Twinning for Promoting Excellence, Ability and Knowledge to develop advanced waste gasification Solutions

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TwinPeaks

Waste-to-energy user and stakeholders report

WP 3 – Task 3.4 / D 3.5

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VYTAUTAS MAGNUS UNIVERSITY M C M X X I I

WIP RENEWABLE ENERGIES

CHALMERS

Technical University of Munich

Authors: Aušra Pažėraitė*, Vytautas Magnus University (VMU), Lithuania
Dainius Genys*, Vytautas Magnus University (VMU), Lithuania
Viktorija Grigaliūnaitė, Vytautas Magnus University (VMU), Lithuania
Rūta Repovienė, Vytautas Magnus University (VMU), Lithuania
Mantautas Račkauskas, Vytautas Magnus University (VMU), Lithuania

* Lead authors

Editors: Aušra Pažėraitė*, Vytautas Magnus University (VMU), Lithuania
Andrius Tamošiūnas, Lithuanian Energy Institute (LEI), Lithuania

Contact: Vytautas Magnus University
Faculty of Economics and Management
Aušra Pažėraitė
Email: ausra.pazeraite@vdu.lt, Tel: +370 687 85407
Daukanto str. 28
LT-44246 Kaunas, Lithuania
https://evf.vdu.lt/en/

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Abbreviations

CTH	Chalmers University of Technology
D	Deliverable
LEI	Lithuanian Energy Institute
TUM	Technical University of Munich
VMU	Vytautas Magnus University
WP	Work package
WtE	Waste-to-energy

1 Introduction

1.1 Task 3.4 - Waste-to-energy user and stakeholders report

Task 3.4 aims to identify the key groups of stakeholders of the WtE value chain (e.g. users, technology developers, service suppliers, policy makers etc.) and then collect opinions of the representative panel of Lithuanian stakeholders on awareness and insights about WtE technologies in Lithuania.

Therefore, the key stakeholders representing the Lithuanian WtE area were identified. The study is done collecting the data through a questionnaire what was distributed among the representative panel of Lithuanian stakeholders. The Association of Lithuanian Chambers of Commerce, Kaunas Region Association of Industrialists and Employers and personal relationships helped to disseminate the questionnaire.

Due to the COVID-19 issues followed by the variety of restrictions, a few focus group discussions were held. The decision was made to meet requirements and respect the availability of participants. The goal of the focus groups is to understand the drivers of adoption/rejection of WtE technologies in Lithuania. One of the focus groups was held in parallel with one of the outreach events held at VMU December 1st, 2021 (M15). Another focus group discussion was held in particular with representatives of the Alliance of Lithuanian Consumer Organizations on (M13). The Alliance of Lithuanian consumer organizations established in 2012 unifies 12 consumer associations.

During the implementation of the project, an additional and unplanned survey was conducted, which aimed to explore the opinion on waste management, primary driving forces to manage the waste properly. This exploratory survey targeted a wide audience, and it was conducted to ensure the completeness and scope of the results.

Therefore, this report allows to identify a complete picture of stakeholders' needs, attitudes, driving forces and opinions on WtE throughout the whole value chain. Being public, this report extents the current knowledge of the issue at hand and might play a role for further researches and collaborations among Lithuanian stakeholders.

1.2 Contents of the Waste-to-energy user and stakeholders report

This Waste-to-energy user and stakeholders report is the result of the study made to explore awareness, opinions and insights about WtE technologies in Lithuania of the representative panel of Lithuanian stakeholders.

Chapter 2 covers the identification of the Lithuanian stakeholders taking into consideration the WtE value chain.

Chapter 3 focuses on the results of application of each of the data collection methods: interviews, focus group discussions and explorative survey. For each method, there are sub-chapters containing:

- a review of the interview results;
- a review of the focus groups discussions;
- a review of the survey results.

Chapter 4 provides summary, comparison and generalisation of the study results by identifying the overall picture of stakeholders' needs, attitudes, driving forces and opinions on WtE throughout the whole value chain.

2 Identification of the Lithuanian stakeholders

The project partners identified potential Lithuanian stakeholders. The stakeholders were divided into target groups in accordance with their role in the WtE production value chain. A generalized picture is provided in Figure 2.1.

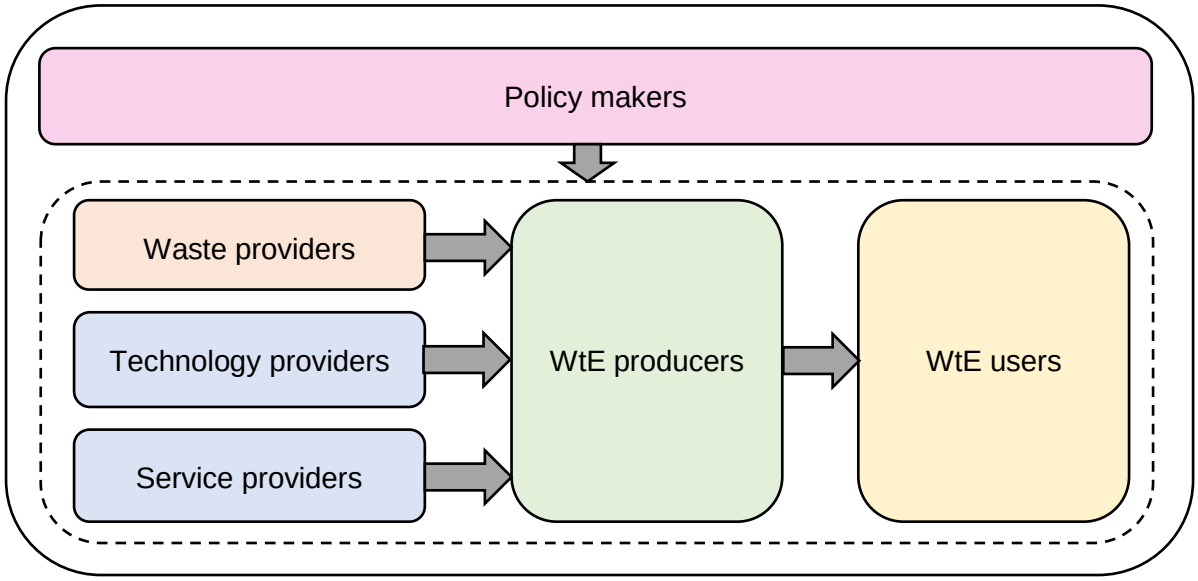


Figure 2.1: Stakeholders in Lithuania

The target group of policy makers represents all state institutions involved in preparation, establishment of the laws, bylaws and corresponding rules that are imposed in the WtE sector, as well as the National Energy Regulatory Council.

The target group of waste providers represents households; small, medium and big organizations that produce waste when performing their activities and those organizations that are responsible for waste management.

The target groups of technology and service providers represent the private organizations and research institutions that work on development or improvements of the WtE technologies. Organizations that provide operation and management independently are also singled-out but the same color assigned to technology and service providers identifies that these activities might and sometimes are performed by the same organization.

The target group of WtE producers represents the private and state-owned energy generators that produce heat and electricity and sell these products to the market or to energy suppliers.

The target group of WtE users represents all the possible WtE users: households, business companies, institutions, other organizations and society at large.

