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Utilizing the Foresight Methodology and Delphi Method to Assess Innovation Effectiveness in Advancing Bulgaria's Green Deal Objectives

Lyubomira GANCHEVA
Sofia University "St. Kliment Ohridski", Sofia, Bulgaria
lggancheva@gmail.com

Abstract. *The EU aims at achieving a climate-neutral economy by 2050 and that the is the essence of the European Green Deal (EGD). This brings the necessity to prepare for such a future. This is not only matter of innovations and new technologies in the energy sector, but brings the necessity to evaluate them properly. Here come in hand the strategic Foresight and specifically the Delphi method, which can serve as an important tool for an informed decision making process in the uncertainty of the green transition.*

Foresight is perfect for a deep analysis of complex multilevel long-term impacts, which could be very useful for energy planning. The Delphi method could enhance that approach through expert consensus over innovations, policy validation and risk management. This paper explores the potential of Foresight and Delphi method to contribute to assessment of innovation effectiveness in the process of the green transition.

Keywords: Foresight, strategic planning, Delphi method, energy innovation, energy transition, European Green Deal, scenario analysis, policy development, sustainable energy, innovation assessment, renewable energy policy, future energy trends.

Introduction

Nowadays energy systems are changing faster than ever due to the complex of environmental concerns, vivid technological breakthroughs, policy alterations and changes in the consumer behavior. Therefore it is of crucial importance for both governments and business to be able to forecast the upcoming future changes and to adapt their strategies and behaviors accordingly. The ambitious aims of the Green deal open the dorr for the higher usage of energy innovations and here comes the need of their proper assessment, especially or a long-term period. Strategic Foresight and Delphi method are perfect for that, where Foresight offers the framework of the strategic planning methodology and Delphi provides the approach to form a consensus of expert opinion in the research process. This paper explores the application of Foresight and Delphi in energy policy, especially in fostering the evaluation of the innovation in the process of achiving the aims of the European Green Deal.

Foresight as a Tool for Strategic Planning: The Delphi Method in Energy Innovation

The EU set ambitious climate neutrality goals by 2050. Assessing the effectiveness of innovation is crucial for their fulfilment and that requires a multilevel multisectoral approach, which combines regulatory framework alterations, policy shifts, technological development and strategic forecasts. Among the most effective tools for that is Forecast methodology and Delphi method, being part of it, as they can provide working instrumentaium for evaluation of effectivenees for a long period of time in a constanly evolving environment and can thus make us more prepared for the anticipated future developments (Bohnerth J. C., 2015; Berkhout F., Hertin J., 2002 and Habegger B., 2020).

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Strategic Foresight offers a structured approach for analysis of a long-term impact of policies and technologies over the energy transition. It varies significantly from planning and traditional forecasting with its potential to analyze different trends, measure and rank them accordingly and thus to actively form the future, not simply to imply linear progressive methods for its prediction. The understanding of that 'future' is no based on the simple combination of forecasts and speculations, but is formed on the basis of strategic planning with research and evaluation of different alternative scanarios of future development (Voros J., 2003). It not only predicts a future, but provides a systematic identification of potenatial scenarios that can serve as a base for an informed decsions taking process. This approach is of a great importance for complex sectors, such as energy and green transition as a whole, where innovations and vast technology jumps combine with regulatory changes and different policies. The Delphi method fosters that process through the systematic gathering of expert opinions and the consensus over newcoming trends, opportunities and challenges (Martin, B., 1995; Loveridge D., 2008).

Even though they may seem similar at first, in fact forecasting and Foresight are totally different by means of their methodologies and application. Traditional forecasting relies on historical data to provide one predominant result for the furure, while Foresight analyses different future scenarios, ranges them and thus forms a dynamic framework for providing the set of probable paths for development. Delphi method further structurizes that process, engaging experts and gathering and setting up their positions to form a consensus opinion. Thus it guarantees that the decisions being made are adaptive and in line with the long-term sustainability goals.

Despite its advantages the strategic planning is facing the serius challenges for insecurity management, uncertainty and multisectoral often irrelative data. Its ability to integrate different perspectives and to react on newcoming events or trends makes it an invaluable instrument for energy planning. Through risk and opportunity identification it guarantees that the taken decisions in the energy sector are stable and still adaptive and match the sustainability goals of the European Green Deal.

