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Designing an online interactive national energy and climate policy simulation tool to enhance the policy decision making process

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ABSTRACT

The complexity of energy systems creates significant challenges for policymakers and other stakeholders. Accordingly, methods, tools and simulation models with various degrees of effectiveness are available to analyse and forecast behaviour of such systems. However, to develop systems thinking capabilities, simulation models must be accompanied by interfaces or other tools that guide, provide feedback and support learning. This study aims to answer how to design a national energy and climate policy simulation tool that can effectively serve as a decision-making tool for policymakers and other stakeholders. This study reflects how 22 respondents distinguishing between policymakers, energy and/or climate practitioners, and other stakeholders were assigned to develop policy strategies for two roles – dark greens and bright greens. Simulation results showed that the absolute majority did not manage to fulfil the objectives of the task, and being a policymaker does not guarantee the successful outcome of the chosen simulation scenarios. Rather, it depends on whether the respondent understood the correlation between the chosen scenarios and achieved results. In addition, and for comparability of the results this study was compared to previously made research for the target group of students who studied Environmental Engineering Master level course 'Environmental Policy and Economics'.

Keywords

Energy system modelling;
System dynamics;
Policy simulation tool;
Policy making interface

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1. Introduction

According to the Paris Agreement [1], the increase in global average temperature 2 °C above pre-industrial levels can be prevented by rapid decarbonization. However, greenhouse gas emissions are not declining enough to meet the goals of the Paris Agreement [2]. An unprecedented energy transition towards a decarbonized and sustainable energy system is required to halt global warming [3]. To tackle climate change, National energy and climate plans were introduced in the EU [4].

Energy transition as a national decarbonization strategy is very complex due to the interconnection between supply and demand sectors and the challenges they are facing [5]. It is difficult for people to understand both simple systems [6-8] and more complex nonlinear feedback systems with delays [9] because people tend to think in linear, non-feedback terms and do not realize the presence of dynamics controlled by feedback loops [10-12]. When dealing with complex feedback systems, policy makers struggle with estimating the effectiveness of policies due to various misperceptions such as wait-and-see approaches [13], misjudging time delays and disregarding the unintended consequences of policies [14], beliefs in "silver bullet" [15-16].

In many systems, short term solutions often harm the system in the long run [17]. Quantitative modelling techniques are used to support decision-makers for both short term and long-term policy pathways [18]. However, taking into consideration climate goals, the evaluation of long-term scenarios is becoming increasingly important [19]. Research [20] shows that instead of implementing policies that might mitigate climate change risks, decision

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List of Abbreviations

F	*Ratio of variances between multiple samples*
P	*Probability*
η^2	*Eta Squared*

makers rely on providing more information, which does not always lead to more effective action. This results in dealing with problems as they arise rather than planning strategically to avoid them, capability traps that deplete the resources needed for ambitious climate action [21], greenwashing [22], implementing policies that are unclear, relying on unproven policies that diminishes the effect, are not climate neutral [23], or take no action [24].

Learning about climate policies through interactive approaches can trigger action [25]. Jones et al. [26] found that decision-makers need simulation tools based on science that assist them to learn by themselves how a climate neutral economy can be achieved. Simulations offer compressed or expanded time and space, allowing policy makers to simulate various effects that might take decades in a few minutes. When dealing with the national energy systems' transition towards climate neutrality, the simulation is the main way how to discover how this complex system works and where high-leverage points lie while improving decision-makers mental models [27-29].

Numerous energy system modelling tools are available [30-32] and they are in permanent development due to new technological advancements and the challenges faced by the energy transition. Models integrated in the tools are a representation of a natural system [33]. Review [34] on energy modelling tools revealed that the use of commercial and non-open-source freeware prevails in direct policy applications. Energy modelling tools used for direct policy-support are more likely to provide graphical user interfaces, whereas in modelling tools used indirectly for policy support applications, direct coding is applied. The main target audience for direct policy support are private and commercial users, academics, government, and public officials, while indirect policy-support is for academic users.

Policy and decision support should be at the centre of research targeting the application of modelling tools. Review underlines the need for further research to identify features and user needs in policy-making processes where modelling tools are applied to real life decision-support. This need goes beyond access to open code as modelling tools should provide support to a more active engagement with a various actor who actively contribute to the energy policy debate by applying modelling outcomes, i.e., modelling tools help to support energy policy and further investment decisions, ensuring the created systems reliability [35]. They can also help to validate the application of energy system modelling tools in the real-world settings.

National climate and energy policy simulation tool for Latvia (the Tool) was developed to serve as a simulation tool to support policy decision making for Latvia's National Energy and Climate Action Plan 2021-2030. As a human behaviour is complex and dynamic [36], and societal and behavioural aspects are considered in system dynamics-based models [37], the Tool is built as a system dynamics model in Stella Architect software and is grounded in state-of-the-art energy science. It is fully documented and is described in more detail in a previous research study [38].

The simulation model of the Tool tracks greenhouse gas emissions compared to the national climate goals 2030 (cumulative energy savings and RES share) in energy demand sectors (residential, tertiary, industrial, public and transport) and supply sector, and allows users to define their own policy scenarios by running it in live mode to immediately see their effect. It is calibrated against historical data. The mathematical model is supplemented with user-friendly interface, enabling users to explore a wide variety of assumptions and policies as they create their own policy scenarios (Appendix Figure 1-3). Since its launch in June 2021, the simulation tool has been used by the national policy makers, Environmental Engineering Master level students and is also integrated into massive open online course on Energy and Climate.

However, for energy system modelling tools to help its users solve energy transition challenges, their functionality and interface should be effective, understandable, and user-friendly. Accordingly, this study is a continuation of previous made research on the Tool's usage among students of the Environmental Engineering Master level course 'Environmental Policy and Economics' as an experiential learning approach [39]. The results of this previous study are compared to the results of the abovementioned research in the Section 3.

More specifically, this study aims to answer how to design a national energy and climate policy simulation tool that can effectively serve as a decision-making tool for policymakers and other stakeholders. To answer the research question, the authors tested the Tool's usability. According to the definition: "Usability is the "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use." [40]. For this purpose, was used one of the most popular user-based evaluation methods - usability testing [40]. However, the second method was adapted specifically for the current case, namely instead of standardized questionnaires (which are widely used for UX evaluation) [40], a feedback survey was created and applied.

The study starts with a detailed description of the methodology in the Section 2, describing the steps of usability testing, which starts with a proper selection and direct addressing of the respondents, providing them a precise assignment and rules for its fulfilment. Further, the Section 3 provides the analysis of the results, starting with a comprehensive description of the respondents and following with an analysis of the assignment results and its comparison with the student's results from the previously made research. The final part of the results consists of an overview of the answers to the closed questions regarding the Tools' usability, as well as answers to the open questions and their analysis of statistical differences using the software JASP 0.18.3. The final part of the Section 4 consists of conclusions and recommendations, providing a positive evaluation of the usability testing and surveys as a method to reveal the key to successful design of the Tool, while concentrating on the solutions primarily for policymakers.

2. Methodology

The main goal of the methodology is to help to identify and assess the usability of the Tool. Two user-based evaluation methods are applied – usability test with the fulfilment of an assignment and customized feedback survey. For the usability test being carried out, it was needed to identify the respondents. However, identifying was made by choosing the potential target group for the usage of the Tool, for the means of comparison of the results for the research were chosen, respondents, who are not related to the energy and climate sector were chosen. Respondents received precise assignments and achievable goals via the simulation running. All the results received were accompanied by a survey and screenshots of the simulations that allowed to make conclusions and recommendations. Diagram 1. below reflects the complete methodology applied and is further described in detail.