When conducting research, it was aimed to approach all the target groups through interviews and/or focus group discussions. Unfortunately, the leading private Lithuanian company of technology development and equipment production went bankrupt. The rest representatives of each target group were successfully approached.

3 Waste-to-energy user and stakeholders study results

3.1 Review of the interview results

The ultimate goal of interviews with the stakeholders' representatives is to collect data on awareness and opinion about WtE technologies in Lithuania. For this purpose, the research approach was prepared.

Research methodology – the aim of a qualitative research approach is to gain knowledge about the research question from the interviewee's perspective. The main characteristics of semi-structured qualitative interviews are useful for achieving the goal: the lighter structure does not impose the opinion of the interviewer; the dominance of open-ended questions allows more detailed information to be gathered; greater attention to the specific situation and sequences of actions indicated by the interviewee provides knowledge of the specific case[1]. A huge strength of face-to-face qualitative interviews is the wealth of information gained through the communication process[2] and the ability to have a clearer understanding of the researching phenomena by specific target group.

Data collection methods: semi-structured qualitative interviews. The technique of semi-structured interviews is not a simple questioning. An important aspect is probing which strengthens the reliability of the data. The semi-structured interview has both a clear structure and flexibility, providing space for additional, control questions. Each interview becomes unique, personal, but at the same time analyses identical research questions[3].

With the consent of the respondents, the interviews were recorded, then the data were transcribed and analysed by grouping it according to the preliminary topics as well as that emerged during the analysis. The duration of the interviews varied from 30 to 55 minutes. Most of the interviews (23) were conducted live, but remotely (i.e., using online communication platforms, like Zoom). 9 interviews were conducted in a self-filling manner, i.e., by sending questions to the informants who themselves filled the answers in blank spaces. The Chamber of Commerce was approached in an attempt to reach service delivery professionals. The administration was asked to distribute the questionnaire to specific (with research topic related) audience, who had the opportunity to contact the authors of the questionnaire and conduct a live interview, or answer the questions themselves. In this way, 35 questionnaires were sent out and returned 9 with completed answers. The implementation of the research took place in three stages: focus group interviews - November 2021; semi-structured interviews November 2021 - January 2022; Interview with the representatives of the Chamber of Commerce - January 2022.

The construction of the questionnaire – was designed to respond to the main purpose of the report - to identify the most important stakeholders and to find out their views on the implementation of Waste-to-Energy in Lithuania. Accordingly, it consists of three parts. In the first, introductory part, the questions are intended to clarify a more general approach to WtE, the suitability and appropriateness of the WtE, and also to assess the main challenges and opportunities for its further development and implementation in Lithuania. The second part, focuses on more specific questions aimed at clarifying the main obstacles to the implementation of WtE, assessing the adequacy of the infrastructure, and providing a subjective opinion on the prospects for the development of WtE. Given the heterogeneity of the research participants and their different relations with WtE, the questionnaire uses main guiding questions, leaving the researcher free to ask additional questions depending on the

[1] King, N. 2004. Using Interviews in Qualitative Research. In: Cassell C., Symon G. (eds). *Essential Guide to Qualitative Methods in Organizational Research*. London: Sage Publications. p. 11-22

[2] Gillham, B. 2000. *Case Study Research Methods*. Continuum: London and New York

[3] King 2004: 69.

informant's profile, responsibilities, etc. This avoids a plethora of questions and superficial answers. Meanwhile, additional questions during the interviews allowed to “go deeper” and focus on the most fruitful information a particular participant could provide. In the third part4, the informants were asked to review public participation and link WtE to broader issues, such as the implementation of the EU Green Course and the potential of WtE to reduce regional exclusion. Finally, the questionnaire ends with a fairly standard question, asking the informant to supplement the interview on what he or she thinks is important, but may not have been asked during the interview. In this way, the participants of the research are given an opportunity to summarize their point of view and highlight their strongest competencies, to emphasize the aspects of the research problem that are of most concern to them (which may not be directly related to the aims of this research). For a full list of guiding questions, see Annex 1.

Identification of stakeholder groups and localization of key players

Prior to selecting specific study participants who could provide the most relevant information, specific WtE stakeholder groups were identified. The stakeholders were divided into target groups in accordance with their role in the WtE production value chain, i.e., users, scientists, technology developers, service suppliers, policy makers. Accordingly, each of these groups was formed according to different activities, nature of work, role / responsibilities, and so on. In this way, the heterogeneity of the research participants was controlled in order to respond to different aspects of the problem.

Conducting the interviews. WtE (end) user / Waste providers group. In order to more accurately and comprehensively identify the assessment of the technology from the consumer side, this group is divided into two. The first part of the group consists of young professionals interested in environmental protection and waste sorting. The second one, is more deeply related to the problem, i.e., public opinion specialists, independent actors, developers of environmental protection and sustainable development initiatives, energy marketing and communication specialists, environmental activists, and representatives of civil society. Finally, representatives of technology consumer companies (working in different fields) also joined this group. WtE technology developers and researchers. Due to the fact that the topic of WtE is of interest to researchers from different disciplines, the research participants were selected to represent different disciplines and share different competencies. In order to fill the group of policy makers, participants were selected to respond to different hierarchical positions in the power chain. Accordingly, interviews were conducted with the highest level (ministry leadership); medium - heads of departments; lower-level professionals - persons performing daily, practical activities, as well as state supervisory authorities (eg regulatory authorities) (for a full list of participants, see Annex 2).

The drivers of adoption/rejection of WtE technologies in Lithuania

The interview starts with a request for the experts to comment on the general situation in the country and assess the acceptability and prospects of WtE, which presents the knowledge and attitudes of the participating experts on the situation of WtE in Lithuania as well as outlines the specific attitude of the particular group of stakeholders. In this respect, four main opinion tendencies emerged among the experts' views. Some informants drew attention to the links between WtE's perspectives and information - its consistency, purposefulness, informativeness of the society, and overall representation of the technology in a public discourse. Others tended to link WtE prospects to societal behavior and financial support. The third tendency raised the risks and suitability of WtE for the existing Lithuanian infrastructure. Finally, the fourth - highlighted the importance of policy coherence and implementation.

To the question “What do you think are the biggest challenges / opportunities for the development of WtE in Lithuania?”, some of the informants identified public awareness or, in other words, lack of information as the biggest challenges. Interestingly, this aspect was

4 This part of the research is not used in the report as it goes beyond the scope of the report, but the data will be discussed in further scientific publications of project participants.

similarly addressed by the policy makers and the technology users / waste providers, as well as the researchers. Everyone said that information could be both a challenge (such as opposing society) and an opportunity (such as changing public attitudes to waste management). Public education can become a crucial factor, as experts say it is directly related to public behavior, which affects the development and applicability of WtE technologies. As we will see later, informativeness is also linked to public response and wider participation in sustainable development programs: if public attitudes are negative, it is difficult to expect successful application of technological development and vice-versa.

