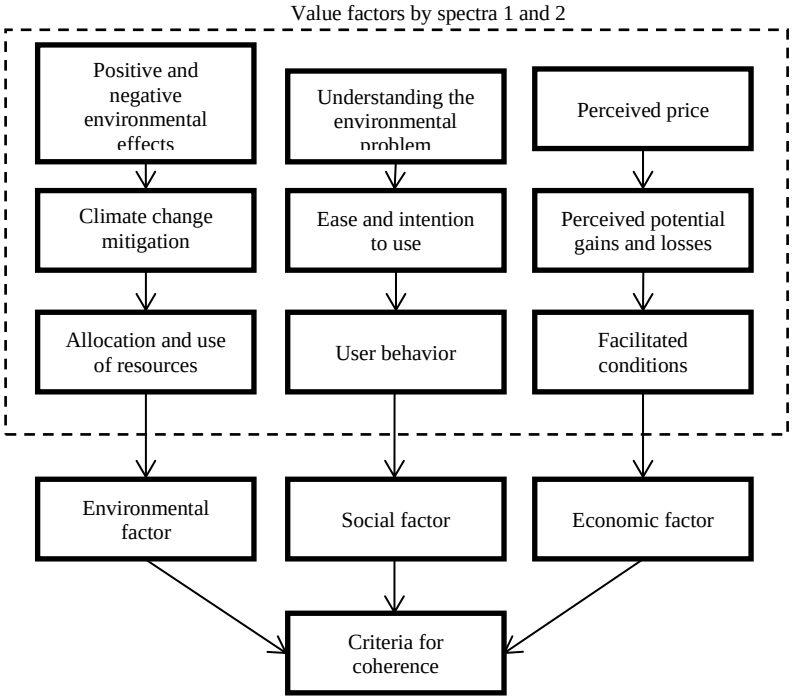

Fig. 5 Value factors of the conceptual technology acceptance model according to the first and second spectras

Figure 5 illustrates how the basic concept of energy acceptability consists of the essential components of sustainability criteria. Assessment according to sustainability criteria is often integrated and often one or two different criteria are assessed together because they are very closely related.

Unambiguously in line with the European Commission's 2018 November 28 The European Commission's Climate Strategies & Targets (2019) set out in 2050, it is obligatory to assess all the set goals and reflect them by examining the current acceptability of the population and to delve into the principle of strengthening such acceptability if it is solely with the set goals.

From an environmental point of view, the energy technologies used must not only be environmentally friendly, but their use must not have any negative effects on the environment. The main perspectives are renewable energy technologies. Renewable energy technologies using renewable energy sources are one of the key components of the questions, which, according to the contingent assessment methodology, seek to reveal a gradual willingness to pay or an absolute reluctance to pay. The renewable energy technologies discussed in the first chapter are an example of how new technologies can be implemented to mitigate the effects of climate change and their consequences. Many technologies are mentioned because it is not possible and economically justified to distinguish one renewable source or one renewable energy technology from others. This means that the use of a combined mix of renewable energy technologies is needed to achieve the overall goal of using renewable energy sources. For such reasons, the compilation of the questionnaire generates both general questions about renewable energy technologies and dividing them into separate ones - wind, hydro, biofuel, sunlight, biogas.

The environmental factor has a strong economic rationale, as it is easy to measure how much the respondent is willing to pay for a certain degree of environmental benefit. One of the key comparative aspects is perceived price. It can be presented directly compared to the current energy tariff. Therefore, when collecting questions with each of the renewable energy technology sources, it is possible to assign them an identical price list by raising the price from 0% to 100% for the same renewable energy technology energy production sources. Perceived potential gains and losses are also assessed by answering these questions, because paying for the same good or service, the same or more, raises the absolute question of whether or not it is worth doing, and in the economic environment it is assessed by whether the population the respondent will incur significant losses, or gains, and thus spend or save more money. There is a strong involvement here in the appeal to environmental benefits, which together with economic

factors is the driving force behind whether a resident, a respondent, will be inclined to accept or not to adopt energy technologies.

One of the indirect economic assessments, which according to the contingent assessment methodology allows to decide what the indirect economic degree of acceptability is, is the population, the respondent is asked provocative questions about the facilitated conditions. Such questions summarize whether a resident will be inclined to accept energy technology if he or she is not directly responsible for it, does not have to pay the full price, or is given special or exceptional conditions. Such a practice is widely applied both in Lithuania and around the world. One of the main processes operating in Lithuania is EU support, which can be used to obtain investment in one or another energy technology. By taking advantage of such investments, it is possible to reduce the payback period and thus achieve a faster return on the acquired energy technologies. Another way is the dependence on who has to pay for the construction, implementation, connection of a new energy technology. This can simply be the case with several actors - the government or a government-owned company, municipalities, the beneficiary itself - a resident or a private business. In the latter way, if the financial resources come from a private business, it should be noted that the private business is a for-profit organization and it also has its own perceived profit margin and payback period.

From the environmental and economic factors listed above, there is also the social factor. It can be argued that new energy technologies will not always bring economic benefits, but can bring significant environmental benefits through the social factor, which is a financial investment with non-financial beauty.

If the respondent fully understands the environmental issues and the new energy technologies used are easy to use and do not cause problems, then this is automatically a strong incentive to adopt such new energy technologies, which should be reflected in the generated questionnaire.

Consumer behavior and decisive psychological factors are very important. The actions of a resident strongly depend on his external behavioral factors - family, culture, etc. This must be generated and reflected in the questionnaire and presented as an evaluation factor (second spectrum). The evaluation of internal consumer behavior actions, according to the contingent evaluation methodology, is also evaluated in the second spectrum as knowledge and perception and is reflected in the generated questionnaire by asking questions that all together shape specific consumer behavior and, in this case, public acceptance of energy technologies.