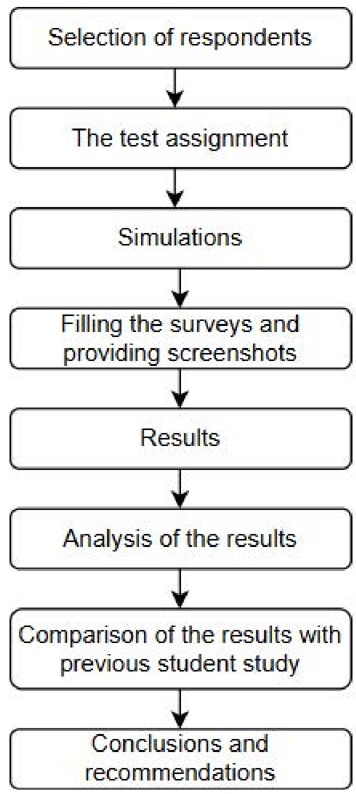

Diagram 1. Interconnection of methods applied.

2.1. Selection of respondents

Respondents were identified based on their professional activity and knowledge in energy policy planning and potential interest in the usage of the Tool. The first user group of respondents were policymakers as their daily professional activities were related to policy design. The second group includes energy and/or climate experts. Although they do not perform policy planning, they have relevant knowledge in the field. The third group of respondents includes representatives of various other professions that are not related in any way to the energy and climate sector. The last two groups were selected to compare the level of coincidence and similarity of assignment and survey results between policymakers, professionals and non-professionals in the energy and climate field. The sample size of each tested group was typical, and as the testing was a single shot, the goal was to reach as many respondents as possible for each of the group [40].

2.2. The test assignment

The Tool's usability was tested in all three groups. The test assignment was formulated in such a way that it reflects the tasks that policy planners face in policy planning. Namely, the assignment was represented the type of tasks that are typical for the Tool users to perform [40]. The description of the task was brief and unambiguous. Respondents were asked to access the Latvian language online version of the Tool. No training or explanation was provided prior to the task fulfilment. Short video instruction is available on the second page of the simulation tool, and descriptive information about each policy measure is provided in the interface of the Tool as a pop-up button with a question mark. The task was to choose between different policy measures to achieve national energy climate and energy goals (set by (Latvian National Energy and Climate Plan updated project) [41]) cumulative savings of 29,522 GWh in all sectors, as well as reach the share of RES – 57% by 2030.

All respondents were assigned the same task to develop policy strategies from the perspective of two roles representing two different ideologies. The roles of ideologies were selected to reduce the impact of respondents' bias caused by their own political and ideological beliefs on their choices. Two opposing ideologies were chosen to demonstrate to respondents how different sets of policy measures presented in the Tool led to achieving national goals. The assigned ideology roles were:

a) dark greens – society representatives who believe that climate change problems are caused by industrialization and capitalism. They believe that population reduction and slowing down technologies can reduce the negative consequences caused by the biosphere [42].
b) bright greens – representatives of the ideology that supports radical growth of the economy and political involvement in new technologies and innovations, while also being sustainable. This ideology has appeared lately and does not support any solutions that do not guarantee prosperity. They believe that support to innovations and metropolitan modernization will transform human lives [42].

The tested groups had to upload interface screenshots of their simulations and results. Simulation results developed by each respondent were evaluated as costs of a selected set of policy measures against the cumulative energy savings goal and RES share goal and how a selected set of policy measures reflects each interest group. Respectively, for dark greens the focus should be on reduction of population and GDP growth supplemented by state-imposed reduction of technology use. However, for bright greens policy measures should focus on the introduction of the latest energy efficiency and RES technologies regardless of costs.

2.3. Survey

After the assignment, the respondents were asked to fill out the survey that was designed specifically considering the structure and content of the Tool, providing both closed and open questions while giving the opportunity for respondents not only answer whether the Tool allowed the respondents to reach the set goal but also provide the explanation and extended opinion about the Tool [40]. The survey was created using the survey administration software "Google Forms" provided by the internet browser "Google Chrome". Access to the survey was possible only by using the received link. The survey contained nine closed questions (answer yes/no), three questions about respondents' credentials, and 12 open questions (Appendix Table 1). Open questions were used to observe respondents explanations about their chosen policy measures and simulation scenarios, as well as to reveal their opinion about the Tool's functionality. The settings of the survey ensured that respondents had to provide written responses to all questions with no option to skip any of them.

3. Results

The results are described starting with a detailed review of respondents of the assignment, their occupation and continuing with the description of the validity of their simulations. Further is given an analysis of the respondents submitted simulations of policy measure scenarios. In conclusion of the results section in detail are described respondents answers to closed and open questions regarding the technical characterization of the Tool.

3.1. Respondents

The assignment and the survey were sent directly via electronic link to 42 persons with a note that it could be disseminated to other potential respondents. 22 persons submitted results. However, the remaining 20 persons replied that did not feel competent enough to test such a tool.

Respondents submitted 259 screenshots of policy scenarios and 528 answers to the survey. To analyse the abovementioned results of the survey, Microsoft Excel spreadsheet and statistics program software JASP 0.18.3 were used.

Among policymakers, 13 of them submitted the results. Four of them represented housing policy (including energy efficiency of buildings), four were related to energy and climate policies, one from strategic planning, business development unit, one from EU funds/recovery funds support program design unit, one from general municipal policy, one related to economics and one related to EU fund support program design for energy efficiency of buildings.

Regarding energy and/or climate experts, three of them participated in this study, representing wind power industry, environmental engineering, and energy and climate NGO). They had no prior experience with the Tool. Despite the small number of respondents in this group, they represented different fields and showed interest in participating in the study as they saw the potential of using the Tool and counted themselves among the interested parties.

The third group of respondents (6 persons) represents other industries, and they constitute almost a third of all respondents who submitted the results. Three of them did not indicate their occupation, however, none of them are related to the energy and/or climate industry or policymaking. Those who reported their occupation are related to consumer loans, agriculture and IT sector.

3.2. The assignment results

This section includes a detailed description of the results, starting with an evaluation of the validity of the received results of simulation scenarios. Meanwhile, in further subsections are analysed the results of scenarios of stakeholder groups and comparing them with students results from the previous made studies. In conclusion of this section are included the results of the survey and evaluation of statistical differences in the views of stakeholder groups regarding different quality and technical indicators of the Tool.

3.2.1. The validity of results

All respondents developed policy strategies and sets of policy measures according to ideology roles with various degrees of activity and success. Table 1 provides a description of the validity of the results.

Further are described the results distinguishing between this study's stakeholder groups and students from the previous made studies, as well as their ideology roles [35].

3.2.2. Cumulative energy efficiency and total cumulative costs

First, were analysed the results of the goal reached by the respondents in each ideology role and the differences in the costs of their chosen policy scenarios. One tendency was approved is that achieving the assignment goals can be fulfilled with different costs, and for both respondent groups – stakeholders and students in both ideology roles the starting point of costs is similar (Figure 1 and Figure 2).

However, the differences appear regarding the goal reached number of respondents. Respectively, for the dark greens ideology role, Figure 1 illustrates the differences in the costs of the chosen policy scenarios for dark greens for the stakeholder group who achieved both goals of the assignment, i.e., cumulative energy savings of at least 29, 522 GWh and RES share 57% on the one hand, and for students who achieved their assignment of reaching 18, 800 GWh and RES share 45%.

The comparison of the results shows that students had a higher number of those who reached the assignment over the stakeholder group. However, such results cannot justify the success of students in substance over the stakeholder group since students had to reach the goal with lower indicators. Such differences in goals

Table 1. Respondents' activity and outputs during the assignment.