- The main challenge is the lack of information: there should be more and talk and more broadly talk about energy production methods, their advantages, and disadvantages, and how to deal with them. Expert 24
- Environmental requirements, proper communication, and possible population resistance. Expert 27
- Poor public information on waste management. To this day, people are encouraged to recycle, but it is not explained what happens to those wastes that are not suitable for recycling. They also do not understand how large a waste stream comes from industry and that most of that waste is not suitable for recycling. There is very little information on landfill problems, so there is no need seen to look for alternatives. In addition, there is a widespread belief that WtE technologies are inherently polluting, smelly, etc., and as soon as the WtE plant is talked about, public hostility arises. Expert 12
- The recycling of waste into energy in society is primarily associated with the incineration of waste, which is received quite negatively. Other technological alternatives are not so widely considered. But for the application of other methods, I would probably see the same greatest challenge in society - as hardly acceptable and negatively received. Expert 11

Accordingly, another part of the experts, talking about the challenges of public attitudes and the future prospects of the technology, pointed to the importance of financial aid for the WtE, which, according to experts, could help to change public attitudes, as well as accelerate the development of WtE technology.

- The best is financial motivation: if the resident recycles - pays less, and if does not recycle – pays more. Also, controls, warnings, fines for improper waste management are necessary, but this should not be overstated, because if the residents have difficult conditions to sort and properly dispose of waste, everything can move to the surrounding environment. Expert 6
- It is important to have clear strategic goals, then it is worth investing purposefully to achieve a significant breakthrough. I would think the same with WtE, otherwise, it’s easy to get into chaos. Expert 1

The third group associated WtE with certain risks that go beyond the scope of this particular technology and may have a wider impact on society. Concerns have been raised about the efficiency of the technology, raising questions about its potential impact on environment and climate change. Addressing the experience of other countries, its suitability for Lithuania was questioned, more precisely, its further development in terms of sustainability. One of the experts raised a similar issue, pointing to the potential danger i.e., the emergence of a business industry (as a consequence of further development of WtE in the country) which could make it difficult to control the processes avoiding counterproductive benefits, like, instead of helping to deal with the country's waste, taking imports from other countries would, according to expert, contribute to accumulation of waste.

- Some of these things are already being abandoned in some countries because it is a very expensive technology to incinerate, filter, etc. and in the end, where to put all the slag and ash generated? <..> The same is true with incineration, the heavy nano-particles with the vapor come out because the filters still don't hold everything. Another thing the slag and ash that will need to be buried were said to be used to build roads, to reposition the layers

in landfills, but here the same thing comes through, we are still hiding it somewhere. So, I do not see the prospects and opportunities for sustainability in incineration, and it was stupid to build two more factories. Expert 7

- It is still very worrying that we are importing waste, it should be banned here at all, so if Poland does not deal with its rubbish, then it has to deal with it in its own territory. And it is still very worrying that these systems, such as cogeneration, operate solely on economic principles. There must be a very strong ecological motive to prevent the import of foreign waste into Lithuania, during which trucks have to pass through Lithuania, emits CO2, and brings that waste. <..> and what seems very wrong is that if we look only at the concept of profit, it is very wrong, because then those cogenerations will be interested in burning more, then we will import the garbage to ourselves, even though we ourselves have reduced the amount of waste. On the other hand, there is a real advantage that it is better than digesting in landfills for those hundreds of years; and the fact that cogeneration is part of the circular economy where waste is converted into energy. Simply put, we have built too much, and those developers are interested in burning as much as possible, while the goal is still to reduce waste. Expert 8

Both experts, however agreed with the benefits of WtE in addressing waste management, but questioned the further development of the technology. Both experts assessed the problem from a consumer and environmental perspective, so ecological arguments predominate in their approach. The experts, using environmental arguments and a deeper relationship between WtE and ecology, highlighted the difference between popular public understanding and expert knowledge.

The last trend within this topic, according to experts, is related to the management and administration of environmental and energy problems. Different experts pointed to international and domestic policy choices. According to experts, WtE is just a technology, the productivity and efficiency of which depend on a wider range of strategic, choices, respectively, it is not easy to unambiguously assess the situation in Lithuania. The expert also drew attention to the fact that the situation in Lithuania also depends in part on the priorities and tendencies of the international environmental and energy policy. Another expert extended the idea by saying that it is best to assess the situation when the main goal is known - what is being sought and what breakthrough is expected, otherwise interpretations may be different or even contradictory.

- Everything is set up correctly in the waste prevention plan, only it needs to be implemented. The infrastructure complies with European standards, they are maintained, licensed, there are responsibilities, but at the same time it is natural that each system has certain “high voltage points”, thus certain solutions are needed, sometimes the system can fail, and it is not just a Lithuanian problem, it is a common thing in all countries. Expert 25
- The other thing is what we want to achieve; on one point is talk about the economy, on the other point is talk about energy, on the third - about the green course. And it is a problem to connect them, the state needs a clear policy on what goal we are pursuing. We can burn everything, we can deliver more of those cogeneration plants, but looking at what we are aiming for. Or maybe we don't need it at all because we will recycle everything, separate food waste, force everyone to use only recycled packaging, and there will be nothing to burn. But when we put it all together, everything goes out so that no one knows how to manoeuvre here. Expert 26

Both experts represent the group of policy makers, thus it is natural they focus on the administration of the problem. We can see that, it is not easy to ensure a smooth administration of the process, especially in a broader context, even disposing sufficient knowledge about technology and its benefits to society. Once again, it was noted by the experts that one thing is to administer the implementation and even the development of the WtE, the other - is to harmonize the process so that it runs smoothly from an economic, social and environmental

point of view. On the other hand, as it was already mentioned it is difficult to crystallize the potential of WtE without clear strategic priorities.

After reviewing the knowledge and attitudes of the study participants towards the assessment of the WtE situation in Lithuania, several opinion tendencies emerged. Summarizing the differences in attitudes between the groups, it can be seen that the issue is contextualized widely, taking different aspects into account. Qualitative research does not allow to make quantitative generalizations, but we can see that a more positive view of WtE's prospects in Lithuania dominated among the respondents. In a more general context, the experts drew attention to the aspects of public awareness, financial aid and more general potential risks. It can be seen that the differences in attitudes are related to the variety of stakeholders groups. It is understandable that the attitude of environmentalists and activists is more conservative in this case, and marketing specialists as well as opinion makers (influencers) interprets the issue as both an opportunity and a challenge. Representatives of technology developers mentioned rather pragmatic aspects that could change the situation in the desired direction. Finally, decision-makers suggested assessments of the current situation from a policy and governance perspective. Despite the differences in attitude between different stakeholder groups, no apparent contradictions or disagreements emerged at this stage of the research. The differences are more of an interpretive nature, related to professional and disciplinary bias rather than principle differences in understanding the operation and applicability of WtE. Such a palette of opinions from different perspectives allows to achieve one of the goals of the report - to collect opinions of the representative of the stakeholders on awareness and insights about WtE technologies in Lithuania.

Advantages

The next section discusses the research participants' attitudes towards the advantages of WtE and the suitability of the technology for Lithuania. Interestingly, only a few experts favored the advantages, while the rest focused on the obstacles. The first - highlighted the existing potential for further sustainable development and the already sufficient, visible, achievements in the waste management. Experts acknowledged that a waste management system already exists, but emphasized the importance and benefits of competition (among technology developers and users), which could make the system even more efficient. Others spoke similarly, but mentioned specific aspects (such as the lack of specific containers) that would improve the situation.