Summarizing Section 2.3, several different aspects of the integration of the conceptual model of application of public acceptance of energy technologies with the method of contingent acceptance assessment can be distinguished. When integrating the model with the method, it is necessary to take into account all internal and external parameters that may lead to one or other results of the contiguous evaluation method. Knowing all the variables, it is possible to design and use a questionnaire and to present a conceptual model, to answer questions about the social acceptability of energy technologies.

3. STUDY OF EVALUATION OF PUBLIC ACCEPTANCE OF ENERGY TECHNOLOGIES IN LITHUANIA

The third chapter describes the study of energy technology public acceptance assessment in Lithuania. Before conducting the research, based on the collected and systematized and analyzed material of the first and second chapters, four main hypotheses of the research are raised:

1. H1 - Lithuanian residents are active users of energy technologies and tend to adopt new energy technologies.
2. H2 - Lithuanians tend to pay more for renewable energy sources.
3. H3 - The main demographic factors that determine the acceptability of energy technologies among the Lithuanian population are: education, age, gender, marital status, income, place of residence, available knowledge and experience.
4. H4 - Other factors determining the acceptability of energy technologies are: cultural, technical, level of development of the country's economy, the country's policy to promote renewable energy technologies, EU energy strategy, user-consumer interaction.

According to the four research hypotheses - H1, H2, H3 and H4, the research object, research goal and four research tasks, respectively, are generated, which must help to reveal and prove or refute the raised hypotheses.

The object of the research is the assessment of the public acceptability of energy technologies of the Lithuanian population.

The aim of the research is to assess the public acceptability of energy technologies of the Lithuanian population.

Research tasks:

1. To determine whether the Lithuanian population is an active user of energy technologies and tends to adopt new energy technologies.
2. Reveal whether Lithuanian residents tend to pay more and a little more for renewable energy sources.
3. To assess the main demographic factors that determine the acceptability of energy technologies and readiness to pay for renewable energy resources in Lithuania.
4. Assess what are the other factors that determine the acceptability of energy technologies and readiness to pay for renewable energy resources in Lithuania.

3.1 Parameters of empirical research of public acceptance of energy technologies in Lithuania

The volume of the research sample is determined on the basis of K. Kardelis' textbook "Research Methodology and Methods" (Kardelis, 2007). The textbook states that in order to obtain statistically significant conclusions, it is necessary to determine the minimum number of studies - the sample volume.

As there are more than two questions in the survey and more than two permissible choices, in order to determine the exact number of respondents, the required number of surveys should be calculated separately for the answer options for each question. In this case, a simpler option is chosen and the permissible inaccuracy and the worst case sample mean are artificially raised, which must ensure that the test remains representative when these parameters are met, and therefore:

$$n = \frac{z^2 * S^2}{\Delta^2 + \frac{z^2 * S^2}{N}} = \frac{1{,}95^2 * 50^2}{3{,}5^2 + \frac{1{,}95^2 * 50^2}{1285111}} = 784\ units.$$

This means that 784 units of intact respondents are needed to conduct the survey to be representative.

The respondents of the survey are residents of the Republic of Lithuania who have their own or rented household.

The method of subject selection, according to Kardelis (2007), is systematic and layered. This means that not completely random residents of Lithuania are selected from the list of respondents, but according to a certain system. Subjects are also divided into separate groups according to similar characteristics. During the survey, the survey is specially divided into electronic and paper, and during the paper survey, where it is possible to control the number and characteristics of respondents, approximately the number of men and women is selected, and each Lithuanian city or region is also divided according to the population. Because the trend is for the online survey to survey more people who have the Internet and are semi-advanced Internet users, and their habits may differ significantly from the population surveyed for the paper survey, a similar number of surveys are artificially created to get the most representative result.

Preparation of the survey and accuracy of the material and data.

The survey questionnaire was formed not only taking into account the analysis of the literature, but also in accordance with the cooperation (joint activity - partnership) agreement no. BS-15600-1967 (VU registration date 29.10.2018) with JSC Lietuvos Energija (now Ignitis Group), in cooperation with the Innovation and Partnership Division.

The main objectives of this agreement are to increase the horizontal and vertical integration of clean technologies, to search for high value-added solutions in the field of clean technologies, through research and experimental development, creation and implementation of innovations, development of other related activities, etc. It was agreed to strengthen human, technical, scientific, capital, innovation, partnership and other capacities, and to establish and promote a network of internal and external cooperation between business, science, training and service actors, providing added value to its members in research and development, marketing, business

governance, human resources development and environmental protection, as well as fostering innovation and facilitating investment, as well as internal and external partnerships.

3.2 Assessment of public acceptance of energy technologies in Lithuania

Testing of hypotheses

In total, four research hypotheses were raised:

• H1 - Lithuanian residents are active users of energy technologies and tend to adopt new energy technologies.

• H2 - Lithuanians tend to pay more for renewable energy sources.

• H3 - The main demographic factors determining the acceptability of energy technologies among the Lithuanian population are: education, age, gender, marital status, income, place of residence, available knowledge and accumulated experience.

• H4 - Other factors determining the acceptability of energy technologies are: cultural, technical, level of development of the country's economy, the country's policy to promote renewable energy technologies, EU energy strategy, user-consumer interaction

The first hypothesis of the study states that the Lithuanian population is an active user of energy technologies and tends to adopt new energy technologies. The survey revealed that 31% of respondents said they were active users of energy technologies, but only 12% of respondents stated that they have and use microgeneration facilities. The first hypothesis of the study is partially confirmed, because the study revealed that Lithuanians want to adopt new energy technologies, but are not yet active users of energy technologies, because they do not have the funds (30% of respondents), technical capabilities (19%) or do not know about microgeneration. technologies (16% of respondents).

The second hypothesis of the study states that Lithuanians tend to pay more than they pay now, for renewable energy sources or, in general, for renewable energy. This hypothesis was confirmed.