	Policy makers	**Energy/climate experts**	**Other users**
Number of Respondents	13	3	6
Valid results	1 submitted both role scenarios 7 submitted only dark greens scenario	All submitted only dark greens scenario	1 submitted both role scenarios 3 submitted only dark greens scenario
Not valid results	1 submitted only results 3 submitted only "General parameters" and did not submit results 1 faced technical problems		1 submitted only results 1 submitted only scenarios and did not submit results

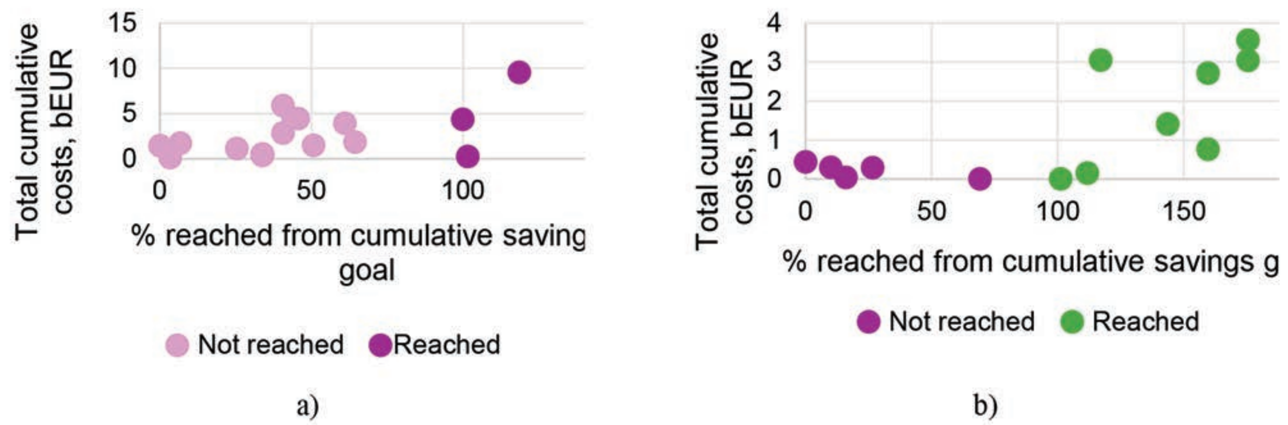

Figure 1: Correlation between the share of cumulative energy efficiency goal and total cumulative costs required for the selected policy set for dark greens role for a) stakeholder groups and b) students.

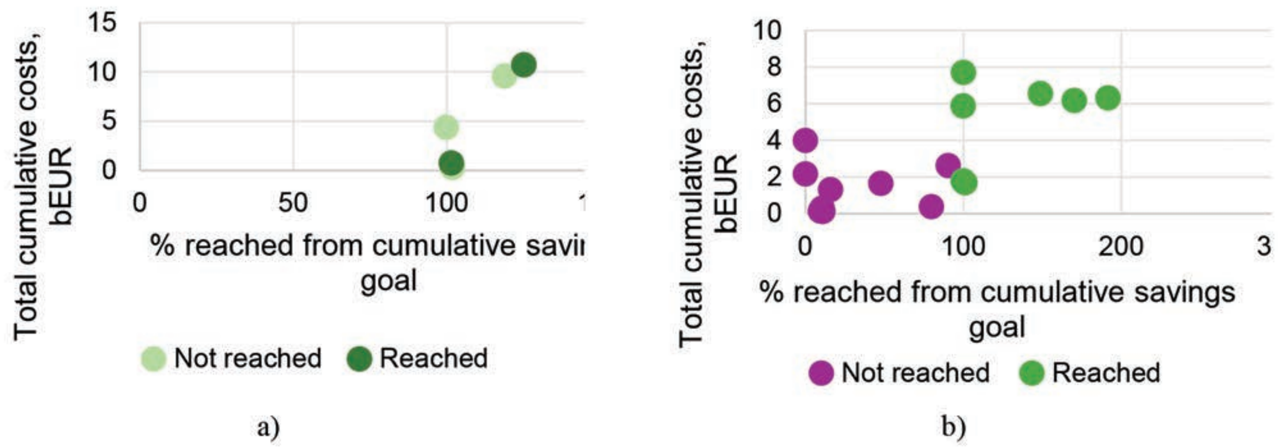

Figure 2: Correlation between the share of cumulative energy efficiency goal and total cumulative costs required for the selected policy set for bright greens role for a) stakeholder groups and b) students.

arose given the difference in time of the assignments (at the time when the respondent groups fulfilled it the set goals were prescribed by Latvian National energy and climate plan's updated project).

Furthermore, Figure 2 shows results for the bright greens ideology role and the differences in the costs of the chosen policy scenarios for the respondents who achieved both goals of the assignment. Similarly, as Figure 1 shows the higher number of the goal reached are students. Though, the results also show that for bright greens role in total for the stakeholder group as well as for students a lower number of the goal reached respondents. At the same time, the given results do not allow to conclude whether the results are lower because both respondents have a lack of knowledge regarding bright greens ideology, and so the role was not accomplished properly either it was a result of a lack of understanding how it could be done using the Tool's functionality.

3.2.3. Assignment achieved results for dark greens

The analysis of the results was continued by reviewing the chosen policy measures for the assignment achieved by respondent groups for dark greens ideology role. Accordingly, Appendix Figure 4 shows the results of chosen policy measures by the assignment achieved stakeholder group for dark greens ideology role. The results that policy measures were chosen on a wide range from several economic sectors, mostly concentrating on GDP decrease, gas price changes, financial support for residential and industry sector, support to RES and introducing CO_2 tax. However, support for RES cannot be admitted as a proper policy measure for dark greens' role since dark greens do not support technology development.

Regarding the students chosen policy measures for the dark greens ideology role, Appendix Figure 5 indicates the focus on population decrease, policy measures in the transport sector, energy efficiency schemes, and excise tax growth on natural gas. As Figure1 showed, students had the highest number of achieved assignment respondents, and following the Appendix Figure 5 policy measures reflected, it can be concluded that students chose the right policy measures that affect the cumulative energy savings from the dark greens ideology role perspective.

3.2.4. Not achieved assignment results for dark greens

For the stakeholder group, Appendix Figure 6shows low financial support to energy efficiency measures for the tertiary and residential sector, as well as several transport sector measures, which, in contrast, result in high energy savings if chosen correctly. One of the mistakes that can be seen from the chosen scenarios is selecting financial support for the tertiary sector, as dark greens oppose consumerism. However, the results of not achieved the assignment of students for dark greens ideology role are represented in Appendix Figure 7. In this case was, constituted a poor number of chosen activities in general, which inevitably lead to failure in fulfilment of the goal (without policy measures, no results will be reached).

3.2.5. Assignment achieved results for bright greens

The results of chosen policy measures of the assignment achieved stakeholder groups for bright greens role in Appendix Figure 8 show that despite the low number of the achieved respondents, the gravity point of chosen policy measures concentrates on the right measures, namely supporting the alternative fuels, switch to public transport, RES in public transport and GDP increase. In contrast, the results of students in Appendix Figure 9 represent a switch to railway and public transport, ESCO reinvestment fund, financial support for the industry sector, and informative campaigns of alternative fuels (that lead to the promotion of new technologies).

3.2.6. Not achieved assignment results for bright greens

The crucial point is that, as Figure 2 already shows, the stakeholder group had an extremely low number of the assignment reached respondents. In addition, Appendix Figure 10 indicates that the chosen policy measures do not correspond to the ideology of the promotion of new technologies (mainly in the transport sector, which has the highest impact on cumulative energy savings). Similarly, the results of students show an extremely low number of any policy measures. Although the chosen measures in Appendix Figure 11 contain the development of biomethane and an informative campaign in alternative fuels, it is not enough for remarkable results to be achieved in policymaking.