- The waste management system in Lithuania is already in place, but the opportunities to increase its efficiency are still very high. I believe that the country should promote the development of competition in this sector and reduce the share of state-owned business covered by the country's security or strategic slogans. The private sector has shown what it can do when implementing a bottle deposit system in Lithuania. We are happy as consumers and proud compared to neighbors. And the unified product, packaging, and waste accounting information system created by the government has no one to be happy and proud of - consumers are angry and dissatisfied. If the competition has already seemed to be introduced in the immovable monopolies of the electricity and DH sectors, why not try to replicate this in the waste management industry? Expert 10
- The sorting and recycling system in Lithuania is quite good, the availability of containers is not bad, the conditions for sorting, asbestos management, and other 8 programs have been provided, but there is still room for improvement. Waste can still be seen on the streets, old furniture, household appliances, machine parts, building materials, etc. left behind in containers, suggesting that the system is not fully arranged. Expert 6
- There are waste streams that need to be incinerated. Just because of today’s pandemic situation, how many disposable masks do we have, and that is the single most hygienic way to dispose of them. Expert 25
- WtE is the motto. But who is hiding under it? These can be very different things, like waste incineration and heat production, but in reality, it is secondary fuel production. If you looked at various EU programming documents, until recently incineration was promoted with

> support, now it is no longer. Incineration of waste is an unavoidable means of dealing with waste streams so that landfills do not increase so that no more than 10% of waste is dumped here. Expert 23

The experts located the place of WtE in the country's waste management process by distinguishing and clearly highlighting the aspects of technological applicability and its benefits. According to experts, in order to reveal the benefits of WtE to full extent the contextual aspects should be taking into account, i.e. the whole chain of waste management needs to be rationalized. Accordingly it consist of waste sorting, collecting, recycling and management. The higher the quality of and the wider the sorting is, the better are the results. Most of the waste can be recycled in Lithuania and some of it can be incinerated. Experts pointed out that incineration should not be overly admired, as almost all waste can be incinerated, but the potential consequences are - a stagnant sorting system, as well as diminishing public waste sorting skills. Experts have repeatedly emphasized the following chain of waste management: sorting, recycling and only then incineration, all of which is not worthwhile or cannot be recycled. Speaking about the prospects of WtE in Lithuania, the experts noted that Lithuania has a big legacy - large mountains of landfills, and the use of WtE technologies can be useful for their management. The participants of the study noted that despite the urgency of the problem, there is no final decision on how to organize this process, although the question ir marked red on the political agenda. Thus, the efficiency of WtE is to be assessed by summing up all aspects (including the environmental impact of waste logistics and transportation), i.e., not only counting number of WtE installations, but also estimating the amount of energy consumed in transporting waste from one point to another and the pollution generated by that transport, as well as in economic terms – how much it will cost to the state and final consumers.

Disadvantages

As it was mentioned the disadvantages received more attention from informants. Experts mentioned different arguments (from administration to economics, from information to infrastructure), which hinders the faster development of WtE in Lithuania. Some participants pointed out that it is important for WtE, as in any other area, to have clear objectives and clear indicators to measure a progress. Which would also allow a more objective assessment of the current situation and the need for further development. Some informants reiterated the consistency and importance of the information, noting the lack of clearer communication from both the developers and the government in formulating the country's need and discussing implementation measures. One of the informants aptly noted that information in the media is often contrasting, which has an impact on public opinion and, possibly, on behavior.

- There are no clear indicators on what we want to achieve and no evaluation criteria for achieving these indicators. Expert 27
- Funding for the new WtE. Expert 15
- No need unless biogas plants. Expert 28
- The answer is that the three existing power plants fully meet the needs of the market and the planned adaptation of the Akmenė cement plant to incinerate municipal waste will further increase competition between WtE for raw materials. Expert 14
- There was information in the media that there are already too many incineration companies in Lithuania. Expert 13

Other participants referred to broader - societal mentality - aspects of WtE development barriers. One informant mentioned the long-standing tradition of waste management in the country as an example: the formation of landfills and the relatively slow reorientation of large companies (working in the field) adjusting itself to WtE. In another case, the aforementioned division of the governmental attitude, when it seems that the benefits of waste sorting and WtE are publicly discussed, but not to translated into practice (for example in governmental institutions). Using the examples of the situation in public and governmental institutions, the expert linked three important aspects - attitude, management and behavior - into one problem.

- The development of WtE in Lithuania is hindered by the fact that the cult of landfills is very strong in our country. (2) Large waste management companies (eg Ekonovus or Ecoservice) do not participate in WtE processes. Expert 12
- There is still no or a lack of sorting opportunities in educational institutions, places like kindergartens, schools should be a priority to cultivate a new generation with understanding, everyday skills of what needs to be done, and today it is still necessary to explain why this needs to be done. In other institutions, even governmental ones, the system is not correct. If we do not agree on the highest level where education is needed, then the society will do what it is said to do, they will not have that inner need; if there will be containers - they will recycle, but if they will not find container - they will not recycle. It doesn't get from me that I want to, and I understand why I need to do it, but that kind of "brought me here, told me so I'll do it." There's a lack of that education, but not the kind of advertising, flyers, posters, but the kind of infrastructure. Expert 7
- What is missing for faster progress? Political Leadership in the Ministry of the Environment. It is a populist saying. But on the other hand, there is some obvious resistance from specific regions as well. Expert 23

We can see from the examples that the effectiveness of WtE also depends on the behavior of society and institutions. The expert mentioned that specific examples of behavior by public authorities not only would illustrate the transition from slogans to activities, but also could have an educational function, i.e. from which others could learn and copy specific examples of how waste management should be organized.

By specifying the disadvantages of WtE, the experts mentioned the importance of not to focus on the nuances of the technology itself, but on its application and wider impact on the overall waste management. WtE certainly has a role to play in this process, but it needs to be clearly defined in terms of the country's strategic interests such as demand, infrastructure, strategic development of renewable energy, and so on. Experts have mentioned the possibility of counterproductive impact of WtE (on the country's interests) in case it begins to over dominate the public waste sorting habits or recycling process.

- It doesn't have to be the predominant way, because the [essence of] materials are lost, they are converted into heat energy, but the immediate essence of the material is changed, we don't get back what was in the product. Slags, residual products, ash are generated and must be safely managed and disposed of in landfill. Expert 25
- Does not encourage recycling, no single priority between economies, green course, and energy. Expert 26
- WtE development depends on many factors. As I mentioned before, if it is disconnected from an integrated vision of the waste management problem and strategic orientations, its development can be sporadic. For example, in the case of price rises for other energy raw materials or supply disruptions, WtE may prove to be an efficient and cheap alternative. However, in the longer term, again as prices, supplies fluctuate, or as new factors enter the supply chain (e.g. as the share of renewable energy increases), WtE may become less effective or even problematic having in mind the broader context of e.g. sustainable energy development or environmental protection. Expert 30

Experts pointed out how WtE is related and at the same time dependent on other energy and environmental issues. WtE contributes to both, but its objectives and functions must be very clearly defined, otherwise it may have the opposite effect. It can be concluded that the potential of WtE technology depends on combination of various aspects, not only self-evident - infrastructure, economic, or political priorities, but also the social and cultural attitudes of society.