The application of Foresight methodology amd Delphi method enables decision-makers to be informed about the sophisticated future development of the energy sector, to navigate all the trands in it and to form stable and still flexible strategies that can resist on the basic trends for anticipated changes. By their usage governments and industry leaders can build stable energy systems that can support the aims of the EGD and sustainable development goals.

Evolution of Foresight

Forecasting originates back from the ancient times when humanity started anticipating changes and wanted to be prepared for the future. Early societies used rudimentary methods such as anticipating of nature processes and historical cycles. Through the years and centuries on the base of those informal methods people step by step forms structured methodologies. In the mid- 20 century planning evolved from short-term into a long-term one, provoked bye technology development and global challenges. Planning gradually becomes multidisciplinary and integrated elements from system theory, behavior theories and economy science. During that period goverments and major insstitutions begin to search for more reliable forecasting methods, which forms the strategic planning instrumentarium for prodiction of social transformations.

The RAND Corporation plays leading role in that process, especially on the base of the work of Herman Kahn in the sphere of scenario planning during the Cold War. His method includes building of scenarios for the future that can lead to political decisions. During the 60s Royal Dutch Shell refines and polishes scenario planning and thus successfully manages to overcome the petrol crisis on the 70s. During that period Japan has become a significant national system planner, using Delphi approacg in the process of formation of long-term science and technology polisies. Delphi becomes widely sored and recognized due to its structured approach of forming a consensus for the evaluation of the future trends and taking informed strategic decsiions.

By the 80s and 90s foecasting became a well-established and used approach in make countries, especially in Europe. The UK's Technological Foresight Programme (Georghiou L., 1996) aimed to align innvoations to the economics and social needs. During this period there is a growing inter=gration of systematical approach in forecasting methodologies, which considers the interconnection between technological, economic and ecological factors and drivers. In stead if simply predicting the future trends, forecasting has become a common approach that can actively form the future through stakeholder participation and angagement.

In the 21st century forecasting adapts to globalization and digoitalisation. The big data boom. Machine learning and simulative methodologies increased its scope and accuracy. Those technologies allow greater flexibility on scenario planning and higher accuracy of understanding new trands. What is more, Foresight becomes more inclusive with a broad accent over social, ethical and cultural characteristics. Thus through stakeholder participation and angagement a broder and more democratic vision for the future is formed.

Foresight is of crsial importance for coping with urgent global problems, such as climate change, economic imbalances and vastly developing technology sector. The European Green Deal can serve as a great example for Forsecast application while forming sustainable policies. The usage of Delphi in such processes can help evaluate the impact of green innovations, to prioritize investments and to make national energy strategies in line with the European sustainability goals. The Foresight effect over adaptivity and strategic thinking could make it a useful and powerfuil instrument for insecurities management to rasie sustainability.

Nowadays Foresight keeps supporting strategic planning and innovations. It helps the formation of common visions based on collective and democratical approach. By assessing key innovations that help decarbonisation and promote sustainable development, Foresight is useful for the successful navigation in a highly changing environment, while Delphi method plays a crucial role in this process, fostering expert scenario analysis for informed decision making in the energy sector.

Contemporary Challenges for Foresight

Despite al of the above said benefits, as every instrumentarion Foresight has its downsides too. One of the main difficulties is the uncertainty management, especially provided that technological, economic, social and ecological factors interact in a sophisticated and multi-layered way. traditional forecasting models often have problems to catch the compexibility of their interaction. Other main challenge is the integration of different perspectives. The effective management of the challenges such as green transition, sustainable development and climate change processes imposes the need for multisectorsal cooperation between government, business, societies. The limited access to reliable data and the unsufficient coordination can really obstruct the effective strategic planning. This brings to the fore the need of interdisciplinary approaches that combine expertise from different sectors and spheres.

Technological development also possesses a two-way meaning – being both challenge and opportunity. Big data analysis, artificial intelligence and software for simulations shorten the process and make the results more accurate, but at the same time their effective application implies the need for technical expertise, clear etical guidelines and stable regulatory framework. The balance between technology potential and social responsibility is of a crucial importance for maximizing the benefits and minimizing the risks.