3.3. Survey results

All respondents, regardless of the group and industry they represent, were not unanimous in answering the survey. However, in two questions concerning the functionality of the Tool and the availability of data, the respondents agreed, and the majority answered that the achievement of the goals depends on the functionality of the Tool. Furthermore, the answers showed that most respondents admitted that the Tool was not easy to use, and it was not easy to understand the Tool's usability options. In addition, the absolute majority did not manage to fulfil the objectives of the task. Nevertheless, despite of a low number of successful respondents and critical of the Tool's usability, the majority still answered positively that the Tool could be used to create an energy and climate policy in the country or in a separate sector in the private sector (see Table 2).

Regarding the open questions survey about the usability of the Tool, it was summarized in the Microsoft Excel spreadsheet. The functionality aspects mentioned by respondents were coded and for each of the aspect statistical difference test was exercised using statistics software JASP 0.18.3. As the dependent variables were not approximately normally distributed, further the non-parametric equivalent was exercised by the Kruskal-Walli's test.

There were statistically significant differences among policymakers, energy and/or climate experts, and other stakeholders group respondents regarding indicators listed in Table 3, which means that it could be considered that listed indicators are not equally important for all stakeholder groups. However, it must be noted that a low number of policymakers mentioned these aspects in the survey despite the results that policymakers had a low success rate (only two policymakers out of 13 submitted both role scenarios, and only one role (light greens) results met the description of the role. There could be several

Table 2. Collected answers to closed questions.

Question	Number of respondents	
	Yes	No
Did you manage to achieve the objectives of the task? (Cumulative final energy consumption savings (GWh) – 29,522 GWh and the total share of renewable energy – 57%)?	4	18
Did the achievement or non-achievement of the objectives depend on the functionality of the simulation tool? For example, ease of use (interface), possible influencing factors of choice (sectors and their indicators), other?	21	1
Was the simulation tool easy to use?	7	15
Was the functionality (usability options) of the simulation tool easy to understand?	7	15
Did the simulation tool give you an understanding of the relationships according to which the simulation works? For example, which factors affect or do not affect the goals to be achieved (energy savings and share of renewable energy)	13	9
Do you think such a tool could be used to create an energy and climate policy in the country or in a separate sector in the private sector?	14	8
Does the simulation tool reflect the tool used to create policies in the practice of countries/companies/ other communities/institutions now?	7	15
Should the simulation tool incorporate the linking functionality with the directions and goals incorporated in the state's valid policy planning documents? For example, in the case of Latvia: Latvia's national development plan, Latvia's sustainable development strategy, Latvia's long-term energy strategy, etc.	20	2
In your opinion, does the tool reflect the possibilities of the national budget of an exact existing country?	20	2

explanations for that, for example, a lack of policy maker knowledge, the failure of the Tool's functionality, and lack of time or motivation to complete the assignment.

Alongside, statistically non-significant differences among stakeholder groups were identified regarding numerous indicators of technical performance of the Tool, and they should be implemented to improve the functionality of the Tool (Table 4).

4. Conclusions and recommendations

Policy making simulation tool may not always be used properly by a policy makers as being a policymaker does not guarantee an understanding of causal loops and relations of different factors of the energy and climate industry on the one hand and the impact on the economy on the other hand. As well as being a policy maker in a certain field does not guarantee the understanding of the application of policy modelling tools. It is crucial that such policymakers can build policy scenarios with the support and suggestions of analysts. However, the alternative is to train and employ policymakers who specialize in simulation and modelling and focus on the long-term consequences of the chosen policy scenarios.

This study has shown that providing the assignment for different stakeholder groups, even emerging industry professionals (students), and analysing each of the group's chosen measures for the fulfilment of the assignment can lead to an understanding of the common mistakes that an exact group made (and so it led to unfulfillment of the assignment). Namely, the common mistakes are poorly chosen policy measures in the sense of their low number (quantity factor), as well as choosing the policy measures that do not lead to and/or do not have an impact on reaching a result. Moreover, assigning an exact ideology to a respondent can show the level of policymaking skills of an exact respondent. Once a respondent has acquired a necessary level of a

Table 3. Statistically significant difference indicators of the Tool.

Indicator	F	p	η^2
The interface pages in the Tool that are difficult to notice	4.850	0.029	0.338
The Tool is deemed to be complex	7.441	<0.004	0.439
Separate tools are needed for policymakers, energy/climate experts and other respondents' group	4.625	<0.023	0.327

Table 4. Statistically non-significant difference indicators of the Tool.

Indicator	F	p	η²
AI assistant would be needed in the Tool	1.382	0.264	0.127
Explanation about the Tool is needed	1.338	0.501	0.123
Save" function needed	4.850	<0.029	0.338
"Reset" function needed	0.688	0.492	0.068
The Tool has too small font size	0.398	0.655	0.040
Year and measure in the Tool have poor visibility	0.246	0.768	0.025
The Tool needs "Undo" function	0.334	0.700	0.034
Video about the Tool's functionality is needed	0.239	0.773	0.025
The Tool is difficult to perceive	2.249	0.150	0.191
The Tool has inconvenient interface	1.242	0.297	0.116
The Tool has inconvenient results traceability	2.178	0.148	0.187
The Tool has technical mistakes	0.605	0.534	0.060
The Tool needs a functionality of setting state budget boundaries	0.688	0.492	0.068
The Tool does not have enough factors	3.421	0.062	0.265
The Tool needs additional performer settings	1.727	0.199	0.154
Factor optimization function is needed	0.688	0.492	0.068
Standard optimization function needed	0.140	0.859	0.014

knowledge of the ideology and its impact on a result achievement, the results can be achieved successfully.

Furthermore, the methodology of this study showed that the assignment with described rules and a specifically designed survey can serve as a helpful approach for designing a policymaking simulation tool, since through analysis of the testing results and surveys answers it is possible to reveal the elements of usability success, as well as users experience, i.e., users attitude expressed in emotions, confidence, response to the exact tool. More precisely, the user's attitude expressed in emotions, confidence and response to the Tool illuminates the drawbacks and failures of the Tool. Nevertheless, the testing and survey were exercised in an individual manner (following only the essential key principles of usability testing), and it still has led to valuable results. It is meaningful to note that: "[..] usability testing is not a perfect usability evaluation method in the sense that it does not guarantee the discovery of all possible usability problems, but it does not have to be perfect to be useful and effective." [32]

Responsiveness results proved that the more audience for the role of the tested group respondents will be addressed, half of them will try to conduct the task and submit the results (in this research, out of 42 respondents, the results were submitted by 22 respondents.

A simulation tool designed for policymakers should be separated from simulation solutions for other stakeholders. It derives from the fundamental difference in the aims of policymakers on the one hand and other stakeholders on the other hand. Namely, policymakers are seeking solutions and their various scenarios that could be designed according to the state's current political ideology and developed framework in the form of policy planning measures and financial opportunities. For policymaking to be transparent and unaffected, a simulation tool could be an instrument that could help policymakers opt out of the cycle of "shifting the burden to the intervener," i.e., shifting the policymaking to outer experts.

However, other stakeholders need being informed of the possible instruments and measures that contribute to reach climate change mitigation goals. Both simulation tools should be designed with a no-doubt user-friendly interface. The survey made in this study showed that there are still challenges on the way to reach the unanimous user-friendly solutions.