Lithuanians tend to pay more for renewable energy sources. The average willingness to pay decreases in all age groups from 0.1563 Eur / kWh in the youngest group to 0.1358 Eur / kWh in the oldest group. Residents also tend to pay more for solar and biofuel energy and these are the most popular forms of renewable energy among respondents. These two types of energy are related to the average willingness to pay in excess of the basic rate of 0.13 Eur / kWh, respectively 21.2% and 25.3%. Solar energy has few externalities compared to other forms of energy. Biofuels are abundant in Lithuania (eg forest and agricultural waste). The smallest difference with the base rate was found for hydropower (18.8%). This can be attributed to the environmental values of the Lithuanian population. The study revealed that Lithuanians tend to pay more for 30%, 75% and 100% renewable energy, i.e. 11.8%, 18.5% and 22.8%, respectively. Another factor that has a significant impact on the willingness to pay for electricity from renewable energy sources is the profession. The highest average willingness to pay (with a share of 30% of renewable energy sources) is among respondents managing their own business (0.1522 Eur / kWh), while the average rates of those working in private business are lower (about 0.148 Eur / kWh). The lowest average willingness to pay is for pensioners and the unemployed (about 0.13 Eur / kWh). This shows that support schemes are important for social groups with lower integration into the labor market to promote the penetration of renewable energy sources.

The third hypothesis of the study states that the main demographic factors that determine the acceptability of energy technologies in Lithuania are education, age, gender, marital status, income, place of residence, available knowledge and accumulated experience. The study showed that gender, education (degree obtained), number of family members, age, type of housing, living space and ownership do not significantly influence the willingness to pay for electricity from renewable energy sources. The units of apartment living space, expressed as willingness to pay, did not show any decisive differences,

as the ranges of space (determined by the first and third quartiles) overlapped or even overlapped in most cases. It was also revealed that the representatives of the younger group tended to pay more for the renewable group than the representatives of the older group, and the older electricity consumers in Lithuania are those who need more knowledge about the importance of renewable energy. This hypothesis was confirmed, because the main demographic factors that determine the acceptability of energy technologies in Lithuania are in fact education, age, gender, marital status, income, but some components, such as living space, did not have any decisive differences.

The fourth hypothesis of the study states that in addition to the factors listed in the third hypothesis, there are additional factors such as cultural, technical, level of economic development, the country's policy to promote renewable energy technologies, EU energy strategy, user-consumer interaction, which determine the acceptability of energy technologies in Lithuania. . The study found that respondents are positive about the contribution of renewable energy technologies to climate change mitigation and economic benefits, leading to greater acceptance of energy technologies. The most technically acceptable energy technologies have been identified as solar and biofuel energy. The policy of promoting renewable energy technologies has a great influence, because the price of renewable energy is very important for the Lithuanian population, and the interaction between the user and the consumer is high according to the reputation of companies and whether they already use clean energy technologies. Survey respondents who prefer certain types of renewable energy sources are more convinced that current energy technologies have a negative impact on the environment and nature, as evidenced by significantly higher scores of 80 to 81.5% compared to general renewables. overall average 76.7). Respondents to the survey expressed a willingness to pay for renewable energy sources used in energy production. However, they opposed integration into the continental European network (Lithuania is currently part of the post-Soviet IPS / UPS

network). This is contradicted by the fact that the continental European grid shows a higher share of renewable energy sources in energy production (compared to IPS / UPS), together with advanced measures such as emission certificates, which are not available for IPS / UPS. It is therefore important to further disseminate the consequences of choosing to synchronize with different networks. It can be said that the fourth hypothesis was confirmed.

After analyzing the research results and interpreting the hypotheses, it was found that all four research hypotheses were confirmed, one of them - partially. Also looking at the individual criteria and components, it can be noticed that in some places there are exceptional exceptions that are typical for the Lithuanian population, but this does not constitute a decisive willingness to pay for energy technologies. In general, it can be said that the Lithuanian population has a positive attitude towards new energy technologies and is ready to accept new and especially renewable energy technologies.

CONCLUSIONS

1. The paper clarifies the concept of energy management policy and reveals its significance in order to ensure the transition to a low-carbon economy and to achieve the goals of climate change and sustainable development. The concept of new energy technology is defined, and new energy technologies are analyzed according to five different energy sources - bioenergy, direct solar energy, geothermal energy, hydropower and wind energy. Systematized methods of assessing the social acceptability of energy technologies according to three dimensions of sustainable development - social, environmental and economic. It has been established that all three dimensions of sustainable development have a significant impact on shaping the public acceptance of energy technologies. Different definitions of public acceptance concepts and evaluation criteria are distinguished. It is systematized and named that the most important criteria that determine the social acceptance of energy technologies consist of demographic characteristics, skills perception, knowledge and experience.

2. Five different models for assessing the acceptability of new energy technologies have been analyzed and substantiated, on the basis of which a conceptual model for assessing the acceptability of energy technologies in Lithuania has been formed. This model can also be applied globally, with evaluations in specific countries or regions. The advantage of the model is explained - its versatility and ability to reveal the public acceptability of energy technologies using the model.

3. A review of research into the assessment of the social acceptability of energy technologies has shown that the main economic methods of assessing the acceptability of public technologies are the revealed and indicated priorities, of which the contingent assessment method is the most widely used to assess the acceptability of new technologies.

4. The principal analysis of the methods of public acceptance assessment of the revealed and indicated priorities of energy technologies has been performed, revealing their application areas, limitations and strengths. It is revealed that the contingent valuation method can be used to assess the willingness to pay for energy production technologies in monetary terms, which involves a separate change in the provision of services or goods by replacing one service or good with another or by making a slight attributive change to existing services and goods. The contingent valuation method reveals a person's willingness to pay for or a willingness to accept possible changes using the survey method.

5. After assessing the reliability of the indicated priority contingent assessment method and the limits of its application, the suitability of the contingent assessment method for the practical implementation of the conceptual energy technology acceptance assessment model in Lithuania is substantiated.