Fast globalization prcesses and social-economic changes require more flexibility in the forecasting methodology. The traditional approaches for long-term forecasting iften could not predict quality new events such as global or health emergencies, ecological catastrophies or political changes. That paved the wasy to the 'rapid Foresight' – a rational way to measure the risks and opportunities in real time. The formation of more adaptive forecasting models is crusial for keeping accuracy and actuality.

Institutional and cultural barriers can limit effectiveness of the process as well. Many organisations resist long-term planning as they find it too astract and hard to make. Specticism and overthinking should be overcomed.

While Foresight has been widely used by policy and industry, academic reserches are still not so much. The gap between theory and practice has still not being filled-up and that is a milestone to be addressed properly. Scientific researches can help further develop the methodology of strategic forecast and offer practical new applications

Main Limitations of Foresight

Foresight faces several challenges due to its complex character and the constantly changing environment. One of the main problems is uncertainty. Even based on a structured analysis the prodiction of future becomes harder and harder in recent years, especially in the energy sector, where new technologies can bring unexpected changes. The European Green Deal focuses on clean energy, but its long-term effects still remain unclear. Other main challenge are higher costs and a lot of time, which the forecasting process takes. The cearyion of different alternative and possible scenarios requires money, espertise, data and research, which is hard for organisations and evensmaller governments. Energy sector need long-term investments fpr a period of over 50 years, but at the same time short-term policies are usually more favorable. Access to data is another challenge and even when there is such, different estimations of that data can lead to different results. The lack of coordination between governments and organisations can lead to a chaos and misunderstanding. Cultural and institutional resistance delays and worsens the situation evern more. What is more, often institutions and organisations focus on current problems in stead of the whole picture. Etical and social problems significantly influence forecasting, as well as the futue scenarios and assumptions, formed under the influence of political and cultural biases. Confodentiallity and security of the data can impede its usage and question its accuracy and applicability.

Foresight's Role in Energy Policy

The energy sector is compex and Foresight can help in this complicated environment to manage the main challenges it causes. It combines different methods and uses both numbers as well as expert opinions. This combined approach helps leaders take better descisions and plan future.

One of the key applicationa of the strategic foresating is the evaluation of the new energy technologies. The European Green Deal focuses on cleaner energy, hydrogen, smart grids, energy storage. Foresight could help to assess those technologies and show their benefits and the main risks they bring with them.

Scenario planning is other important and useful tool. It can study the different ways that the renewable energy can gorw and how that will impact economy and environment. Those scenarios can account market trends, regulations and new technologies. Green transition affects business and communities. The good planning can also help measure risks and ensure that the energy transition is a fair one. It can also identify the needsfor professional training and form new opportunities fr the communities.

New technologies help making forecasting more and more precise, based on AI and machine learning. This is extremely important in the energy sector with its complexity on dofferent levels. Strategic forecasting can be best used when society, business and reserchers work together and maintain common interest. Public-private partnerships can help fasten the usage of clean energy and implement new sustainable technologies and behavioral practices.

The successful implementation of Foresight should be based on the compilation of economic, social and ecological factors. It should also identify and measure different risks. The European Green deal shows why Foresignt matters in the filed of the energy policy – it can help form the new policy framework based on the analysis of the scenarios, it could enhance the regulations, stimulate and fasten investments and prepare the leaders for the challenges such as climate changes, economic fluctuations and energy shortage. The usage of forecasting instrumentarium, stakeholder participation and engagement and multifactorial approach make Foresight a powerful tool in the fulfillment of the aims of the EGD. Thus it can help strengthen energy planning, encourage investments and keep the overall energy transition framework.

Delphi Method's Role in Energy Policy

The Delphi method is a structured and iterative technique, which is especiallu designed in order to collect expert opinions and buid a consensus over sophisticated topics. It is extremely useful in the situation of long-term challenges, especially in the sphere of energy planning, as it ensures. Systematic integration of various and often different and even opposite opinions in a workable and stress-free way. One of the main advantages of Delphi is its ability to lower uncertainty through expert engagement in several rounds of discussions. This method guarantees anonymousity through the participants and thus minimizes the biases and leadership of opinions. It encourages open and fair feedback and thus builds a well-rounded consensus.