The development of WtE as a business branch of energy industry, according to experts, is noticeable and has the potential to expand. However, there are some risks in such development. For example, if this [as specific, autonomous business branch of energy industry

dispatched from overall concept of waste management] development evolves without supervision, it could have a wider impact on the whole waste management process. In such a case it is likely that there will be less waste for recycling and waste incineration will become dominant. However, experts were not inclined to answer unequivocally whether WtE, if we can recycle, is really the best solution in terms of sustainable development? They acknowledged the immediate benefits but were not assured of long-term benefits. In addition, the experts emphasized another problem specific to Lithuania that the issue of WtE is not consistently administered in Lithuania. This is because responsibilities are scattered across different institutions and municipalities, making decisions dependent on different decision-makers and different priorities, lacking a coherent approach, systematic administration from start to finish and thinking in a complex way.

The progress / achievements of WtE application in Lithuania

Different groups tend to treat WtE progress differently, as they approach it from different backgrounds. Some experts noted that Lithuania has already made notable progress in WtE, which is already beneficial. The work done in developing both the WtE infrastructure and service supply, is helping to tackle the problem of waste management in the country. Experts acknowledged that given the technological complexity of WtE and the time-consuming nature of the policy implementation related to its application, and last but not least the ambivalence of public attitudes towards it, it should not be surprising that achieving the expected results took some time.

- Lithuania has already made progress. Expert 2
- In Lithuania, the infrastructure is in place, the network is full, Lithuania is able to manage waste in this way on its own, and there is no need for us to transport it elsewhere. Expert 25
- Progress, albeit delayed, is evident - production is taking place, smoke is coming out of chimneys, energy is being generated. Lithuania in general is characterised by long and complex procedures for the preparation of spatial planning documents, and given the public's sensitivity to the construction of such facilities, it is hardly surprising that it has taken so many years to build the power plants. But the road has been travelled. Expert 9

Some experts, while acknowledging the progress achieved, tended to raise the same aspects which prevent bigger progress. Accordingly, very specific aspects were mentioned (e.g. communication with contractors or the regulation of waste imports, or requirements on the capital structure of WtE companies). It is understood that such specific aspects were mentioned by representatives of groups involved in the development of WtE. Here, some differences emerge in the attitude: experts working in the WtE industry tend to emphasize the potential of WtE as a specific business, and therefore see the regulation of the import of additional "raw material" for their company as a kind of obstacle. Meanwhile, experts more familiar with public attitudes and behavior also pointed to the internal problems of "waste logistics", where they said that the delayed emptying of waste containers can have a demotivating effect on the behavior of the general public, as the lack of a place to dispose of the waste can lead people to dump it anywhere.

- Problems with contractors, control of waste imports from other countries. Expert 24
- Answer to the question is – valid requirements for structure of capital. Expert 14
- Particularly a problem in apartment blocks, because there are always overflowing containers, and a person coming with several different bags of rubbish finds overflowing sorting containers, and has to put the rubbish in one common container. This should be a much more frequent waste collection, for example in the cottages the plastic is collected once a month, so the bins are often overcrowded, next to the overload, and the wind carries the rubbish, and in the mixed bins every week, people see that everything doesn't fit anymore, and they throw it all in the mixed bins, even though they would like to sort the plastics. Expert 8

It is worth noting that the progress of the WtE has been accompanied by another critical point. While many experts acknowledged the technological progress of WtE, there were some who identified the need for even greater technological progress, particularly in terms of environmental impact. At the same time, it was again pointed out that the country lacks a more coherent approach to the management of public interest, i.e. the lack of priorities and investment suggests an inconsistency in the prevailing management of public interest.

- More technological progress is probably needed to foster WtE applicability and to increase their public acceptance as cleaner alternatives of waste management. Expert 11
- Because it is not desirable. On the issue of biogas plants, there is no incentive for farmers to use anaerobic digestion as a substitute for mineral fertilisers. Expert 28
- The technology itself is developed well enough. It is no more polluting than the production of other types of energy products, and at the same time solves other problems. But it does not tackle the problem itself, i.e. reducing the waste. It is about dealing with the consequences of the problem, but not about reducing the problem itself. It is necessary, but as a supporting measure. If left unchecked, it can become counter-productive - encouraging consumption, increasing waste, etc. The whole point is to reduce waste. Expert 30

Today, Lithuania, along with EU, is struggling with - greenhouse gas emissions or the growth of waste as a source of pollution. High-temperature combustion/incineration technologies are therefore in demand because they contribute to achieving these goals. However, according to experts, the emergence and growth of secondary or tertiary recycle and reuse technologies is creating tensions that are likely to intensify in the future. Sorting and recycling are not yet as advanced as incineration (either technologically or in terms of societal behavior), they are still expensive and complex technologies, while the application of incineration is relatively simple and already provides benefits. On the one hand, it is very much in line with the public mentality of "you don't need to sort or bother with recycling, just compact it and bring it to us for incineration and you can even enjoy cheaper heating". On the other hand, it is important to look at the bigger picture and future perspective, and not to forget to look at the benefits in terms of sustainable development and sustainable growth.

- To date, the capacity to incinerate waste has been mapped out and the quantities of municipal waste we need to recycle have been calculated. The part that is generated after the mechanical biological treatment plants will not be eligible for recycling activities, which means that the aim should be to divert as much of the fraction generated as possible to recycling and to minimise the need for disposal operations. <...> The European Commission was concerned that incineration can in no way replace recycling activities. And to this end, a restriction was put in place that all separately collected waste, recyclable waste, cannot be diverted to incineration, because we are losing a very important, key resource, and if we divert a lot of our investment to incineration, then it means that there is not enough to divert the investment to recycling operations. And waste has become very complex, it has become complex, it requires technological progress in this area, to adapt to that. Expert 25
- For the Vilnius and Kaunas CHP plants, it was calculated that waste from municipal waste treatment would be used. But the problem is that they have received money on that basis, but they are not always going to burn what they generate, and that is one problem, because they are paying more for it. And that is the challenge, because they say that they are not waste managers, even though they have received money as waste managers. Expert 26
- I would say we can go towards incineration, but don't forget sorting, recycling. So yes, there is a certain danger, a certain conflict, because the technologies will improve and start competing with each other. Many people may say - why don't you allow us to develop and provide tangible benefits to society? However, it must be understood that this [incineration] is an intermediate solution, especially when we do not know how other technologies will

develop or what other technologies will be discovered that can provide even more intensive and efficient use of the waste. So maybe it is not worth introducing incineration plants because there may not be anything to incinerate. Expert 18

Summarizing the experts' views, several different levels of acceptance or rejection of WtE in Lithuania emerged. The first one (not in order of importance, but in random order of experts) relates to the country's international commitments and the domestic response to global trends. The expert pointed out that this practice should be followed when developing WtE in Lithuania. This would help to adopt international practices, tap into broader markets, take advantage of technological advances, and represent globally agreed environmental priorities. The second expert highlighted the internal processes taking place in Lithuania, using examples to illustrate the links between consistency in problem administration and business competition. According to him, even with the infrastructure and technology in place, the smooth functioning of WtE can be hampered by the incomplete and (un)clearly defined (and perceived) roles of market actors. A third expert proposed a different perspective for assessing the development of WtE in Lithuania, introducing not only the dimension of sustainable development, but also a time perspective. He suggested that the technology should be evaluated alongside the evolution of society and the country's energy system, trying to predict future energy demand, the growing green energy balance and the emergence of other innovative technologies.