6. After applying the prepared model, a study of the assessment of the public acceptability of new energy technologies for the Lithuanian population was performed. A sample of the survey was established, which should consist of at least 784 respondents in order for the survey to be representative. The respondents of the survey are households of the Republic of Lithuania.

7. A survey questionnaire was developed to determine the readiness of households to pay for new energy production technologies. According to the cooperation agreement with JSC Lietuvos Energija, the survey was divided into 2 parts - electronic and paper. 342 respondents participated in the electronic survey, and 500 questionnaires with answers were collected by means of a paper questionnaire.

8. After the assessment of the public acceptability of energy technologies in Lithuania, four hypotheses were tested:

8.1. The first hypothesis of the study states that the Lithuanian population is an active user of energy technologies and tends to adopt

new energy technologies. The survey revealed that 31% of respondents said they were active users of energy technologies, but only 12% of respondents stated that they have and use microgeneration facilities. The first hypothesis of the study is partially confirmed, because the study revealed that Lithuanians want to adopt new energy technologies, but are not yet active users of energy technologies, because they do not have the funds (30% of respondents), do not have technical capabilities (19%) or do not know about microgeneration. technologies (16% of respondents).

8.2. The second hypothesis of the study states that the Lithuanian population tends to pay more than it now pays for renewables. increases to 0.154 Eur / kWh, respectively, and increases to 0.1596 Eur / kWh at 100%. In addition, energy consumers with a relatively low willingness to pay for a small share of renewables may continue to be reluctant to pay more, even when renewables become more expensive.

8.3. Residents also tend to pay more for solar and biofuel energy and these are the most popular forms of renewable energy among respondents. These two types of energy are related to the average willingness to pay in excess of the basic rate of 0.13 Eur / kWh, respectively 21.2% and 25.3%.

8.4. The study revealed that Lithuanian residents tend to pay more for 30%, 75% and 100% of renewable energy in the electricity generation balance, 11.8%, 18.5% and 22.8%, respectively.

8.5. The third hypothesis of the study states that the main demographic factors that determine the acceptability of energy technologies in Lithuania are education, age, gender, marital status, income, place of residence, available knowledge and accumulated experience. The study showed that gender, education (degree obtained), number of family members, age, type of housing, living space and ownership do not significantly influence the willingness to pay for electricity from renewable energy sources. However, younger (and unmarried) respondents show the greatest willingness to pay.

Another factor that has a significant impact on the willingness to pay for electricity from renewable energy sources is the profession. The highest average willingness to pay is among respondents running their own business.

8.6. The fourth hypothesis of the study states that in addition to the factors listed in the third hypothesis, there are additional factors such as cultural, technical, level of economic development, the country's policy to promote renewable energy technologies, EU energy strategy, user-consumer interaction, which determine the acceptability of energy technologies in Lithuania. . The survey revealed that respondents are positive about the contribution of renewable energy technologies to climate change mitigation and economic benefits, leading to greater acceptance of energy technologies. The most technically acceptable energy technologies have been identified as solar and biofuel energy. The policy of promoting renewable energy technologies has a great influence, because the price of renewable energy is very important for the Lithuanian population.

8.7. In the survey, respondents who prefer certain types of renewable energy sources are more convinced that current energy technologies have a negative impact on the environment and nature, overall average 76.7).

9. The results of the survey showed that only 12% of respondents have microgeneration facilities, but as many as 31% of respondents stated that they are active energy consumers or prosumer. This indicates a lack of knowledge about the concept of active energy consumers. Therefore, educational programs are needed in Lithuania to acquaint with the basic concepts of renewable energy systems.

10. In summary, all four hypotheses of the study were confirmed, one of them in part. It can be said that the Lithuanian population has a positive attitude towards new energy technologies and is ready to accept new renewable energy technologies and pay more for them than for traditional energy production sources.

11. However, it is necessary to improve energy policy in order to ensure the public acceptance of new energy technologies, which would facilitate the formation of habits and the implementation of energy policy that changes the preferences of the population and ensure a successful transition to a low-economy. If the degree of acceptance of public energy technologies decreases, it will be difficult to force the Lithuanian population to use what they do not believe in. This requires educating, educating and training society and shaping social norms by providing as much information as possible about the benefits of renewable energy and encouraging investment in these technologies by overcoming behavioral and psychological barriers.

RECOMMENDATIONS

1. The development of new technologies using renewable energy sources is hampered by a number of economic, social, regulatory, organizational, behavioral and psychological barriers. Although public policies and measures exist to overcome economic, social, regulatory and other barriers to market penetration of new energy production, policy measures addressing behavioral and psychological barriers are needed.

2. Better market penetration of renewable energy technologies can only be achieved through the identification of population preferences and the acceptability of new energy production technologies and the development of effective policy packages that integrate population preferences into policy decisions.

3. In addition, policies to promote new energy production technologies and public support for new technologies aim to integrate the external benefits of these technologies to society, so financial support for renewable energy technologies should not exceed the population's willingness to pay for these technologies. to reveal the external benefits of new energy production technologies.

4. Many Lithuanians do not have enough theoretical knowledge to fully understand the peculiarities of the Lithuanian energy economy, therefore it is necessary to continue educating the public using the political infrastructure - through the Ministries of Education and Science and Energy, to allocate funds for the education and acquaintance of the population not only with the existing, but also with the new energy technologies, to develop independence in decision-making. Education about the Lithuanian energy sector could be provided by governmental and municipally owned companies engaged in relevant activities - electricity, water management, heat management, etc. activities. Lithuanian higher universities could cooperate with these companies.

5. Understanding the Lithuanian energy economy can bring direct economic and environmental benefits. By knowing and understanding how the energy system works, citizens can choose more precisely and intelligently the right infrastructure that is more cost-effective and environmentally friendly, e.g. renewable energy sources - solar, biofuel energy.

6. Investors and companies engaged in commercial activities in the energy sector, understanding the wishes and readiness of the Lithuanian population to pay for energy technologies, can plan investments, operating budgets and implement technologies that will be more acceptable to the Lithuanian population. Pilot projects and positive results can lead to the successful development of economically and environmentally beneficial energy infrastructure and the development of the energy system.