Numerous researches point out the importance of the way the experts are choses for the Delphi method, as this is usually the bassis of producting reliable forecastsat the end (Jolson M.A., Rossow G. L., 1971, and Rowe G., Wtight G., 1999). However, papers in the filed of social psychology show that solely that precision of participant can not guarantee a fair judgement, as long as it is not accompanied by a diversity within the panel (Yaniv I., 2011, and Lamberson P. J., Page S. E., 2011). Those diverse groups - by means of different factors such as demographic factors and professional backgrounf - ensure that there are several different and independent point of views (Yaniv I., 2011, and Wiersema M. F., Bantel K. A., 2017).

The importance of heterogeneity in Delphi studies has been recognized in several reserches, which show that mixed panel lower polarization of opinions (Yaniv I., 2011), as well as social desirability bias (Ecken P., Gnatzy T., Gracht H. A., 2011). What is more, this diversity enhances the so called 'bracketing', where the participant have average answers to the question (Gnatzy T., Warth J., Gracht H., Darkow I-L., 2011) and they act as a useful sum-up of the different opinions and all of this leads to more precise forecasts (Yaniv I., Milyavsky M., 2007, and Johnson T.R., Budescu D. V., Wallsten T. S., 2001).

The fact that the results from the Delphi reserches are usually used for strategic decisions, where the wide range of expert opinions is important. Several papers show that this improves the accuracy of the decisions being made (Bonaccio S., Dalal R. S., 2006, and Sniezek J. A., Schrah G. E., 2004), and this effect is amplified when the input comes from multiple, independent sources (Yaniv I., Milyavsky M., 2007;, Johnson T.R., Budescu D. V., Wallsten T. S., 2001, and Soll J. B., 1999). This is why a number of scientists insist on the usage of different entry data and consider that aspect as funamental to enhance the Delphi process.

In the context of energy innovations this method is extremely effective in the identification of key technological solutions, regulatory barriers and policies that support the green transition. The structured nature of Delphi ensures policy makers to assess different scenarios and to prioritize those strategues that are based on consensus. This is very useful in spheres where fast technological changes, economic unsecurity and regulatory changes make traditional forecasting tools unsufficient. The iterative interaction between the experts guarantees that the final resommendations are sufficient and combine the necessary different perspectives of experts from varoous sectors. The ability of Delphi to structure various evaluations into applicable political recommendations guarantees that the results are sufficient and makes it very useful in the eergy planning.

This research applies Delphi for the assessment of the effectiveness of technologies in Bulgaria in the fulfillment of the amis of the European Green Deal. This method has the potential to identify sustainable and viable innovations.

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Literature review

During the recent years Foresight researche expanded in several directions and fields, but still their application in the energy sector remains vast in insufficient. There are researches that show how Foresight and Delphi can be used for scenario planning and predict the main challengeso f the green transition, but they cover mostly America and Western Europe. In Eastern Europe and especially in Bulgaria there is no official information that Foresight and Delphi have been used in the energy sector.

A review of European and Bulgarian energy transition policies showed that there is a neceesity for a strategic forecasting, where Foresight can be useful. Currently the Bulgarian energy sector is still predominantly dominated by the standart forecasting tools on the base of extrapolation, which are not sensitive to new technologies and changes on the behavior of the enrgy producers and consumers. This undelines the necessity of new type of researches how forercasting tools can be used to measure the fulfilment of the aims of the European Green Deal.

This article is part od a research, which aims to fill that gap by providing a in-depth ana;ysis of the available methodologies to forecast the Bulgarian energy sector. Through review of political framework, technology and stakeholders points of view it aims to offer a practical view of how forecasting can enhance decision making process in the energy sector and to allow government officials and and industry leaders navigate the complexities of the energy transition more effectively.

Practical Approach to Foresight and Innovation Assessment

Foresight is widely used in the formation of policy and business strategies, but its application in the energy sector is still not explored enough. This research aims to fill in that gap and study how the Foresight and Delphi could be integrated in the energy planning process in order to assess the effectiveness of the innovations that help Bulgaria reach the national aims of the European Green

Deal. Given the increasing need of the national energy to incorporate sustainable and resilient green energy systems, the practical implication of this methodology could provide a structured approach for the identification of the implementation of those key innovations.