Suitability of Lithuanian infrastructure (including market size and logistics) for WtE development

After discussing the insights of the research participants on the general situation, the advantages and disadvantages of the technology, this part moves on to a more detailed analysis of WtE prospects, asking experts to assess the suitability of the Lithuanian infrastructure for the development of WtE. In this respect, differences in views between experts emerged, with a strong proportion saying WtE is suitable (or more suitable than not suitable at all) for Lithuania, while another strong proportion of participants said the opposite - it is rather suitable (or not suitable at all). Although it is not appropriate to use quantitative arguments in a qualitative study, it is noteworthy that the experts were almost evenly divided on this issue. Let us look at the arguments used by the different experts to support their opinions.

The group that was positive about the WtE infrastructure spoke not only of its sufficiency, but also of its reasonable and thoughtful development. Among the experts, the issues of waste collection and the importance of the attitudes and behaviour of the population dominated, to a lesser extent the efficiency or applicability of WtE technology itself.

- I think there is a lot of potential to develop WtE in Lithuania, but there needs to be a clear assessment (cost-benefit analysis, SWOT analysis). Such an assessment could lead to a broader discussion. Expert 27
- I think that we already have sufficient infrastructure for WtE. Gasification is the same as incineration, but with a different name. Expert 2
- There are separate containers for textiles, but their system is not adequate. Mostly the sorting containers are full, not emptied on time, too few, not convenient for the residents. Expert 6
- The system for collecting waste from residents in Lithuania is largely up and running. The network of waste containers in residential areas is indeed extensive. The network of bulky waste collection sites is also sufficient, but their performance could be significantly improved in terms of customer friendliness. As these sites are 'government-run', the attitude of their staff towards customers is 'government-run' in the worst sense of the term. A unified information system for the accounting of products, packaging and waste is a necessary system, but one that needs to be strongly improved. Because it has also been developed "governmentally". Expert 20

- Almost all developed European countries have the right infrastructure for the development of WtE, i.e. waste collection systems and road networks. Lithuania is no exception. Expert 11

Another group of experts, more critical of Lithuania's infrastructure and the development of WtE, talked about improving the existing waste collection system and the problems of excess and accumulation of waste itself. They reiterated the argument that WtE plays only an intermediate role in the overall waste management chain and only addresses the consequences of the problem, not the causes.

- It seems to me that there is still a lot of room for improvement in the sorting system itself, not that we are throwing away glass in general, but that we are somehow bringing it back to the market. Expert 9
- The most problematic thing is the primary packaging, and there are different types of packaging - combined, different types of plastic, and not all of it is recycled. Well glass is all right. Paper is, let's say average, because I would assume that a lot of contaminated paper comes in, but technology is improving, so it's separating now. Electronics also have a system. Well, maybe the bigger problem is hazardous materials, people don't know where to put them, various aerosols, paint residues, but overall, in terms of the bulk of the waste, it is a fact that combined packaging is the biggest problem, mainly food packaging. The results of the walk around our country "For a Clean Lithuania!" during the Walk for Walking for Life, half of the total amount of waste found is food packaging, 53% of which is food packaging, 28% plastic, 13% metal, 4% glass, 2% paper food packaging, which is the largest in the waste stream. Expert 8
- Lithuania lacks infrastructure. Alytus, for example, has recently invested heavily in residential waste collection and sorting. It would be interesting to see how they are doing now. They have bought a lot of waste sorting bins and issued them to people for home use. At the same time, they have broken a lot of stereotypes about stink... This is of course related to the mentality of society, but both lend themselves to the desired change if acted upon in a purposeful and deliberate way. Expert 23

Despite the perceived shortcomings and the imperfections of the existing infrastructure, experts spoke of the potential of the technology. In this case, the study participants attributed the barriers to the development of WtE not so much to the technological infrastructure itself, but to the behaviour of society and the complicated structure of the waste itself, in particular combined packaging, which is rather problematic to manage. So-called "contaminated waste" complicates the whole process considerably and, according to experts, limits the potential of WtE. Interestingly, end-users of the technology and, to some extent, policy makers were more positive about the future of WtE in Lithuania, while other groups were more reserved.

Summary of the interview results

Experts agree that WtE is an excellent solution for managing a large part of the waste that cannot be recycled, but it is part of a larger process. That is to say, you cannot isolate one link and disconnect it from the chain. Thus, WtE should also be seen as part of a wider waste management process. Sorting, recycling and incineration should all be balanced and not seen as separate and independent or unrelated businesses. According to the experts, it is important to distinguish between incineration and WtE. Whereas waste incineration is not recognized as part of the circular economy, either at directive or strategic EU level, WtE is. This is important to distinguish. WtE are second generation biofuels such as biomethane, made from all non-food products.

Regarding the suitability of the existing infrastructure in Lithuania, WtE experts pointed to the historical situation. In Lithuania, a 10-region waste management system was created, based on the counties that existed at the time. Regional landfills were built accordingly. Today, however, the situation has changed fundamentally. There are three WtE plants in Lithuania

and most of the waste should go there. This situation calls for a "system reboot" because the 10 regional waste management centres do not meet the country's waste management priorities and have no prospects. When discussing what should be done, experts suggested that sorting could be abandoned in these regional centres and that already sorted biogenerating waste and biomass could be transported there. The machines that brought the fuel could be loaded with unsorted waste and transported for treatment to WtEs in major cities, where some of it would be used and some of it would be returned after sorting. Although experts acknowledged the limitations of such a proposal, as it would not solve the fundamental problem of waste collecting, it would generate gas and therefore benefits.

According to experts, the potential for WtE development is strongly linked to infrastructure and public sorting habits. Both aspects require attention and concrete solutions. According to the experts, if high quality in sorting is reached, mechanical biological treatment would not be needed in waste management, which would significantly reduce the cost component. Sorting of food waste and degradable waste is very important, because once they are mixed in the general stream, they cannot be used in compost because they are contaminated with heavy metals. By contrast, sorting them in mechanical biological treatment plants allows them to be transformed into energy products. Otherwise, and this is the most common case, it goes to incineration. Experts believe that the largest waste generators are the major cities - Vilnius, Kaunas and Klaipėda - but none of these cities have biogas generators.

Some experts highlighted WtE as a niche of a specific business opportunity. If WtE is developed exclusively as a business, the whole coherence and sustainability of the waste management process is jeopardized by this concept. The criticism is based on the natural business imperative for profit, but the risk is that the profit motive will lead to an increase in production volumes, i.e. burning as much waste as possible, converting as much waste as possible into heating (or other energy products), while arguing and emphasizing the benefits of the technology in terms of solving the strategic challenges (e.g. reducing pollution, reducing waste and generating heating for the town). However, the dominance of WtE is likely to have a negative impact on other waste management sectors such as sorting and recycling. Thus, WtE should also be seen as part of a broader waste management process. Both sorting, recycling and WtE should be balanced and not seen as separate and independent or unrelated businesses.

Summarizing the aspects of attitudes towards WtE among different stakeholder groups in Lithuania, some differences of concern about the future of WtE in the country emerged, but no principle differences in the assessments were evident. All groups seemed to agree on the potential of the technology in waste management, and there were no those who categorically denied it. Different groups rationalized their views with arguments closer to their background (e.g. environmental activists with ecological arguments, public researchers with public attitudes and behavior, policy makers with problem administration and management, etc.), but all the groups were quite familiar with both the technology and the more general situation in the country.