LIST OF REFERENCES

1. Accenture. (2015). [interactive]. The new energy consumer architecting for the future. [žiūrėta 2016 m. birželio 5 d.]. Access through internet: https://www.accenture.com/t20150523T035714__w__/ch-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub3/Accenture-New-Energy-Consumer-Architecting-Future.pdf#zoom=50

2. Ahrens, U., Diehl, M., & Schmehl, R. (Eds.). (2013). Airborne wind energy. Springer Science & Business Media.

3. Akubue, A. (2000). Appropriate technology for socioeconomic development in third world countries. The Journal of Technology Studies, 26(1), 33-43.

4. Balaguru, P., Raj, B. V., & Vignesh, B. E. (2013). Low Cost Energy Production Using Wind Belt Technology. International Journal of Engineering and Innovative Technology (IJEIT), 2(9).

5. Barbier, E. B. (1987). The concept of sustainable economic development. Environmental conservation, 14(2), 101-110.

6. Beck, F., & Martinot, E. (2004). Renewable energy policies and barriers. Encyclopedia of energy, 5(7), 365-383.

7. Bell, D., Gray, T., Haggett, C., 2005. The 'Social Gap' in wind farm citing decisions: explanations and policy responses. Environmental Politics 14, 460–477.

8. Bergstrom, J. C., Dillman, B. L., & Stoll, J. R. (1985). Public environmental amenity benefits of private land: the case of prime agricultural land. Journal of Agricultural and Applied Economics, 17(1), 139-149.

9. Bianchi, N. O., Catanesi, C. I., Bailliet, G., Martinez-Marignac, V. L., Bravi, C. M., Vidal-Rioja, L. B., ... & Lopez-Camelo, J. S. (1998). Characterization of ancestral and derived Y-chromosome haplotypes of New World native populations. The American Journal of Human Genetics, 63(6), 1862-1871.

10. Bird, L., Wustenhagen, R., Aabakken, J., 2002. A review of international green power markets: recent experience, trends, and market drivers. Renewable and Sustainable Energy Reviews 6 (6), 513–536.

11. Bishop, R. C., Heberlein, T. A., & Kealy, M. J. (1983). Contingent valuation of environmental assets: Comparison with a stimulated market. Nat. Resources J., 23, 619.

12. Bronfman, N. C., & Cifuentes, L. A. (2003). Risk perception in a developing country: the case of Chile. Risk Analysis: An International Journal, 23(6), 1271-1285.

13. Bronfman, N. C., Jiménez, R. B., Arévalo, P. C., & Cifuentes, L. A. (2012). Understanding social acceptance of electricity generation sources. Energy Policy, 46, 246-252.

14. Bronfman, N. C., Vázquez, E. L., & Dorantes, G. (2009). An empirical study for the direct and indirect links between trust in regulatory institutions and acceptability of hazards. Safety Science, 47(5), 686-692.

15. Bronfman, N. C., Vázquez, E. L., Gutiérrez, V. V., & Cifuentes, L. A. (2008). Trust, acceptance and knowledge of technological and environmental hazards in Chile. Journal of Risk Research, 11(6), 755-773.

16. Buehler, R., & Pucher, J. (2011). Sustainable transport in Freiburg: lessons from Germany's environmental capital. International Journal of Sustainable Transportation, 5(1), 43-70.

17. Bukała, J., Damaziak, K., Krzeszowiec, K. K. M., Małachowski, J., & Sobczak, K. (2015). Analysis approach for a diffusor augmented small wind turbine rotor.

18. Carson, R. T. (2000). Contingent valuation: a user's guide.

19. Carson, R. T., & Hanemann, W. M. (2005). Contingent valuation. Handbook of environmental economics, 2, 821-936.

20. Carson, R. T., Flores, N. E., & Meade, N. F. (2001). Contingent valuation: controversies and evidence. Environmental and resource economics, 19(2), 173-210.

21. Chaudhuri, S. K., & Lovley, D. R. (2003). Electricity generation by direct oxidation of glucose in mediatorless microbial fuel cells. Nature biotechnology, 21(10), 1229-1232.

22. Chen, H., Cong, T. N., Yang, W., Tan, C., Li, Y., & Ding, Y. (2009). Progress in electrical energy storage system: A critical review. Progress in Natural Science, 19(3), 291-312.

23. Cheng, Y. S., Cao, K. H., Woo, C. K., & Yatchew, A. (2017). Residential willingness to pay for deep decarbonization of electricity supply: Contingent valuation evidence from Hong Kong. *Energy Policy*, *109*, 218-227.

24. Davis, F. D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", MIS Quarterly, 13 (3): 319–340, doi:10.2307/249008

25. Davis, F. D., & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: three experiments. International journal of human-computer studies, 45(1), 19-45.

26. Davis, F. D.; Bagozzi, R. P.; Warshaw, P. R. (1989). "User acceptance of computer technology: A comparison of two theoretical models", Management Science, 35: 982–1003, doi:10.1287/mnsc.35.8.982

27. Dyllick, T., & Hockerts, K. (2002). Beyond the business case for corporate sustainability. Business strategy and the environment, 11(2), 130-141.

28. Dupuy, M., Xuan, W. (2016). [interactive]. China's String of New Policies Addressing Renewable Energy Curtailment: An Update. [žiūrėta 2016 m. birželio 5 d.]. Access through internet: http://www.raponline.org/blog/chinas-string-of-new-policies-addressing-renewable-energy-curtailment-an-update/

29. Eder, L. V., Filimonova, I., Nemov, V., & Provornaya, I. (2018). Forecasting sustainable development of transport sectors of Russia and EU: Energy consumption and efficiency. International Journal of Energy Economics and Policy, 8(2), 74-80.