The author prepares a research that will combine Foresight and Delphi and will develop a framework for the evaluation of the impact of those key innovations over the fulfillment of the green transition aims and how the adaptability and flexibility of those tools will be used in the dynamic market and regulatory environment. The study will go through several rounds of Delphi method between a broad range of Bulgarian energy experts from academia, industry and government sectors with background and know-how of the national and EU energy system. Through the different rounds of the Delphi (3 or 4) the participants will reach consensus over the key innovations cruscial for the green transition of Bulgaria, their application, then on the base of that consensus a list of scenarios for the future development of the national energy system will be formed, they will be evaluated through their potential impact on sustainability and policy alignment. Finally the study will provide key findings and practical recommendation for policymakers and stakeholders.

By marking key innovations and best practices and outlining major opportunities and challenges the research will provide a roadmap fr incorporating Foresight nd Delphi in the national energy planning process and using that methodology to measure the effectiveness of those innovations, which help Bulgaria to achieve the aims of the European Green Deal.

Conceptual Framework

The conceptual framework of the study provides the theoretical base that settles the key terms, main concepts and the relations between them. It integrates fundamental scientific and methodological principles, which are connected with innovations, national energy system, decarbonisation and strategic forecast.

Based on the literature review a conceptual framework is created and it serves as a base for the assessment of the effectiveness of the innovations in the national green transition process in Bulgaria in the context of the European Green Deal. It connects the teoretical concepts with the practical aspects and forms key questions related to the influence innovations have over sustainability, economic effectiveness and energy security.

The main research question is "*What tools for evaluating the effectiveness of innovations can be developed and applied to the national energy sector of Bulgaria in the context of the European Green Deal?*".

The main focus is put over the usage of Foresight for strategic forecasting and Delphi for gathering and validating expert opinions and building consensus over them. It supports the strategic goals of the study and offers an effective tool for the assessment of innovations and the formulations of practical recommendation for the optimization of the energy mix.

This conceptual framework not only structures the research, but provides a base for the empirical part of it.

Analytical Framework

The analytical framework serves as a tool for gathering, processing and evaluating the data within the research. It includes qualitative methods to assess the effectiveness of innovations together with scenario development phase.

The forecasting period was chosen to be from 2025 to 2050 due to the long-term nature of the energy sector. What is more, it hsould also reflect the deadlines of the European Green Deal. This time frame ensures a thorough analysis of the scebarios in the process of the green transition.

The decision to use Foresight and Delphi reflects their ability to structure expert opinions and provide reliable forecasts in a changing and uncertain environment. It was previously stated how this methodology is especially suitable for long-term forecasts, where the traditional statistic tools fail to be sufficient enough. Foresight facilitates scenario building and the formulation of sustainable strategies.

Delphi method provides a reliable tool to assess the effectiveness of innovations in Bulgaria in the context of the european Green Deal and is useful as it manages tre uncertainties in the long-term forecasts. Its iterative character provides realibla results.

The formulated hypotheses are:

1. Innovations are a key factor in accelerating the energy transition, contributing to national climate goals and the resilience of energy systems.
2. The effective application of the Foresight approach and Delphi methodology enables the development of reliable and applicable innovation strategies that address the complexity and uncertainty of the energy transition.

The first hypothesis highlights the significance of innovation as a fundamental driver for the achievment of the climate goals and sustainable development. The secon one examines the usage of Foresight and Delphi as effective tools for long-term forecasting of the energy sector.

Methodology

The methodological section of the study adopts interdisciplinary approach, which combines qualitative methods and scenario forming to ensure an overall understanding of the complex interactions between innovations, sistainability, decarbonisation and effectiveness. The qualitative aspect focuses on building consensus between expert opinions, the second part includes formation of laternative scenarios and the assessment of the impact of the innoavtions.

Data collection is organized in several key phases. The Delphi technique is used for reserch of the complex and changing environmenr by several rounds of conduction of expert opinions.

Secondary data sources include scientific publications, reports from international organizations and strategic policy documents related to the European Green Deal, national energy systems and energy innovation. They include statistical data from reliable sources such as Eurostat, the International Energy Agency and Bulgaria’s Ministry of Energy.

The expert panel consists of sa broad range of representatives of academia, industry, government, which are carefully selected based on their experience in energy policy, strategic planning and innovations. As previously markes, this wide range is broad in order to achieve more reliable results.

Appendix 1 contains tthe initial plan for the Delphi rounds, including the structured questions.