Regarding the technical functionality evaluation, in the author's view an essential role should be given for the Tool to be accompanied by informative and explanation containing material that would help users understand how the Tool works technically, as well as provide a description of the interrelations of scenarios built in the Tool. As the respondents were not provided with any additional explanatory material during the simulation, it created problematic goal achievement and discouraged respondents from understanding the Tool's functioning.

The importance of informative material is reflected in the respondent's commentaries in the survey, stating that the Tool is complex and its user must have quite versatile and in-depth knowledge, understanding the correlations between different indicators to reach exact results. Not all respondents had knowledge about each energy sector, their interconnection with other economy sectors and what was realistically feasible and achievable. The respondents commented that in some cases, they followed intuition, and after chaotically changing the units, the opinion arose on the functionality possibilities. Not always it is a good strategy since irrational scenarios lead to unrealistically large amounts of used finances or put a disproportionate load on citizens and businesses. Therefore, it is crucial to explain a correlation between the chosen scenarios and the results. For example, the Tool does not contain an explanation as to why, if financing is available in the residential sector from 2021, then cumulative savings suddenly appear only from the middle of 2024 and then remain unchanged from the middle of 2026, although building renovation measures are implemented throughout the years and the cumulative savings should increase steadily.

In addition to informative material, a video instruction (tutorial) would be a successful accompanying tool for learning the Tool's usage techniques since a video is interactive and demonstrates to the learner the most core of the elements to be learned. Moreover, watching a video often takes much less time and improves the perception of the learner. The respondent's answers to the survey show how video is important for simulation makers. As a result, the policy simulation tool can serve not only as a direct instrument for policy scenario creation but also as a learning platform of the energy and climate issues.

Q2

Appendix

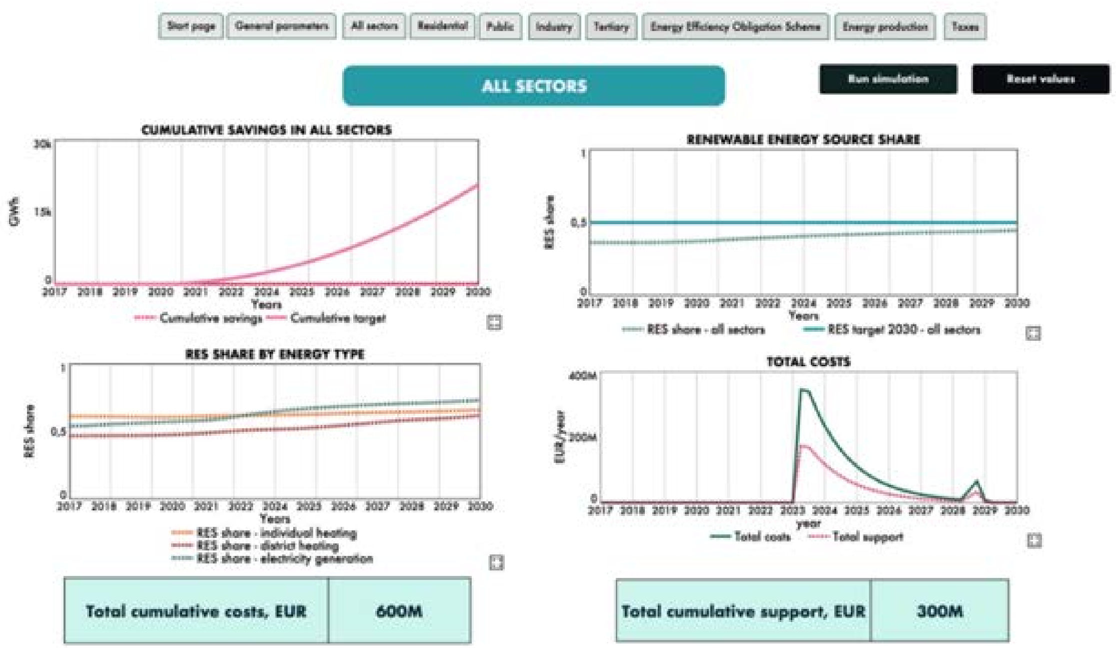

Figure 1: Internet-based model interface page for all sectors.

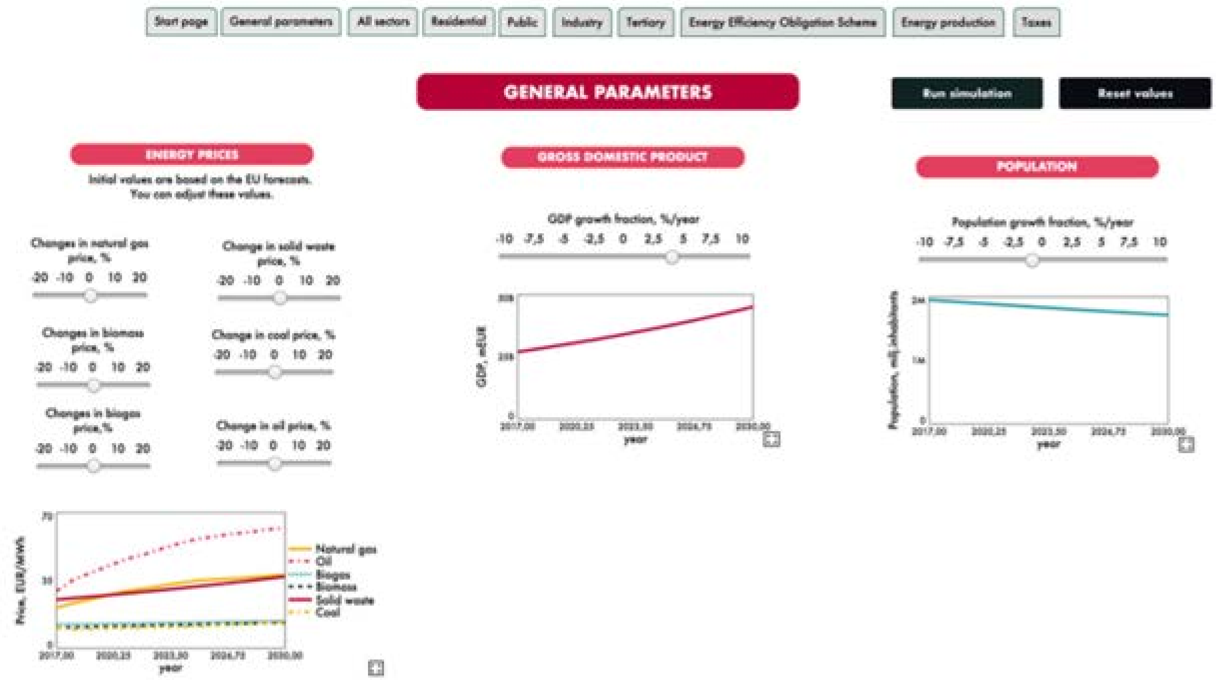

Figure 2: Internet-based model interface page for general parameters.

Figure 3: Internet-based model interface page for support for renewable energy sources.

Table 1: Open questions.