30. Ehrenberg, A. S. C., & Mills, P. (1990). Viewers' willingness to pay. International Thomas Business Publishing.

31. Ek, K., 2005. Public and private attitudes towards ‘‘green’’ electricity: the case of Swedish wind power. Energy Policy 33, 1677–1689.

32. Ellis, G., Barry, J., & Robinson, C. (2007). Many ways to say ‘no’, different ways to say ‘yes’: applying Q-methodology to understand public acceptance of wind farm proposals. Journal of environmental planning and management, 50(4), 517-551.

33. European Commission Climate strategies & targets. (2019). [interactive]. The European Commission calls for a climate-neutral Europe by 2050. [žiūrėta 2019 m. rugsėjo 24 d.] Access through internet: https://ec.europa.eu/clima/policies/strategies/2050_en#tab-0-0

34. Fankhauser, S., & Jotzo, F. (2018). Economic growth and development with low-carbon energy. Wiley Interdisciplinary Reviews: Climate Change, 9(1), e495.

35. Farah, P. D. (2015). Sustainable energy investments and national security: arbitration and negotiation issues.

36. Fernando, C. A. N., Bandara, T. M. W. J., & Wethasingha, S. K. (2001). H 2 evolution from a photoelectrochemical cell with n-Cu 2 O photoelectrode under visible light irradiation. Solar energy materials and solar cells, 70(2), 121-129.

37. Ferry, R., & Monoian, E. (2012). A field guide to renewable energy technologies.

38. Gerking, S., De Haan, M., & Schulze, W. (1988). The marginal value of job safety: a contingent valuation study. Journal of risk and uncertainty, 1(2), 185-199.

39. Golay, M. W. (2001). On social acceptance of nuclear power.

40. Gordon, I. M., & Knetsch, J. L. (1979). Consumer's surplus measures and the evaluation of resources. Land Economics, 55(1), 1-10.

41. Gracia, A., De Magistris, T., & Nayga Jr, R. M. (2012). Importance of social influence in consumers' willingness to pay for local food: are there gender differences?. Agribusiness, 28(3), 361-371.

42. Hamilton, K., & Clemens, M. (1999). Genuine savings rates in developing countries. The World Bank Economic Review, 13(2), 333-356.

43. Hansen, T. B. (1997). The willingness-to-pay for the Royal Theatre in Copenhagen as a public good. Journal of cultural economics, 21(1), 1-28.

44. Heinzle, S. L., Boey Ying Yip, A., & Low Yu Xing, M. (2013). The influence of green building certification schemes on real estate investor behaviour: Evidence from Singapore. Urban Studies, 50(10), 1970-1987.

45. Huijts, N. M., Midden, C. J., & Meijnders, A. L. (2007). Social acceptance of carbon dioxide storage. Energy policy, 35(5), 2780-2789.

46. Huijts, N. M., Molin, E. J. E., & Steg, L. (2012). Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. Renewable and Sustainable Energy Reviews, 16(1), 525-531.

47. Yaman, S. (2004). Pyrolysis of biomass to produce fuels and chemical feedstocks. Energy conversion and management, 45(5), 651-671.

48. Yang, H. J., Cho, Y., & Yoo, S. H. (2017). Public willingness to pay for hydrogen stations expansion policy in Korea: results of a contingent valuation survey. *International Journal of Hydrogen Energy*, *42*(16), 10739-10746.

49. Yoo, S., Domercq, B., & Kippelen, B. (2004). Efficient thin-film organic solar cells based on pentacene/C-60 heterojunctions. Applied Physics Letters, 85(22), 5427-5429.

50. Young, W., & Tilley, F. (2006). Can businesses move beyond efficiency? The shift toward effectiveness and equity in the corporate

sustainability debate. Business Strategy and the Environment, 15(6), 402-415.

51. Jones, B. A., Ripberger, J., Jenkins-Smith, H., & Silva, C. (2017). Estimating willingness to pay for greenhouse gas emission reductions provided by hydropower using the contingent valuation method. *Energy Policy*, *111*, 362-370.

52. Kardelis, K. (2007). Mokslinių tyrimų metodologija ir metodai: vadovėlis / Kęstutis Kardelis. -Kaunas: Judex, 2007.-400p. Lietuvos kūno kultūros akademija. Edukologija ir kiti socialiniai mokslai. UDK 001.8(075.8). ISBN 9955-655-35-6.

53. Kim, J. Y., Lee, K., Coates, N. E., Moses, D., Nguyen, T. Q., Dante, M., & Heeger, A. J. (2007). Efficient tandem polymer solar cells fabricated by all-solution processing. Science, 317(5835), 222-225.

54. Kim, T. K., & Hong, N. K. (2005). Measuring the willingness to pay for food-safety attributes. The Korean Journal of Agricultural Economics.

55. Knetsch, J. L. (2005). Gains, losses, and the US-EPA economic analyses guidelines: A hazardous product?. Environmental and Resource Economics, 32(1), 91-112.

56. Kosenius, A. K., & Ollikainen, M. (2013). Valuation of environmental and societal trade-offs of renewable energy sources. Energy Policy, 62, 1148-1156.

57. Kuravi, S., Trahan, J., Goswami, D. Y., Rahman, M. M., & Stefanakos, E. K. (2013). Thermal energy storage technologies and systems for concentrating solar power plants. Progress in Energy and Combustion Science, 39(4), 285-319.

58. Labay, D. G., & Kinnear, T. C. (1981). Exploring the consumer decision process in the adoption of solar energy systems. Journal of consumer research, 271-278.

59. Langford, I. H., Bateman, I. J., & Langford, H. D. (1996). A multilevel modelling approach to triple-bounded dichotomous choice

contingent valuation. Environmental and Resource Economics, 7(3), 197-211.

60. Le Kama, A. D. A. (2001). Sustainable growth, renewable resources and pollution. Journal of Economic Dynamics and Control, 25(12), 1911-1918.