The Delphi process starts with open questions to the experts, in which they are supposed to outline the most urgent challenges in the sphere of energy innovations. The first round aims to identify key topics, which are further refined. The structured phase of the study includes questions based on ranking and Likert-scale that outline the expert opinions on policies and priorities, innovation assessment criteria, regulations and obstacles. The participants are asked to measure barriers foe the new innovations, regulatory challenges and to outline the key new technologies and innovations that can foster the green transition, as well as how they can be integrated into the energy system of Bulgaria. Financial stimuls, national legislation, peculiarities of the Bulgarian energy system, costs, efefctiveness and efficiency will be discussed. Through the several iterative rounds the experts will further dig into the questions and aim to form a consensus, where the bias is minimized.

Several scenarios are formed by the experts, some of which are based on the high RES integration, other on a more balanced energy mix or on a slower green transition. Each of the those scenarios will be analysed by means of factors such as: technological readiness for adoption, policy alignment, market readiness, cost-efective analysis, approval policies, impact of financial mechanisms.

The last phase sums up the whole expert impact into a roadmap with practical recommendations.

The usage of these methodologies is based on theor relevance towards the research questions of the study.

Results and discussions

Foresight application in the assessment of energy innovations has a strong potential eith grest impact on policy development and strategic planning. Delphi method is crucial for the formation of expert consensus and the generation of energy scenarios. Results show that Foresight can improve the decision making in the sector by providing stractured and reliable approach for evaluation of new technologies and innovations, regulatory changes and investment priorities. The expert inclusion and participation in Delphi can provide ralistic results and help decision makers to estimate the potential scenarios more effectively.

One of the important discovery of Foresight and Delphi is that they possess the potential to lower the uncertainty in the energy sector. The experts help identify long;term trends, evaluate potential barriers and different innovation pathways.

The study confirms that the iterative character if Delphi ensures the profound understanding of the energy sector and facilitates stable ans sustainable strategies for its development. It also sjows that even though Foresight and Delphi are often used in the industry and political planning, they are still not implied enough in the energy sector.

The usage of Foresight and Delphi fosters cross-sectoral collaboration and the interaction between different stakeholders – government industry, academia, society. They can use them to build identification of synergies between political aims, market needs and technology and agreement on long-term startegies.

Still there are some challenges to the wider usage of those tolls – limitation and restriction of the data, institutional resistance, complexity and difficulty in application and human and financial costs.

Still, Bulgaria can used the benefits of Foresight and Delphi in its energy transition process, as they can significantly enhance the assessment of effectiveness of the innovation in the context of the European Green Deal and its aims. This methodology can provide a more adaptive and sustainable framework for the energy strategy of the country and help it accelerate the achievement of a more sustainable development.

The study shows that the decision makers can use the tools in the process of policy formation, can lower the risks and build more flexible strategies for a green transition.

Conclusion

This article highlights the potential of the Forecast methodology fpr strategical planning and the Delphi method for consensus of expert opinions to strengthen the energy planning and the assessment of the energy innovations. It emphasizes how forecasting ensures informed decision making, lowers and manages uncertainty and fosters cooperations between the stakeholders.

The structured approach of this methodology helps polititians envision trends, evaluate risks and flatten innovation strategies with long-term goals for sustainability. Through the usage of structured expert opinions this study can provide a reproducible framework for the integration of forecasting into the national energy policy formation and can guarantee that the evaluations are in line with the long-term economic and environmental priorities.

Evem tough this tool is used in policy and industry, it is still new and underused in the energy sector, which provides a great opportunity. The study aims to fill in that gap and to demonstrate the value of this approach in order to increase the effectiveness of the innovations on the energy sector.

By aligning forecasting methodology with the aims of the European Green Deal, Bulgaria and ither EU countries could improve the hreadiness of theor energy strategies and the implication of the innovations in the sector. Delphi can ensure that there will be practical recommendation to make sure that the energy policy stays adaptive and resistant to emerging trends.

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Appendix 1 – Delphi Study Plan

Stage 1: Identification and Initial Assessment
At this stage, experts will be invited to identify key technologies, behavioral patterns, and policy measures, as well as assess their likelihood of success and key challenges for their implementation.
Sample questions:

1. Which of the following technologies will be most important for the successful implementation of the Green Deal by 2050? (Please choose up to three and rate their significance on a scale of 1 to 10.)