3.2 Review of the focus group discussions

Due to the covid-19 issues followed by the variety of restrictions, there were held a few focus group discussions. The decision was made to meet requirements and respect the availability of participants. The goal of the focus groups is to understand the drivers of adoption/rejection of WtE technologies in Lithuania. One of the focus groups was held in particular with representatives of the Alliance of Lithuanian Consumer Organizations on (M13). The Alliance of Lithuanian consumer organizations established in 2012 unifies 12 consumer associations. Another focus group discussion was held in parallel with one of the outreach events held at VMU December 1st, 2021 (M15).

The discussion with the representatives of the Alliance of Lithuanian consumer organizations was held in a remote mode. The discussion was attended by three people who are not only representatives of the organization, but also have other activities: business management, financial management and one of them is working at the European Economic and Social Committee. The discussion took approximately half an hour.

First, the participants of the discussion were briefly introduced to the project, the main objective of the project and the goal of the discussion that is the understanding of the drivers of adoption/rejection of WtE technologies in Lithuania. The desire to live more sustainably, to have a bigger share of electricity produced domestically and cheaper heat was mentioned in the discussion of the factors that contribute to a positive public attitude towards WtE.

Another important factor may be that the public wants amount of garbage not to be grown in landfills. The latter, together with waste management, is understood as one of the most important environmental problems in the country.

On the other hand, representatives of the Alliance of Lithuanian consumer organizations expressed opinion that society is concerned about waste incineration. It might be an issue to perceive the incineration process whose residues can be dangerous to the environment and the people living nearby. A few years ago, this attitude was followed by the public protests against waste incineration in Kaunas region. Participants of the focused group discussion noted that it is quite difficult for the public to have positive attitudes towards WtE adoption simply because of a lack of information.

Proper information would not only provide a better understanding of WtE processes, but also the waste management itself. The participants of the discussion especially emphasized comprehensive information and education about waste management in general. This would provide knowledge and encourage the habit of proper sorting. The latter is important primarily for the achievement of a larger scale of circular economy in Lithuania. Incineration should become more acceptable to the public, but only as a last option, when nothing else can be done with waste that is left.

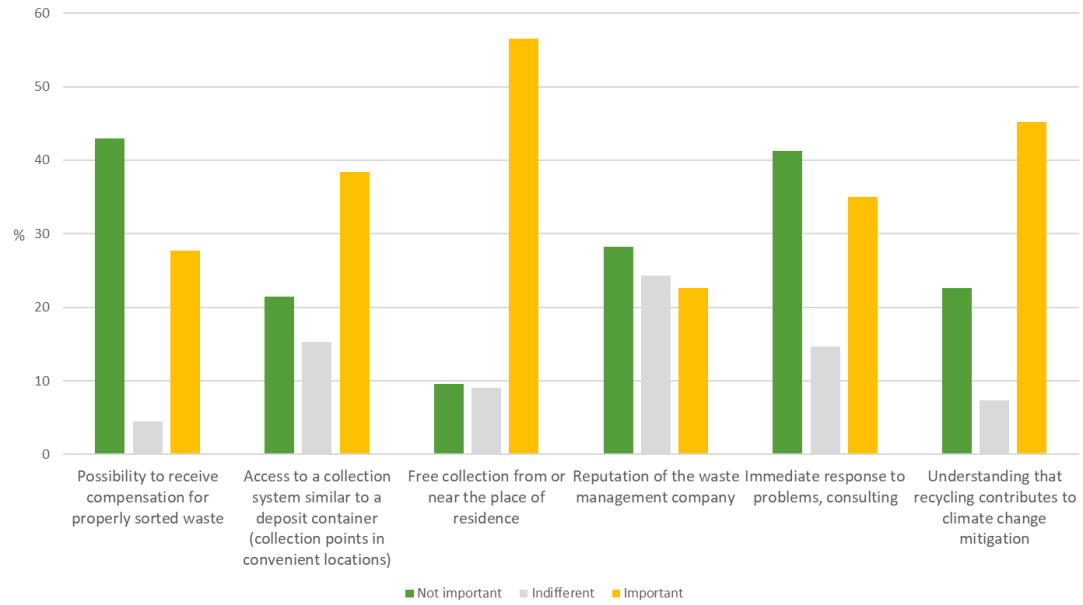
The focus group discussion that was held in parallel with one of the outreach events have showed pretty much the same results despite the fact that the group composition differed significantly. There were 9 participants representing households, small and medium enterprises, technology developers, researchers from several institutions of highest education, a former environmental policy maker, others from civil society. The discussion lasted one hour and a half. The participants of the discussion emphasized the same drivers of adoption/rejection of WtE technologies in Lithuania. It is worth noting that the emphasis on the need for the educational activities was prioritized together with the paying of attention to some risk. The risk behind informational and/or educational campaign is that society might perceive the campaigns negatively, as propaganda or "*green brain washing*". It is therefore necessary to get known the audience very well. Based on this, the information and education can be provided throughout a well design campaign. Otherwise, a campaign can do more harm than good because there is mistrust in waste management. This sense of mistrust is diminishing, but it still exists. It has also been mentioned several times that waste incineration should only be an option when the potential of the circular economy is exhausted. The public should also be educated about this.

The participants of the focus group discussion pointed out that in addition to information and education, there are also very practical things. Among the practical things are such as assistance in waste management: a sufficient and convenient network of public sorting containers, easier ways to manage hazardous and bulky waste. Such waste is generated less frequently, and its dimensions can cause inconvenience when people would like to properly manage their waste. All the practical issues should be solved in a way that is primarily convenient to the society because convenience plays a crucial role in encouraging to manage waste in a proper way.

3.3 Review of the survey results

The quantitative approach was not initially planned, but it was decided to conduct a survey. This helped to reach a broader audience meeting the covid-19 challenges. After a survey was made, a scientific paper was prepared and published[5]. Therefore, the presentation of the results is taken from the published paper:

The acceptability of any new energy technology and scale of involvement are crucial for moving towards a climate-neutral society and the circular economy. On the one hand, a large part of the public tends to support these developments. On the other hand, a significant share of society is also reluctant to take an active role in the processes taking place in the energy sector and contribute to the achievement of generally accepted goals more quickly. There is a prevailing belief that institutions and companies are primarily responsible for the world and its future, but not customers with their consumption and behavioural habits. Also, the preconditions for consumer involvement lie in their perceived benefits, which are not limited to the economic or functional value dimensions, but also include emotional and social ones. There is also a need to communicate and educate about the benefits to be perceived. Therefore, the study aimed to determine important aspects of utilizing the value perceived when aiming at consumer involvement in the processes taking place in the energy sector. Research on involvement in the energy sector, driven by the concept of value and value utilization, has only recently begun and is not abundant. Therefore, an exploratory research strategy was applied to achieve the aim. This strategy is applicable to study the indeterminate relationships between the variables, identify possible directions for further research, and form initial insights. The quantitative survey method (N=133) used to determine consumer preferences. Analysis of the results showed that the free collection of the waste from or near the place of residence has been identified as a key factor in assessing the decision to sort waste, and the second most important factor is the understanding that this activity contributes to mitigating the negative effects on the climate. The third most important factor is the availability of a system similar to the collection of deposit. It can be argued that the most important factor in the decision to sort waste is related to economic value dimension, then with emotional and finally with functional.