61. Lee, C. Y., & Heo, H. (2016). Estimating willingness to pay for renewable energy in South Korea using the contingent valuation method. Energy Policy, 94, 150-156.

62. Lietuvos Respublikos socialinės apsaugos ir darbo ministerija. (2019). [interactive]. Pagrindiniai socialiniai rodikliai. [žiūrėta 2019 m. sausio 18 d.]. Access through internet: https://socmin.lrv.lt/lt/veiklos-sritys/socialine-statistika/pagrindiniai-socialiniai-rodikliai

63. Martin, E., Shaheen, S. A., Lipman, T. E., & Lidicker, J. R. (2009). Behavioral response to hydrogen fuel cell vehicles and refueling: results of California drive clinics. International Journal of Hydrogen Energy, 34(20), 8670-8680.

64. Maruyama, Y., Nishikido, M., & Iida, T. (2007). The rise of community wind power in Japan: Enhanced acceptance through social innovation. Energy Policy, 35(5), 2761-2769.

65. Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. Information systems research, 2(3), 173-191.

66. McFarland, J. R., Reilly, J. M., & Herzog, H. J. (2004). Representing energy technologies in top-down economic models using bottom-up information. Energy Economics, 26(4), 685-707.

67. Myers, L., & Bahaj, A. S. (2007). Wake studies of a 1/30th scale horizontal axis marine current turbine. Ocean Engineering, 34(5), 758-762.

68. Mitchell, R., & Carson, T. R.(1989). Using Surveys to Value Public Goods: The contingent Valuation Method. Washington DC: Resources for the Future.

69. Molin, E. (2005). Causal analysis of hydrogen acceptance. Transportation Research Record: Journal of the Transportation Research Board, (1941), 115-121.

70. Mozumder, P., Vásquez, W. F., & Marathe, A. (2011). Consumers' preference for renewable energy in the southwest USA. Energy economics, 33(6), 1119-1126.

71. Ntanos, S., Kyriakopoulos, G., Chalikias, M., Arabatzis, G., & Skordoulis, M. (2018). Public perceptions and willingness to pay for renewable energy: A case study from Greece. *Sustainability*, *10*(3), 687.

72. O'Garra, T., Mourato, S. (2007). Public preferences for hydrogen buses: comparing interval data, OLS and quantile regression approaches. Environmental and Resource Economics, 36(4), 389-411.

73. O'Garra, T., Mourato, S., & Pearson, P. (2008). Investigating attitudes to hydrogen refuelling facilities and the social cost to local residents. Energy policy, 36(6), 2074-2085.

74. Oerlemans, L. A., Chan, K. Y., & Volschenk, J. (2016). Willingness to pay for green electricity: A review of the contingent valuation literature and its sources of error. *Renewable and Sustainable Energy Reviews*, *66*, 875-885.

75. Olsen, J. A., & Smith, R. D. (2001). Theory versus practice: a review of 'willingness-to-pay'in health and health care. Health economics, 10(1), 39-52.

76. Pino, L., Vita, A., Cordaro, M., Recupero, V., & Hegde, M. S. (2003). A comparative study of Pt/CeO 2 catalysts for catalytic partial oxidation of methane to syngas for application in fuel cell electric vehicles. Applied Catalysis A: General, 243(1), 135-146.

77. Poortinga, W., ir Pidgeon, N. F. (2003). Exploring the dimensionality of trust in risk regulation. Risk Analysis: An International Journal, 23(5), 961-972.

78. Protière, C., Donaldson, C., Luchini, S., Moatti, J. P., & Shackley, P. (2004). The impact of information on non-health

attributes on willingness to pay for multiple health care programmes. Social Science & Medicine, 58(7), 1257-1269.

79. Qiblawey, H. M., & Banat, F. (2008). Solar thermal desalination technologies. Desalination, 220(1), 633-644.

80. Ragheb, M. (2011). Vertical axis wind turbines. University of Illinois at Urbana-Champaign, 1.

81. Raju, M., & Grazier, M. (2008). Energy harvesting. ULP Meets Energy Harvesting: A Game-Changing Combination for Design Engineers.

82. Razak, J. A., Sopian, K., Ali, Y., Alghoul, M. A., Zaharim, A., & Ahmad, I. (2009). Optimization of PV-wind-hydro-diesel hybrid system by minimizing excess capacity. European Journal of Scientific Research, 25(4), 663-671.

83. Razmjoo, A. A., Sumper, A., & Davarpanah, A. (2019). Development of sustainable energy indexes by the utilization of new indicators: A comparative study. Energy Reports, 5, 375-383.

84. Rogers, E.M., 1995. Diffusion of Innovations, fourth ed. The Free Press, New York.

85. Sachs, J. D., Woo, W. T., Yoshino, N., & Taghizadeh-Hesary, F. (2019). Importance of green finance for achieving sustainable development goals and energy security. Handbook of Green Finance: Energy Security and Sustainable Development, 1-10.

86. Sarkodie, S. A., & Strezov, V. (2019). Effect of foreign direct investments, economic development and energy consumption on greenhouse gas emissions in developing countries. Science of the Total Environment, 646, 862-871.

87. Saxe, M., Folkesson, A., & Alvfors, P. (2007). A follow-up and conclusive report on the attitude towards hydrogen fuel cell buses in the CUTE project—from passengers in Stockholm to bus operators in Europe. International journal of hydrogen energy, 32(17), 4295-4305.

88. Scarpa, R., & Willis, K. (2010). Willingness-to-pay for renewable energy: Primary and discretionary choice of British

households' for micro-generation technologies. Energy Economics, 32(1), 129-136.

89. Schroeder, P., Anggraeni, K., & Weber, U. (2019). The relevance of circular economy practices to the sustainable development goals. Journal of Industrial Ecology, 23(1), 77-95.

90. Shaheen, S., Martin, E., & Lipman, T. (2008). Dynamics in behavioral response to fuel-cell vehicle fleet and hydrogen fueling infrastructure: an exploratory study. Transportation Research Record: Journal of the Transportation Research Board, (2058), 155-162.