- Solar Trains
- Bladeless wind turbines
- Small Modular Reactors (SMRs)
- Perovskite Solar Cells
- Direct Air Capture (DAC)
- Other (please specify)

2. Which new behavioral patterns will have the greatest impact on the adoption of these technologies? (Please choose up to three and rate their significance on a scale of 1 to 10.)

- Decentralized home energy production
- Choosing green electricity
- Energy-self-sufficient communities
- Electric Vehicle Sharing Programs
- Other (please specify)

3. What are the main financial barriers to the implementation of these technologies? (Please select up to three obstacles and rate their severity on a scale of 1 to 10.)

- Lack of investment
- Insufficient subsidies
- High cost of implementation
- Limited access to green investments
- Other (please specify)

4. Which regulatory barriers will make it difficult to adopt these technologies? (Please rate on a scale of 1 to 10 the severity of each obstacle.)

- Strict regulations
- Slow approval process
- Unclear regulatory requirements
- Lack of cross-border agreements
- Other (please specify)

5. Which policy measures will best support the deployment of these technologies? (Please choose up to three and rate their significance on a scale of 1 to 10.)

- European Regulations
- National subsidies

- Decarbonisation policies
- Support for renewable energy projects
- Other (please specify)

Stage 2: Assessment and Development of Scenarios
Experts will assess the likelihood of success of different technologies and models in various contexts and develop possible scenarios for the future of the Green Deal.

1. How likely are the following technologies to be successfully deployed by 2050? (Please use a scale of 1 to 10 for each technology.)
- Solar Trains: [ ]
- Bladeless wind turbines: [ ]
- Small Modular Reactors (SMRs): [ ]
- Direct Air Capture (DAC): [ ]

2. What are the main economic barriers to the deployment of the following technologies? (Please choose up to three for each technology and rate the severity on a scale of 1 to 10.)
- Solar Trains: [ ]
- Bladeless wind turbines: [ ]
- Small Modular Reactors (SMRs): [ ]
- Direct Air Capture (DAC): [ ]

3. In which contexts (economic, social, political) will these technologies be most successful? (Please rate the probability of success in the following contexts on a scale of 1 to 10 for each technology.)
- Solar trains:
    - Economics: [ ]
    - Social: [ ]
    - Political: [ ]
- Bladeless wind turbines:
    - Economics: [ ]
    - Social: [ ]
    - Political: [ ]

4. What are the main regulatory barriers to these technologies? (Please rate on a scale of 1 to 10 for each technology.)
- Solar Trains: [ ]
- Bladeless wind turbines: [ ]
- Small Modular Reactors (SMRs): [ ]
- Direct Air Capture (DAC): [ ]

5. Which of the following scenarios do you think is most likely by 2050? (Please select one.)
- Technological progress and social adaptation
- Slow implementation and technological failures
- Combined scenario with partial execution

Stage 3: Final Assessment and Recommendations

At this stage, the experts will assess the likelihood of the implementation of the proposed scenarios and provide final recommendations for policies and strategies that will accelerate the successful implementation of the Green Deal.

1. What is the probability that each of the following scenarios will be realized by 2050? (Please rate on a scale of 1 to 10.)

- Technological progress and social adaptation: [ ]
- Slow implementation and technological failures: [ ]
- Combined scenario with partial execution: [ ]

2. Which policy measures will have the strongest impact on the success of the chosen scenario? (Please choose up to three and rate their impact on a scale of 1 to 10.)

- European Regulations
- National subsidies
- Global agreements
- Local initiatives

3. Which economic incentives will accelerate the deployment of the selected technologies? (Please choose up to three and rate their impact on a scale of 1 to 10.)

- State subsidies
- Preferential loans
- Green Investment Funds
- Tax breaks for renewable energy projects

4. What additional measures can be implemented to accelerate the implementation of the Green Deal? (Please choose up to three and rate their performance on a scale of 1 to 10.)

- Financial incentives
- New regulations
- Educational campaigns
- Public-private partnerships

5. Which public participation strategies will contribute the most to the success of the Green Deal?

- Citizens' consultations
- Local Community Inclusion Programs
- Sustainable Consumption Training Programs
- Promoting green initiatives at the household level