Question
• Please indicate your name, e-mail, contact phone number, name of the country you represent.
• Which respondent group you represent?
• How long did it take you to complete the task?
• What was the influencing factor for completing/not completing the task to the end?
• Please indicate the rationale/example of the rationale that the achievement or non-achievement of the objectives depends on the functionality of the simulation tool (in any case, the answer is both yes and no).
• Please indicate the rationale/example of the rationale that the simulation tool was or was not easy to use.
• Please describe the rationale/example of the rationale that the simulation tool was or was not easy to understand.
• Please name factors which allowed you to reach or not reach the goals of the Task.
• Please describe and justify the simulation scenarios you chose (Namely what policy measures you chose to achieve the goal and describe the chosen strategy).
• Please describe the possible situations/scenarios/policies where such a tool can be used?
• What functionality (interface usability) improvements do you think should be made in the simulation tool?
• Please describe the rationale/example of the rationale that the tool reflects one that can be used to create policies in the practice of countries/companies/other communities/institutions now.
• Please describe the rationale/example of rationale that the Tool incorporate the linking functionality with the directions and goals incorporated in the state's valid policy planning documents? For example, in the case of Latvia: Latvia's national development plan, Latvia's sustainable development strategy, Latvia's long-term energy strategy, etc. (If the respondent represents another country, the policy planning documents of the relevant country known to the respondent should be included in the application).
• Please describe the rationale/example of the rationale that the Tool reflect the possibilities of the national budget of an exact existing country.
• Other comments/recommendations you would like to make regarding the simulation tool and its potential to be used for practical policy making.

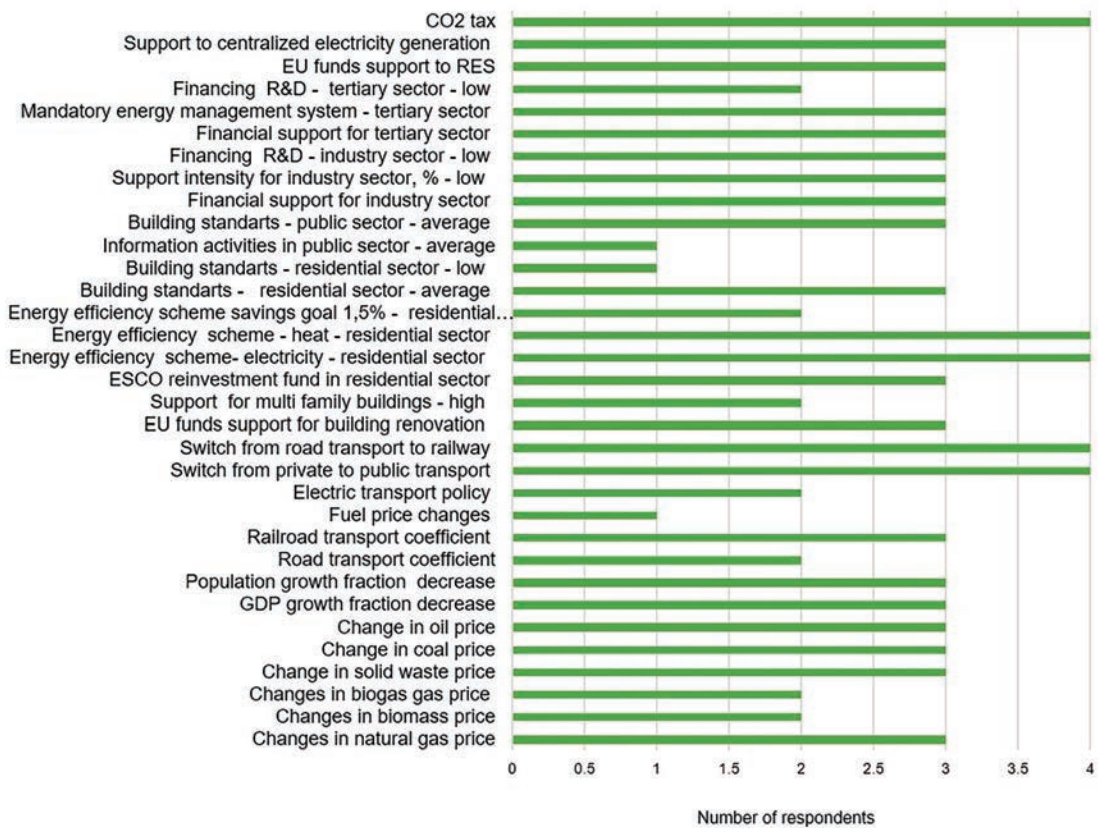

Figure 4: Policy measures used for the assignment achieved stakeholder groups for dark greens role.

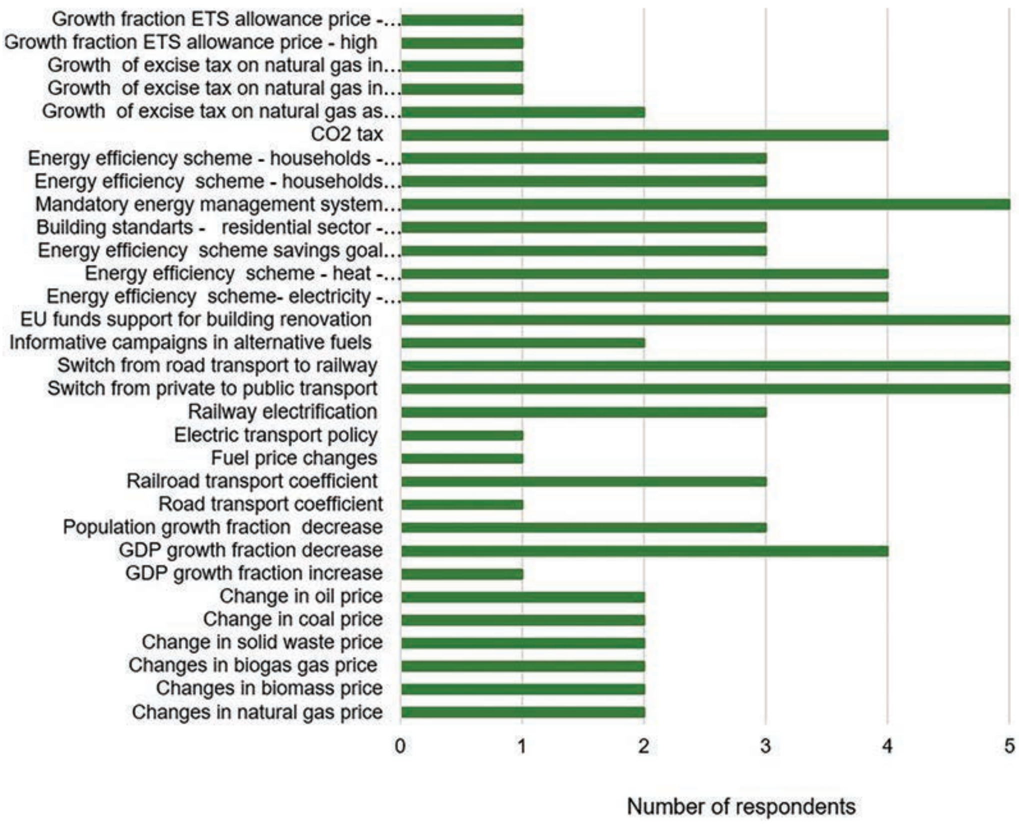

Figure 5: Policy measures used for the assignment achieved students for dark greens role.