91. Siegrist, M., & Cvetkovich, G. (2000). Perception of hazards: The role of social trust and knowledge. Risk analysis, 20(5), 713-720.

92. Simon, A., Wustenhagen, R. (2006). Factors influencing the acceptance of wind energy in Switzerland, poster presented at the workshop ‘‘Social acceptance of renewable energy innovation’’, Tramelan, Switzerland.

93. Slovic, P. (1987). Perception of risk. Science, 236(4799), 280-285.

94. Spash, C. L. (2006). Non-economic motivation for contingent values: Rights and attitudinal beliefs in the willingness to pay for environmental improvements. Land Economics, 82(4), 602-622.

95. Stavins, R. N., Wagner, A. F., & Wagner, G. (2003). Interpreting sustainability in economic terms: dynamic efficiency plus intergenerational equity. Economics Letters, 79(3), 339-343.

96. Sundt, S., & Rehdanz, K. (2015). Consumers' willingness to pay for green electricity: A meta-analysis of the literature. *Energy Economics*, *51*, 1-8.

97. Taylor, S., & Todd, P. (1995). Understanding household garbage reduction behavior: a test of an integrated model. Journal of Public Policy & Marketing, 14(2), 192-204.

98. Taylor, S., ir Todd, P. (1995). An integrated model of waste management behavior: A test of household recycling and composting intentions. Environment and behavior, 27(5), 603-630.

99. Tytell, E. D. (2006). Median fin function in bluegill sunfish Lepomis macrochirus: streamwise vortex structure during steady swimming. The Journal of experimental biology, 209(8), 1516-1534.

100. Toke, D., Breukers, S., Wolsink, M., 2008. Wind power deployment outcomes: how can we account for the differences? Renewable and Sustainable energy Reviews 12, in press. doi:10.1016/j.rser.2006.10.021.

101. Uribe-Toril, J., Ruiz-Real, J. L., Milán-García, J., & de Pablo Valenciano, J. (2019). Energy, Economy, and Environment: A Worldwide Research Update. Energies, 12(6), 1120.

102. Vasylieva, T., Lyulyov, O., Bilan, Y., & Streimikiene, D. (2019). Sustainable economic development and greenhouse gas emissions: The dynamic impact of renewable energy consumption, GDP, and corruption. Energies, 12(17), 3289.

103. Vatn, A. (2004). Environmental valuation and rationality. Land economics, 80(1), 1-18.

104. Venkatesh, V. (2000), "Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model", Information systems research, 11 (4), pp. 342–365

105. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS quarterly, 425-478.

106. Venkatesh, V.; Bala, H. (2008), "Technology Acceptance Model 3 and a Research Agenda on Interventions", Decision Sciences, 39 (2): 273–315, doi:10.1111/j.1540-5915.2008.00192.x

107. Venkatesh, V.; Davis, F. D. (2000), "A theoretical extension of the technology acceptance model: Four longitudinal field studies", Management Science, 46 (2): 186–204, doi:10.1287/mnsc.46.2.186.11926

108. Venkatesh, V.; Morris, M. G.; Davis, G. B.; Davis, F. D. (2003), "User acceptance of information technology: Toward a unified view"

109. Wade, N. S., Taylor, P. C., Lang, P. D., & Jones, P. R. (2010). Evaluating the benefits of an electrical energy storage system in a future smart grid. Energy policy, 38(11), 7180-7188.

110. Wen, J. (1998). Evaluation of tourism and tourist resources in China. International Journal of Social Economics, 25 (2/3/4): 467-485.

111. Wolsink, M. (2012). The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources. Renewable and Sustainable Energy Reviews, 16(1), 822-835.

112. Wustenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. Energy policy, 35(5), 2683-2691.

113. Zelenika, I., & Pearce, J. M. (2014). Innovation through collaboration: scaling up solutions for sustainable development. Environment, development and sustainability, 16(6), 1299-1316.

114. Zhu, D., & Beeby, S. (2011). Kinetic energy harvesting. In Energy harvesting systems (pp. 1-77). Springer New York.

115. Zhu, K., Neale, N. R., Miedaner, A., & Frank, A. J. (2006). Enhanced charge-collection efficiencies and light scattering in dye-sensitized solar cells using oriented TiO2 nanotubes arrays. Nano letters, 7(1), 69-74.

PUBLICATIONS

1. Yan, Q., Wan, Y., Mikalauskas, I., & Mikalauskiene, A. (2017). Smart Grids for Renewable Energy: Costs and Benefits. Transformations in Business & Economics, 16.
2. Mikalauskas, I., Mikalauskiene, A. (2017). Cultural Acceptance Differences of Renewable Energy Technologies. International Journal of Culture and History. IJCH 2017 Vol.3(4): 270-274; ISSN: 2382-6177; doi: 10.18178/ijch.2017.3.4.111.
3. Mikalauskiene, A., Streimikiene, D., and Mikalauskas, I. (2017). Sustainable Energy Development. International Journal of Social Science and Humanity. IJSSH 2017 Vol.7(10): 667-671; ISSN: 2010-3646; doi: 10.18178/ijssh.2017.V7.904.
4. Štreimikienė, D., Mikalauskienė, A., Atkočiūnienė, Z., & Mikalauskas, I. (2018). Renewable energy strategies of the Baltic States. Energy & Environment, 0958305X18790961.
5. Mikalauskiene, A., Štreimikis, J., Mikalauskas, I., Stankūnienė, G., & Dapkus, R. (2019). Comparative Assessment of Climate Change Mitigation Policies in Fuel Combustion Sector of Lithuania and Bulgaria. Energies, 12(3), 529.
6. Štreimikienė, D., Balezentis, T., Mikalauskas, I., Shen, Z. (2020). Towards Carbon Free Economy and Electricity: The Puzzle of Energy Costs, Sustainability and Security based on Willingness to Pay. Energies, TBP.

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