[5] Pažėraitė A., Repovienė, R., Grigaliūnaitė, V. Vertės įveiklinimas įtraukiant vartotojus į energetikos sektoriuje vykstančius procesus = Utilisation of value for the consumer involvement in the processes of the energy sector // Energetika = Power engineering. Vilnius: Lietuvos mokslų akademija, 2021, T. 67, nr. 1-2, p. 20-34. Doi: https://doi.org/10.6001/energetika.v67i1.4533

Figure 3.2: Factors making influence on the proper waste sorting

In addition, the importance of factors also depends on the age category: in the age category of 18-29 years, emotional value dimension occupies a more important place, while in the 30-39 and 40-49 years age groups economic value dimension plays more important role. The analysis of the results also revealed that information on waste sorting should be communicated more intensively and clearly, especially on official institutions‘ websites or on social media accounts of institutions and in online media.

4 Summary and generalization of study results

The study helped to identify the following stakeholders' groups: policy makers, waste providers, WtE technology providers, WtE service providers, WtE producers and WtE users.

There were applied three research methods to collect opinions of the representative panel of the identified Lithuanian stakeholders on awareness and insights about WtE technologies in Lithuania. The stakeholders take on WtE development in Lithuania could be summarized in SWOT analysis

	From technological point of view	**From strategic/public interest point of view**
Strengths	WtE is an effective and efficient method to deal with waste suitable for current infrastructure in the country.	WtE is a well-developed technology which already is beneficial (corresponding with strategic interests).
Weakness	WtE reduces the development of other waste management methods as sorting and recycling.	It is difficult to reveal full potential of WtE due to public mentality (unwilling to sort the waste), lack of proper education and well utilised driving forces, waste logistics (separation of contaminated wasted) and administrative (lack of unified governing strategies) reasons in the country.
Opportunities	WtE is relatively easy integrated and balanced into current energy infrastructure as a part of an extensive waste management process.	WtE mediates energy demand and increases green energy in overall energy balance in the country.
Threats	WtE tends to grow into specific business industry which interest might contradict with strategic goals of the country.	WtE has uncertain future in the light of other technological (waste management) progress and changing consumer attitudes and behavior.

The overall results show that WtE is perceived quite positively from those stakeholders that are more closely related to the issue at hand. On the other hand, there is seen a slight concern towards possible conflicting situation between WtE and circular economy.

It is worth mentioning, that society feels held hostage to unsustainable consumption habits due to ineffective promotion, education. Therefore, the growing interest of young people in sustainable consumption, proper waste management and similar issues offers the prospect of a greater breakthrough in the adoption of innovative technologies that support sustainability.

Appendix

A. The questions of semi-structured interview.

Sections of the questions	Questions
1) Introductory, general questions	Which model of waste management would be the best for Lithuania in your opinion? What are the biggest challenges / opportunities in developing WtE in Lithuania? Describe the development of WtE in Lithuania from energy security point of view?
2) The main, specified questions addressing the problem	What is stopping from making tangible progress? Whether and why Lithuania is failing? Could you assess the suitability of Lithuanian infrastructure (including market size and logistics) for WtE development? WtE is being presented as a sustainable business niche in the media relating it to the context of the EU green deal, but is it really so from an environmental point of view? WtE is designed to deal with the consequences of consumption, i.e. manage the waste, but as this grows into a business niche, what impact it might have? Will it not lead to an increase waste consumption? How would you assess the role of society (both in terms of attitudes and practical behavior) in the context of waste management and further development of WtE?
3) Additional, broader questions	Could you assess the response of civil society (both in terms of attitudes and practical behavior) to the development of WtE (how does this help or hinder)? In your opinion, what are the most likely benefits of the EU green deal for Lithuania?

B. A full list of research participants

Code	Stakeholder group	Expertise	Activity	Type of interview
Expert 1	WtE (end) user / Waste providers	3 years environmental activism	Young specialist	Interview
Expert 2	WtE (end) user / Waste providers	6 years environmental activism	Young specialist	Interview
Expert 3	WtE (end) user / Waste providers	4 years waste management	Young specialist	Interview
Expert 4	WtE (end) user / Waste providers	4 years public behavior in waste management	Young specialist	Interview
Expert 5	WtE (end) user / Waste providers	4 years energy marketing	Young specialist	Interview
Expert 6	WtE (end) user / Waste providers	10 years sustainable development and environmental activism	Social entrepreneur	Interview
Expert 7	WtE (end) user / Waste providers	23 years environmental public behavior researching	Market and society opinion researching	Interview
Expert 8	WtE (end) user / Waste providers	15 years energy and sustainability marketing	Social entrepreneur	Interview
Expert 9	WtE (end) user / Waste providers	8 years environmentalism communication	Communication manager	Interview
Expert 10	WtE (end) user / Waste providers	10 years environmental protection	Social entrepreneur	Interview
Expert 11	WtE (end) user / Waste providers	12 environmental activism	Independent analyst	Self-filling
Expert 12	WtE (technology) user / Waste providers	10 years sustainable development	Food industry representer	Self-filling
Expert 13	WtE (technology) user	Heating sector	Director of commerce	Self-filling
Expert 14	WtE (technology) user	Heating sector	Head of service quality	Self-filling
Expert 15	WtE (technology) user	Heating sector	Medium level decision maker	Self-filling

Expert 16	WtE (technology) user / WtE producer	Heating/electricity sector	Medium level decision maker	Self-filling
Expert 17	WtE (technology) user / WtE producer	Heating/electricity sector	Medium level decision maker	Self-filling
Expert 18	WtE researcher	28 years, Ecology, environmental researcher	Chief researcher, natural science, ecology	Interview
Expert 19	WtE researcher	30 years, energy and energy technology research	Scientist, natural science, energy technologies modelling and monitoring	Interview
Expert 20	WtE researcher	25 years environmental consciousness and public behavior research	Scientist, Social sciences, sociology	Interview
Expert 21	WtE researcher	20 years civic movement and environmentalism research	Scientist, social sciences, sociology	Interview
Expert 22	WtE researcher	18 years energy and sustainability consumerism research	Scientist, social sciences, economy	Interview
Expert 23	Policy makers	30 years environmental activism/protection policy development	Top management, Ministry of environment	Interview
Expert 24	Policy makers	12 years decision making	Governmental sector	Self-filling
Expert 25	Policy makers	10 years international policy analysis and implementation	SNE at the European Commission, DG Environment	Interview
Expert 26	Policy makers	12 years WtE situation monitoring and policy implementation	Environmental specialist, VAATC	Interview
Expert 27	Policy makers	20 years policy making, decision making	Governmental sector	Interview

Expert 28	Waste provider / energy user	Circle economy activist	Civil society sector	Self-filling
Expert 29	Technology developers and service provider	University and business	Applied research	Interview
Expert 30	Technology developers	35 years energy and energy technology and policy development	Top management, Lithuanian energy institute	Interview
Expert 31	Technology and service provider	University and business	Applied research	Interview
Expert 32	Technology and service provider	Former Enerstena	Applied research	Interview