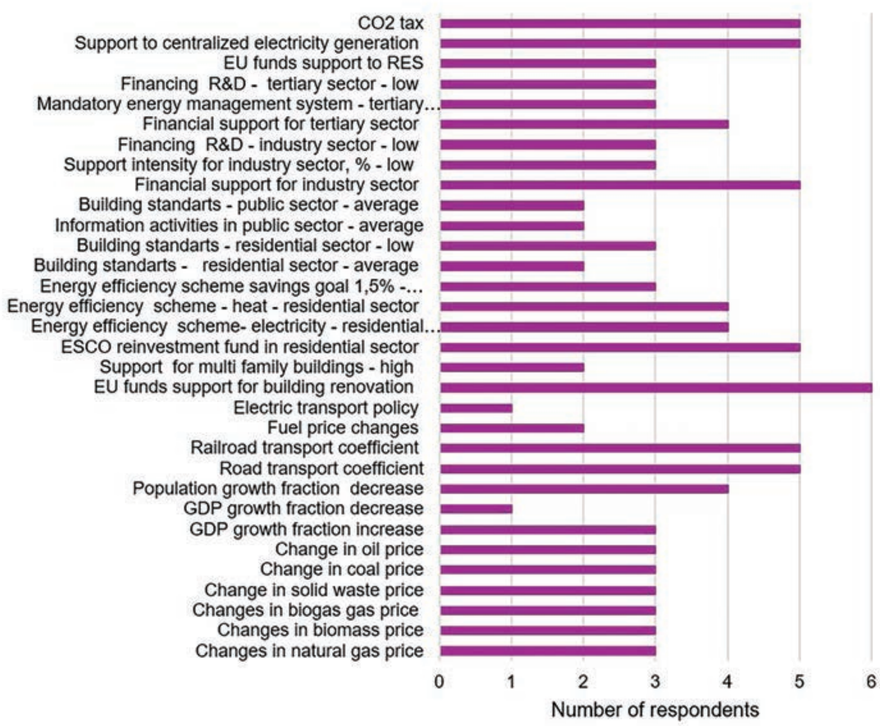

Figure 6: Policy measures used for the not achieved assignment stakeholder groups for dark greens role.

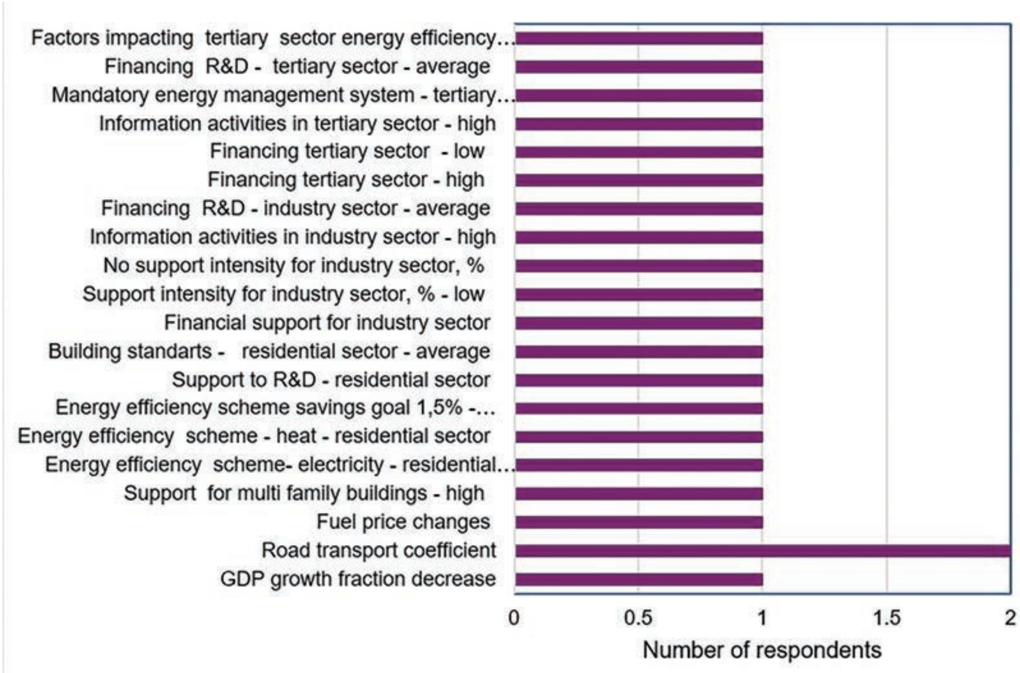

Figure 7: Policy measures used for the not achieved assignment students for dark greens role.

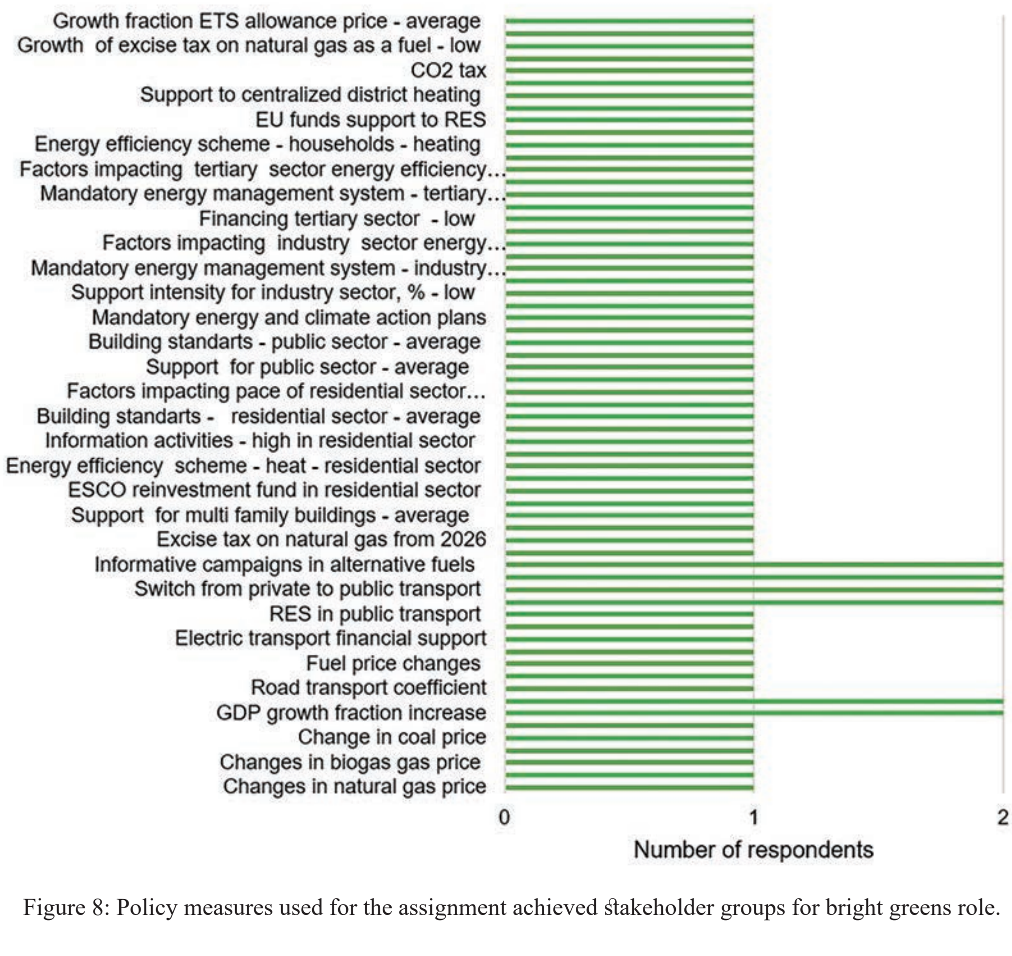

Figure 8: Policy measures used for the assignment achieved stakeholder groups for bright greens role.

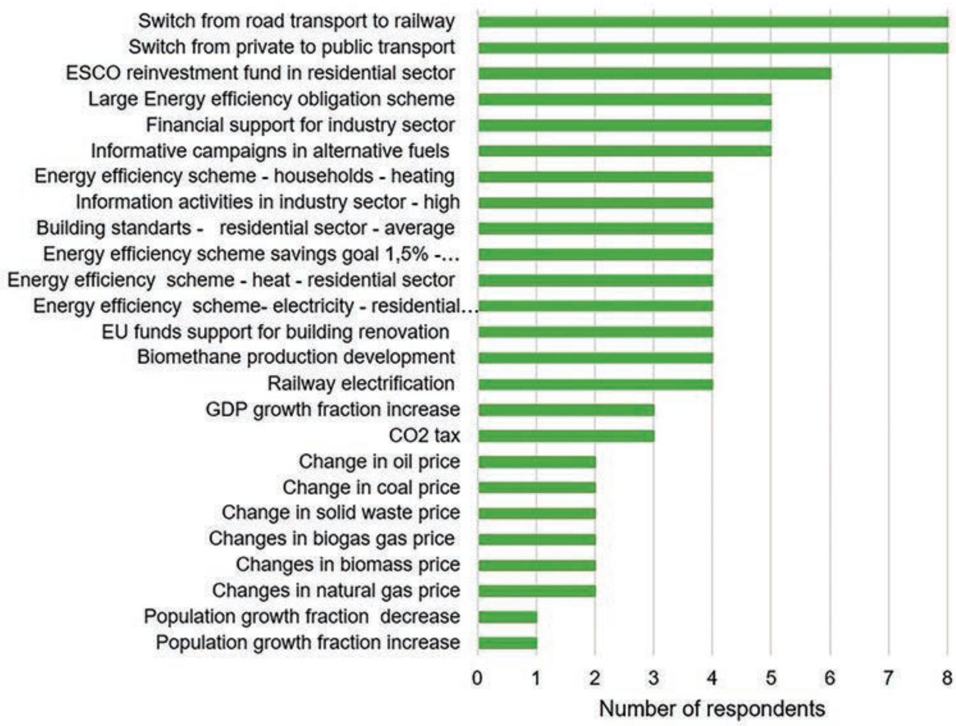

Figure 9: Policy measures used for the assignment achieved students for bright greens role.

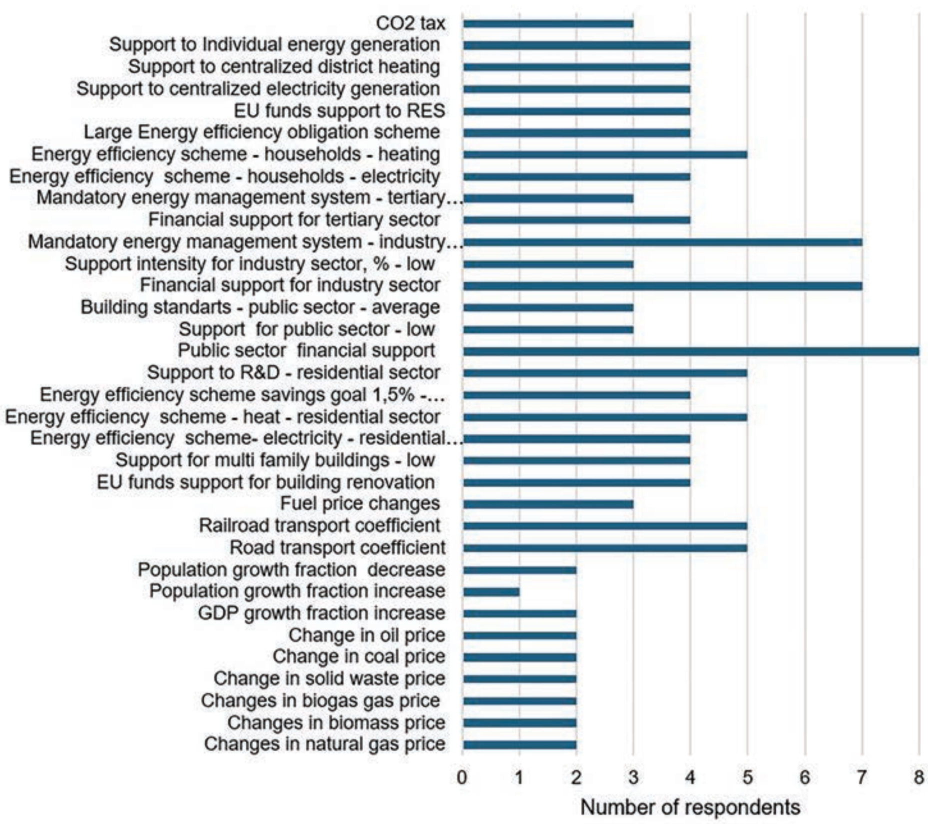

Figure 10: Policy measures used for the assignment not achieved stakeholder groups for bright greens role.

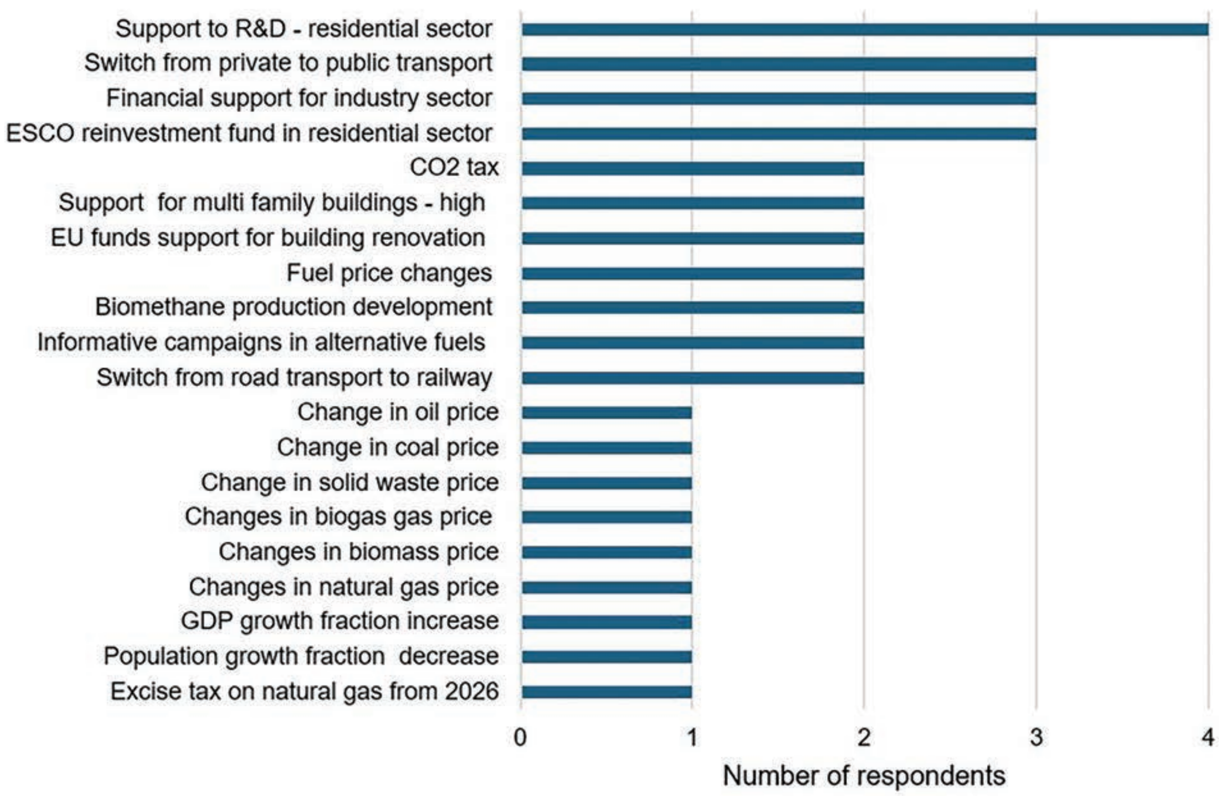

Figure 11: Policy measures used for the assignment not achieved students for bright greens role.

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